MUSEUM OF NEW MEXICO

OFFICE OF ARCHAEOLOGICAL STUDIES

Living on the Northern Rio Grande Frontier: Eleven Classic Period Pueblo Sites and an Early Twentieth-Century Spanish Site near Gavilan, New Mexico

Volume 1: Overview and Site Descriptions

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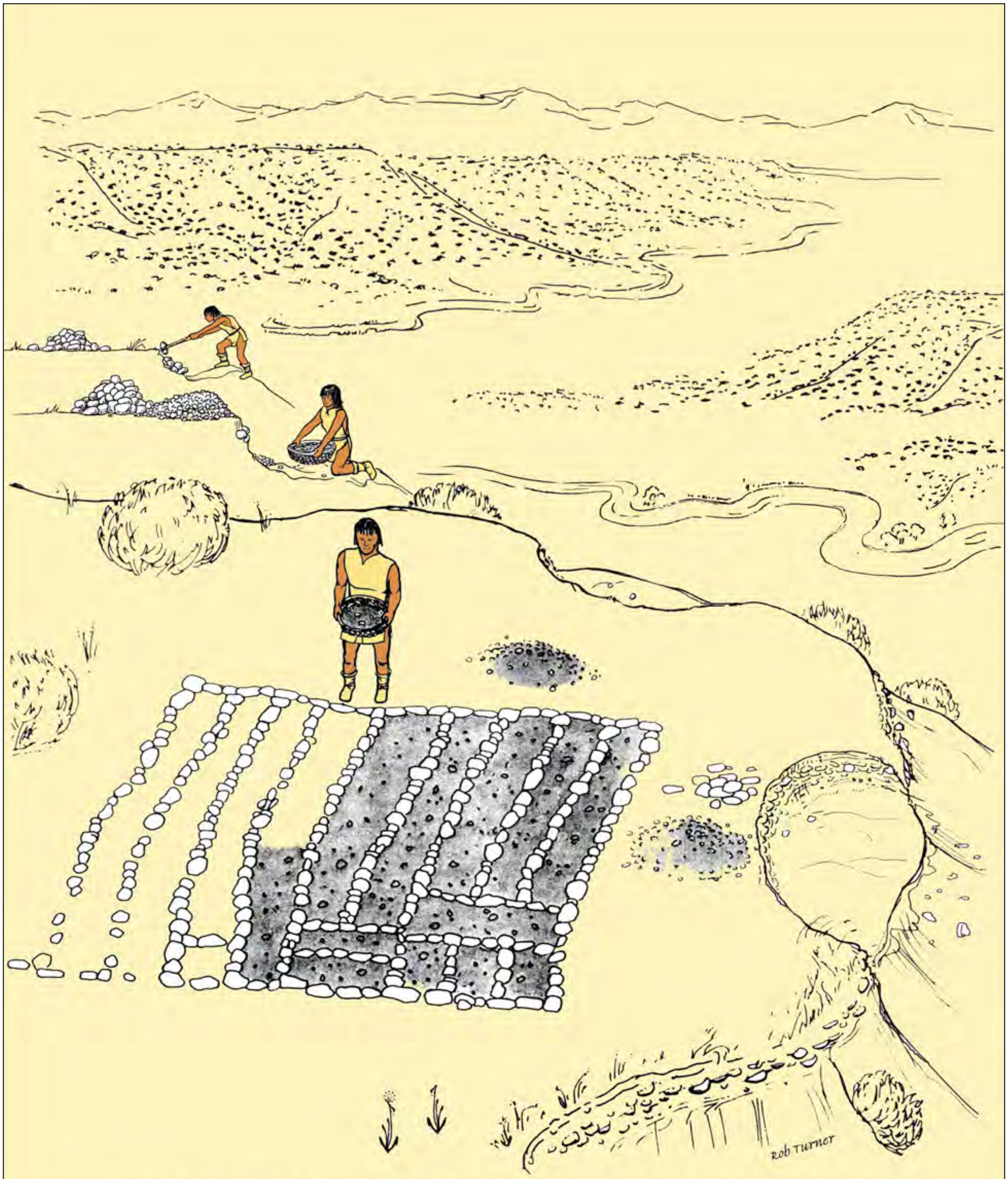

Artist's conception of cobble-and-mulch grid garden preparation, above Rio Ojo Caliente

Administrative Summary

Between July 29 and December 20, 1997, the Office of Archaeological Studies of the Museum of New Mexico conducted archaeological data recovery investigations at twelve sites along U.S. 285 in Rio Arriba and Taos Counties, New Mexico. This project was conducted at the request of the New Mexico Department of Transportation. Excavations were carried out in preparation for the reconstruction of U.S. 285 near the communities of Gavilan, Duranes, Gallegos, and Ojo Caliente.

Data recovery efforts were aimed at recovering information relevant to local prehistory and history. The array of cultural properties examined included nine Classic period farming sites (LA 105703—LA 105709, LA 105713, and LA 118547), segments of a Classic period trail (LA 118549), deposits associated with the Classic period occupation of Hilltop Pueblo (LA 66288), and the remains of an early twentieth-century store and morada (LA 105710). While each of these sites extended into project limits, none was completely within the planned construction zone. Our investigations are considered to have exhausted the potential of the parts of these sites within project limits to yield information relevant to local prehistory and history.

MNM Project No. 41.6131.
NMDOT Project No. NH-285-9(7)346.
BLM Permit No. 21-8152-97-2a, with amendments.
State of New Mexico Permit No. AE-77, with amendments.

Acknowledgments

I and the contributors owe a great deal of gratitude to the many people who helped this project in one way or another. The fieldwork began during the hottest days of summer and lasted into the coldest depths of winter. To all of those who worked through the extremes of weather and suffered through the long daily commute we would like to express our deepest appreciation. We would especially like to thank our volunteers, who did all of that without any pay! We felt ourselves very fortunate to be given this chance to work in the beautiful Ojo Caliente Valley on some very interesting, impressive, and important sites. Thus, we would also like to thank the staff of the Environmental Section of the New Mexico Department of Transportation for their support and for providing us with this opportunity.

Finally, before this report could be completed we suffered the loss of a valued friend. Sam Sweesy started working for the OAS as a volunteer in 1988, served as a laborer for several years, and eventually became an assistant archaeologist—all this as his third career, after he had officially retired from the aerospace industry and run a successful string of camping stores in California. An ornery old cuss (he would have been most offended by the use of the word "old" to describe him), Sam was a pleasure to work with. We'll miss him and would like to dedicate this report to his memory. —JLM

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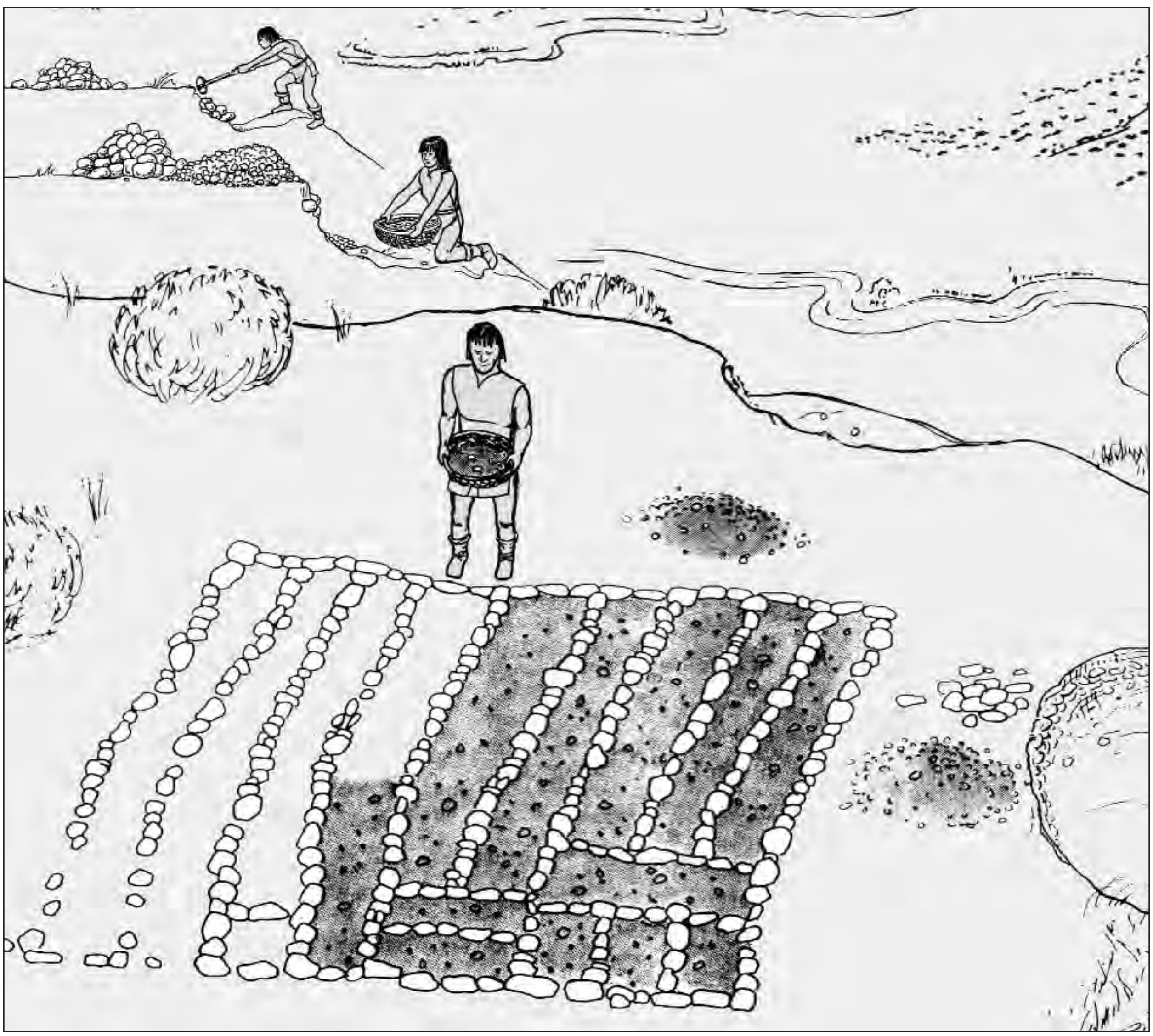
Part 1

Project Background and Overviews



Chapter 1. Introduction

James L. Moore

At the request of the New Mexico Department of Transportation (NMDOT, formerly the New Mexico State Highway and Transportation Department), the Office of Archaeological Studies (OAS), Museum of New Mexico, conducted data recovery investigations at twelve sites along U.S. 285 in Rio Arriba and Taos Counties, New Mexico (Fig. 1.1). The impetus for these investigations was the reconstruction of a section of U.S. 285 near the communities of Gavilan, Duranes, Gallegos, and Ojo Caliente in the Ojo Caliente Valley of northern New Mexico. Highway reconstruction included road widening and slope cutting along a gravel terrace that flanks the east side of most of this section of U.S. 285. Except for two sites in the valley bottom (LA 66288 and LA 105710), the sites were situated on top of and along the west edge of the gravel terrace included in the slope cut. None of the sites investigated were completely within the highway right-of-way; all extended outside project limits, and in several cases only a small part of a given site was within project limits.

The associated right-of-way was originally inventoried by Marshall (1995), and eleven sites were examined in more detail in 1995 to determine whether they warranted further study (Wiseman and Ware 1996). Eight of these sites (LA 105703–LA 105709 and LA 105713) were determined to be loci of prehistoric farming and were recommended for data recovery without subsurface testing (Wiseman and Ware 1996:1). Limited testing was conducted at Hilltop Pueblo (LA 66288) and LA 105710. LA 105712 was determined to be outside project limits and was not tested or recommended for data recovery.

Just as the data recovery phase was beginning, the Environmental Section of the NMDOT discovered that additional width had been added to the east side of the right-of-way at the south end of the project. This area had not been examined by previous phases of archaeological investigation. A supplemental archaeological survey was conducted, which found another farming site that was partly within project limits (LA 118547) and a probable prehistoric trail (LA 118549) running along the east side of the right-of-way that had not been identified by previous studies (Levine 1997). Both of these sites were added to the data recovery plan, increasing the number of sites scheduled for examination to twelve.

Fieldwork during the data recovery phase was conducted between July 29 and December 20, 1997. Timothy D. Maxwell of the OAS was principal investigator, and fieldwork was directed and carried out by OAS staff and volunteers. Investigations at the nine farming sites (LA 105703–LA 105709, LA 105713, and LA 118547) and the trail (LA 118549) were directed by James L. Moore. Field studies at Hilltop Pueblo (LA 66288) and the García store (LA 105710) were directed by Jeffrey L. Boyer. Field assistants were Susan Moga, Guadalupe Martinez, Sonya Urban, David Hayden, Steven Lakatos, and Marcy Snow. Crew members included Philip Alldritt, Sam Sweesy, Theresa Fresquez, Rick Montoya, and Laura Rick. Mechanical excavations were conducted by Eligio Aragon of Alley Cat Excavating. We were joined in the field for parts of the project by Jane Lindskold, Linda Lambert, and Marian Chavie, who graciously volunteered their time and whose efforts are greatly appreciated. This report was edited by Tom Ireland, and the graphics were produced by Ann Noble and Rob Turner.

The sites investigated by this study were on land administered by the USDI Bureau of Land Management (BLM) or the New Mexico State Land Office (SLO). Sites on land administered by the BLM included LA 66288, LA 105703, LA 105704, LA 105709, LA 105710, LA 105713, LA 118547, and parts of LA 118549. Fieldwork was conducted at these sites under BLM Permit No. 21-8152-97-2a, with amendments. Four sites (LA 105705, LA 105706, LA 105707, LA 105708) and parts of a fifth (LA 118549) were on State Trust land administered by the SLO. Fieldwork at these sites was conducted under State of New Mexico Permit No. AE-77, with amendments.

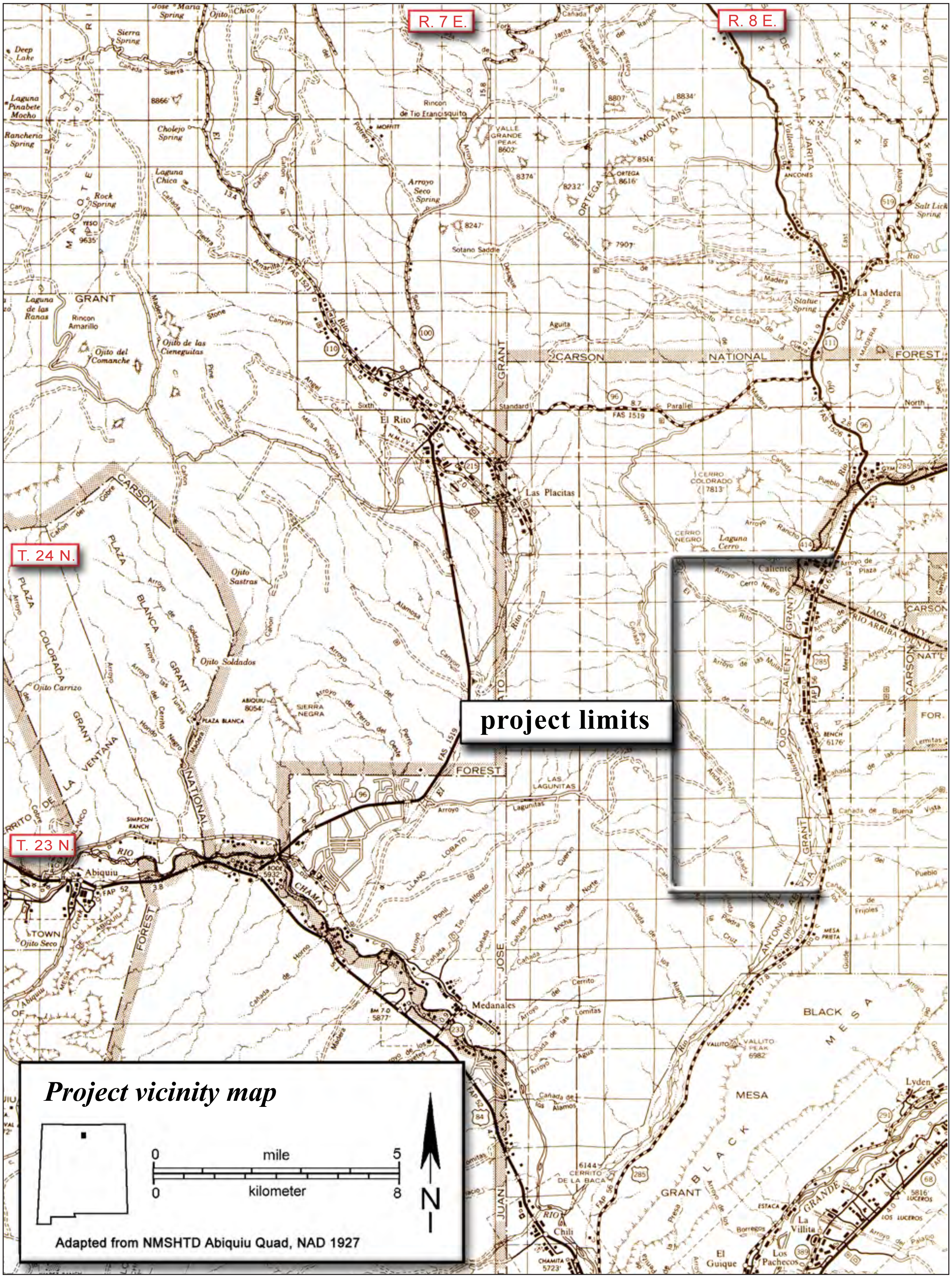


Figure 1.1. Project vicinity map.

Numerous personnel were involved in laboratory analysis of the materials recovered during data recovery. C. Dean Wilson conducted the ceramic artifact analysis, assisted by Carol Price, who graciously volunteered her time. Chipped stone analysis was conducted by James L. Moore, with assistance from Sonya Urban. Historic artifacts were examined by Natasha Wilson, assisted by David Norris. Mollie S. Toll and Pamela McBride conducted botanical field studies on the farming sites, and Pamela McBride examined macrobotanical samples. Susan Moga completed a study of nonhuman bone, supervised by Nancy Akins. Laura Rick analyzed gravel samples for the farming sites under the supervision of James L. Moore. Finally, palynological analysis of sediment samples was conducted by Dr. Richard Holloway of Quaternary Services in Flagstaff, Arizona.

Most of the sites examined were used during the Rio Grande Classic period (A.D. 1325–1600). Temporally diagnostic sherds collected and recorded at the nine farming sites were primarily biscuit wares, which indicate Classic period use. The features identified on the farming sites were dominated by gravel-mulched plots used for growing crops, and borrow pits that were the source of most of the materials used to build those fields. While other types of farming features such as contour terraces and check dams were also identified at a few sites, they were quite rare. Informal occupation areas at four of the nine farming sites consisted of scatters of chipped stone artifacts and occasional ground stone artifacts, sherds, thermal features, and possible fieldhouse locations. These areas appear to represent temporary occupational areas used while nearby fields were being cultivated. Chipped stone artifacts, common along the terrace edge at these sites, probably represent use of that zone for material acquisition.

Hilltop Pueblo (LA 66288) is about 200 m east of Nute (LA 298), a large Classic period village considered ancestral by the Tewas (Harrington 1916). The pottery recovered from Hilltop Pueblo also indicates a Classic period occupation. It is uncertain whether it was an independent entity or a part of Nute that was separated from the main village by a short distance. The trail (LA 118549) extends through most of the project area and was traced as far south as Ponsipa'akeri, another large Classic period village considered ancestral by the Tewas (Harrington 1916). The configuration of the trail and its close association with several farming sites indicate that it was a prehistoric travel corridor dating to the Classic period occupation of the valley.

LA 105710 was a multicomponent site containing prehistoric and historic remains. Most of the prehistoric component consisted of materials washed downslope from Hilltop Pueblo. Two simple hearths associated with the prehistoric occupation of that site were found in the profiles of backhoe trenches and represent the only in situ prehistoric features found at LA 105710 or LA 66288. The historic component was the main focus of excavation at this site. Two historic structures were identified at LA 105710—an abandoned morada at the edge of the right-of-way that was avoided rather than excavated, and the remains of a small store operated by Candido García in the early 1930s. Also included in this site was a concentration of wolfberry bushes thought to represent the former location of corrals used by the Archuleta family.

These twelve sites provide us with a look at two very different periods of use and adaptation in the Ojo Caliente Valley. The excavation of these sites and the analysis of materials recovered during this study were aimed at answering a series of questions posed in the data recovery plan (Wiseman and Ware 1996). Further questions were generated as data recovery and analysis proceeded and were added to those in the data recovery plan. This report is structured in four basic sections. The first section describes the project in general, the research design, field and laboratory methods, and overviews of the natural and cultural environments of the area. The sites are described in the second section, and the results of data recovery at each are detailed. Discussions of the artifact analyses conducted by OAS staff comprise the third section. The fourth section contains research reports and syntheses concerning the sites.

Based on the results of this study, we determined that the potential for yielding important data was exhausted in the sections of sites that extended into the right-of-way for this highway construction project. No further investigations within project limits were indicated. However, it should be noted that all twelve sites included in this study extend outside project limits. Further studies may be necessary at these sites if U.S. 285 is scheduled for further widening or reconstruction that would expand the right-of-way examined for the current project.

Chapter 2. The Physical Environment of the Project Area

James L. Moore

According to Fenneman (1931), the project area falls within the Southern Rocky Mountain Province of the western United States. The main features of this physiographic province in New Mexico are the central Rio Grande Valley, flanked to the east and west by parallel mountain ranges that form the south end of the Rocky Mountains. Both ranges are linear in form and run north-south; the Sangre de Cristos are on the east side of the Rio Grande Valley, and the Jemez and Nacimiento ranges are on the west (Fenneman 1931:104–105). Structurally, the project area is in the northern Española Basin. The Rio Ojo Caliente, which drains the project area, is a tributary of the Chama River, which flows into the Rio Grande just north of Española.

Geomorphology

The northern Española Basin is one of six or seven similar basins that comprise the Rio Grande depression between southern Colorado and southern New Mexico (Kelley 1979:281). In structure, the Española Basin is a broad, gentle, northeast-trending syncline with downwarping along its west margin (May 1979:83). It is bounded on the west by the Jemez Mountains, on the northwest by the Tusas and Brazos ranges, on the north by the Taos Plateau, on the east by the Sangre de Cristos, on the south by the Cerrillos hills and the north edge of the Galisteo River Valley, and on the southwest by the La Bajada fault escarpment and the Cerros del Rio (Kelley 1979:281). The Rio Grande enters the basin in the north through the Taos Gorge and exits in the south through the Whiterock Gorge (Kelley 1979:281).

The Española Basin is 64 to 80 km long by 47 to 64 km wide (Woodward 1974:126) and developed after a long period of geologic stability that prevailed during the late Eocene and most of the Oligocene. The basin began forming when the margin of the Colorado Plateau began foundering along the roots of early Laramide uplifts, producing the downwarping and extensional faulting that became the Rio Grande rift (Kelley 1979:281). Several features that form the modern boundary of the Española Basin were already in place when it began to subside, including the Nacimiento, Jemez, Brazos, and Sangre de Cristo uplifts (Kelley 1979:281). These ranges were the main sources of the materials deposited in the basin and formed the Santa Fe group. These sediments were augmented by volcanic materials during the Miocene and early Pliocene as eruptions occurred in the Jemez, Brazos, and Sangre de Cristo areas (Kelley 1979:281). Most of the Santa Fe formation had been deposited when uplifting along the east edge of the basin caused major subsidence during the late Pliocene. This was followed by a long period of geologic stability, erosion, and the development of pediments (Kelley 1979:281).

According to Kelley (1979), the Ortiz surface is the most widespread and well-preserved pediment in the basin, but it has mostly been removed by erosion. Black Mesa represents a local remnant of the Ortiz surface. There are also several lower pediments in the basin, but none occur in the Ojo Caliente Valley. Extensive erosion during the Quaternary formed the inner valleys of the Rio Grande depression, and this dissection was greatest in the Española Basin (Kelley 1979:285). This process formed valleys and gorges with as much as 300 m of relief (Kelley 1979:285).

Kelley (1979:284) feels that the Rio Ojo Caliente was initially a tributary of the Rio Grande, flowing into that river near present-day Embudo. However, the basalt flow that formed Black Mesa deflected the Rio Ojo Caliente, turning it into a tributary of the Chama River. As the Rio Ojo Caliente cut downward through the Santa Fe formation it created a series of gravel terraces, mostly along the east side of the valley between Ojo Caliente and Black Mesa (Kelley 1979:287). At least three terrace levels are represented on the east side of the river between 30 and 75 m above the river (Kelley 1979:287). The few terraces that occur along the west side of the river differ somewhat in elevation from those on the east side (Kelley 1979:287), so their relationship is questionable. Gravels in the terraces are predominantly Precambrian quartzites originating northwest of La Madera (Kelley 1979:287).

Geology and Stratigraphy

The stratigraphy of the Ojo Caliente area is summarized by May (1979:84), from which the following discussion is taken, except where noted. Other than an exposure of Precambrian rocks near Ojo Caliente, the Abiquiu Tuff of Oligocene to Miocene age is the lowest exposed stratigraphic unit and is 0 to 60 m thick. This formation unconformably overlies igneous and metamorphic rocks of Precambrian age and consists of a tuffaceous sandstone with a layer of volcanic-pebble conglomerate near the top. The Abiquiu Tuff is mostly composed of volcanic sediments derived from the San Juan Mountains and is overlain by formations of the Santa Fe Group (Galusha 1974:285).

The Abiquiu Tuff formation grades into the Los Piños formation in the north part of the Ojo Caliente area, and the Chama–El Rito member of the Tesuque formation in the south. The Los Piños formation is a 410 m thick series of volcanic- and metamorphic-pebble conglomerates and tuffaceous sandstone beds. It is similar to and intertongued with a thin layer of the Chama–El Rito member in the Ojo Caliente area. Evidence suggests that the Los Piños formation represents a broad, south-sloping alluvial fan built of materials eroded from a volcanic source to the north—possibly the southern San Juan Mountains—during the Oligocene and Miocene periods.

The Chama-El Rito member is 30 to 550 m thick and consists of slightly tuffaceous sandstone and siltstone containing lenses of volcanic-pebble conglomerate. The upper member of the Tesuque formation, the Ojo Caliente sandstone, is of Miocene age and is 160 m thick. It is primarily an eolian sandstone with a few beds of tuff and tuffaceous sandstone near the bottom. Along the sides of Black Mesa this formation is overlain by the Chamita formation, which consists of a series of fluvial sandstones of upper Miocene age. Tuffs and tuffaceous sandstones are also common in that formation.

Soils

Soils of the study area are described by Hacker and Carleton (1982:48, 50, 81–82, 85, 94–95, 98), and this discussion is summarized from their work. Soils on the gravel terraces south of Ojo Caliente are of the Sedillo-Orthents association. Sedillo soils comprise about 45 percent of the association and are deep, well-drained gravelly loams that have formed in alluvium on terraces with slopes of 3 to 15 percent. The upper part of this soil tends to be a layer of brown gravelly loam about 7.6 cm thick. This is underlain by about 20 cm of reddish brown and brown very gravelly clay loam. The substrate is a pink and brown very gravelly sandy loam, which occurs to a depth of 1.5 m. Below 20 cm this soil is slightly to strongly calcareous. Sedillo soils are moderately slowly permeable, with moderate runoff and slight wind erosion hazards.

Orthents occur on slopes of 30 to 45 percent and comprise about 35 percent of the association. These soils are deep, gravelly, and well drained. The surface layer is typically a very gravelly loam, which is underlain by a very gravelly clay loam. Permeability is moderate to moderately rapid, and this soil has high water-erosion and slight wind-erosion hazards.

Several other soils are minor components of this association. Silva, Manzano, Fernando, and Hernandez soils each comprise about 5 percent of the association. The Silva series consists of deep, well-drained soils forming in mixed alluvium and eolian sediments on upland fans and valley sides with slopes of 0 to 10 percent. The surface layer is a brown to dark brown loam 5 cm thick, underlain by various clay loams to a depth of 1.5 m. The Manzano series consists of deep, well-drained soils forming in mixed alluvium on valley bottoms and alluvial fans with slopes of 0 to 5 percent. This series contains several brown to dark brown clay loams to a depth of 1.5 m. The Fernando series is also comprised of deep, well-drained soils forming in mixed alluvium, in this case on alluvial fans with slopes of 0 to 7 percent. This series has A and B horizons of light brown to brown silt loam, underlain by clay loams to a depth of 1.07 m, which in turn are underlain by loam for another 45 cm. Finally, the Hernandez series consists of deep, well-drained soils forming in mixed alluvium and eolian sediments on alluvial fans and valley bottoms with slopes of 0 to 5 percent. This series grades from a brown loam on the surface through several horizons of clay loam to a depth of 1.5 m.

Soils at the base of the gravel terraces in the vicinity of LA 66288 and LA 105710 are categorized as Royosa loamy sand. This soil occurs on 1- to 8-percent slopes and is deep and somewhat excessively drained. Occurring on undulating to gently rolling landforms, Royosa loamy sand formed in eolian materials in old dunes. The surface layer is typically a brown sand about 20 cm thick, underlain by brown loamy sand to a depth of 1.5 m. Royosa is highly permeable, and it has slight water erosion and high wind erosion hazards. Also included with this soil in mapping were small areas of Vibo, Petaca, and Manzano soils; the latter has already been described. The Vibo series consists of deep, well-drained soils forming in mixed alluvium on alluvial fans with slopes of 3 to 10 percent. This series grades from a brown sandy loam on the surface through sandy clay loams, sandy loam, and loamy sand to a depth of 1.5 m. Petaca soils do not occur in the study area.

Biotic Environment

The condition of the local plant and animal populations is far from pristine due to human exploitation of the study area for a variety of purposes through time. Prehistorically, there were at least five large Classic period (A.D. 1325–1600) villages in the Ojo Caliente Valley, with some evidence of a sedentary Pueblo population extending back into the Coalition period (A.D. 1150–1325). Before those times, Archaic remains in the valley indicate the occasional presence of groups of transient hunter-gatherers. Drastic changes to the biotic structure of the project area probably did not occur until it was occupied by farmers, though even the hunter-gatherers could have affected the ecology of the region to some extent.

Human use of the Ojo Caliente area since the Coalition period has undoubtedly caused changes in the biotic environment. Pueblo gravel-mulched fields built along the edges and tops of gravel terraces flanking both sides of the Rio Ojo Caliente have changed the character of those areas in ways that can still be seen today. The use of wood for building, cooking, and heating probably left zones around villages virtually denuded by the end of the Pueblo occupation. Similarly, Spanish use of the region for farming and grazing affected the distribution and types of plants used for forage by cattle and sheep. Heavy use of wood for building and fires probably again left the area nearly denuded around settlements. While the woodlands have begun recovering since more efficient means of heating and cooking became widely available, grazing in the uplands flanking the valley and farming in the river bottom have continued to change the character of the biotic environment. Thus, descriptions of local flora and fauna based on modern data are not directly comparable to the conditions experienced by prehistoric populations.

Local Vegetation

The distribution of plants is conditioned by a number of factors, including the availability of water, exposure, and soil type. Thus, the types of plants growing adjacent to the Rio Ojo Caliente differ from those occupying the valley margin and upland areas. The uplands bordering the Ojo Caliente Valley generally contain two bands of piñon-juniper woodland in the study area. The lower band is fairly narrow and occupies the west-facing slope of the gravel terrace that borders the east side of the valley, extending up drainages cut into the terrace by east-west-flowing intermittent streams. This band of woodland often extends up to the terrace top and in places spills over onto the gravel-mulched fields that usually line the west edge of the terrace. Rather than invading a new area, the woodland is probably just beginning to reoccupy parts of the terrace top that were cleared of trees, perhaps as early as the Classic period, when the gravel-mulched fields were built.

A higher band of woodland begins at the base of the next gravel terrace to the east, extending upslope and often onto the top of that terrace, which also contains some gravel-mulched fields but was not as heavily used as the lower terrace. The dominant soils on the terrace are of the Sedillo-Orthents association. Hacker and

Carleton (1982:50) indicate that careful grazing of this soil will create an understory dominated by western wheatgrass, blue grama, galleta, and Indian ricegrass. Overgrazing results in dominance of ring muhly, broom snakeweed, and big sagebrush. To that list can be added cholla, which is fairly common in the study area. Thus, this soil association has been overgrazed, and the modern vegetative cover does not reflect its prehistoric condition.

A third band of woodland exists in the valley bottom adjacent to the river but differs somewhat from the upland bands. Right along the river is a band of riparian vegetation dominated by cottonwoods. Tamarisk, introduced from Europe, and willow also occur. Flanking the riparian zone and occupying most of the Royosa loamy sand is a woodland zone dominated by juniper and piñon, with an understory containing blue grama and Indian ricegrass (Hacker and Carleton 1982:48).

Piñon-juniper woodlands are one of the largest ecosystems in the Middle Rio Grande Basin and the Southwest in general (Gottfried et al. 1995:95). The distribution of woodlands and the density and size of trees are controlled by available soil moisture and season of precipitation. Moist areas support relatively dense stands of tall trees, while dry areas contain scattered trees of low stature (Gottfried et al. 1995:98). This variety is visible in the study area, where trees are denser and taller in the valley bottom adjacent to the Rio Ojo Caliente, and smaller and more scattered on the flanking terrace slopes and tops. A diverse variety of understory plants can occur in piñon-juniper woodlands that have not been heavily affected by grazing. Surveys in Bandelier National Monument have recorded about 450 species of vascular plants in this zone (Gottfried et al. 1995:103). At least 100 forbs and 36 grasses have been recorded at Mesita de los Ladrones near Pecos, and at least 6 tree taxa, 12 shrubs, 31 forbs, and 15 grasses were found in Comanche Canyon, just north of our study area (Gottfried et al. 1995:103). Thus, undamaged piñon-juniper woodlands tend to have a very diverse understory containing many more species than were noted at the sites examined during this study.

Local Wildlife

In general, piñon-juniper woodlands support at least 70 species of birds and 48 species of mammals. Species distribution is determined by geographic location and type of piñon-juniper habitat (Gottfried et al. 1995:104). Birds that commonly live in piñon-juniper woodlands include the piñon jay, scrub jay, screech owl, gray flycatcher, mockingbird, lark sparrow, and plain titmouse; turkeys also occur where ponderosa pine is available for roosting (Gottfried et al. 1995:104). Several types of raptors also occur in this zone, including golden eagle, Swainson's hawk, Cooper's hawk, red-tailed hawk, kestrel, and great-horned owl (Gottfried et al. 1995:105). Many species of bats have been netted at night in piñon-juniper woodlands, but whether they simply forage there or roost in the trees is currently unknown (Gottfried et al. 1995:105).

Artiodactyls commonly found in piñon-juniper woodlands include mule deer and elk. Pronghorns live in the more open zones. Predators include mountain lions, coyotes, gray foxes, long-tailed weasels, western spotted skunks, and hog-nosed skunks (Gottfried et al. 1995:105). Common small mammals are cliff chipmunk, rock squirrels, brush mice, piñon mice, rock mice, white-throated woodrats, and Mexican woodrats (Gottfried et al. 1995:105). Jackrabbits, cottontails, prairie dogs, pocket gophers, and kangaroo rats also live in this type of environment (Anschuetz 1998:253).

The Modern Climate

In general, the climate of New Mexico is moderate in terms of temperature and arid to semiarid in terms of precipitation; there is plenty of sunshine, skies are clear, relative humidity is low, and the amount of evaporation over open water is high (Tuan et al. 1973:185). Temperature ranges are rather high between day and night and winter and summer because the dry, clear air allows rapid heating and cooling (Tuan et al. 1973:185). Three general climatic zones are recognized in New Mexico: arid, semiarid, and subhumid/humid. Differences in climate are a function of latitude, location in relation to moisture-bearing winds, and variation in elevation (Tuan et al. 1973:186, 188). Ojo Caliente is near the boundary between semiarid and subhumid/humid zones, but since humid conditions only occur in the highest parts of mountains, the study area is actually at a boundary between semiarid and subhumid zones (Tuan et al. 1973:187).

Gabin and Lesperance (1977:272) present annual and monthly means for precipitation from 1923 to 1970, temperature from 1929 to 1970, and potential evapotranspiration from a weather station at Gavilan (Table 2.1). According to these figures, the Gavilan area receives an average of 428 mm of precipitation each year. Mean precipitation levels peak between July and September, while mean temperature peaks between June and August. Not surprisingly, the latter are also the months when moisture loss through evapotranspiration is greatest. Potential evapotranspiration measures moisture loss in irrigated crops (Gabin and Lesperance 1977), so these losses are probably higher than they would be in crops bred for dry farming. Still, these would be the months when moisture loss was highest, so below-average precipitation would severely affect dry-farmed crops. High evapotranspiration may somewhat offset the benefits of these wet months.

Gabin and Lesperance's (1977:272) precipitation figures are much higher than those supplied by Maxwell (2000:99) for the general area, which were obtained from the National Climatic Data Center of the National Oceanic and Atmospheric Administration. Maxwell (2000:99) provides a regional mean precipitation level of 279 mm, which is only 65 percent of Gabin and Lesperance's (1977:272) mean. Three stations at Abiquiu Dam, El Rito, and Ojo Caliente were used in Maxwell's study, and statistical differences in precipitation levels are noted between the stations (Maxwell 2000:11). Extremes in annual precipitation for the period measured ranged from a low of 104 mm in 1956 to a high of 556 mm in 1941 (Maxwell 2000:99). Since the precipitation mean provided by Gabin and Lesperance is about 77 percent of Maxwell's maximum extreme, it could be too high. However, Maxwell's (2000:144) reconstruction of prehistoric precipitation patterns yielded a mean of 402.5 mm between A.D. 1200 and 1500, which is fairly close to the modern mean provided by Gabin and Lesperance (1977). Variation in precipitation levels during the years monitored is probably responsible for the large difference in the means provided by these studies. Fortunately, the distribution of precipitation by month is similar in both data bases. Maxwell (2000:99) indicates that the region receives about 51 percent of its annual precipitation between May and September, and Gabin and Lesperance's (1977:272) figures are comparable at 52.4 percent.

Other climatic factors are also important for farmers. Critical among them is the number of

Table 2.1. Precipitation and evapotranspiration at Gavilan

Month	Mean Precipitation (mm)	Mean Temperature (degrees F)	Potential Evapotranspiration (mm)	Moisture Surplus (mm)	Moisture Deficit (mm)
January	27.6	18.9	6.3	21.3	-
February	30.7	23	8.6	22.1	-
March	31.5	30.7	16.8	14.7	-
April	27.2	40.7	35.3	-	8.1
May	26.2	48.6	69.4	-	43.2
June	22.6	57.3	110.2	-	87.6
July	57.4	64.5	145.8	-	88.4
August	72.9	62.9	122.9	-	50
September	45.2	55.1	74.2	-	29
October	29.7	44.4	36.3	-	6.6
November	24.4	31.5	13	11.4	-
December	31.7	22.8	7.6	24.1	-

Source: Gabin and Lesperance (1977:272).

frost-free days available for plant growth. If the frost-free period is too short, crops will not mature, yields may be lower, crops could be damaged, and viable seed might not be produced. On the average, the last killing frost in the project area occurs between May 20 and 30, while the first killing frost is usually between September 20 and 30 (Tuan et al. 1973:88–89). This provides the area with 120 to 140 frost-free days (Tuan et al. 1973:87), which is sufficient for corn farming.

However, Tuan et al. (1973:79) note that there are some problems with modern meteorological measurements. A standard instrument shelter is normally positioned 1.83 m above the ground surface. Closer to the ground, which is where most crops grow, frosts can occur later in the spring and earlier in the fall (Tuan et al. 1973:79). This is not taken into account in measures of frost-free days, so the frost-free season may be shorter at ground level than these figures suggest. Differences in topography also affect the occurrence of killing frosts, because cold, dry, dense air tends to collect in hollows (Tuan et al. 1993:79). This means that valley bottoms are often colder than adjacent highlands (Anschuetz and Maxwell 1987). Studies at Hopi and Mesa Verde have demonstrated that cold-air drainage can significantly shorten the length of the growing season in valleys (Adams 1979; Cordell 1975). Thus, terraces flanking valley bottoms may actually have longer frost-free periods.

Reconstructions of the Past Climate

A detailed climatic reconstruction does not exist for our specific study area. Maxwell (2000:142–145) reconstructed prehistoric precipitation patterns for the lower Chama River Valley, which should be more applicable to our study that reconstructions by Rose et al. (1981) for the Santa Fe area to the south, and by Orcutt (1999a) for the general Northern Rio Grande region. The period of interest in this discussion spans the Coalition and Classic periods between A.D. 1150 and 1600, which is when the Ojo Caliente Valley was occupied by Pueblo farmers. At this time there is no evidence of earlier farmers in the area, and there were few or no Pueblos living in the valley when the Spaniards founded their first colony at San Gabriel, thus officially ushering in the historic period.

The Lower Chama River

For the lower Chama River, Maxwell (2000:144) calculated an annual mean precipitation level of 402.5 mm between A.D. 1200 and 1500, with a standard deviation of 62.2 mm. He also charted ten-year running means for precipitation, which smoothed variation and suggested a slow, periodic pattern of prehistoric rainfall variation (Maxwell 2000:144, Fig. 8). At no time between A.D. 1200 and 1500 did precipitation for this area seem to exceed or fall short of the mean by as much as one standard deviation. However, there did seem to be a pattern of several generally good years followed by several generally bad years, and the sequences were often of similar duration.

According to Maxwell's (2000:144) data, the period opened with about nine years of above-average precipitation, followed by around 23 years of below-average precipitation lasting until ca. 1230. Precipitation was above the mean between ca. 1230 and 1248, dropping back below the mean from ca. 1249 to 1264, except for one year (1263) of above-average precipitation. This was followed by above-average precipitation between ca. 1265 and 1278, and a period of below-average precipitation between ca. 1279 and 1288, except for one year (1281) with above-average precipitation. Above-average precipitation levels again prevailed between ca. 1289 and 1316, followed by a 35-year period of high-frequency variation around the mean that ended around 1349. Precipitation levels were again above average between ca. 1350 and 1367, followed by a very short period of below-average precipitation that ended around 1372. At that point, the region entered a period of above-average precipitation that lasted until ca. 1390, followed by below-average precipitation until ca. 1410. Between ca. 1411 and 1420 there was a short period of above-average precipitation, which was followed by a short period of below-average precipitation that lasted until ca. 1428. Precipitation was generally above average between ca. 1429 and 1451, though with two short episodes of below-average precipitation (1438–1440 and 1445–1448). Below-average precipitation dominated between ca. 1452 and 1486, returning to above average until ca. 1497. A quick dip below the regional average lasted until nearly 1500, and the sequence ended with above-average precipitation.

The Santa Fe Area

Rose et al. (1981:104–105) reconstructed precipitation patterns for Arroyo Hondo Pueblo, near Santa Fe, between A.D. 985 and 1970, though our period of interest is A.D. 1150 to 1600. Rose et al. (1981) calculated departures from the mean by decades, overlapping each decade by five years and plotting them at the midpoint, effectively graphing the variation in five-year increments. The Santa Fe area was experiencing a period of mostly below-average precipitation between ca. 1150 and 1173, except for a short period in the center of that span. Precipitation was above average between ca. 1174 and 1183, dropping back to below average until ca. 1193. Precipitation levels were above average between ca. 1194 and 1213, dropping back below the mean from ca. 1214 to 1228. Precipitation levels were generally above the mean between ca. 1229 and 1245. Except for a brief period from ca. 1268 to 1273, precipitation levels were mostly below or near average from ca. 1246 to 1293. The next 25 years or so (1294–1318) saw higher than average levels.

There was a short interval of below-average precipitation ca. 1319–1323, followed by a longer interval ca. 1324–1335, when precipitation was above the mean. Below-average precipitation prevailed between ca. 1336 and 1343, followed by higher than average levels ca. 1344–1358. The next 40 years saw short intervals of above-average precipitation ca. 1369–1378 and 1384–1388, and below-average precipitation ca. 1358–1368, 1378–1383, and 1389–1398. The fifteenth century began with a 15-year period of above-average precipitation between about 1399 and 1413. This was followed by below-average precipitation between ca. 1414 and 1425 before heading into about 23 years of above-average precipitation ca. 1426–1448. Precipitation was below average from ca. 1449 to 1463, above average between ca. 1464 and 1473, below average between ca. 1474 and 1485, above average between ca. 1486 and 1495, and below average between 1496 and 1508 to close out the fifteenth century.

The period of below-average precipitation that began the 1500s gave way to a short period of above-average precipitation between ca. 1509 and 1515, followed by below-average levels between ca. 1516 and 1523. Precipitation levels were again above average between ca. 1524 and 1543, followed by short periods of below-average precipitation ca. 1544–1553 and above-average precipitation between ca. 1554 and 1558, and a long period of below-average precipitation between ca. 1559 and 1585. The 1500s closed out with a period of above-average precipitation between 1586 and 1600.

The Northern Rio Grande

Orcutt's (1999a:234–239) reconstruction of the general Northern Rio Grande area was specifically applied to the southern Pajarito Plateau. This reconstruction was done differently from those provided by Maxwell (2000) and Rose et al. (1981), but there is enough comparability that it can be used in this discussion. Orcutt (1999a:231) used the Palmer Drought Severity Index (PDSI) to evaluate climatic trends in the Bandelier area. PDSI "provides an estimate of moisture availability by using both temperature and precipitation to approximate evapotranspiration rates" (Orcutt 1999a:231). As such, it is considered a better measure of climate than precipitation rates or temperature alone. Each year during the period of interest was evaluated and classified as dry, slightly dry, normal, slightly wet, or wet. The former two categories refer to below-average conditions, while the latter two refer to above-average conditions.

Except for one year when slightly wet conditions prevailed (1156), the period between 1150 and 1161 was drier than normal. Conditions were normal to slightly wet between 1162 and 1168, switching to dominantly dryer than normal between 1169 and 1181 except for normal years at 1172–1173 and 1176–1177. Conditions were mostly normal between 1182 and 1188, except for one above-normal year (1186). Conditions were below normal between 1189 and 1194 except for 1192, when they were normal. A long period of above-normal to normal conditions prevailed between 1195 and 1215, followed by dominantly below-average conditions between 1216 and 1227. Conditions returned to normal or above normal between 1228 and 1249, and were below average from 1250 to 1258. Average to above-average conditions were back between 1259 and 1276 before entering a fairly long period of mostly below-average conditions between 1277 and 1296. The latter period essentially corresponds to the period of the Great Drought, which contributed to abandonment of most of the Colorado Plateau by 1300.

A long period of above-normal to normal conditions from 1297 to 1338 ended the thirteenth century and began the fourteenth century, except for one below-average year in 1319. Conditions were below average from 1339 to 1353, and at or above average between 1354 and 1363. Below-average conditions prevailed between 1364 and 1367, with a period of mostly normal conditions between 1368 and 1377, except for two above-average years in 1373 and 1375. Climatic conditions were below average between 1378 and 1380, and above average to normal between 1381 and 1389. Dryer than normal conditions occurred from 1390 to 1394, with normal or above-average conditions between 1395 and 1398.

The 1400s began with a period of below-average conditions between 1399 and 1404, followed by normal to better than average conditions between 1405 and 1414. Below-average conditions again prevailed between 1415 and 1426. Except for 1427, which was a normal year, conditions were wetter than average between 1427 and 1437. This was followed by a brief interval of below-average conditions from 1438 to 1440, and mostly normal conditions between 1441 and 1445 (except for 1443, which was above normal). The region then entered a fairly long period of below-average conditions that lasted from 1446 to 1466, except for a single year with normal conditions at 1442. This was followed by a short stretch of normal to above-normal years between 1467 and 1471 before again entering a period of below-average conditions that lasted from 1472 to 1483.

Mostly above-normal conditions prevailed from 1484 to 1495. The transition between the fifteenth and sixteenth centuries was a period of below-normal to normal conditions; the latter occurred at 1499–1504 and 1506, and the former at 1505 and 1507–1510. Conditions were mostly above normal between 1511 and 1516. Except for three normal years between 1521 and 1523, below-normal conditions prevailed from 1517 to 1528. Normal conditions occurred between 1529 and 1534, except for 1530, when conditions were above normal. Two years of below-normal conditions in 1535 and 1536 were followed by another span of mostly normal years between 1537 and 1544, interrupted by two years of above-average conditions in 1540 and 1541. This was followed by five years of below-average conditions from 1545 to 1549, and eleven years of normal to above-normal conditions between 1550 and 1560.

Conditions during the remainder of the 1560s were mostly below average (1561–1566) or normal. The latter prevailed between 1567 and 1573, except for 1572, when conditions were better than normal. A long period of below-average conditions began in 1573 and lasted until 1594, and the sixteenth century ended with normal (1595–1596) to above-normal (1597–1599) conditions.

Climatic Reconstructions

The three climatic reconstructions discussed above were built differently, so they may have limited comparability. The reconstructions presented by Maxwell (2000) and Rose et al. (1981) used retrodicted precipitation data to build curves that show long-term variation in precipitation levels. Both curves were smoothed to eliminate high levels of annual variation and show longer-term periodicity, but different methods were used to smooth them. Since the data used in this discussion were taken from graphic representations of those curves, dates given in the above discussions should be taken as approximate. Orcutt's (1999a) reconstruction differs from these precipitation curves by also taking reconstructed temperatures into account to determine growing conditions in terms of moisture availability.

With these potential problems in mind, Figure 2.1 compares the reconstructions in a rather simplistic manner. Orcutt's (1999a:234–230) data are condensed into three categories—better than normal, normal, and below normal—and plotted by year. Normal years are left blank. Data from Maxwell (2000:144) and Rose et al. (1981:104–105) are interpreted from their smoothed curves, so the beginnings and ends of periods of above- and below-average precipitation are relative rather than absolute. While Rose et al. (1981) also present the raw data used to construct their precipita-

Figure 2.1. Climatic reconstructions for the Northern Rio Grande area compared. Normal (average) years in reconstruction by Orcutt (1999a) and Rose et al. (1981) are left blank.

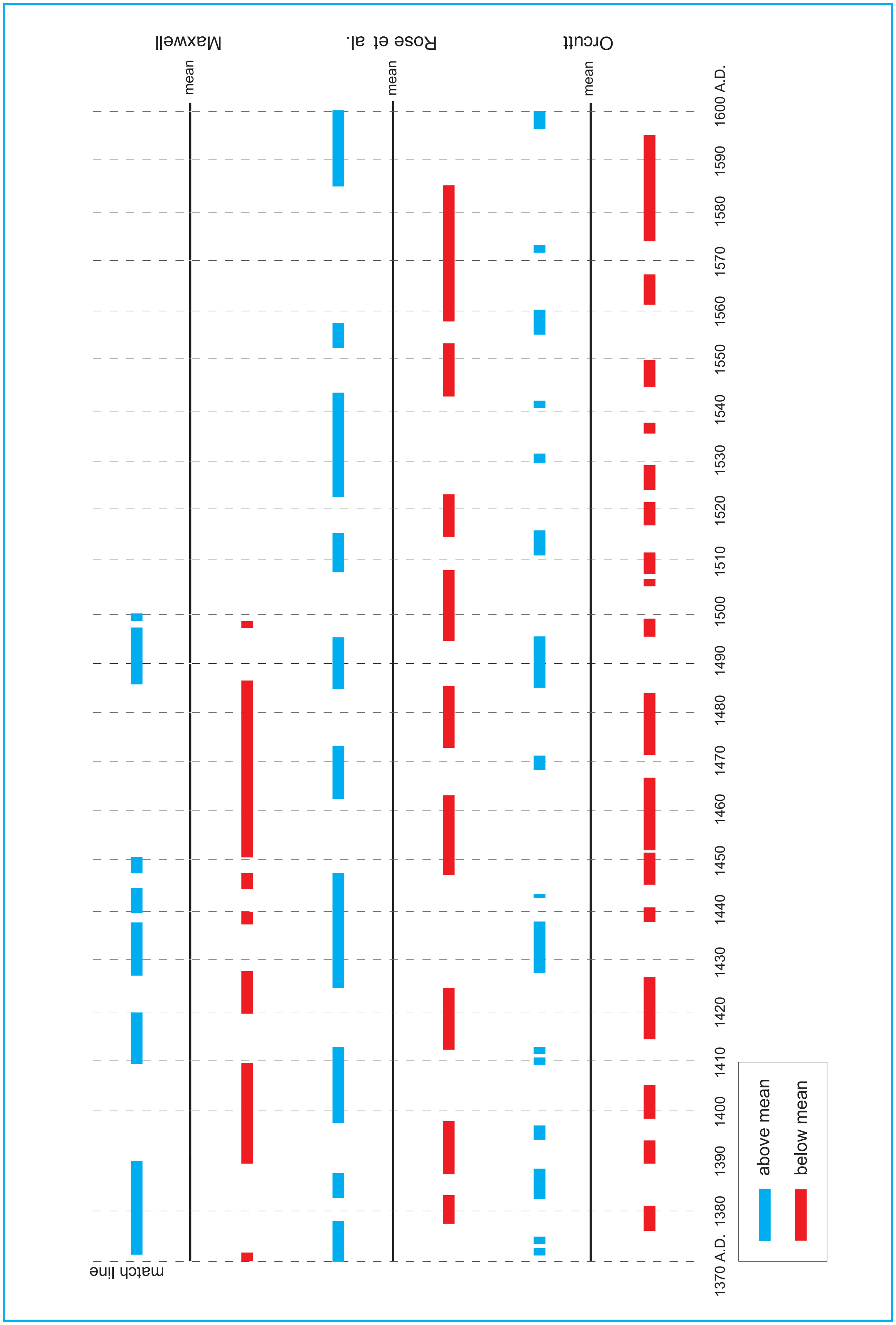


Figure 2.1 (continued)

tion curve, plotting those data against the information taken from the other reconstructions resulted in too much noise for interpretation in this venue, so we returned to the smoothed curve to ease interpretation.

The reconstructions plotted in Figure 2.1 were compared to see how closely they corresponded to one another, and the results of this comparison are presented in Table 2.2. Overall, the three reconstructions were comparable for less than two-thirds of the years between 1200 and 1500. The highest level of comparability was between the reconstructions of Maxwell and Orcutt, and the lowest between those of Maxwell and Rose et al. The greatest amount of correspondence, in general, was for the years between 1200 and 1300, while the least amount of comparability was usually for the years between 1300 and 1400. While this may just be coincidence, it could also indicate that there was less climatic variability in the Northern Rio Grande between 1200 and 1300 than there was between 1300 and 1400.

All three reconstructions tend to agree on certain trends. The 1200s opened with a period of above-average conditions that lasted 7 to 13 years. This was followed by a period of below-average conditions between 1215 and 1228+. Conditions returned to above average between 1230 and 1246+ and dipped back down below average between 1248 and 1260+. There was little further agreement until 1268, when conditions returned to above normal until 1273. The next period of agreement was between 1282 and 1288+, when conditions were again below average.

The 1300s seem to have opened with a period of above-average conditions between 1300 and 1316. Other periods of agreement in the fourteenth century were 1372–1377 and 1383–1388, when conditions were above average, and 1390–1394, when conditions were below average. Otherwise, there were only a few other very short periods of correspondence between the three reconstructions in this century. Disagreement between the reconstructions continued into the early 1400s. They agreed on periods of above-average conditions from 1410 to 1413, 1428 to 1438, 1441 to 1445, and 1486 to 1495. Periods of below-average to average conditions reflected in all three reconstructions included 1420–1425, 1451–1463, and 1473–1485.

So what does this mean? Obviously, all three of these reconstructions cannot be valid for the study area. Maxwell's (2000) reconstruction was built from data obtained nearest the study area, and so it is probably the most valid. However, Orcutt's (1999a) reconstruction takes more data into account, is considered applicable to the general Northern Rio Grande region, and essentially assesses the probability of drought, while Maxwell's reconstruction is a smoothed annual precipitation curve. Fortunately, there is a fairly high degree of correspondence between these reconstructions (Table 2.2).

Overall, what all three reconstructions indicate is that precipitation levels, and therefore crop-growing conditions, were quite variable through time, fluctuating between periods of high and low variability around the mean (or average conditions). There was no disagreement about this aspect of the natural environment. Maxwell (2000:147) calculated that there was only a 61-percent chance of receiving sufficient rainfall for a corn crop during the growing season in the Rio Chama area. According to Orcutt's (1999a) model, agricultural conditions were nor-

Table 2.2. Levels of correspondence between the climatic reconstructions (Maxwell 2000; Orcutt 1999; Rose et al. 1981)

Time Period (A.D.)	Maxwell vs. Orcutt	Maxwell vs. Rose et al.	Rose et al. vs. Orcutt	All Three Reconstructions
1150-1200	-	-	53.3%	-
1200-1300	84.8%	73.0%	93.8%	77.4%
1300-1400	65.7%	60.0%	64.7%	47.6%
1400-1500	82.1%	58.0%	77.8%	63.0%
1500-1600	-	-	62.5%	-
Overall	77.5%	63.7%	72.6%	62.6%

mal or above normal only 57.6 percent of the time between 1150 and 1600 in the Northern Rio Grande. Between 1200 and 1500—the period examined by Maxwell (2000)—the percentage of years with normal to above-normal conditions increased slightly to 59.3 percent. This percentage is so close to the figure derived by Maxwell that the difference is probably negligible.

Sufficient moisture for growing corn was only available about 60 percent of the time in the Northern Rio Grande during the period of interest to this study. There were two basic ways in which this shortfall could be corrected—surplus crops could be stored, or supplemental moisture could be delivered to crops. Had drought years been predictable, production and storage of surplus might have been able to get the population through bad years. However, as Figure 2.1 shows more than anything else, periods of below-average precipitation (or growing conditions) were anything but predictable. Thus, storage of surplus alone would not work; natural precipitation levels had to be supplemented. This could be done in two ways—extra water could be delivered to crops, or soil moisture levels could be enhanced and conserved. Gravel-mulched fields were built to enhance and conserve ground moisture, and their widespread occurrence in the Northern Rio Grande suggests that they were an efficient means of delivering extra moisture to crops, enabling the population to survive most periods of adverse climatic conditions.

Chapter 3. Overview of the Prehistoric Period

James L. Moore, Steven A. Lakatos, and Jeffrey L. Boyer

Through most of its prehistory the Ojo Caliente Valley was linked to a much larger cultural area referred to as the Northern Rio Grande, which stretches from the south edge of La Bajada Mesa to the north end of the Taos Valley and encompasses the Santa Fe area, Galisteo Basin, Pajarito Plateau, Tewa Basin, the Pecos region, and the Taos district. The prehistory of this large region becomes especially closely linked after agriculture appears and spreads, and farming populations began moving in response to climatic change or the need for more land. Since some parts of this region are better known than others, this discussion will not always focus specifically on the study area. Histories of archaeological investigations of the Rio Chama and Rio Ojo Caliente drainages are presented by Anschuetz (1998) and Maxwell (2000) and are not repeated here.

Paleoindian Period (9200–5500 B.C.)

The earliest occupation of the Southwest was during the Paleoindian period, which contains three broad temporal divisions. Holliday (1997:225) provides dates for these divisions from the southern Plains: Clovis, 9200 to 8900 B.C.; Folsom, 8900 to 8000 B.C.; and Late Paleoindian, 8000 to 7000 B.C. Dates for these divisions probably have similar ranges in northern New Mexico, though the end of the Late Paleoindian tradition is usually given as 5500 B.C. in that area. The Late Paleoindian division groups together several different artifact complexes distinguished by variations in projectile points and tool kits that may reflect differences in lifestyle. Fiedel (1999) has reevaluated early Paleoindian radiocarbon dates in light of information provided by other dating methods. He concludes that radiocarbon dates between 12,500 and 10,000 B.P. are problematic because of large-scale fluctuations in carbon-14 ratios, yielding dates that may be off by as much as 2,000 years. Thus, he suggests that the Clovis occupation should be redated at 13,400 to 13,000 B.P. (11,400–11,000 B.C.), and Folsom should be similarly dated about 2,000 years earlier than it currently is.

At one time all Paleoindians were classified as big-game hunters. Some researchers now feel that the Clovis people were unspecialized hunter-gatherers, while Folsom and many later groups turned increasingly toward the specialized hunting of migratory game, especially bison (Stuart and Gauthier 1981). While some Paleoindians drifted out of New Mexico with the migratory big game, those that remained undoubtedly subsisted by a broadly based hunting-gathering economy. The early Archaic inhabitants of the region probably evolved out of this population. Evidence of Paleoindian occupation is rare in the Northern Rio Grande and typically consists of diagnostic projectile points and butchering tools found on the modern ground surface or in deflated settings (Acklen et al. 1990).

Recently, two Clovis period components have been reported in the Jemez Mountains (Evaskovich et al. 1997; Turnbow 1997). Data recovery at one component identified two medial Clovis point fragments associated with a single thermal feature and tool manufacturing debris (Evaskovich et al. 1997). Identification of Paleoindian occupations in a montane setting may suggest a changing subsistence adaptation. An increased focus on the hunting of smaller game and collection of wild plant foods toward the end of the Paleoindian period may reflect changes in climate (Haynes 1980; Wilmsen 1974).

In 1961, Alexander (1964) found a "late Paleo-Indian point" on a pueblo site near the mouth of Taos Canyon. This site was revisited by Wood and McCrary (1981), but the point could not be relocated. Bases of Belen-Plainview points have been found on sites with later components at Guadalupe Mountain (Seaman 1983) and south of Carson (Boyer 1985). Boyer (1988) found a reworked obsidian Folsom point north of Red Hill on the northwest side of the Taos Valley. The point was submitted for obsidian hydration dating, but the material source could not be determined, so no date was obtained (Condie and Smith 1989).

Two isolated late Paleoindian Cody complex artifacts have been reported from the Galisteo Basin (Honea 1971; Lang 1977), and Boyer (1987) reports an isolated Cody knife from the mountains south of Taos. The little evidence of Paleoindian occupation that has been found on the Pajarito Plateau is mostly restricted to isolated projectile points (Powers and Van Zandt 1999). Isolated Clovis, Folsom, Agate Basin, Milnesand, and Scottsbluff points have been found on the Pajarito Plateau and in the nearby Cochiti Reservoir district (Chapman and Biella 1979; Root and Harro 1993; Steen 1982; Traylor et al. 1990). Though no Paleoindian sites have been identified in the study area, the presence of a handful of diagnostic artifacts indicates that Paleoindians were present in the Chama–Ojo Caliente Valleys. Anschuetz et al. (1985) note that isolated Clovis and Folsom points have been found in this region, and a secondarily deposited horizon of possible Paleoindian date was identified in the Abiquiu Reservoir area.

The paucity of Paleoindian remains through much of this area may be attributed to low visibility rather than lack of occupation. Paleoindian remains may be masked by later Archaic and Pueblo deposits. Poor visibility may also be attributed to geomorphology: surfaces or strata containing Paleoindian remains may be deeply buried and only visible in settings where these deposits are exposed. Cordell (1978) contends that the locations of known Paleoindian sites correspond to the areas of New Mexico where erosion has exposed ancient soil surfaces. If so, it may not be surprising that Paleoindian sites have not been found in the Tewa Basin and the study area, which are areas of regional soil accumulation and only local erosion.

Archaic Period (5500 B.C.–A.D. 600)

At an early date, archaeologists realized that the Archaic occupation of northern New Mexico was in many ways distinct from that of its southern neighbor, the Cochise. Bryan and Toulouse (1943) were the first to separate the northern Archaic from the Cochise, basing their definition of the San José complex on materials found in dunes near Grants, New Mexico. Irwin-Williams (1973, 1979) defined the northern Archaic as the Oshara tradition, and investigations along the Arroyo Cuervo in north-central New Mexico allowed her to tentatively formalize its developmental sequence. However, in applying that chronology outside the area in which it was developed, one must realize that specific trends might not occur throughout the Oshara region. Thus, at least some variation from one region to another should be expected.

The Oshara tradition is divided into five phases: Jay (5500 to 4800 B.C.), Bajada (4800 to 3200 B.C.), San José (3200 to 1800 B.C.), Armijo (1800 to 800 B.C.), and En Medio (800 B.C. to A.D. 400 or 600). Jay and Bajada sites are usually small camps occupied by microbands for short periods of time (Moore 1980; Vierra 1980). The population was probably grouped into small, highly mobile nuclear or extended families during these phases. San José sites are larger and more common than those of earlier phases, which may suggest population growth. Ground stone tools are common at San José sites, suggesting a significant dietary reliance on grass seeds. Irwin-Williams (1973) feels that corn horticulture was introduced by the beginning of the Armijo phase ca. 1800 B.C. Others (Berry 1982; Wills 1988) feel that corn did not appear in the Southwest until somewhat later, perhaps no earlier than 1,000 B.C. Base camps occupied by macrobands appeared by the late Armijo phase, providing the first evidence of a seasonal pattern of population aggregation and dispersal.

The En Medio phase corresponds to Basketmaker II elsewhere and represents the transition from a nomadic hunter-gatherer pattern to a seasonally sedentary lifestyle combining hunting and gathering with some reliance on corn horticulture. During this phase the population again seems to have increased. Seasonally occupied canyon-head home base camps became more numerous and began occurring in previously unoccupied locations (Irwin-Williams and Tompkins 1968). A strongly seasonal pattern of population aggregation and dispersal seems likely, with a period of maximum social interaction at home base camps followed by a breakup into microbands occupying smaller camps in other locations. While some corn was grown during this period, there does not seem to have been a high degree of dependence upon horticulture, and the population mostly subsisted on foods obtained by hunting and gathering.

Variation from this pattern occurred in southeast Utah, where Basketmaker II people appear to have been nearly sedentary and highly dependent on corn (Matson 1991). Similarly, during the late San Pedro phase in southeast Arizona (which corresponds to Basketmaker II in many ways), nearly sedentary villages dependent on corn agriculture appear to have existed (Roth 1996). Thus, in many areas of the Southwest the Archaic was coming to an end during this period. Northern New Mexico varied from this pattern, and no sedentary preceramic villages have been identified in that region. While the Archaic ended around A.D. 400 in northwest New Mexico when pottery and the bow were introduced and a shift was made to a more sedentary agricultural subsistence system, this process seems to have occurred later in the Northern Rio Grande. There, the Archaic is thought to have ended around A.D. 600 in some areas and even later in others.

The Northern Rio Grande Archaic may or may not be related to Irwin-Williams's Oshara Tradition. Projectile points illustrated by Renaud (1942, 1946) resemble the Jay, Bajada, and San José types commonly attributed to the Oshara. Cordell (1979) compared Archaic remains from the Northern Rio Grande to those in the Arroyo Cuervo district and saw many similarities. However, similar Archaic point styles occur over a vast region stretching from California to Texas and northern Mexico to the southern Great Plains, so stylistic resemblance cannot always be taken as evidence of similar cultural affinity. Subsequent cultural developments along the Northern Rio Grande suggest that the people in this area differed from those occupying the traditional Pueblo heartland in the Four Corner's region. Those differences quite likely had their basis in the makeup of the Archaic populations that originally settled these regions. Thus, a similarity in projectile point styles does not necessarily mean that the Northern Rio Grande and Four Corner's areas were occupied by groups of common cultural or even linguistic origin. Indeed, it is quite likely that they were not.

Most Archaic sites found in the Santa Fe area and Tewa Basin date between the Bajada and En Medio phases, though Early and Middle Archaic sites tend to be rather rare. These occupations are generally represented by widely dispersed sites and isolated occurrences (Anschuetz and Viklund 1996; Doleman 1996; Lang 1992; Post 1996, 1999). Early and Middle Archaic assemblages represent brief occupations with an emphasis on hunting. Materials associated with these occupations are typically mixed with deposits of later temporal components. Early and Middle Archaic sites have been recorded along the Santa Fe River and its primary tributaries (Post 2004). Until recently, temporal information from this period was derived from obsidian hydration dating (Lang 1992). However, recent excavations in the Santa Fe area have identified thermal features that yielded radiocarbon dates between 6000 and 5000 B.C. (Anschuetz 1998; Larson and Dello-Russo 1997; Post 1999). The limited number of associated artifacts recovered by these excavations indicates brief occupations geared toward hunting by small, highly mobile groups.

Although several Middle Archaic sites have been identified in the Jemez Mountains (Larson and Dello-Russo 1997), archaeological evidence of Middle Archaic occupations in the Santa Fe area are rare. A single hafted San José scraper was identified at a site southeast of Santa Fe (Lang 1992). This tool was mixed with Late Archaic and Pueblo period materials, making it difficult to associate an obsidian hydration date with a discrete component of the chipped stone assemblage. The Las Campanas project identified a late San José phase site that yielded one temporally diagnostic projectile point, tool production debris, and ground stone artifacts (Post 1996). These artifacts were associated with one thermal feature, but no datable charcoal was obtained.

Recently, excavations along the Santa Fe Relief Route identified four Middle Archaic sites. Radiocarbon dates obtained from thermal features ranged between 3200 and 1800 B.C. Two sites contained shallow structures with associated chipped and ground stone artifacts (pers. comm., Stephen Post, 2000). Although associated materials were not abundant, they may indicate a longer and more formal site occupation than is visible at earlier sites (Post 1999).

Early and Middle Archaic sites seem to be rare in the Cochiti Reservoir area, just south of La Bajada Mesa. Chapman (1979:64) indicates that the only diagnostic artifacts reflecting use of that area during the Early or Middle Archaic were two bases of either Bajada or San José points. Otherwise, the types of projectile points and point fragments described during that survey suggest that the main Archaic use of that area occurred during the Armijo and En Medio phases (Chapman 1979:64). No domesticates were identified in flotation samples obtained from associated thermal features, but it should also be noted that only two seeds from samples taken on different sites were identified by this analysis (Chapman 1979:72), so preservation was quite bad.

Middle and Late Archaic sites are common in the lower Rio Chama basin, but most of the Archaic sites investigated in the Chama–Ojo Caliente area are in and around Abiquiu Reservoir. Schaafsma (1976, 1978) completed the first systematic research on the Archaic occupation of that area. Fifty-six Archaic sites were identified in his study, of which 13 were excavated. Most were simple scatters of chipped stone artifacts or isolated projectile points, but five were large base camps situated at the mouths of major drainages on the Rio Chama terrace. More recent work in this area has been completed by Bertram et al. (1989). Eighteen sites were investigated in this study, of which eight contained Archaic components. A Late Archaic occupation was suggested for four sites, all of which seem to have been reused at later times (Bertram 1989; Schutt et al. 1989). Middle to Late Archaic occupations were noted at five sites, and in some instances multiple occupations were suggested by the presence of diagnostic projectile points or obsidian hydration dates from various time periods (Bertram 1989; Schutt et al. 1989).

Anschuetz et al. (1985) note interesting regional variations in the distribution of Archaic sites in the lower Chama Valley. Tools associated with intensive food processing are rare or absent at sites near Abiquiu but are common at sites near the confluence of the Rio Chama and Rio Grande. They feel this demonstrates a differential pattern of seasonal use and exploitation from one end of the valley to the other. In addition to hunting and gathering activities, the Chama Valley also served as a source of Pedernal chert between the Paleoindian and Protohistoric periods. Though this material is abundant in Rio Chama and Rio Grande gravels, Pedernal chert was also quarried around Cerro Pedernal and Abiquiu Reservoir, and quarries in the former location were originally termed the Los Encinos Culture (Bryan 1939).

Late Archaic sites are fairly common in the Santa Fe area, and this is consistent with regional data (Acklen et al. 1997). An increase in sites during the Late Archaic may be due to changes in settlement and subsistence patterns occurring during the Armijo phase. Changes in settlement patterns include evidence of seasonal aggregation, longer periods of occupation, and use of a broader range of environmental settings. Subsistence changes include the adoption of horticulture, which has been identified at sites south of La Bajada Mesa. Armijo phase sites have been identified in the piedmont area around the Santa Fe River (Post 1996, 1999; Schmader 1994). These sites range from small foraging camps to larger base camps with shallow structures. Radiocarbon dates obtained from thermal features suggest they were occupied between 1750 and 900 B.C. (Post 1996, 2004; Schmader 1994).

An Archaic site at the edge of the Tewa Basin and Pajarito Plateau was occupied during the late Armijo or early En Medio phase (Moore 2001a). Excavations at LA 65006 indicated that it was reoccupied on several occasions and that during its main occupation the site served as a workshop for the manufacture of large general-purpose obsidian bifaces (Moore 2001a). Though a few corn pollen grains were recovered from this site, their context was unclear, since no macrobotanical evidence of corn was recovered. Indeed, a few kilometers south of LA 65006, Lent (1991) excavated a Late Archaic pit structure with an associated roofed activity area that dated between ca. 610 B.C. and A.D. 180, recovering absolutely no evidence for the use of domesticates.

En Medio phase sites are the most common evidence of Archaic occupation in the Santa Fe area. These sites are widely distributed across riverine, piedmont, foothill, and montane settings (Acklen et al. 1997; Kennedy 1998; Lang 1993; Miller and Wendorf 1955; Post 1996, 1997, 1999; Scheick 1991; Schmader 1994; Viklund 1988). This phase is represented by finds ranging from isolated occurrences to limited-activity sites to base camps with structures and formal features. Increased diversity in settlement pattern and site types suggest population increase, longer site occupations or reduced time between occupations, and truncated foraging range.

A wide range of En Medio phase habitation and special-activity sites have been identified north of La Bajada Mesa in the Santa Fe area and Tewa Basin. Although many of these sites contain structures, formal features, and grinding implements, evidence of horticulture is virtually absent. Excavation of Late Archaic sites at Las Campanas near Santa Fe (Post 1996) yielded projectile points diagnostic of the period between A.D. 500 and 850. This in addition to a lack of evidence for the use of horticulture during this period suggests that Archaic subsistence strategies may have continued to be used into the early or middle A.D. 900s north of La Bajada Mesa (Dickson 1979; McNutt 1969; Post 1996).

Pueblo Period (A.D. 600–1600)

The Pueblo period chronology follows the framework presented by Wendorf and Reed (1955), which subdivides the Pueblo period into the Developmental (A.D. 600–1200), Coalition (A.D. 1200–1325), and Classic (A.D. 1325–1600) periods. They further subdivide the Developmental and Coalition periods according to changes in pottery types and architectural characteristics. The Developmental period is divided into Early Developmental (A.D. 600–900) and Late Developmental (A.D. 900–1200), and the Coalition period into Pindi and Galisteo "stages." Although Wendorf and Reed (1955) coined names for these stages, they did not assign absolute dates, merely inferring them.

Modifications to the terminology and temporal divisions developed by Wendorf and Reed (1955) have been proposed by Wetherington (1968), McNutt (1969), and Dickson (1979). Wetherington assigned phase names to the periods in the Santa Fe and Taos districts and slightly modified the dates. McNutt renamed one period, preferring Colonization to Developmental, divided that period into "components," and changed the dates for the Coalition period. Dickson subdivided each period into three phases. Terminology aside, each of these researchers found a need to subdivide each period of the Pueblo occupation into early and late components, and one researcher introduced a middle component. Again, subdivisions were based on perceived changes in pottery types and architecture. For each researcher, these subdivisions may have been appropriate and useful for addressing the goals of their studies. For the purpose of this discussion, however, only the Developmental and Classic periods are divided into early and late subperiods.

Early Developmental Period (A.D. 600–900)

Early Developmental period sites dating before A.D. 800 are rare in the Northern Rio Grande. Although sites dating between A.D. 800 and 900 are more numerous, they are typically represented by limited-activity areas and small settlements (Wendorf and Reed 1955). Most reported Early Developmental sites are south of La Bajada Mesa, primarily in the Albuquerque area, and a few are reported at higher elevations along the Tesuque, Nambe, and Santa Fe drainages (Lang 1995; McNutt 1969; Peckham 1984; Skinner et al. 1980; Wendorf and Reed 1955). Early Developmental sites tend to be situated along low terraces overlooking primary and secondary tributaries of the Rio Grande. These locations may have been chosen for their access to water and farmland (Cordell 1978). Terrace locations may also have provided access to ecozones with a wide range of foraging resources (Anschuetz et al. 1997).

Early Developmental habitation sites typically contain one to three shallow, circular pit structures with little or no evidence of associated surface structures (Allen and McNutt 1955; Peckham 1954, 1957; Stuart and Gauthier 1981). One exception is a settlement north of Santa Fe that was identified by Lang (1995) and apparently contains between 5 and 20 structures. Unfortunately, the contemporaneity of the structures in this small settlement has not been established.

Excavation data indicate that a suite of construction methods were employed to build these early structures. Typically, structures were excavated up to 1 m below ground surface and were commonly 3 to 5 m in diameter. Walls were sometimes reinforced with vertical poles and adobe (Allen and McNutt 1955; Condie 1987, 1996; Hammack et al. 1983; Peckham 1954; Skinner et al. 1980). Walls, floors, and internal features commonly lacked plaster. Ventilators were placed on the east to southeast sides of these structures, but Peckham (1954) reported one on the north side of a structure. Common floor features include central hearths, ash-filled pits, upright "deflector" stones, ventilator complexes, ladder sockets, and four postholes. Other, less common floor features include small pits identified as sipapus, warming pits, pot rests, and subfloor pits of various sizes and depths (Allen and McNutt 1955; Condie 1987, 1996; Hammack et al. 1983; Peckham 1957).

Ceramics associated with Early Developmental sites include plain gray and brown wares, red-slipped brown wares, and San Marcial Black-on-white (Allen and McNutt 1955). These types persist through the Early Developmental period with the addition through time of neck-banded types similar to Alma Neckbanded and Kana'a Gray, as well as Kiatuthlanna Black-on-white, La Plata Black-on-red, and Abajo Red-on-orange (Wendorf and Reed 1955). The accumulation of pottery types and surface textures, as opposed to sequential types and textures, appears to be characteristic of the Developmental period, as well as of the Highland Mogollon area (Wilson et al. 1999).

The types of decorated pottery found at Developmental period sites might be indicative of cultural affiliation with peoples living to the west and northwest of the Northern Rio Grande region. However, Early Developmental inhabitants also obtained red and brown wares through trade with Mogollon peoples to the south and southwest (Cordell 1978). Although cultural affiliation may seem more secure in assemblages that are clearly dominated by specific ware groups, cultural affiliation is difficult to determine at Early Developmental sites that contain various percentages of gray, brown, and white wares.

No Early Developmental period sites have been found in the Chama–Ojo Caliente Valleys, and there is no evidence of a resident Pueblo population in that region during this period. Though some sites in the region are considered evidence of periodic temporary use of these valleys during the Early Developmental period, those assertions are generally based on projectile point styles rather than more temporally sensitive artifacts, like pottery (Moore 1992; Schaafsma 1976). In general, these are small corner-notched arrow points that are considered to have fallen out of use by about A.D. 900. However, this scenario is based on data from the Four Corners area, and the situation seems to have been quite different in the Northern Rio Grande. Indeed, Moore (2003) demonstrates that this type of point was manufactured into the seventeenth century in the Pecos area, and later in this report it is shown that they occur at several of our Late Classic period sites. This is similar to the accumulative pattern noted in the Highland Mogollon (Moore 1999a), where new point styles are added without replacing earlier types, resulting in a suite of projectile point styles at Late Pueblo sites. Thus, small corner-notched arrow points are probably not temporally sensitive in the Northern Rio Grande, and their presence cannot be taken as evidence of an Early Developmental period component.

Late Developmental Period

Late Developmental period sites have been identified from the Taos Valley south to the Albuquerque area. This period is marked by an increase in the number and size of residential sites, occupation of a wider range of environmental settings, and appearance of Kwahe'e Black-on-white (Cordell 1978; Mera 1935; Peckham 1984; Wendorf and Reed 1955; Wetherington 1968). Late Developmental residential sites expanded into higher elevations along the Rio Grande, Tesuque, Nambe, and Santa Fe drainages (Allen 1972; Ellis 1975; McNutt 1969; Peckham 1984; Skinner et al. 1980; Wendorf and Reed 1955). These sites are commonly located along low terraces overlooking the primary and secondary tributaries of these rivers, which provided access to water, farmland, and a variety of foraging resources (Anschuetz et al. 1997; Cordell 1978). Although Late Developmental sites are more common at higher elevations than are Early Developmental sites, there is little evidence of Late Developmental occupation on the Pajarito Plateau (Kohler 1990; Orcutt 1991; Steen 1977). Toward the middle of this period, the first Pueblo residential sites were established in the Taos district (Boyer 1997).

Late Developmental sites typically consist of a house group containing one or two pit structures, a shallow midden, and sometimes an associated surface structure containing 5 to 20 rooms

(Ellis 1975; Lange 1968; Peckham 1984; Stubbs 1954; Stuart and Gauthier 1981; Wendorf and Reed 1955). These house groups occur singly or in clusters that are sometimes considered to comprise a community (Anschuetz et al. 1997; Wendorf and Reed 1955). The Pojoaque Grant Site (LA 835) is often used as an example of one of these early communities. This site includes 20–22 house groups containing 10–20 rooms each, their associated pit structures, and a large kiva. However, all of these groups may not have been occupied contemporaneously. House groups are located along low ridges that trend southwest from a prominent sandstone mesita. Those built near the base of the mesita and near the great kiva appear to have been occupied by A.D. 900. Other groups seem to have been built at different times during the Late Developmental period.

An array of construction techniques has been identified in Late Developmental period residential sites (Ahlstrom 1985; Allen 1972; Boyer and Lakatos 1997; Ellis 1975; Lange 1968; McNutt 1969; Stubbs and Stallings 1953; Skinner et al. 1980). Surface structures are commonly constructed of adobe, and little evidence of actual masonry has been reported and is generally limited to stones incorporated into adobe walls or upright slabs used as foundations or footers for adobe walls (Lange 1968; McNutt 1969; Stubbs 1954). Contiguous rectangular rooms are most common, though subrectangular and D-shaped rooms are also reported. Floors are often unplastered, with a few reported examples of adobe, cobble, and slab floors (Ahlstrom 1985; Boyer and Lakatos 1997; Ellis 1975; McNutt 1969; Stubbs 1954; Skinner et al. 1980). Floor features are not common in surface rooms, and when present they typically include hearths and postholes.

Variety in size, shape, depth, and building techniques is typical of Late Developmental pit structures. Circular pit structures are most common, followed by subrectangular. Structure depths range from 0.3 to 2 m below ground surface, and they tend to be between 3 and 5 m in diameter. Surface structure wall treatments vary from the unplastered surface of the original pit excavation to multiple courses of adobe with or without rock, wattle and daub, upright slabs used as foundations, adobe reinforced with vertical poles, or combinations of these techniques (Allen and McNutt 1955; Boyer and Lakatos 1997; Lange 1968; Stubbs 1954; Stubbs and Stallings 1953). Floors range from compact use surfaces to well-prepared surfaces. Common floor features include central hearths, upright "deflector" stones, ash-filled pits, ventilator complexes, ladder sockets, and four postholes toward the interior of the structure. Other, less common floor features include sipapus, subfloor channels, pot rests, and subfloor pits of various sizes and depths. Ventilators were constructed by connecting the exterior vent shaft to the interior of the structure with a tunnel or narrow trench. Trenches were subsequently roofed using latillas, effectively creating a tunnel. Exteriors of shallow structures were connected to the interior through an opening in the wall. Ventilators were commonly oriented to the east and southeast (Allen and McNutt 1955; Boyer and Lakatos 1997; Lange 1968; Stubbs 1954; Stubbs and Stallings 1953).

Utility ware ceramics found at Late Developmental sites include types with corrugated and incised exteriors in addition to the plain gray, brown, and neck-banded types associated with the Early Developmental period. The array of decorated white wares includes types that were both imported and manufactured locally. Common types are Red Mesa Black-on-white, Gallup Black-on-white, Escavada Black-on-white, and Kwahe'e Black-on-white. Less common types include Socorro Black-on-white, Chupadero Black-on-white, Chaco Black-on-white, and Chuska Black-on-white (Allen 1972; Franklin 1992; Lange 1968; pers. comm., Peter McKenna, 2000). Although decorated red wares are present in Late Developmental assemblages, they occur in low frequencies and include types from the Upper San Juan, Tusayan, and Cibola regions.

The quantity of imported decorated pottery and appearance of Kwahe'e Black-on-white, a locally made type similar to white wares produced in the San Juan Basin region, is believed to illustrate a continued affiliation between the Northern Rio Grande and San Juan regions (Gladwin 1945; Mera 1935; Warren 1980; Wiseman and Olinger 1991). Although most of the imported decorated pottery types suggest a continued relationship with people to the west and northwest, Late Developmental peoples also obtained decorated pottery and brown utility wares from the Mogollon region to the south and southwest (Cordell 1978).

There is no direct evidence of use of the Chama–Ojo Caliente region during the Late Developmental period. The only artifact indicative of such use is a single Kwahe'e Black-on-white sherd recovered from Ku, a large village on the Rio del Oso that was occupied from the Coalition into the Classic period (Peckham 1981). This sherd is considered to represent an heirloom piece owned by an occupant of that village (Peckham 1981:131).

Coalition Period

The Coalition period is marked by three major changes: an increase in the number and size of residential sites, the use of surface rooms as domiciles rather than for storage as was common during the Late Developmental period, and a shift from mineral to vegetal-based paint for decorating pottery (Cordell 1978; Peckham 1984; Stuart and Gauthier 1981; Wendorf and Reed 1955). The apparent increase in number and size of residential sites during this period suggests population increase and an extension of the village-level community organization identified during the Late Developmental period. Areas like the Pajarito Plateau, which saw very limited use during the Late Developmental period, became a focus of occupation during the Coalition period, while areas like the Tewa Basin, which saw heavy use during the Developmental period, lost much of their population by A.D. 1200. The apparent increase in number of sites seems to be a function of the areas that have been investigated by archaeologists and points to the amount of work that has been done on the Pajarito Plateau as opposed to elsewhere in the Northern Rio Grande.

Coalition period sites are commonly at higher elevations along terraces or mesas overlooking the Rio Grande, Tesuque, Nambe, Santa Fe, and Chama drainages (Cordell 1978; Dickson 1979). These locations provided access to water, farmland, and a variety of foraging resources (Cordell 1978). Although residence at higher elevations provided reliable water and arable land, innovative methods were needed to produce crops in these cooler settings (Anschuetz et al. 1997), including intensification of water management and farming practices. The use of check dams, reservoirs, and gridded fields, especially during the later parts of this period and the succeeding Classic period, are examples of this intensification (Anschuetz 1998; Anschuetz et al. 1997; Maxwell and Anschuetz 1992; Moore 1981).

Coalition period residential units typically contain 10 to 20 surface rooms, one or two associated pit structures, and a shallow midden (Peckham 1984; Stuart and Gauthier 1981; Wendorf and Reed 1955). Surface structures often consist of small linear or L-shaped roomblocks oriented approximately north-south. These roomblocks are one to two rooms deep, with a pit structure or kiva incorporated into the roomblock or located to its east (Kohler 1990; Steen 1977, 1982; Worman 1967). Sites that exhibit this layout are generally considered to date to the early part of the Coalition period. Although most Coalition period sites are relatively small, some contain up to 200 ground-floor rooms (Stuart and Gauthier 1981) and are commonly U-shaped and oriented to the east, enclosing a plaza or plazas. Generally, large Coalition period sites with enclosed plazas are considered to date to the late part of the period (Steen 1977; Stuart and Gauthier 1981).

A variety of construction techniques was used to build Coalition period surface and subsurface structures. Walls of surface and subsurface structures were built from adobe with or without rock, masonry, or combinations of these techniques. Adobe construction incorporated unshaped tuff into adobe walls on the Pajarito Plateau (Kohler 1990; Steen 1977, 1982; Steen and Worman 1978; Worman 1967). Masonry walls usually consist of unshaped or cut tuff blocks mortared with adobe and sometimes chinked with small tuff fragments (Kohler 1990). The most common room shape is rectangular, though a few examples of subrectangular and D-shaped rooms have been reported (Kohler 1990; Steen 1977, 1982; Steen and Worman 1978; Worman 1967).

Variety in the size, shape, and depth of pit structures is common during the Coalition period. Circular pit structures are the most common type, followed by subrectangular. Pit structures range in depth from 0.3 to 2 m below ground surface, and they are commonly 3 to 5 m in diameter. Walls of pit structures were built with the same techniques that have been described for surface rooms. Common floor features include central hearths, upright "deflector" stones, ash-filled pits, ventilator complexes, and four post-holes toward the interior of structures. Other, less common floor features include sipapus, entryways, pot rests, and subfloor pits of various sizes and depths. Ventilators were built by connecting exterior vent shafts to the interior of the structure with a tunnel, though shallow structures were vented by an opening in the wall. Ventilators were most commonly oriented to the east and southeast (Kohler 1990; Steen 1977, 1982; Steen and Worman 1978; Stuart and Gauthier 1981; Stubbs and Stallings 1953; Wendorf and Reed 1955; Worman 1967).

Utility wares most commonly have corrugated, smeared corrugated, or plain exteriors, and more rarely have striated, incised, or tooled exteriors. Decorated white wares include Santa Fe Black-on-white, Galisteo Black-on-white, Wiyo Black-on-white, and very low percentages of Kwahe'e Black-on-white. Few trade wares are reported from Coalition period sites; those that are found tend to be White Mountain Redware (Kohler 1990; Steen 1977, 1982; Steen and Worman 1978; Worman 1967).

In the Santa Fe area, large villages like the Agua Fria School House Ruin (LA 2), LA 109, LA 117, LA 118, and LA 119 were established early in the Coalition period. Other large sites, such as Pindi (LA 1) and Tsogue (LA 742), seem to have been established during the Late Developmental period and grew rapidly during the Coalition period (Franklin 1992; Stubbs and Stallings 1953). The Coalition period also saw the first establishment of farming villages on the Pajarito Plateau (Crown et al. 1996; Orcutt 1991) and in the Galisteo Basin (Lang 1977). At the same time, the first permanent Pueblo population was becoming established in the Chama–Ojo Caliente region.

Though the Coalition period occupation of the study area has often been characterized as small-scale with residence in small villages, plenty of evidence suggests that this was not necessarily the case. Two medium-sized Coalition period villages have been excavated in the north part of the Chama Valley near Abiquiu Dam: Riana Ruin (Hibben 1937) and Palisade Ruin (Peckham 1981). These sites may be models for the initial Pueblo settlement of the Chama–Ojo Caliente frontier. The occupation of Palisade Ruin may have begun with the construction of one or more pit structures, one of which was later remodeled into a mealing room (Peckham 1981:139). Between 45 and 50 surface rooms were eventually built in a U shape around an east-oriented plaza that was closed by a palisade on its east side (Peckham 1981). Cutting dates of A.D. 1312 and 1314 indicate that construction of above-ground rooms began in the early fourteenth century, and occupation of this village was thought to have been fairly short (Peckham 1981). The ceramic assemblage from this site was dominated by varieties of Wiyo Black-on-white, and a small amount of Santa Fe Black-on-white also occurred.

Riana Ruin contained at least 23 surface rooms and one pit structure (Hibben 1937). Rooms were built in an L-shaped configuration oriented toward the southeast, where a small plaza was partly enclosed by the roomblock and partly by a low wall constructed of basalt boulders (Hibben 1937). Cutting dates from building timbers suggest that Riana was built around 1335 (Stallings 1937a), and it appears to have been short-lived, lasting perhaps no more than a dozen years (Hibben 1937). The ceramic assemblage from this site was dominated by Wiyo Black-on-white, though some pottery similar to Santa Fe Black-on-white was also identified.

Two larger Coalition period villages have also been identified in the Chama Valley. Leafwater Pueblo was partly excavated in the 1950s and is reported by Luebben (1953). This village probably contained more than 100 rooms, in places rising to at least two stories, and forms a trapezoid around an enclosed southeast-oriented plaza. Most of the pottery associated with the occupation of this village was Wiyo Black-on-white, though a small amount of a transitional form of Santa Fe Black-on-white was also identified (Luebben 1953:29). The presence of at least two pit structures, one occurring under rooms in the north part of the village, suggests that the initial occupation may have been by a small group that lived in temporary pit structures before and while the first surface rooms were under construction (Luebben 1953; Peckham 1981). The second of the larger Coalition period villages is Tsiping Ruin, just south of Palisade Ruin (Peckham 1981). This village was established around A.D. 1315 and was occupied into the mid-fourteenth century (Beal 1987; Peckham 1981).

More recently, surveys in the Chama Valley have recorded at least four medium to large Coalition period villages (discussed and summarized in Anschuetz 1998:219–220), as well as numerous other sites. Maestas Pueblo (LA 90844) and AR-03-10-06-1230 have ceramic assemblages dominated by Santa Fe Black-on-white and were most likely built in the thirteenth century during the early part of the Coalition period. These early villages contain between 100 and 200 rooms. Maestas Pueblo is a multistoried quadrangular village with two small plazas and two possible pit structure depressions in the Rio del Oso Valley. AR-03-10-06-1230 is a linear pueblo with multiple pit structures just west of the Classic period village of Poshu'ouinge. The other two recently located villages have ceramic assemblages that contain both Wiyo Black-on-white and Santa Fe Black-on-white. LA 98319 is made up of two linear roomblocks and contains more than 100 rooms. AR-03-10-06-1231 is a compact village of about 40 rooms arranged in a quadrangular pattern, with associated cobble-bordered farming plots.

The survey that identified Maestas Pueblo also documented a sizable Coalition period occupation, which may have begun in the thirteenth century (Anschuetz 1998:273–274). Santa Fe Black-on-white was recorded at over half (n=125; 51.7 percent) of the prehistoric Pueblo sites identified by this survey, including nearly 60 percent (n=31) of the architectural sites. Santa Fe Black-on-white was found at all seven of the largest habitation sites, including Pesedeuinge, Leafwater, Maestas Pueblo, and Te'ewi. Some evidence of the use of intensive agricultural methods during the Coalition period was also identified.

In addition to these "pure" Coalition period villages, evidence of earlier components containing mixtures of Santa Fe Black-on-white and Wiyo Black-on-white has been found beneath several of the large Classic period villages in this region. During the excavation of Te'ewi at the confluence of the Rio del Oso and the Rio Chama, Wendorf (1953a) found a concentration of Santa Fe Black-on-white and Wiyo Black-on-white in two roomblocks adjacent to the southwest corner of the north plaza and felt that this represented the earliest section of the village. Bugé (1978) uncovered evidence of a Coalition period structure under Ponsipa'akeri in the Ojo Caliente Valley. A similar date is suggested for housemounds at the west end of Tsama near the confluence of El Rito Creek and the Rio Chama (Archaeological Conservancy 1996:3, cited in Anschuetz 1998:220). Beal (1987) notes that Coalition period occupations also underlie the villages of Hupobi and Sapawe, the former in the Ojo Caliente Valley, and the latter along El Rito Creek in the Rio Chama drainage.

Thus, there is now a substantial body of evidence of a Coalition period occupation in the Chama and Ojo Caliente Valleys. Villages like Maestas Pueblo and AR-03-10-06-1230 represent fairly substantial early Coalition occupations that seem to have begun and ended during the thirteenth century. Villages like Palisade and Riana represent comparatively small, short-lived late Coalition residential sites that failed and were abandoned in a generation or less. Leafwater, LA 98319, and AR-03-10-06-1231 are late Coalition villages that held much larger populations and were probably occupied for substantially longer periods. Tsiping is similar to these sites, but unlike them was occupied into the Early Classic period. For some reason all of these villages failed and were abandoned before the period of highest population density in the valley. However, not all Coalition period settlements were abandoned before this time. Coalition period ceramics have been found at six of the large Classic period villages in the Chama and Ojo Caliente Valleys and probably indicate the initial founding dates for those villages. It is also likely that excavations at many of the other large Classic period villages in this region would identify similar deposits, indicating initial construction during the Coalition period and survival into the Classic period.

Classic Period

Wendorf and Reed (1955:53) characterize the Classic period as "a time of general cultural fluorescence." Occupation shifted away from the uplands and began to concentrate along the Rio Grande, Rio Chama, Rio Ojo Caliente, and Rio Santa Cruz, as well as in the Galisteo Basin. Large villages containing multiple plazas and roomblocks were built, and regional populations peaked. The construction of large, multiplaza communities superseded the village-level community organization of the Late Developmental and Coalition periods. In the Santa Fe area, large villages like the Agua Fria School House Ruin (LA 2), Arroyo Hondo (LA 12), Cieneguilla (LA 16), LA 118, LA 119, and Building Period 3 at Pindi (LA 1) flourished during the early part of this period. Although these large villages grew rapidly during the Early Classic period, only Cieneguilla remained occupied after A.D. 1425.

Regional ceramic trends shifted to the use of carbon-painted biscuit wares in the northern part of this region, including the Tewa Basin, northern Pajarito Plateau, and the Chama–Ojo Caliente area. Polychrome glaze wares were dominant in the southern part of the region, including the Galisteo Basin and southern Pajarito Plateau. The Santa Fe area essentially marked this division in pottery styles. Biscuit wares were produced to the north and glaze wares to the south. Although reasons for the appearance and proliferation of glaze-painted pottery are ambiguous, many researchers believe it developed from White Mountain Redware. Similarities between types in the two regions are viewed as evidence of large-scale immigration into the Northern Rio Grande from the Zuni region and the San Juan Basin (Hewett 1953; Mera 1935, 1940; Reed 1949; Stubbs and Stallings 1953; Wendorf and Reed 1955). Other researchers attribute the changes seen during this period to expanding indigenous populations (Steen 1977) or the arrival of populations from the Jornada branch of the Mogollon in the south (Schaafsma and Schaafsma 1974).

For whatever reason, this was a time of village reorganization. Older sections of sites like Pindi and Arroyo Hondo were reoccupied (Lang and Scheick 1989; Stubbs and Stallings 1953). Intercommunity changes are also suggested by decreasing kiva-to-room ratios (Stuart and Gauthier 1981) and the revival of circular subterranean pit structures with an assemblage of floor features reminiscent of the Late Developmental period (Peckham 1984). Clearly defined plaza space and "big kivas" (Peckham 1984:280) suggest social organization that required centrally located communal space, which may have been used to integrate aggregated populations through ritual (Adams 1991).

The need for defined communal space may also be related to the introduction of the Kachina Cult into the Northern Rio Grande during this period (Adams 1991; Schaafsma and Schaafsma 1974). A shift from geometric designs to masked figures and horned serpents in kiva murals and the occurrence of shield-bearing anthropomorphic rock art figures suggest the acceptance of new ideological concepts (Adams 1991; Dutton 1963; Hayes et al. 1981; Schaafsma 1992). Changes in community structure and settlement patterns during the Classic period may reflect adaptation of the indigenous inhabitants of the region to new populations, ideological elements, and organizational systems.

The process of aggregation into large villages and movement to areas bordering major streams continued through the Classic period in the Northern Rio Grande. Population decline began in the Early Classic period on the Pajarito Plateau and continued through the middle of the period (Orcutt 1991). Most of the large villages in that area were abandoned by 1550, though some continued to be occupied into the Late Classic period between 1550 and 1600 (Orcutt 1991). This population seems to have moved into the Rio Grande Valley. Keres villages like Santo Domingo and Cochiti claim affinity with Classic period villages in the southern Pajarito Plateau, and Tewa villages like San Ildefonso and Santa Clara claim affinity with Classic period villages in the northern Pajarito Plateau.

At least 16 large villages were occupied in the Chama–Ojo Caliente region during the Classic period, and 15 have Tewa names and are considered ancestral to existing villages. Of these villages, Leafwater (Kap) was abandoned in the Coalition period, and Tsiping was abandoned early in the Classic period. Most of the rest were occupied until nearly A.D. 1540, though Mera (1934) suggests that the absence of Sankawi Black-on-cream and late glaze wares at many of them indicates that they were abandoned by A.D. 1500. Only five villages—Sapawe, Psere, Te'ewi, Ku, and Tsama—may have been occupied as late as 1598 to 1620 (Schroeder 1979; Schroeder and Matson 1965). Euroamerican materials, including sheep and cattle bones and metal recovered from Sapawe and Tsama, represent direct evidence of occupation into the historic period (Ellis 1975).

The Chama Valley was abandoned by

Pueblos as a residential area by A.D. 1620 at the latest. That population moved into the Rio Grande Valley, either joining with or forming some of the existing Tewa villages. Residents of San Juan Pueblo consider Homayo, Howiri, and Posi'ouinge to be ancestral (Bandelier 1892:50; Ortiz 1979). Sapawe is also claimed as ancestral by some Tewas (Bandelier 1892:53). Jeançon (1923:76) reports traditions at San Juan and Santa Clara Pueblos that mention migration from the Chama Valley to their villages.

Chapter 4. Overview of the Historic Period

James L. Moore

By tradition, the Ojo Caliente Valley was part of the region occupied by the northern Tewas, and is often considered part of the Rio Chama drainage system. Harrington (1916) recorded Tewa names for most of the large abandoned pueblos in these valleys, which they consider ancestral. Indeed, the hot spring near Posi'ouinge in the Ojo Caliente Valley is thought to be the home of the grandmother of Poseyemu, the Tewa culture hero (Harrington 1916; Parsons 1926). Few of these villages appear to have been occupied when the Spaniards first entered New Mexico, and the northern Tewa population seems to have been mostly concentrated in the Tewa Basin by that time.

Castañeda's chronicle of the Coronado expedition of 1540 to 1542 mentions that the people of the province of Yuqueyunque (or northern Tewa) had "four very strong villages in a rough country, where it was impossible for horses to go" (Winship 1896:137). These villages were not visited by Coronado, and Schroeder (1979:250) believes they were in the Chama Valley and may have included the ancestral Tewa pueblos of Sapawi, Psere, Te'ewi, Ku, or Tsama. The rough country mentioned by Castañeda could have been a reference to the northern Pajarito Plateau, which was also occupied by ancestral Tewas, but since recent research suggests that the large Tewa villages on the Pajarito Plateau were abandoned by the end of the Middle Classic period, ca. A.D. 1400 to 1500 (Preucel 1987), this is unlikely. If Schroeder is correct in placing all of these villages in the Chama Valley, then the Ojo Caliente Valley was abandoned by the Tewas by the early 1500s. However, since no one from Coronado's expedition visited these villages and their names were not recorded, there is no real evidence that only the Chama Valley was occupied at that time. Thus, it is possible that the northern Tewas occupied both valleys until nearly 1600.

Schroeder and Matson (1965:129–134) suggest that most of the Tewa villages in the Chama–Ojo Caliente drainages were abandoned by the time Castaño de Sosa visited nearly all of the existing northern Tewa villages in 1590–1591. They suggest that the village of Te'ewi in the Chama Valley may have been visited by de Sosa's expedition, otherwise the northern Tewas seem to have been concentrated in the Tewa Basin by this time. Spanish explorers encountered at least eight villages in the Tewa Basin including San Gabriel (Yunque), San Ildefonso (Powhoge), Santa Clara (Kapo), San Juan (Ohke), Jacona, Tesuque, Nambe, and Cuyamunge.

Documents related to Juan de Oñate's colonizing expedition in 1598 provide a confused list of villages in the Tewa area (Hammond and Rey 1953:346). The list seems both incomplete and includes names that are not mentioned for this area by any other expedition. Five of the eight historically known northern Tewa villages are listed, including Tesuque (possibly), San Ildefonso, Santa Clara, San Juan, and San Gabriel, as are possible versions of names for Tsirege and Tsama, which are considered ancestral by the Tewas but were abandoned by at least the early 1600s (Schroeder 1979:250). Five other villages are listed in the Tewa district, but their names are suspiciously similar to those of several southern Tiwa pueblos (Schroeder 1979:250). This may represent a clerical error, since these names are not associated with the Tewas in other documents.

Eight villages were occupied by the Tewas in the 1620s, as noted by Fray Alonso de Benavides in his Memorial of 1630 (Ayer 1916). People from other northern Tewa pueblos probably joined these villages, either voluntarily as part of a continuing process of population movement out of the Chama–Ojo Caliente drainages and off the Pajarito Plateau, or because of forced resettlement as part of the Spanish policy of combining villages to make governing them easier. Two Tewa villages—Jacona and Cuyamunge—were abandoned after the Pueblo Rebellion of 1696 and were never resettled. The six remaining villages were inhabited through the Spanish period and continue to exist to the present day, interacting with the European populations that moved into the region. No formal Tewa occupation of the Ojo Caliente Valley can be documented after about 1598, when the first European colony was established in New Mexico.

The historic period in New Mexico began with the entrance of the first Spanish exploring expedition into the region in 1540. Several methods have been used to divide the European occupation into shorter periods. One of the most common methods is to divide the history of the region into politically based periods, including Protohistoric (1540 to 1598), Spanish Colonial (1598 to 1821), Mexican Territorial (1821 to 1846), American Territorial (1846 to 1912), and Statehood (1912 to present). This overview takes a somewhat different approach and partitions the historic period by changes in economy and transportation methods. Thus, we divide the historic occupation of New Mexico into the Exploration period (1540 to 1598), early Spanish Colonial period (1598 to 1680), Pueblo Revolt period (1680 to 1693), late Spanish Colonial period (1693 to 1821), Santa Fe Trail period (1821 to 1880), and Railroad period (1880 to present).

Exploration Period (1539 to 1598)

Based on information gathered by Alvar Nuñez Cabeza de Vaca and his companions following the disastrous Narváez expedition to Florida (Covey 1990), the Spanish Empire became interested in lands north of New Spain in the 1530s. Fray Marcos de Niza was dispatched on a scouting mission into the Southwest in 1539, and a major expedition under Francisco Vázquez de Coronado explored the region between 1540 and 1542. No other formal contact between New Spain and New Mexico occurred until 1581, when Father Agustín Rodríguez and Captain Francisco Sánchez Chamuscado led an expedition up the Rio Grande to the Pueblo country (Hammond and Rey 1966). Ostensibly to rescue two priests left by the Rodríguez-Chamuscado expedition, Antonio de Espejo led a party into New Mexico in 1582. Gaspar Castaño de Sosa attempted to illegally found a colony in 1590–91 but was arrested and returned to Mexico (Simmons 1979). A second illegal attempt at colonization was made by Francisco de Legua Bonilla and Antonio Gutiérrez de Humaña in 1593, but their party was decimated as a result of conflict with Indians (Hammond and Rey 1953).

Early Spanish Colonial Period (1598 to 1680)

Oñate established the first legal and successful European colony in New Mexico at San Juan Pueblo in 1598. By 1600 the Spaniards had moved into San Gabriel del Yunque, sister village to San Juan, which was abandoned for their use by its residents (Ellis 1987). The lack of visible wealth in the new province caused unrest among the Spaniards (Espinosa 1988:7), many of whom seem to have accepted the challenge of establishing the new colony because they thought they would soon get rich. This unrest in addition to Oñate's neglect of the colony while on frequent journeys of exploration eventually contributed to his loss of the governorship. Oñate was replaced as governor in 1607 by Pedro de Peralta, who arrived in New Mexico in 1609 and moved the capital to Santa Fe, which he founded around 1610 (Simmons 1979).

Oñate's colony was a disappointment because of its failure to find the wealth that was expected to exist in New Mexico. Many settlers wanted to abandon the colony, and the government was seriously considering doing just that (Espinosa 1988:8–9). However, the baptism of 7,000 Pueblo Indians in 1608 and reports that many others were ready for conversion provided a viable alternative to an economically autonomous colony (Espinosa 1988:9). New Mexico was therefore allowed to continue, and its maintenance was almost entirely underwritten by the royal treasury (Simmons 1979:181). The colony was maintained as a mission area in the seventeenth century, its primary function being conversion of the Pueblos to Christianity. Because of this, the church was extraordinarily powerful and influential, causing considerable conflict with the secular government (Ellis 1971:30–31). Beginning in the 1640s this struggle weakened the Spaniards hold on the province (Simmons 1979:184).

Rather than furnishing a permanent military garrison for New Mexico, the Spanish government created a class of citizen-soldiers responsible for defense. As a reward for their services, these citizen-soldiers were given the right to collect an annual tribute from the pueblos—the *encomienda* system. The number of *encomenderos* was set at 35 (Espinosa 1988). In times of trouble, of course, all able-bodied citizens were liable for military service (Espinosa 1988:10). Pueblo Indians were also conscripted to serve as laborers on Spanish farms and haciendas under *repartimiento*, a system of forced labor that was designed to provide workers for Spanish holdings (Simmons 1979:182). While laborers were supposed to be paid for their work, abuses of the system were common, and the Spaniards often failed to compensate them (Simmons 1979:182–183).

Since New Mexico was primarily viewed as a mission effort, the secular population received little official support. The church in New Mexico was supplied by a caravan system, which was notoriously inefficient (Moorhead 1958). While caravans were theoretically scheduled for every three years, as many as five or six years often passed between deliveries (Moorhead 1958; Scholes 1930). However, Ivey (1993:41) indicates that even with irregularities there was an average of only three years between caravan arrivals through most of the seventeenth century. Still, irregular supply at fairly long intervals led to serious shortages of important supplies such as metal and kept the cost of manufactured goods high.

Supplies carried by the caravans were meant for support of the missions, though at times goods were also carried north for profit (Hackett 1937; Moorhead 1958). This was especially true of the years between 1664 and 1671, when the caravan passed out of the church's control and was contracted to Don Juan Manso. Apparently, Manso used up to half of the wagons to carry goods for sale in New Mexico (Scholes 1930). According to Ivey's (1993:44) calculations, the supply caravans each carried more than 80 tons of goods—quite a bit of material—that included durable goods as well as foods and cloth. Products shipped out of New Mexico by the missions provided income that enabled them to purchase luxury items that would not otherwise have been available (Ivey 1993:46).

In addition to shipments controlled by the missions and governors, private trade over the Camino Real also occurred. A fairly wide variety of goods moved in both directions: "Imports represent practical, utilitarian tools, equipment, household items, and a range of luxury goods, primarily clothing and textiles. The latter consisted of materials made in New Spain as well as yard goods imported from Europe and China. In return, New Mexicans sold coarse, locally made textiles and clothing (mostly stockings), hides, and aside from animals on the hoof, occasional subsistence foods locally produced" (Snow 1993:141). Most pottery used for domestic purposes was purchased from the Pueblos and Apaches. Majolica imported from Mexico was considered somewhat of a luxury, at least into the nineteenth century (Snow 1993:143). This was partly due to the cost of long-distance freighting. However, it was still cheaper than Chinese porcelain and, initially, English ironstone (Snow 1993:143). While the markup on majolica was not as great as might be expected (Snow 1993:143), manipulation of the New Mexican monetary system by Chihuahuan merchants probably assured them of considerable profit and kept the price of imported pottery high when compared to locally produced Pueblo wares.

On the civilian side, the seventeenth-century upper class was mainly comprised of the families of the governor and the 35 encomenderos (Scholes 1935; Snow 1983). Though governors were banned from engaging in trade, they often broke this regulation by sending goods south with the caravans or shipping them independently (Scholes 1935). The encomenderos were given the right to collect tribute from pueblos in lieu of salaries. An example of how this worked is Francisco Anaya Almazán, who at one time held half of the villages of Quarai and Picuris and all of La Cienega in encomienda (Snow 1983:355). The prestige of the encomenderos coupled with the requirement that they maintain a residence in Santa Fe raised them to a dominant position in the local government and economy (Anderson 1985:362). But not all encomenderos were equal, and a few dominant families formed the core of the upper class: "Their wealth was greater than that of families of lesser social standing; the best lands were theirs; they had greater opportunities to engage in trade; and they probably received the best encomiendas" (Scholes 1935:98). The Lucero de Godoy, Gómez, Domínguez de Mendoza, Romero, Baca, and Duran y Chávez families were among the most prominent in seventeenth-century New Mexico (Scholes 1935). This class was critical to the early Spanish Colonial economy. Not only did the encomenderos receive goods like cotton blankets and buffalo hides from Pueblos as tribute, they may also have acted as the upper level of a redistribution network based on kin ties or population clusters (Snow 1983:351).

Even with the tribute system and the ability to occasionally send goods south for sale in Mexico, the early Spanish Colonial economy was based on a stable barter system rather than hard cash (Snow 1983:348). Goods like corn, wheat, piñon nuts, hides, and cotton blankets were used in lieu of coinage, and the accumulation and shipment to Mexico of these products by governors and mission personnel seem to have done little to stimulate the local economy (Snow 1983:348).

Trade with the Plains Apaches was also an important source of income during this period and mostly occurred at Pueblos along the edge of Spanish New Mexico including Pecos, Taos, and the Salinas villages. Much of this trade was between the Pueblos and Apaches, but the Spaniards also exploited the relationship for goods that could be sold in Mexico. Slaves, an important trade commodity, were bought from the Apaches for resale to the mines of northern Mexico. The Spaniards often supplemented this source of slaves by raiding Apache villages during the seventeenth century. These raids antagonized both the Apaches and their Pueblo trading partners, and caused the former to unleash a series of devastating raids against the Spaniards and certain Pueblos in the 1660s and 1670s (Forbes 1960). Apache raiding, in turn, exacerbated the Pueblos' resentment of the Spaniards, sparking several rebellions that finally culminated in the general revolt of 1680.

Pueblo Revolt Period (1680 to 1693)

A combination of religious intolerance, forced labor, the extortion of tribute, and Apache raids led the Pueblo Indians to revolt in 1680, driving the Spanish colonists from New Mexico. The Pueblos resented Spanish attempts to supplant their traditional religion with Christianity, and numerous abuses of the encomienda and repartimiento systems fueled their unrest (Forbes 1960; Simmons 1979). These problems were further exacerbated by nomadic Indian attacks, either in retaliation for Spanish slave raids or because of drought-induced famine (Ellis 1971:52; Sando 1979:195). The colonists who survived the revolt retreated to El Paso del Norte, accompanied by the few Pueblo Indians who remained loyal to them.

Attempts at reconquest were made by Antonio de Otermín in 1681 and Domingo Jironza Petriz de Cruzate in 1689, but both failed (Ellis 1971). In 1692 Don Diego de Vargas negotiated the Spanish return, exploiting factionalism, which had again developed among the Pueblos (Ellis 1971:64; Simmons 1979:186). De Vargas returned to Santa Fe in 1693 and reestablished the colony. Hostilities continued until around 1700, but by the early years of the eighteenth century the Spaniards were again firmly in control.

Late Spanish Colonial Period (1693 to 1821)

Though failing in its attempt to throw off the Spanish yoke, the Pueblo Revolt caused many changes. The hated systems of tribute and forced labor were never formally reestablished, and the mission system was scaled down (Simmons 1979). The royal government continued to subsidize the province, but it now served as a buffer against the enemies of New Spain, not as a mission field (Bannon 1963). New Mexico was a distant province on the frontier of New Spain and continually suffered from a shortage of supplies while shielding the inner provinces from Plains Indian raids and the ambitions of the French in Louisiana. These aspects of frontier life are critical to an understanding of late Spanish Colonial New Mexico.

Relations between Spaniards and Pueblos became more cordial during this period. This was at least partly due to changes in the structure of both groups, as the Spanish population rapidly grew and finally surpassed that of the Pueblos by the late 1780s (Frank 1992). The increased number of Spaniards created demand for land in the Rio Grande core area, and a drop in the Pueblo population caused a shortage of cheap labor.

These trends resulted in a shift from large landholdings to smaller grants (Simmons 1969). A large labor force was no longer needed to work Spanish holdings, which was just as well because the demise of the repartimiento system meant that the Pueblos could no longer be forced to provide labor. Also contributing to this trend was an increased danger of attack by Plains Indians beginning in the early eighteenth century.

Spanish New Mexico was a frontier on the edge of New Spain during the Early Spanish Colonial period. This situation changed after 1700 as a core area developed around the social and economic center at Santa Fe. Other parts of New Mexico remained a frontier, though now they were centered on the core around Santa Fe rather than the merchant centers of Mexico. The development of New Mexico into a core and frontier was undoubtedly related to its physical separation from the primary core in Mexico, and because for so much of its history it essentially had to stand alone. While the local economy remained linked to the primary core in Mexico through a few wealthy families and merchants, New Mexico also developed an internal economy dominated by trade between the Spaniards and both Pueblo and Plains Indians. This is probably what led to the formation of what Frank (1992:17) has called "the dynamic folk culture and innovative elaboration of Spanish tradition" that prevailed in New Mexico. Separated from the mainstream economy and society, the territory generated its own versions of them.

While New Mexico developed into a secondary core and frontier during this period, it remained on the frontier of New Spain and continued to be dependent on the primary core. For much of the late Spanish Colonial period the secondary core seems to have included little more than the capital and its immediate environs, perhaps expanding a bit during periods of peace and contracting when hostilities resumed. It was not until late in the period that the core seems to have begun a steady expansion.

With the reconquest of New Mexico, much of the earlier economic system was abandoned. The dominance of the church and formal mission supply caravans eventually ended. The military role of the encomenderos was filled by regular presidial garrisons at Santa Fe and El Paso, and they were replaced as an economic force by families who prospered as merchants and/or by dealing sheep. However, most of the people who reoccupied New Mexico were poor farmers and herders.

By the middle of the eighteenth century a considerable trade had developed between New Mexico and Chihuahua (Athearn 1974), mostly to the benefit of the Chihuahuan merchants. This was documented by Father Juan Agustín de Morfí in 1778 (Simmons 1977). Not only did the Chihuahuan merchants inflate prices, they also invented an complex monetary system that was manipulated to increase profits (Simmons 1977:16). Though Frank (2000) suggests that the complexity of the monetary system described by Morfí was more closely related to a need to convert the value of bartered goods into pesos, the conversion rates still benefited the Chihuahuan merchants and kept most New Mexican merchants in debt. Thus, New Mexico was poorly supplied with goods sold at inflated prices. This problem was partly rectified by trading with local Indians for pottery, hides, and agricultural produce, and some goods were apparently manufactured by cottage industries. Unfortunately, many products had no local substitutes.

Metal, especially iron, was in short supply in New Mexico (Simmons and Turley 1980). Nearly all iron was imported from Spain, and colonial iron production was forbidden by royal policy to protect the monopoly enjoyed by Vizcaya (Simmons and Turley 1980:18). While imported iron was relatively cheap in Mexico, by the time it arrived on the New Mexico frontier it was quite costly. The supply of tools and weapons was limited by the lack of metal, and those that were produced were expensive. The lack of metal and the unreliable supply system hurt New Mexico in its role as a defensive buffer. Many accounts mention scarcities of firearms and other weapons (Kinnaird 1958; Miller 1975; Reeve 1960; Thomas 1940). In addition, only a few soldiers were stationed at the New Mexican presidios, forcing local authorities to use militias and other auxiliary troops. Continued conflict with nomadic Indians caused many settlements to adopt a defensive posture, and even individual ranches were built like fortresses.

By the 1730s, attempts were being made to reestablish the New Mexico sheep industry, and at least one shipment of wool was sent south by

1734 (Baxter 1987:26). In the following year, the governor embargoed all exports of wool, livestock, and grain, considering them harmful to the colony (Baxter 1987:26). A number of citizens petitioned the governor to lift the embargo, arguing that "trade in the forbidden commodities offered the only means available to purchase manufactured goods for themselves, their wives, and children" (Baxter 1987:27). Even so, the embargo remained in place, and the acquisition of manufactured goods continued to be difficult.

One of the most important developments in this period was the *partido* system, in which the owners of large numbers of sheep apportioned parts of their flocks out to shepherds, receiving the original animals and a percentage of the increase at the end of the contract period.

> Increased use of partido brought an increase in livestock numbers, but also added another dimension to the local economy. As multiplying flocks made management more difficult for their owners, partido provided a means of spreading responsibility and served as a substitute for wage payments in a region virtually without cash. . . . Partido offered advantages to merchants who accepted sheep in exchange for goods, and to widows or children who inherited flocks but were unable to manage them or sell them because of export regulations and the local cash shortage. (Baxter 1987:29)

By the mid-1750s the embargo on livestock trading seems to have been relaxed. A few traders managed to manipulate the system, which was dominated by merchants in Chihuahua, and had accumulated fortunes by this time. As Baxter (1987:44) notes, "Frequently allied by marriage ties, this little group of "haves" not only maintained a tight grip on New Mexico's economy, but increasingly dominated political and religious affairs as well. Usually, extensive livestock interests, cared for by dependent partiderios, provided the foundation for their growing wealth and set them apart from less affluent competitors." The development of wealthy *partiderios* and relaxation of the trade embargo should have set the stage for accelerated economic growth. Unfortunately, other factors intervened, slowing growth for several decades.

Between 1750 and 1785 New Mexico was hit by a defensive crisis caused by intense Plains Indian and Apache raids (Frank 1992, 2000). While New Mexico suffered from varying degrees of hostile Indian activity virtually from its founding (Forbes 1960), certain periods were worse than others. Attacks by Utes and Comanches began as early as 1716 with raids against Taos, the Tewa Pueblos, and Spanish settlements (Noyes 1993:11). In particular, the Comanches were bent upon driving the Apaches from the Plains and cutting their ties to the French colonies in Louisiana, from whom they were indirectly receiving firearms (Noyes 1993). In conjunction with this they raided Taos, Pecos, and Galisteo Pueblos—the villages that were most closely tied to the Apaches by trade. However, most of the Comanches' fury was directed against the Apaches during this period.

By 1740 the Apaches had been driven off the Plains or south of the Canadian River, and the Comanches were at peace with the Spaniards (Noyes 1993:24–25). This peace was short-lived, because by the mid-1740s the Comanches were mounting intensive raids against Pecos and Galisteo Pueblos, culminating in a series of devastating attacks against Spanish settlements east of the Rio Grande. These raids caused the temporary abandonment of many villages on the east edge of the colony from Albuquerque northward in the late 1740s (Carrillo 2004; Noyes 1993:25). While Governor Tomás Vélez Cachupín established short-lived periods of peace during his two terms of office (1749–54 and 1762–66), most of the years between 1750 and 1780 were marked by war with the Comanches (Noyes 1993).

Raiding by Athabaskans aggravated this situation. Apaches raided New Mexican settlements sporadically in the 1750s and 1760s. The latter period of hostility was apparently sparked by a severe drought in 1758 and 1759 (Frank 1992:39). A second drought in the 1770s caused a deterioration of the defensive abilities of the territory and led to a resumption of raids by the Navajos (Frank 1992:39–40). By the late 1770s, southern New Mexico was under attack by the Sierra Blanca, Mimbres, Gila, Natage, and Lipan Apaches (Thomas 1932:1). In alliance with the Navajos, the latter three groups even raided Zuni, Albuquerque, and nearby settlements (Thomas 1932:1).

During the early 1770s the government of King Carlos III began to rebuild its power in New Spain (Frank 1992, 2000). Solving the problem of Indian raids against the northern provinces was part of this process. The defenses of northern New Spain were reorganized beginning in 1772. Vigorous campaigning had driven the Apaches back by 1776, and a line of presidios was established (Frank 1992; Thomas 1932). Despite these successes, Indian raids continued to be a major problem. With the reorganization of northern New Spain into the Provincias Internas in 1776 came the development of a plan that eventually proved successful: "Established in 1776, Don Teodoro de Croix received the command of the Interior Provinces and arrived in Mexico City early in 1777 to take over his duties. In the few brief years, 1777–1783, that Croix served his king on this immense frontier, he found a solution for this Indian problem and held for all time the border line of Mexico against northern aggression" (Thomas 1932:14). According to Croix's plan, continual campaigns were to be undertaken against the Apaches from Nueva Vizcaya, Sonora, Coahuila, and New Mexico, and an alliance was to be sought with the Comanches against the Apaches (Thomas 1932:18–19). Governor Juan Bautista de Anza of New Mexico concluded a peace treaty with the Comanches in February 1786, which also allied the two nations against their common enemy, the Apaches (Noyes 1993:80; Thomas 1932:75). The Comanches and Utes reconciled their differences soon afterward and concluded a peace treaty (Thomas 1932:75). Later in the same year, Anza successfully broke up an alliance between the Gila Apaches and Navajos who had been plaguing settlements in southern Arizona, and concluded a peace with the Navajos (Thomas 1932:52). As Frank (1992:95) notes, these events

> brought New Mexico into an era of relative peace for the first time since mid-century. Although the province experienced continued occasional raids, nothing close to the frequency and magnitude of the Comanche and Apache raids of the 1770s occurred during the next quarter century. . . . Until the last years of Spanish rule, the alliance system erected to protect the northern provinces from Plains Indians hostility gave the inhabitants of New Mexico respite from the burden of their own defense and freed energies needed to improve the quality of other aspects [of] their lives on the frontier of New Spain.

Unfortunately, just as hostilities on the New Mexican frontier were ending, a second disaster hit. A major smallpox epidemic struck New Mexico in 1780–81, killing a large portion of the population (Frank 1992:64). While rising birth rates soon countered the immediate effects of the epidemic on the population, it had a much longer lasting effect on demography—the Hispanic population surpassed that of the Pueblos for the first time and held that position until the Anglo influx beginning in the second half of the nineteenth century (Frank 1992:64–65). The reduction of population may have concentrated capital at the same time that communications with Mexico over the Camino Real were freed up, and settlers gained the ability to open new lands without fear of Indian attack (Frank 1992:71). Thus, while in the short run the epidemic seriously disrupted New Mexico, in the long run it may have enhanced the province's ability to take advantage of the economic opportunities provided by the newly established peace.

Frank (1992:166) suggests that the juxtaposition of these trends created an economic boom between 1785 and 1815. Beginning in 1732, a 10-percent tithe was levied on New Mexico by the Bishop of Durango, and the right to collect it was auctioned for a flat annual fee (Frank 1992:168–169). Frank (1992:191) traces the economic boom through the value and competition for the tithe rental in New Mexico: "The increase in the real value of the tithe contracts represents a measurable and significant increase in the per capita production of the Vecino population of late colonial New Mexico. The rising value of the tithe rental signifies an active and expanding provincial economy during the last decades of colonial New Mexico."

At the same time the Hispanic population was expanding outward from the established settlement zone (Frank 1992:199). New Mexicans were founding a series of new frontiers as they moved into areas that had previously been closed because of the danger of Indian attack. The improving economic situation undoubtedly fueled this drive, since new lands were required to graze the continually increasing flocks of sheep that were the basis of wealth in the province.

Despite the improving economic situation, New Mexico still depended on shipments from the south to provide manufactured goods, particularly metal and cloth, that could not be produced locally. Caravans continued to supply New Mexico via the Camino Real. While they still followed an irregular schedule, by the middle of the eighteenth century they operated almost annually (Connor and Skaggs 1977:21). Since the ox-drawn wagons of the seventeenth century were eventually replaced by mule trains, it is likely that fewer goods were carried by the caravans (Connor and Skaggs 1977:21). There were apparently only a few New Mexican merchants, and they were exploited by their suppliers in Chihuahua, who managed to keep them in almost perpetual debt. Isolation and dependence on Chihuahua caused goods sold in Santa Fe to cost several times their original value (Connor and Skaggs 1977:21–22; Frank 1992:237–239).

While circulating cash is considered to have been nearly nonexistent in colonial New Mexico, Baxter (1987) notes several occasions on which relatively large sums of cash were used to pay taxes or purchase goods for shipment north. This indicates that hard cash did exist in New Mexico during this period but was concentrated in the hands of a few at the top of the economic ladder and rarely entered into local transactions. Barter continued to be used for the exchange of goods in New Mexico, and hard currency was reserved for purchasing goods for transport north (Frank 2000). Thus, economic conditions for most New Mexicans through the seventeenth and eighteenth centuries seem to have been rather dismal. The economy was controlled by small groups of wealthy families both before and after the Pueblo Revolt, who retained most of the profits realized through trade with Mexico. Some of this wealth trickled down from the upper class to the bulk of the Spanish population. During the seventeenth century this may have taken the form of a redistribution system in which goods collected as tribute from the pueblos found their way into the hands of the Spanish lower class. During the eighteenth century this was replaced by the partido system, which theoretically provided a means for poor Spanish settlers to better themselves.

No Spanish settlements are known to have existed in the Chama and Ojo Caliente drainages until the first half of the eighteenth century. This was primarily due to hostilities with Plains and Apache Indians, which effectively kept the Spanish-controlled section of New Mexico from expanding until that time. The upper Chama drainage and presumably the Ojo Caliente Valley were under Navajo control in the early 1700s. The Spaniards vigorously campaigned against the Navajos between 1705 and 1714 (Hendricks and Wilson 1996). Spanish settlers were finally beginning to enter the Chama and Ojo Caliente Valleys by the 1730s, but the region was devastated by Comanche and Ute raids in 1747, forcing the evacuation of villages and farms and a general retreat to Santa Cruz de la Cañada and San Juan Pueblo (Carrillo 2004). Nomadic Indian raids continued to be a problem, even after the area was resettled in 1750.

Santa Fe Trail Period (1821 to 1880)

Under the Treaty of Cordova, Mexico gained independence from Spain on August 24, 1821, and New Mexico became part of the Mexican nation. Mexican independence brought two major changes to New Mexico—a more lenient land grant policy and expansion of the trade network (Levine et al. 1985). Mexican colonial law and custom concerning settlers' rights was applied to New Mexico, resulting in conflict over ownership of lands held by the Pueblos. Trade between Missouri and Santa Fe began soon after independence and dominated the New Mexican economy for the next quarter century (Connor and Skaggs 1977). Trade with the United States brought ample and comparatively inexpensive goods to New Mexico and broke the Chihuahuan monopoly. This is reflected in the material culture of sites from this period, at which more manufactured goods occur than ever before.

Numerous expeditions into the recently acquired Louisiana Purchase brought American explorers and traders west from the Missouri River, eventually establishing the Santa Fe Trail. The first trading expedition to use this general route was that of William Becknell in 1821. The initial goal of Becknell's expedition was to trade with the Comanches, but they encountered some Mexican rangers and were persuaded to change their plans and trade in Santa Fe instead (Gregg 1844:13). Because of their favorable report, others soon followed. While the trail was officially opened in 1821, the amount of commerce moving over it to New Mexico was limited for the first several years of its existence, and there were only eight to ten expeditions between 1821 and 1824 (Connor and Skaggs 1977:34). Trade began in earnest after 1825, which is when the United States completed a survey of the trail to mark its route and secure safe passage through Indian Territory (Connor and Skaggs 1977).

The eastern terminus of the Santa Fe Trail was at Franklin, Missouri, until 1828. From that year on the trail began at the new town of Independence, Missouri (Connor and Skaggs 1977). Expeditions tended to leave in small groups and form up later at Council Grove, where they would elect leaders and agree on the rules to be followed (Connor and Skaggs 1977; Gregg 1844). Two main routes were used: the Mountain branch, which followed the Arkansas River to Bent's Fort before turning south, and the Cimarron branch, which crossed the Arkansas River between the south bend and present-day Dodge City and then headed southwest along the Cimarron River. The Cimarron branch (1,392 km from Franklin to Santa Fe) was shorter than the Mountain branch (1,463 km) (NPS 1990:14). After the move to Independence, the Cimarron branch was 1,212 km long, while the Mountain branch was 1,282 km long (NPS 1990:14). The Mountain branch was the more popular route during the early years of the trail but became less popular during the later years, even though it was an easier journey because of better water availability (Connor and Skaggs 1977).

Trade over the Santa Fe Trail expanded geographically to Chihuahua and in the volume of consumer goods transported until 1828, when factors like Indian raids, military escorts, and Mexican trade regulations caused notable fluctuations in the flow of commerce (Pratt and Snow 1988:296). The economic impact of such an extensive trade network may be hard to detect, but it is likely that local inhabitants were introduced to a wide variety of material goods that were previously impossible or too expensive to acquire (Pratt and Snow 1988:302).

The first ruts caused by traffic over the trail were seen after Becknell's second expedition to Santa Fe in 1822, in which goods were transported in three ox-drawn wagons (Connor and Skaggs 1977:33). Otherwise, most early expeditions carried goods on the backs of horses and mules (Connor and Skaggs 1977:35). Most of the later expeditions transported goods in wagons drawn by mules or oxen, which could carry much heavier loads, often traveling four wagons abreast to avoid being strung out for miles in hostile territory (Duffus 1930:137; Gregg 1844:24).

The Santa Fe trade was disrupted in the three years preceding the Mexican War (1846 to 1847) because of a Mexican embargo against American goods (Connor and Skaggs 1977:203). As a result of that conflict, New Mexico was seized by the United States in 1846. The years immediately following the acquisition of New Mexico by the United States were characterized by a growing interest in commerce and a market economy that demanded more dependable means of transportation (Pratt and Snow 1988). Long-distance stagecoach routes were established by 1850 to transport travelers and mail.

Trade again declined during the Civil War. A resurgence of trade over the Santa Fe Trail following the end of that war eventually sealed its doom (Connor and Skaggs 1977:204). Railroad promoters saw the possibilities of overland routes to the West and began developing their finances. The railroad reached Santa Fe by 1880, effectively bringing trade over the trail to an end, since it was much more cost-effective to ship goods by rail.

This period saw profound changes in the economic and ethnic structure of New Mexico. The movement of materials over the Santa Fe Trail meant that many goods that had been difficult or impossible to obtain during most of the Spanish periods could now be acquired. Initially, there seems to have been a lack of sufficient currency in both New Mexico and Chihuahua to support the Santa Fe trade (Connor and Skaggs 1977). However, records indicate that large amounts of raw materials were bartered in New Mexico and Chihuahua for the American goods, and without the barter system it is doubtful that the Santa Fe trade would have long survived (Connor and Skaggs 1977:200).

In addition to material goods, the Santa Fe trade also brought citizens from the United States to New Mexico. Most remained only a short while, but some settled down for good, entering into economic relationships with local merchants. This trickle became a flood when New Mexico was annexed by the United States in 1846. Eastern settlers came to New Mexico in increasing numbers seeking economic opportunity, and sometimes finding it.

The New Mexican economy underwent major changes during this period. The influx of eastern goods most likely disrupted the Spanish economic system. An indication of this may be the growth of pottery production by Spaniards from a rarity to a minor cottage industry. Spanish pottery production is questionable prior to 1821, except on rare occasions by a few individuals. After 1821 pottery appears to have been produced in numerous Hispanic villages, as suggested by Carrillo (1997). This may be a reflection of changes in the economic relationship between the Hispanic and Pueblo populations.

Before the Santa Fe trade began, Pueblos were dependent on Spanish traders for manufactured goods and metal. After the Santa Fe trade began, such goods became cheaper and more easily obtained, and Spanish traders no longer held a monopoly, especially after 1846. Pueblo pottery was an important, albeit inexpensive, commodity to the Spaniards. It was used for storing and cooking food, and in poorer households it was also used for serving food. The availability of abundant and comparatively cheap Euroamerican pottery from the East may have cut into Spanish demand for Pueblo pottery. At the same time, less pottery may have been available because of the altered supply of manufactured goods. Pueblo pottery may have become more difficult or expensive to acquire, providing a niche for disadvantaged Hispanics to enter.

Railroad Period (1880 to Present)

The arrival of the railroad significantly altered supply patterns in New Mexico. Rail lines reached New Mexico in 1878, when construction began in Raton Pass (Glover and McCall 1988:112). By 1879 the Atchison, Topeka & Santa Fe line was in Las Vegas, and by early 1880 it was completed to Lamy (Glover and McCall 1988). With this link to the eastern United States, New Mexico entered a period of economic growth and development, primarily in the larger urban areas (Pratt and Snow 1988:441). This linkage also ended New Mexico's long-term position as a frontier territory. It was now firmly linked to the economy of the United States as a whole. In addition to increasing the ease of supply to the region, it made New Mexico more accessible to tourism from the East, which soon became an important facet of the local economy.

With the availability of rapid and inexpensive transport, several industries boomed in New Mexico. While sheep and wool production expanded, the cattle industry was also stimulated and soon became the dominant ranching industry. Mining expanded into the early 1900s, and coal became an important export. The transformation of the New Mexican economy into its modern form was well under way by the time it became the forty-seventh state in 1912.

The arrival of the railroad created another major economic impact, one that rivaled the opening of the Santa Fe Trail in importance. Goods manufactured in the East could now be easily and cheaply transported to New Mexico, resulting in great changes in consumption patterns. While traditional Hispanic consumption patterns seem to have survived the changes in availability of manufactured goods that occurred when the Santa Fe Trail opened, they did not long survive the flood of goods carried by the railroad.

An example of this process is the use of Pueblo pottery for cooking and storage. This practice continued into at least the early Railroad period, as shown by the results of excavation at the Trujillo House and La Puente in the Chama Valley (Moore et al. 2004). Pueblo pottery, apparently supplemented by Hispanic-made wares, was used at these sites until at least the end of the nineteenth century. However, they were associated with large amounts of Euroamerican wares that seem to have mostly replaced the traditional Pueblo and Mexican wares used for serving and consuming food. As the Pueblos began producing increasing amounts of pottery for the tourist trade, their wares became more expensive. At the same time, alternative methods for cooking and storing food were becoming available. Eventually, the use of earthenwares for these purposes virtually disappeared.

Trade over the Santa Fe Trail represents the first erosion of the traditional New Mexican economy, which was mostly based on the barter of agrarian products and goods produced by individuals. Before that time there is little evidence of the circulation of money in New Mexico, and indeed the early Santa Fe traders complained that there was little hard cash in the territory, and what little was available was controlled by just a few families (Connor and Skaggs 1977). Even though much of the commerce conducted over the Santa Fe Trail continued to be based on barter, New Mexico in general was finally introduced to a cash economy. As the territory became integrated into the United States after 1846 and especially after the railroad arrived in 1880, New Mexico finally became fully integrated into the cash economy that dominated the rest of the North American continent.

Ojo Caliente

The Ojo Caliente area was officially settled by Spaniards in 1735 (Ebright 1994:26), part of a process of expansion that brought Spanish settlers into the Chama Valley as well. Fray Agustín de Morfí reported that there were 46 families at Ojo Caliente by 1744, and that the settlement had a chapel (Thomas 1932:94). Along with the Chama Valley, Ojo Caliente was hard hit when the Comanches and Utes began a series of major attacks against settlements along the eastern Spanish frontier in 1747, and in 1748 the settlers petitioned Governor Joaquín Codallos y Rabal for permission to move to a safer location (Adams and Chávez 1956:78; Quintana and Snow 1980:44; Swadesh 1974:35). This was intended to be a temporary measure, and by 1750 orders were issued to the refugees to reoccupy the region on pain of surrendering their grants (Swadesh 1974). However, few settlers returned to the area, and even fewer stayed (Quintana and Snow 1980:44). Juan Muñíz was one of the exceptions, and he reoccupied his grant in 1752 to avoid losing it and opening himself to prosecution for desertion (Swadesh 1974:42). Baxter (1987:45) also notes that an estate inventory from around 1762 mentioned "substantial numbers of partido cattle and sheep at Ojo Caliente in the Rio Arriba," indicating that others were also living in the region.

By 1766 most of the area still was not resettled, and Governor Cachupín reverted grants in the Ojo Caliente area to the Crown, and reopened them to other settlers (Simmons 1968:79). The area was not officially reoccupied until 1768–69, when 53 families returned with grants issued by Governor Cachupín (Adams and Chávez 1956:78; Frank 2000:43). Among the grants made at this time were at least two to Genízaros—in 1768, 13 Genízaros received a grant for a settlement on the land of Juana de Herrera, and in 1769, 22 Genízaros were granted land for a settlement above the hot spring.

By 1770 the new settlers had been attacked by Comanches at least three times, including one occasion where 500 warriors were led against them by Cuerno Verde, one of the Comanche's greatest chieftains of the time (Noyes 1993). Rather than having built a defensible village, the settlers were apparently living in houses scattered through the valley. Governor Pedro Fermín de Mendinueta ordered the inhabitants of Ojo Caliente to build a more defensible community, but the settlers preferred to abandon the region and began to do so in 1770 (Frank 2000:49, 244, n. 55). Ojo Caliente remained abandoned in the Domínguez report of 1776, where it is noted that some of the furnishings from the chapel had been temporarily transferred to Santa Cruz de la Cañada (Adams and Chávez 1956:78–79). Annotations on the Miera y Pacheco maps of 1779 note that the settlements in the Ojo Caliente Valley were "ruined by the enemy Comanche" (Frank 2000:43). An army led by Governor Anza camped at the deserted settlement of Ojo Caliente in August 1779 en route to a decisive victory over the Comanches in which Cuerno Verde was slain (Noyes 1993). Even with this victory, the period of conflict did not end until 1786, when Governor Anza concluded a lasting peace through an alliance with the Comanches against the Apaches and Navajos (Frank 2000; Thomas 1932).

The Ojo Caliente Valley was a dangerous location for settlement during most of the Spanish Colonial period because it was one of the primary routes followed by raiding Comanches and Kiowas into Spanish New Mexico (Frank 2000:43; Swadesh 1974:40). As Frank (2000:43) notes, "The elimination of Ojo Caliente afforded raiding parties traveling from the north easier access to carry out raids on Abiquiu, Chama, and the jurisdiction of Santa Cruz de la Cañada." Thus, until peace was concluded with the Comanches in 1786, it was nearly impossible to establish a stable community in the valley, especially considering the Spanish settlers' reluctance to construct a defendable village rather than live in scattered ranchos. Swadesh (1974:40) notes that Genízaros were repeatedly granted lands in the Ojo Caliente Valley, only to be driven out.

Safe, stable settlements were impossible to establish in the Ojo Caliente Valley until after Anza concluded his peace with the Comanches in 1786. Reduced conflict with Plains Indians after that event allowed the valley to be safely resettled and the resident population to expand. By the end of the Spanish Colonial period in 1821, settlement had spread north into the aptly named Cañada de los Comanches, where numerous families lived in at least two villages in that area (Swadesh 1974:55). Freedom from Spain resulted in many legal changes in the status of Indians and Genízaros. When the latter were given formal citizen status, their grants were broken up and lands were distributed in severalty to the Genízaro families. As Swadesh (1974:54) notes, this process was accomplished with few complications at Ojo Caliente because the lands had been regranted so often that the Genízaro grants had lost the special status usually accorded them. Other than a few scattered artifacts, no remains from this early period of history in the Ojo Caliente Valley were encountered during this study. A more detailed account of the later history of the area is presented in Chapter 25.

Chapter 5. Problem Domains and Field Methods

James L. Moore

Problem domains for most of the sites examined during this study were developed by Wiseman and Ware (1996). These questions were not modified when two more sites—LA 118547 and LA 118549—were added to the scope of this study. LA 118547 can be easily placed under the umbrella of the existing problem domains, since it is a farming site very similar in age and structure to eight of the sites already scheduled for data recovery. Unfortunately, LA 118549 did not fit into the existing project structure as easily. LA 118549 is a trail that runs through most of the project area and continues south beyond project limits. Trail segments paralleled most of the farming sites examined during this project, so it was possible to partly integrate our study of the trail into the investigation of those adjacent sites. However, a very different approach was needed to provide adequate descriptions of the trail and enough data to place it in the proper perspective.

The first section of this chapter presents the problem domains the project was structured to address and is mostly taken from the research design developed by Wiseman and Ware (1996). We develop an additional problem domain on the function and meaning of the trail and how it fit into the prehistoric landscape. We also present a few new research issues for other site classes. Descriptions of the field methods used to extract the data required to address the research issues comprise the second section. The last section presents a series of definitions and descriptions of terms used to describe the farming features encountered during this study.

Problem Domains: What We Were Looking For

The research issues developed for this study fall into four problem domains: the section of Hilltop Pueblo (LA 66288) within project limits, historic use of LA 105710, the nine farming sites, and the trail (LA 118549). Each problem domain is discussed separately.

Problem Domain 1: Hilltop Pueblo

As Wiseman and Ware (1996:50–57) note, Hilltop Pueblo (LA 66288) is a large single-plaza adobe village dating to the Classic period. It includes a structural mound and adjacent, related scatter of cultural refuse. Hilltop Pueblo itself is situated on top of a high terrace and is outside project boundaries, but some of the associated cultural refuse scatter extends into the U.S. 285 right-of-way. These materials occur in a large dune at the base of a higher terrace that the village sits upon. The dune was examined during testing by a series of auger transects to determine whether structural remains might be present. While numerous cultural materials were encountered within the dune, no structural remains were found.

This problem domain was mainly developed to address the potential relationship between the cultural remains encountered within the dune and Hilltop Pueblo. The preliminary study suggested that both areas were used contemporaneously and were related (Wiseman and Ware 1996:50). Several possible functions for the dune were suggested, including a fieldhouse location overlooking adjacent fields, exterior activity areas associated with the village, and a garden or agricultural area (Wiseman and Ware 1996:50). Specific research questions were designed to evaluate these possible functions and help determine the capacity in which this area functioned.

Research Issue 1: Genesis and structure of the dune. Wiseman and Ware (1996:55) believed that an investigation into the genesis and structure of the dune at LA 66288 was critical to understanding the role it played in the occupation of Hilltop Pueblo. By learning how the dune formed and detailing its internal structure and relationships, it was expected that we would be able to correlate the deposits and cultural materials found within this physiographic feature. The relationship between strata defined in the dune was expected to be critical to our attempts to date the cultural manifestations found within it.

Determining the origin of sediments in the dune was considered an important aspect of the overall research design. A source of materials must exist for eolian deposits. Denudation of nearby land is often the source of materials transported by wind and deposited in dunes. As Wiseman and Ware (1996:55) suggest, "If that denudation takes place in agricultural field areas, then it is likely that the growing potential of those fields is lessened or precluded, thereby creating the need for the development of other fields and perhaps alternative kinds of fields and farming strategies. The use of the dune for cropping and the construction of grid gardens on the high terrace are two potential answers to this problem."

By determining the origin of dune sediments, whether or not that area was used for farming, Wiseman and Ware (1996:55) felt that one or more of the following questions could be explored: (1) Did grid gardens derive from a need for additional fields to feed an increasing human population? (2) Were grid gardens built to replace fields lost to erosion? (3) Was there a general denudation of the landscape caused by natural or cultural processes?

Thus, explaining the derivation of sediments in the dune at the base of the terrace occupied by Hilltop Pueblo could be an important step in determining why the intricate gridded fields that this region is known for were built.

Research Issue 2: Pedestrian pathway. Wiseman and Ware (1996:55–56) felt that the dune that constitutes the south end of LA 66288 and the north end of LA 105710 served as a major pedestrian corridor between Hilltop Pueblo, the nearest source of water in the Rio Ojo Caliente, and associated fields in the valley bottom. Thus, they felt that evidence of a path providing access between the village and the valley bottom might be found in this part of the site. However, the potential of locating such a corridor was not considered to be very high. If found, such a pathway was expected to resemble a similar feature discovered at Sapawe in the nearby El Rito Valley. In that case, the suspected pathway was found in a mechanically excavated trench and occurred as a shallow depression in the trench profile (Wiseman and Ware 1996:55). Any such pathway at LA 66288 should be similar in form and was expected to occur as a 10–20 cm deep depression ranging between 0.5 and 1.0 m wide.

There are two potential problems with this research issue that were not considered in the data recovery plan. First, there is the trail (LA 118549) discovered at the beginning of the data recovery phase. As is discussed in a later chapter, the trail disappeared at the south end of LA 105710 as it descended into the valley bottom from its more common route about midway up the slope of the gravel terrace that forms the east edge of the Ojo Caliente Valley. We were uncertain whether disappearance of the trail was the result of historic disturbance of that area from the construction and use of the García store and the morada at LA 105710, or whether it was a consequence of the trail's entering a general occupation zone associated with Hilltop Pueblo in which no formal pedestrian corridors occurred. This problem is exacerbated by the potential relationship between Hilltop Pueblo and the village of Nute in the valley bottom. If these sites represent separate buildings that were integral parts of a single village, then continual traffic between them and activities occurring in the intervening space could have resulted in the formation of numerous activity areas without any specific traffic corridors. Conversely, if these sites were not associated and the intervening space was not the locus of overlapping activity areas, then one or more pedestrian corridors similar to those seen at Ponsipa'akeri (discussed in a later chapter) and Sapawe might occur.

The more likely of these scenarios is that the trail (LA 118549) descended to the valley floor to enter a general occupational zone associated with the occupation of Hilltop Pueblo and possibly Nute because the descent of the trail to the valley bottom at this point is not typical of its routing. Typically, the trail remains between one-third and two-thirds of the way up the terrace slope until a major drainage that deeply dissects the west edge of the terrace is encountered. At that point, the trail curves around the corner of the terrace, disappearing into the intervening valley bottom and reappearing on the opposite edge of the valley. As the trail approaches Hilltop Pueblo and Nute from the south, it leaves the terrace slope and descends into the valley bottom rather than continuing along the terrace slope below Hilltop Pueblo. Thus, if Nute, Hilltop, and the trail were contemporaneous, the trail would enter a heavily used area between the two sections of village rather than directly approaching either. If this is the case, the likelihood of finding identifiable pedestrian corridors in this area would be low.

Research Issue 3: Outdoor activity areas. Wiseman and Ware (1996:56) feel that the quantities of cultural materials found on and within the dune during testing are too great to have derived from an unintentional, random scattering of trash from Hilltop Pueblo. Rather, they feel that the consistent distribution of cultural materials between the surface of the dune and the depths reached by augering represent the accumulation of eolian materials and artifacts over decades to as much as a century or more.

This accumulation may have been the result of the continual use of the dune for a variety of activities. Wiseman and Ware (1996:56) suggest that if the dune was used as a general-activity zone by the occupants of Hilltop Pueblo, evidence of the activities performed there should be present, including hearths, postholes representing the remains of ramadas, pits, and compacted use-surfaces.

Research Issue 4: Fieldhouses. Prehistoric use of the dune that forms the south end of LA 66288 and the north end of LA 105710 may have been more substantial than the possibilities suggested in Research Issue 3. Indeed, the suite of potential activities performed in this area may have necessitated construction of more substantial structures than ramadas or shades. Wiseman and Ware (1996:56) suggest that this area could also have been the location of one or more fieldhouses associated with farming in nearby areas. If this assumption is correct, they felt that data recovery efforts should be able to locate the remains of such a structure(s). The potential structural remains were expected to take the form of wall remnants and associated formal or informal floors and use-areas.

Research Issue 5: Gardens. Wiseman and Ware (1996:56) also consider the possibility that the dune was used as a garden area; however, they caution that finding verifiable evidence of this type of use would be very difficult. Perhaps the only strong evidence of this type of use that could be recovered would be high concentrations of domesticate pollen indicative of the cultivation of such crops as corn, beans, or squash. However, this type of evidence is often difficult to find even in active fields because of the way in which pollen from these cultigens is produced and transported. Thus, the possibility that this type of evidence would be available from LA 66288 was very low. The interpretation of these types of data can also be complicated by the use of the dune as an outdoor activity area or fieldhouse location. All in all, this possibility would be equally difficult to prove or disprove.

Research Issue 6: Dating the prehistoric occupation. Providing dates for whatever strata or features are encountered in the dune was considered crucial for understanding the processes that led to its formation and placing the site in a regional framework. This was to be accomplished by analyzing whatever reliable temporally diagnostic materials were recovered and establishing an internal chronology based on the stratigraphy encountered in the dune (Wiseman and Ware 1996:56–57).

Problem Domain 2: The Historic Occupation at LA 105710

Among the historic features identified at LA 105710 by Wiseman and Ware (1996) were an abandoned morada, the remains of a store, a road used for hauling wood from the terrace top, and a corral. Both of the historic structures are thought to date to the early twentieth century. The García store was at the south end of LA 105710 within project boundaries. This small one-room structure was used for about four years before the proprietor went out of business. The importance of this structure is that it was owned and operated by a local Hispanic man, which is considered to be very unusual for this period in northern New Mexico (Kutsche and Van Ness 1981).

The morada is represented by a low mound and standing corner buttresses at the northeast edge of LA 105710. An abandoned road used to gather wood from the terrace top crossed LA 105710 from east to west, just north of the morada. A corral used to hold livestock and marked by a concentration of wolfberry bushes was identified during testing (Wiseman and Ware 1996:61). These features were outside construction limits, so further studies were limited to ethnohistorical inquiries. Though the following research issues are only concerned with the morada and the García store, any information on the corral and wood hauling road available during ethnohistoric interviews would also be collected to amplify our understanding of these features.

Research Issue 7: Dating the morada. Testing provided only a vague idea of when the morada was constructed and used (Wiseman and Ware 1996:61–62). Marshall (1995) suggests a construction date ca. 1870, which Wiseman and Ware (1996:62) feel may indicate that this was not the first morada constructed by the community, considering that the Ojo Caliente Grant was established in the eighteenth century. Analysis of construction details in the morada would hopefully provide a more accurate date for this structure.

Research Issue 8: Internal organization of the morada. Because the morada was completely dismantled, documentation of the remains in the absence of excavation has little chance of revealing the internal organization of the structure. Wiseman and Ware (1996:62) felt that the only way to ascertain that organization was through ethnohistoric interviews.

Research Issue 9: Location and construction details of the Calvario. Wiseman and Ware (1996:62) indicate that the Calvario of the Ojo Caliente morada was not found during survey or testing. The Calvario, a large cross set at the far end of the Via Crucis, is a focal point of rituals performed during Holy Week. As they note, Calvarios are generally placed on high points near moradas (Wiseman and Ware 1996:62), which in this case may or may not have been outside project limits. Since no physical evidence of this feature was found, ethnohistoric interviews with local residents were considered to be the only way to establish its location. Such interviews could be especially important should the Calvario prove to be within project boundaries.

Research Issue 10: Location and organization of the Via Crucis. The procession route and Stations of the Cross are another major feature of the morada complex (Wiseman and Ware 1996:62). Since these were not permanent features but were set out each Holy Week, Wiseman and Ware (1996:62) indicate that it is unlikely that they could be located by archaeological means. Again, ethnohistoric interviews with local residents represent the only avenue open to identifying the locations of these features.

Research Issue 11: Oratorios. Information available to Wiseman and Ware (1996:62) indicated that two buildings, both of which were physically separate from the morada, were used as chapels in functions of the Penitente Brotherhood. Information on the location, construction details, ownership, and dates of these structures is needed. Since neither structure is still standing, these data will probably only be available through ethnohistoric interviews with local residents.

Research Issue 12: Construction details and interior organization of the García store. Testing suggested that the building housing the García store was completely dismantled at some time in the past, and only the foundations remained for archaeological investigation (Wiseman and Ware 1996:63). Few data concerning construction details and the interior organization of the store are expected to be available archaeologically. Thus, ethnohistoric interviews might be the only way to ascertain the number of rooms, the placement of doors and windows, and the location of counters and shelves.

In addition to the points raised by Wiseman and Ware (1996:63) on this research issue, ethnohistoric interviews can also be used to augment and help interpret information obtained through excavation. Though the store was dismantled down to its foundations, some information about its internal structure could still be obtained through archaeological studies. These data can be examined in light of information provided by ethnohistoric interviews to aid in their interpretation and perhaps verify any archaeological conclusions, thus enhancing both methods of inquiry.

Research Issue 13: Specific types of goods sold and their points of origin. Wiseman and Ware (1996:63) note the importance of determining the types of goods sold by the García store. Such information would reflect the greatest needs of the community, the types of affordable luxury items, the comparative wealth (or lack of wealth) of the inhabitants of the Ojo Caliente area, and changes in community wealth structure through time. Archaeological recovery of examples of the goods sold at the store would be the best way in which to address this research issue, but testing suggested that few artifacts would be recovered from the store during data recovery (Wiseman and Ware 1996:63). Ethnohistoric interviews may be the only way to determine what was sold in the store and could supplement and amplify any archaeological data that were obtained.

Research Issue 14: Social dynamics of the García store. Interest in the social aspects of the García store derives from two factors: the proprietor of the store was a local Hispanic man, and entrepreneurial enterprises tended to cause social disruption in northern New Mexico (Wiseman and Ware 1996:63). As Kutsche and Van Ness (1981) indicate, there is a general belief in northern New Mexico that store owners take advantage of their customers in various ways, including charging high prices for the goods they are selling and paying low prices for locally produced goods (Wiseman and Ware 1996:63). These types of actions can cause social rifts, which can be especially disadvantageous in small communities, where cooperation is necessary for survival.

Information on the proprietor of the García store, his position in the local community, and his role in the economy of the area could provide important information concerning community dynamics and economic success. Ethnohistoric interviews with local residents and archival studies may provide information useful in evaluating this research issue.

Problem Domain 3: Prehistoric Gravel-Mulched Fields at Nine Classic Period Sites

Most of the sites investigated by this study consist of groups of farming plots that are dominated by gravel-mulched fields. As Wiseman and Ware (1996:64–67) point out, gravel-mulched fields have long been known in the Chama and Ojo Caliente drainages, but detailed studies of them are a relatively recent phenomenon. Eight prehistoric farming sites (LA 105703–LA 105709 and LA 105713) were originally scheduled for examination during this study, and LA 118547 was added as data recovery efforts were beginning.

Except for LA 105704, the farming sites are all extensive and only partly within project limits. Their use is generally presumed to coincide with the major Pueblo occupation of this area during the Classic period. In addition to the research issues generated in the research design, a few other issues were added after observations of certain aspects of site structure were made during field investigations.

Research Issue 15: Dating. As Wiseman and Ware (1996:67–68) note, providing absolute dates for prehistoric fields is a very difficult proposition. Because fields reflect a nonresidential use, they tend to lack materials that could provide absolute dates for the period of use. Some materials that might be available tend to provide dates with long probability ranges or that are less than reliable. Hearths tend to be rare at farming sites, and if wood from trees—susceptible to the "old wood" phenomenon—was used for fuel, it is often difficult to derive useful temporal data. Similarly, hydrated rinds can be measured on obsidian to provide information on when that artifact was manufactured. Unfortunately, the rate of hydration in obsidian is affected by both temperature and moisture content and can vary significantly from one side of a valley to another, depending on local microclimates (Ridings 1991). To reduce the effects of climatic variability, the best candidates for this type of dating generally come from at least 1 m below the surface. Even when deeply buried samples occur, however, data on annual moisture and temperature variation are needed for accurate dating.

Since neither charcoal nor adequate obsidian samples were expected to be available, chronometric control would necessarily be provided by analysis of pottery. By collecting all visible ceramic artifacts within project limits and transecting the remainder of each site to record the types of pottery present, it was hoped that suitable chronometric data would be collected.

Research Issue 16: Crop mix. Determining the mix of crops grown in these fields was considered of critical importance (Wiseman and Ware 1996:68–69). Previous studies have recovered corn and cotton pollen from gravel-mulched fields, but were these the only crops whose use could be substantiated? Some investigators (Bugé 1981; Lang 1979, 1980; Lightfoot 1990) have suggested that in addition to the fields themselves, the ubiquitous borrow pits that occur in association with gravel-mulched fields may have also been used for agriculture. These questions will be addressed by collecting and analyzing pollen samples from the fields and a sample of borrow pits.

Research Issue 17: Characterization of field structure and dynamics. Wiseman and Ware (1996:69) note that questions pertaining to field dynamics—how gravel-mulched fields were built, how they functioned, their potential productivity, their life expectancy, and other characteristics—represent important issues that have not been adequately addressed. When drawing conclusions about these issues, most researchers have used data from modern experiments in the use of gravel mulching, extrapolating from them to explain past field dynamics. There is a lack of replicative experiments concerning prehistoric gravel-mulched fields in northern New Mexico, so published accounts can only be used as a general guide.

However, detailed construction data are needed to adequately conduct experiments on prehistoric gravel-mulched fields. Information on field-construction sequences and methods, gravel size, raw-material sources, and surface treatment variation are also needed. Field methods were tailored to collect these data from the sites studied, both by observation and excavation.

Research Issue 18: Embedded lithic extraction and processing activities. Earlier studies of gravel-mulched fields found that chipped stone artifacts indicative of raw-material quarrying were common on field surfaces. Ware (1995) concluded that lithic raw-material extraction and initial core processing were important aspects of field construction and use in the area. Does this pattern extend to the current project area?

Research Issue 19: Methods of field tending. During data recovery, we noted several instances where scatters of artifacts, sometimes with associated features, may represent temporary occupational zones. What does the presence of such zones tell us about how fields were tended, and do they provide any information that may be linked to land tenure systems?

Research Issue 20: Shrines and fields. Several definite and potential shrines were noted on and adjacent to fields during data recovery. Do these features match descriptions of the modern shrines used by the Tewas? Are shrines integrated into field complexes, or are they separate entities? How do these shrines compare to prehistoric shrines identified in other parts of the Southwest?

Problem Domain 4: The Prehistoric Trail

The existence of a trail that links nearly all of the prehistoric sites investigated during this project was noted as data recovery efforts began. LA 118549 runs up the east side of the Ojo Caliente Valley, extending from as far south as Ponsipa'akeri to as far north as LA 105713. As detailed in the site descriptions in this report, the structure of the trail, how it was routed, and other types of data suggest that it was a prehistoric pedestrian corridor. While numerous trails have been documented on the Pajarito Plateau, and Harrington (1916) discusses several that were still known to the Tewas in the early twentieth century, none were previously known or recorded in the Ojo Caliente Valley north of Ponsipa'akeri. The juxtaposition of the trail and farming sites leads us to ponder whether there is a direct relationship between them, or whether this apparent co-occurrence is merely fortuitous?

Research Issue 21: The function of trails in Pueblo society. Were trails mere pedestrian corridors, or were they related to more esoteric aspects of Pueblo religion and ritual? Indeed, did the Pueblos use more than one type of trail, or did trails serve a dual function as pedestrian corridors and as part of the ritual system?

Research Issue 22: Was the trail built to link farming sites to villages? This issue is closely linked to Research Issue 22 and continues our examination of how trails might have functioned in prehistoric Pueblo society. By examining the structure of LA 118549 is it possible to determine whether it functioned primarily as a corridor for pedestrian travel to and from fields, or whether it had another purpose? Could it also have had the secondary function of channeling traffic to and from fields on the east side of the Rio Ojo Caliente?

Field Methods: How We Looked For It

The same general field methods were used at all of the sites investigated by this study, though they varied in specific applications. In particular, the methods used to study the prehistoric fields and trail differed from those used to examine the portion of Hilltop Pueblo within project limits, as well as those used to look at the historic remains at LA 105710. This variation in methods did not create problems in the interpretation of data collected from the sites, because different questions were asked of the various classes of sites, as detailed in the previous section of this chapter.

General Methods

The first step in data recovery was establishing a main site datum, the point from which all vertical and horizontal measurements originated. Since the main datum was rarely the highest point on a site, it was assigned an arbitrary elevation of 10 m below datum to prevent the occurrence of both positive and negative elevations. Sites were mapped by laser transit and/or optical transit, and the locations of all visible cultural features within study limits, excavation units, grid lines, surface artifacts, and relevant topographic features were plotted.

Hand excavation was conducted in 1 by 1 m grids, which were provenienced differently according to the type of site being investigated. Excavation proceeded in arbitrary 10 cm levels unless natural stratigraphic units were identified, in which case the natural strata became the vertical units of excavation. Unless otherwise noted, soil removed from excavation units was screened through 1/4-inch mesh hardware cloth, and all artifacts noted were collected. The same field specimen number was assigned to all artifacts from an excavational unit, but different artifact classes were bagged separately. Standard forms were used to record data from all excavation units.

The methods used to investigate small nonfarming features and structures differed from those used to explore areas outside structures or excavate large features. Small nonfarming features were divided in half, usually along the longest axis. The first half was dug in arbitrary 10 cm levels, if possible. After the exposed deposits were profiled, the second half was excavated by natural strata. A flotation sample was obtained from each cultural stratum defined within small nonfarming features, and samples of datable materials were collected, when available. Upon completion of excavation a second cross section was drawn at a perpendicular to the profile, a plan of the feature was prepared, and the feature was photographed.

When a structure was identified, an exploratory grid was excavated into its interior in arbitrary 10 cm levels to define the natural stratigraphy. The structure was divided into quadrants and excavated, profiling exposed walls to provide perpendicular cross sections showing the strata encountered in relation to walls and floors. Samples of building materials were taken, and portions of the floor were removed to search for subfloor features. Photographs of the completed excavation were taken, detailing walls, floor, and any internal features that were exposed.

Larger features were sampled, but no attempt was made at complete excavation. In this case, excavation proceeded in 1 by 1 m grids. After the internal stratigraphy of the feature was identified in an exploratory grid excavated in arbitrary 10 cm levels, subsequent grids were dug by natural strata. Profiles of stratigraphic exposures were drawn, and photographs were taken when they could be used to better illustrate an aspect of the exposed deposits.

Mechanical equipment was used to open up larger exposures for examination in some instances. These trenches permitted far more extensive stratigraphic exposures and allowed us to examine features in a less time-consuming way than did hand-excavated trenches. Materials removed from mechanically excavated trenches were not screened, though artifacts noted during excavation were recovered for analysis. While this did not provide a statistically valid sample, it did augment the collections from hand-excavated units. The locations of mechanically excavated trenches were plotted on site plans. At least one wall was profiled, showing exposed strata and elevations at the surface and bottom of the trench. Soil samples were obtained from these trenches in certain instances, as detailed in individual site reports.

Excavation Details: Farming Sites

Except initially at LA 105704 and LA 105709, grid lines were not defined at farming sites. Main site datums were placed where the largest exposure of site was immediately visible to help limit the number of mapping stations needed for completing the site plan. Though the data recovery plan called for the complete mapping of cultural features at these sites, this procedure was modified during examination of LA 105707 because it was too time consuming. At subsequent farming sites examined, detailed plans were prepared only for the area within construction limits and an adjacent 25–30 m wide zone. Only site limits and the perimeter of associated occupational areas were plotted outside detailed mapping zones. Features that were completely within or that partly extended into the detailed mapping zone were described, noting characteristics of construction and the matrix used to fill gravel-mulched grids. The size of features that extended outside the detailed mapping zone was estimated by pacing, otherwise feature size was calculated from site plans.

Features were numbered and their limits defined during site mapping. In most cases, boundaries between features were easily defined by visual inspection. Arbitrary boundaries were occasionally imposed when transitions between features were unclear due to erosion or subsequent cultural activities. Because it is very difficult to photograph farming features, representative photographs were taken, usually showing construction details.

Gravel-mulched grids within construction limits were examined using 2 by 2 m excavation units (EU). Each EU was given an alphabetic designation, and individual grids were numbered, beginning with the northeast grid and running clockwise. Thus, the northeast grid of EU-A was designated Grid A-1, the southeast as Grid A-2, and so on. Since excavation was aimed at deriving information concerning construction characteristics, not all materials removed during excavation were screened. Only two of the four grids were screened to recover associated artifacts, though cultural materials noted in the unscreened grids were also collected for analysis. Two soil samples were taken from each EU: a small sample of sediments for pollen analysis, and a larger sample to examine gravel sizing. Photographs were taken of each EU before and after excavation, and preexcavation and postexcavation plans were drawn.

EUs were placed in locations judged capable of providing necessary feature construction data. In addition to placement across alignments that formed the exterior perimeter of features, EUs were also situated where they could be used to examine alignments that formed interior subdivisions in fields, where large cobbles or small boulders were set in a patterned configuration, or where surface indications suggested that atypical construction details could be examined.

Only a few borrow pits were examined in detail, because excavation of this type of feature was felt to have little potential for returning useful information. In the few instances that borrow pits were examined in detail, mechanically excavated trenches were used to provide exposures of the natural strata that these features were dug into, as well as the sediments deposited after they were used. Soil samples were obtained from mechanical trenches in borrow pits to provide information on the types and concentrations of domesticate pollen that might be present and to examine gravel sizing. Other borrow pits within detailed mapping zones were simply described and mapped.

All visible artifacts within the right-of-way were collected for analysis. Artifacts were generally collected by feature or portion of site and not by exact provenience. However, cultural materials were collected by exact provenience at a few sites to provide more precise information on artifact patterning. Visible surface artifacts outside the right-of-way were recorded by pedestrian transects spaced 2 to 4 m apart and provenienced by feature when possible. These data can be used to augment information available from the detailed analysis of collected materials but are not directly comparable, since only a few attributes were recorded for the noncollected sample.

Excavation Details: Other Sites

Excavation at nonfarming sites tended to follow the general methods discussed earlier in this section, except for the trail (LA 118549). Because LA 66288 and LA 105710 were adjacent to one another and a sand dune that contains cultural deposits was contiguous between them, the boundary between them was arbitrarily drawn, and they were placed in the same coordinate system. The main datum for these sites, designated as the intersection of the 500N and 500E grid lines, was at the north end of LA 105710. The elevations and coordinates of mapping points used to construct plans for both sites were calculated from this datum. Because of the long, linear nature of LA 118549, no main datum was defined for it. Instead, segments adjacent to farming sites were mapped in relation to the features defined at those sites. Other segments were not mapped but are shown on aerial photographs in a later chapter.

LA 66288 and LA 105710 were completely mapped, and the locations of all cultural and pertinent topographic features were noted. Differences in vegetative densities allowed us to trace many of the walls at Hilltop Pueblo, permitting definition of roomblocks and a plaza. Other than the obvious structures at LA 105710, vegetational differences representing the former locations of corrals were also plotted. In addition, the positions of abandoned roads and modern erosional channels were mapped.

Three 1 by 1 m grids were used to explore dune deposits at LA 66288 to determine whether cultural strata were present. When no cultural features or deposits were exposed in these exploratory grids, three long trenches were mechanically excavated to provide more extensive exposures of dune deposits. Artifacts noted during mechanical trenching were collected but could not be provenienced to specific strata. Since essentially the same strata were exposed in all three trenches, only one was profiled; a series of pollen samples was also obtained from this trench to provide environmental data, and bulk soil samples were taken from two strata that contained higher concentrations of organic materials.

Both prehistoric and historic components were defined at LA 105710. Fortunately, there was spatial separation between the components. The prehistoric remains occurred mostly at the north end of the site in the same dune that was examined at LA 66288. The historic component included the remains of a morada at the north end of the site, two corrals in the central part of the site, and the foundations of a small store at the south end. Only the store foundations were within the right-of-way, and they were the only historic remains that were examined in any detail.

Three 1 by 1 m units were excavated at the north end of LA 105710 to explore the south end of the dune examined at LA 66288, but no cultural deposits or features were located. As at LA 66288, two long trenches were then mechanically excavated to permit examination of more extensive exposures of dune deposits. Artifacts noted during mechanical trenching were collected but could not be provenienced to specific strata. Since essentially the same strata were exposed in both trenches, only one was profiled; a series of pollen samples was obtained from this trench to provide environmental data, and bulk soil samples were taken from two strata that contained higher concentrations of organic materials. Two simple hearths were also defined in this stratigraphic profile and excavated as small features.

Since the morada and corrals at LA 105710 were outside the right-of-way, no detailed studies of them were possible. The morada was mapped and photographed, and architectural characteristics were noted and described. The extent of a concentration of vegetation that represented the location of the corrals was mapped, but no further studies of those features were possible.

Examination of the García store at LA 105710 began with the excavation of two 1 by 1 m units, one on each side of a north-south foundation wall. Excavation of the interior grid suggested that the foundations and floor of the structure were relatively intact, and excavation continued using the methods detailed earlier. A series of 1 by 1 m units were then excavated around the perimeter of the structure in 10 cm thick arbitrary levels, ending at what was judged to be the ground surface at the time the structure was in use.

Because LA 118549 was a long, linear feature of the landscape representing a prehistoric pedestrian corridor, it was approached much differently than the other sites. As noted earlier, only segments adjacent to farming sites were mapped. Those segments were also described, and representative measurements of the trail's width and depth were taken. All surface artifacts noted along described segments were collected for analysis and compared to materials recovered from the nearby farming sites. Two trenches were mechanically excavated across the segment of trail that was mapped adjacent to LA 105709. These exposures were examined to determine whether they contained evidence of formal construction of the trail, and profiles of each trench were drawn.

Terms Used to Describe Farming Features

Many of the terms used to describe features at the farming sites are not in general use but were developed during our field investigations to accurately describe the features being examined. Terms in general use for Pueblo farming features are also defined for those who are not familiar with them.

Borrow pits. Wide, shallow pits, the source of materials used to build and mulch adjacent fields.

Boundary alignment. A low wall, usually only a single course high and wide, built around the perimeter of a field (Fig. 5.1).

Check dam. An alignment of cobbles or boulders placed across erosional channels to halt downcutting and/or permit buildup of soil that could be used as a farming plot. Check dams often occur in clusters, and subsequent construction occurs in an upstream direction as earlier features became filled with soil.

Contour terrace. An alignment of cobbles or boulders built perpendicular to a slope. The most common type of contour terraces slowed runoff from slopes and caught eroded soil. Besides providing small farming plots, these features sometimes also helped protect fields at the base of slopes from erosion.

Cobble-bordered field. A field that is bordered and often subdivided by cobble alignments, with no obvious alteration of the surface within the borders.

Gravel-mulched field. A field that is usually bordered and often subdivided by cobble alignments, with a layer of mulch applied to the surface of the field that consists of unsorted gravels ranging in size from pea gravels to small cobbles.

Interior subdividing alignment. A low wall, usually only a single course high and wide, used to subdivide a field into smaller plots. These alignments are similar to those built around field perimeters and occur in conjunction with boundary alignments (Fig. 5.2).

Pattern of noncontiguous, evenly spaced large elements. Large cobbles or small boulders placed in a patterned arrangement in fields. While these elements often occur in alignments, they were not placed next to one another, but were usually evenly spaced up to a few meters apart (Fig. 5.3).

Rock pile. Concentration of cobbles to small boulders that were probably originally stacked, but currently may be scattered by erosion or traffic over the surface of a site. These are problematic features that could variably have served as spoils piles, stockpiles of building materials, or small field shrines.

Spoils pile. A pile of cobbles and small boulders that usually occurs within or next to a borrow pit and represents materials rejected for use as gravel mulch (Fig. 5.4).

Terrace-edge borrow pit. A borrow pit that was excavated at the edge of a terrace, usually right at the break between the terrace top and the terrace slope (Fig. 5.5).

Terrace-interior borrow pit. A borrow pit that was excavated some distance away from the edge of a terrace on the terrace top (Fig. 5.6).

Figure 5.1. Boundary alignment around a gravel-mulched field at LA 105707.

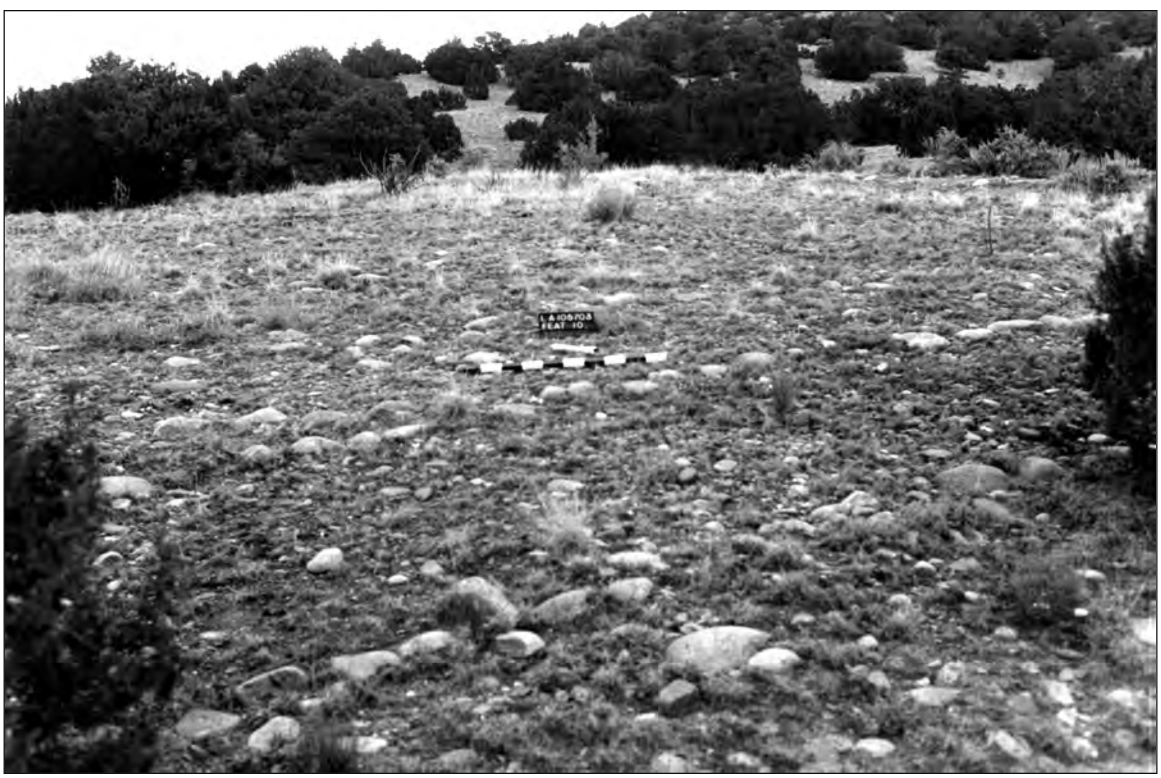


Figure 5.2. Interior subdividing alignments in Feature 10, LA 105703.

Figure 5.3. Pattern of noncontiguous, evenly spaced elements in EU-F, LA 118547.

Figure 5.4. Spoils pile adjacent to Feature 11 at LA 105703, a terrace-edge borrow pit.

Figure 5.5. Feature 6, a terrace-edge borrow pit at LA 105703.

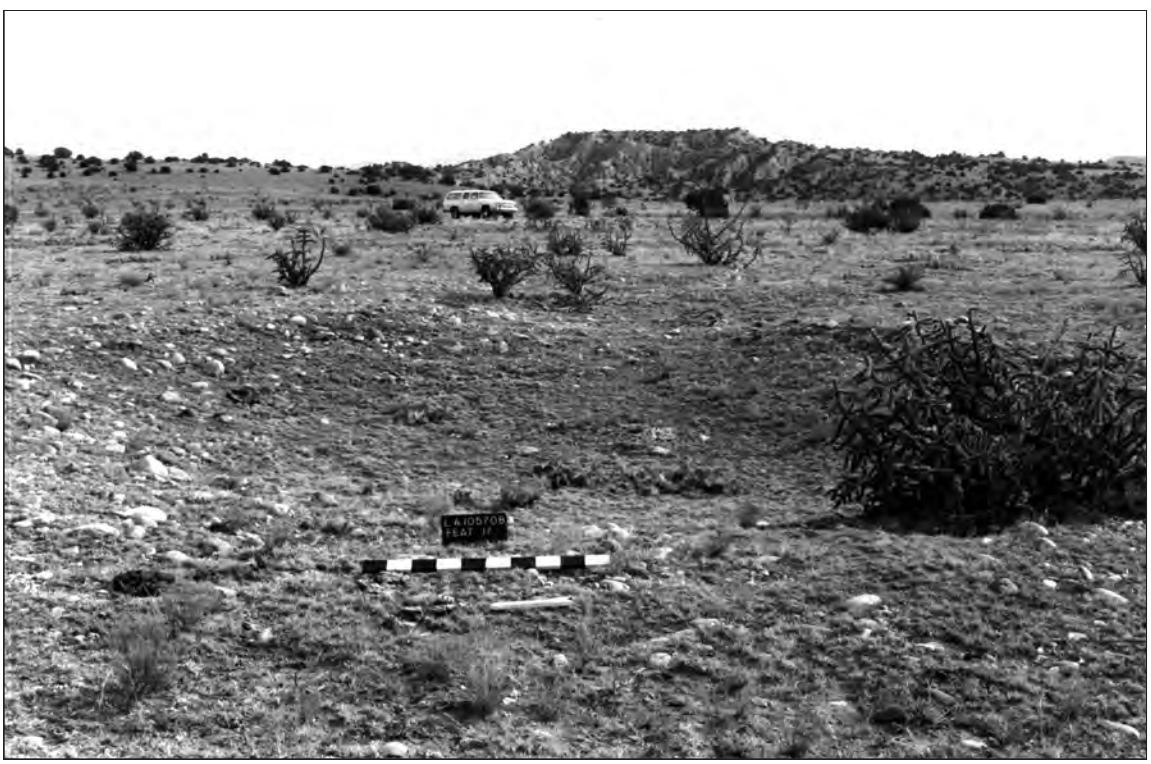
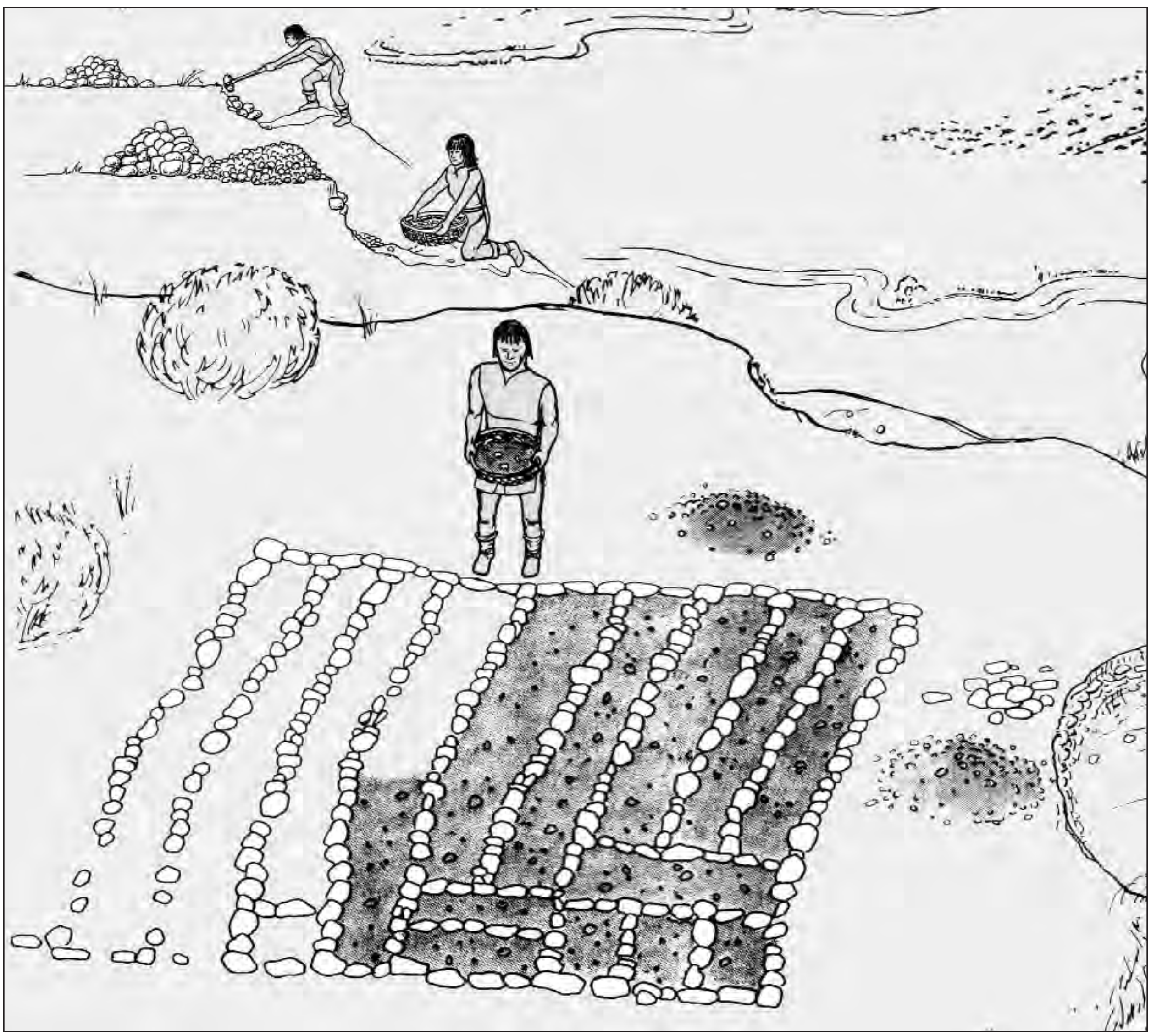


Figure 5.6. Feature 17, a terrace-interior borrow pit at LA 105708.

Part 2

Site Descriptions



Chapter 6. Hilltop Pueblo: Investigations at LA 66288 and the Prehistoric Component at LA 105710

Jeffrey L. Boyer

LA 66288 and the adjacent northern portion of LA 105710 make up a large site composed of a small, Classic period pueblo (Hilltop Pueblo) and an associated artifact scatter. The sites are on the east side of U.S. 285 in the community of Gavilan, on land administered by the Bureau of Land Management (see Fig. 1.1). Because the prehistoric components of both sites are related to the occupation of Hilltop Pueblo, the boundary separating the two sites has been arbitrarily defined as a small arroyo immediately south of the pueblo. Because most of LA 105710 consists of historic structures and features associated with the Hispanic community of Gavilan, the prehistoric components of LA 105710 are also described in this chapter. Chapter 14 is devoted to investigations of the historic component of LA 105710.

The portions of the Hilltop Pueblo site investigated during this project were at the base of the gravel terrace on which Hilltop Pueblo itself is located. Deposits at the terrace base, thought initially to be the location of activities and features associated with Hilltop Pueblo, were determined during our investigations to be a series of colluvial and alluvial sediments and soil horizons dating after the occupation of the small pueblo. Artifacts recovered from the terrace base deposits during testing and data recovery had been redeposited from trash left by pueblo residents in middens on the edge and sides of the terrace. Although the redeposited materials provide only a tenuous basis for dating Hilltop Pueblo, radiocarbon dates obtained from charcoal in a stratum possibly associated with the pueblo and from an isolated hearth feature indicate that it was occupied early in the Classic period, probably in the first quarter of the fifteenth century.

Because the prehistoric artifacts recovered from the Hilltop Pueblo site came only from contexts involving redeposited materials and sediments and do not provide information relevant to addressing the research issues proposed for this site (with the exception of dating), this chapter does not include discussions of artifacts recovered from the site. The reader is referred to the relevant chapters for descriptions of these materials.

Testing Investigations at LA 66288

As recorded by Williams (1988) and Marshall (1995), LA 66288 covers an area of about 300 by 300 m. This area includes Hilltop Pueblo itself and an artifact scatter extending from about 25 m east of the pueblo to about 60 m west of the existing U.S. 285 right-of-way (Marshall 1995:35). Marshall recorded a possible roomblock or midden area within the right-of-way at the southern end of the site and scattered artifacts within the west side of the right-of-way. Based on this information, Wiseman and Ware (1996) conducted test investigations at LA 66288 that were limited to surface artifact inventory within the right-of-way and four series of auger tests, one on the west side of the right-of-way and three on the east side. The auger tests on the west side of the right-of-way indicated that the artifact-bearing deposits in that area had been disturbed by or were the result of previous highway construction, since prehistoric sherds were found with late historic glass and modern plastic items (Wiseman and Ware 1996:29–31). No additional investigations were recommended for that area, and none were conducted during the data recovery phase. On the east side of the right-of-way, Wiseman and Ware excavated three series of auger tests in the area identified by Marshall as a possible roomblock or midden area. This area is at the foot of the terrace slope below (southwest of) Hilltop Pueblo. The auger tests revealed prehistoric sherds and chipped stone artifacts at depths up to 1.5 m below modern ground surface (Wiseman and Ware 1996:25–29). Based on these results, Wiseman and Ware recommended data recovery excavations to determine the origin of these artifacts and search for subsurface structures, features, or living surfaces.

Testing Investigations at LA 105710

When Wiseman and Ware returned to LA 105710 to conduct testing investigations, they focused their activities on the area within the right-of-way immediately south of LA 66288 and west of the morada, limiting their efforts to surface artifact inventory and three series of auger tests. Wiseman and Ware were concerned that this part of LA 105710 was part of the same "dune" feature (the terrace base deposit) that they tested at LA 66288 and that their inventory recorded mostly prehistoric artifacts in this area. The auger tests revealed prehistoric sherds and chipped stone artifacts from depths of up to 1.5 m below modern ground surface (Wiseman and Ware 1996:32–37). Based on these results, Wiseman and Ware recommended data recovery excavations in this area to determine the origins of these artifacts and to search for subsurface structures, features, or living surfaces.

Identifying Hilltop Pueblo

Marshall (1995:34) notes that Hilltop Pueblo is about 200 m east of Nute (LA 298), a large pueblo considered an ancestral Tewa site (Harrington 1916). Harrington's (1916:168) informants identified Nute'onwekeji, "ashes estufa pueblo ruin," as the northern edge of an area known as Tfugæ'iwe, "place of *Falco nisus*." *Falco nisus* is the Latin name for the chicken hawk, and the Tewa name is obviously related to the Spanish name for the local community, Gavilan (hawk) (see also Harrington n.d.). Harrington was not able to determine whether the Tewa name is a translation of the Spanish name of the community or vice versa. However, his informants did identify the area of the Gavilan community, bounded on the north by Nute Pueblo and Arroyo Gavilan and on the south by Arroyo de los Lemitas, as the location of a battle between the Tewa culture hero Poseyemu and the Euroamerican god Josí (José? Jesús?) (Harrington 1916:169). Apparently, Harrington's informants either did not know of the ruin that has become known as Hilltop Pueblo or did not differentiate between it and Nute.

Morley (1910a:19–20) recorded Nute Pueblo in his summary of the School of American Research's 1910 Rio Grande Expedition:

> On the way home 2 miles above the last house (or 2 miles from camp) we encountered the Gavilan ruin so-called. This is on the west side of the wagon road about 150 yds. and just south of a big wash or arroyo head. It is east of the Rio Ojo Caliente, however. It is rather unusually located for a Pajaritan site, being so near the bed of the stream. In this position it has been subjected to considerably more washing than any other Pajaritan sites in this canyon, and it will be a difficult task to secure even an approximate ground plan.

Elsewhere, Morley (1910b:6) describes Nute Pueblo as follows:

> The ruin of Nute'eowi or [?] as it is sometimes called stands on the eastern bank of the Rio Ojo Caliente two miles below the Mexican town of that name. In this position the ruin has been subjected for centuries to the not infrequent overflowals of the stream and the repeated washings of its high water. These in the course of time have so reduced the several mounds and worked over the site that it is now impossible to trace the true ground-plan. For this reason no attempt was made to map the site. Low mounds of irregular shape and size scattered here and there appear to conform roughly to the sides of two and possibly three courts. All remains of the estufas seem to have disappeared either having washed away or covered up by sediment deposited in great quantities by the stream at flood season.

Morley (1910b) produced a small sketch map of Nute Pueblo showing a C-shaped roomblock open to the south and, to the immediate east, an L-shaped roomblock open to the northeast. No mention is made in Morley's journals of the structure now known as Hilltop Pueblo; it appears that the expedition's San Juan Pueblo workers/informants did not identify the pueblo for the expedition's archaeologists. Morley (1910b) wrote that Nute Pueblo had another name, but he did not mention the second name in his manuscript. It is tempting to think that it might have been Tfugæ'iwe, referring to the community of Gavilan.

Beal (1987) was not able to relocate Nute Pueblo and, like Harrington and Morley, does not mention Hilltop Pueblo. We could infer from this situation that either Harrington's and Morley's informants did not know of Hilltop Pueblo or that the two pueblos were not differentiated because they were considered to be part of the same community. Although Hilltop Pueblo is not as large as the other known Classic period pueblos along the Rio Ojo Caliente, it is an obvious feature and is well known to modern residents of Gavilan.

People living west of U.S. 285 across from Hilltop Pueblo are also aware of Nute Pueblo, which is visible from the highway, and showed us that surface artifacts, particularly sherds, are common in the fields, yards, and driveways between Nute and Hilltop Pueblos. This situation is reflected in the site descriptions by Marshall and Wiseman, in which LA 66288, including the pueblo and its artifact scatter, extends up to 60 m west of the highway. However, it seems clear that, based on surface artifacts, it is not really possible to define a line separating LA 298 (Nute) and LA 66288 (Hilltop) except in an arbitrary fashion. Consequently, because LA 298 is the larger pueblo and should have a larger surrounding artifact scatter, we suggest that Hilltop Pueblo and its artifact scatter, including LA 66288 and the prehistoric component of LA 105710, are limited to the east side of U.S. 285. In this scenario, which we follow in this report, LA 66288 consists of the pueblo mound and surrounding artifact scatter and is bounded on the north by Arroyo Gavilan, on the south by a dredged arroyo separating LA 66288 and LA 105710, on the west by U.S. 285, and on the east by the limit of the artifact scatter (Fig. 6.1). The prehistoric component of LA 105710 is on the terrace slope at the northern end of the site just south of the dredged arroyo.

Data Recovery Procedures

LA 66288 and LA 105710 were mapped using optical and laser transits. Figure 6.1 shows the site features and areas excavated at LA 66288 and the northern end of LA 105710, which includes the prehistoric component excavation area. During the testing phase, a primary datum was established at the north end of LA 105710. Because of the close proximity of the sites, the arbitrary nature of the line dividing them, and the actual continuity of the terrace slope and base feature investigated at both sites, this datum was also used to define auger test locations at LA 66288. The datum, which was originally designated 0/0, was redesignated 500N/500E during data recovery and used to establish a grid across LA 66288 and LA 105710, oriented to true north. Using the results of auger testing to select excavation locations, six 1 by 1 m grid units were excavated in arbitrary 10 cm levels at LA 66288 and LA 105710. At LA 66288, units were excavated to 1.3 m (one unit) and 1.5 m (two units) below modern ground surface. At LA 105710, units were excavated to 1.4 m (two units) and 1.5 m (one unit) below modern ground surface. Elevations were maintained relative to the arbitrary elevation of the primary datum. All fill was screened, and all recovered artifacts were collected.

The testing failed to reveal any evidence of cultural features or deposits but suggested that this area was comprised of a series of natural slope-wash (and eolian?) strata. Consequently, five backhoe trenches were excavated to obtain a more extensive view of the subsurface stratigraphy of this portion of the site (Table 6.1). Locations of the trenches are shown in Figure 6.1. At LA 66288, Trench 1 was placed at the base of the terrace slope, Trench 2 was placed across an arroyo channel previously identified as an abandoned road, and Trench 3 was placed across a gravel bar between the arroyo on the south side of the site and another arroyo channel that had been identified as an abandoned road. At LA 105710, Trench 1 was placed immediately west of the morada, while Trench 2 was placed 15 m southwest of the morada. Artifacts observed in the backdirt of these trenches were collected, although their exact stratigraphic proveniences could not be defined. Profiles of the south walls of Trench 1 at each site were drawn. Pollen samples were collected from 10 strata defined in the LA 66288 Trench 1 profile and 12 strata in the LA 105710 Trench 1 profile. Bulk soil samples were collected from two strata having darker organic

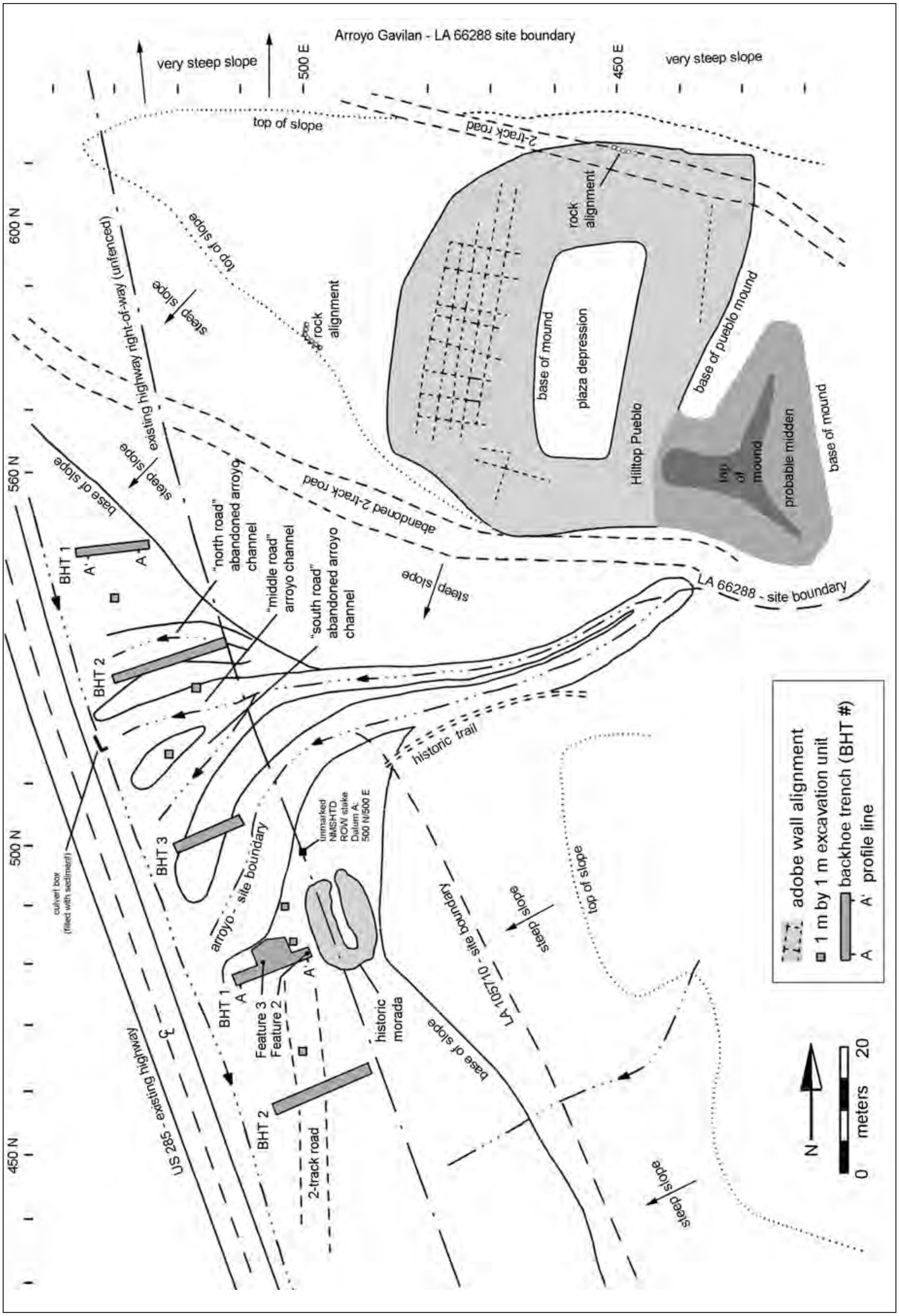


Figure 6.1. Plan of prehistoric component at Hilltop Pueblo, LA 66288 and LA 105710.

Table 6.1. Backhoe trench data for Hilltop Pueblo

Site No.	Trench No.	Length (m)	Width (m)	Maximum Depth (m)	Profile
LA 66288	1	12	16	1.77	yes
	2	19	1.6	1.9	no
	3	12	1.6	1.2	no
LA 105710	1	13	1.6	1.92	yes
	2	18	1.6	1.6	no

material than surrounding strata.

Two small, informal basin hearths were exposed in Trench 1 at LA 105710, one at the east end of the trench and the other in the north wall of the trench. Trench 1 was subsequently widened to the north (Fig. 6.1) to facilitate excavation of the hearth in the north trench wall and to examine a gravel lens first thought to be a surface but eventually defined as an alluvial lens. The hearths were defined, photographed before and after excavation, excavated, profiled, mapped, and described on feature forms. The fill of both hearths was collected for flotation analyses. No other features were observed, and the two hearths could not be associated with surfaces, other features, or buried soil horizons. They apparently represented very short-term use of the dune area during the years of soil deposition.

Investigations at the Hilltop Pueblo Site

Figure 6.1 shows the Hilltop Pueblo site as defined during this project, including LA 66288 and the northern portion of LA 105710. The site measures about 150 m east-west by 90 m north-south, is roughly triangular in shape, and covers approximately 6.7 ha. Hilltop Pueblo is roughly rectangular, with roomblock mounds surrounding a probable plaza depression. The pueblo mound is 65 m north-south by 50 m east-west. Room wall alignments are visible as vegetation differences on two roomblock mounds—at least 42 rooms are apparent in the western roomblock, while a long alignment is evident in the eastern roomblock. Based on visible wall alignments and the size of the mound, we estimate that the structure had at least 200 ground-floor rooms. The height of the roomblock mounds (1 to 1.5 m above modern ground surface) suggests that some portions of the pueblo were multistoried. At the pueblo's southeast corner is a large, roughly triangular mound that may be a midden, based on its generally dark, ashy color. The pueblo is on a narrow northwest-trending ridge that is part of the edge of the gravel terrace overlooking the Rio Ojo Caliente floodplain. Artifacts are scattered at least 25 m east of the pueblo on top of the ridge northwest of the pueblo and on the slopes and base of the terrace west and south of the pueblo. The latter area was examined during data recovery.

Soil and Sediment Strata in the Terrace Base Deposit

Data recovery investigations at the Hilltop Pueblo site showed that information about the portion of the site within the existing right-of-way could be useful in addressing the research issues developed in the data recovery plan (Wiseman 1996:56–58). Those issues begin with defining the origin and structure of the sandy "dune" feature at the base of the terrace slope.

Figure 6.2 shows the profile of the south wall of Backhoe Trench 1 at LA 66288, which was excavated 1.5 to 1.8 m below modern ground surface. Twenty-three strata were identified in the profile. Figure 6.3 shows the profile of the south wall of Backhoe Trench 1 at LA 105710, which was excavated 1.6 to 2.3 m below modern ground surface. Of the 23 strata defined in the backhoe trench profile at LA 66288, 15 were not found in Backhoe Trench 1 at LA 105710. Of these, 12 were strata specific to small, alluvial channels (Fig. 6.2). Sixteen strata (Strata 24–39) were identified at LA 105710 that were not found at LA 66288. As Figure 6.3 shows, most of these strata were also specific to small alluvial channels that cut across the eastern half of the profile. In other words, the major strata in each profile were substantially identical. The following descriptions of strata are presented in descending order from top to bottom of the profiles.

Stratum 1. Stratum 1 was the A-horizon topsoil at the surface of the historic/modern stabilized deposits at the base of the terrace. It was light yellowish brown, contained considerable amounts of organic material including roots and

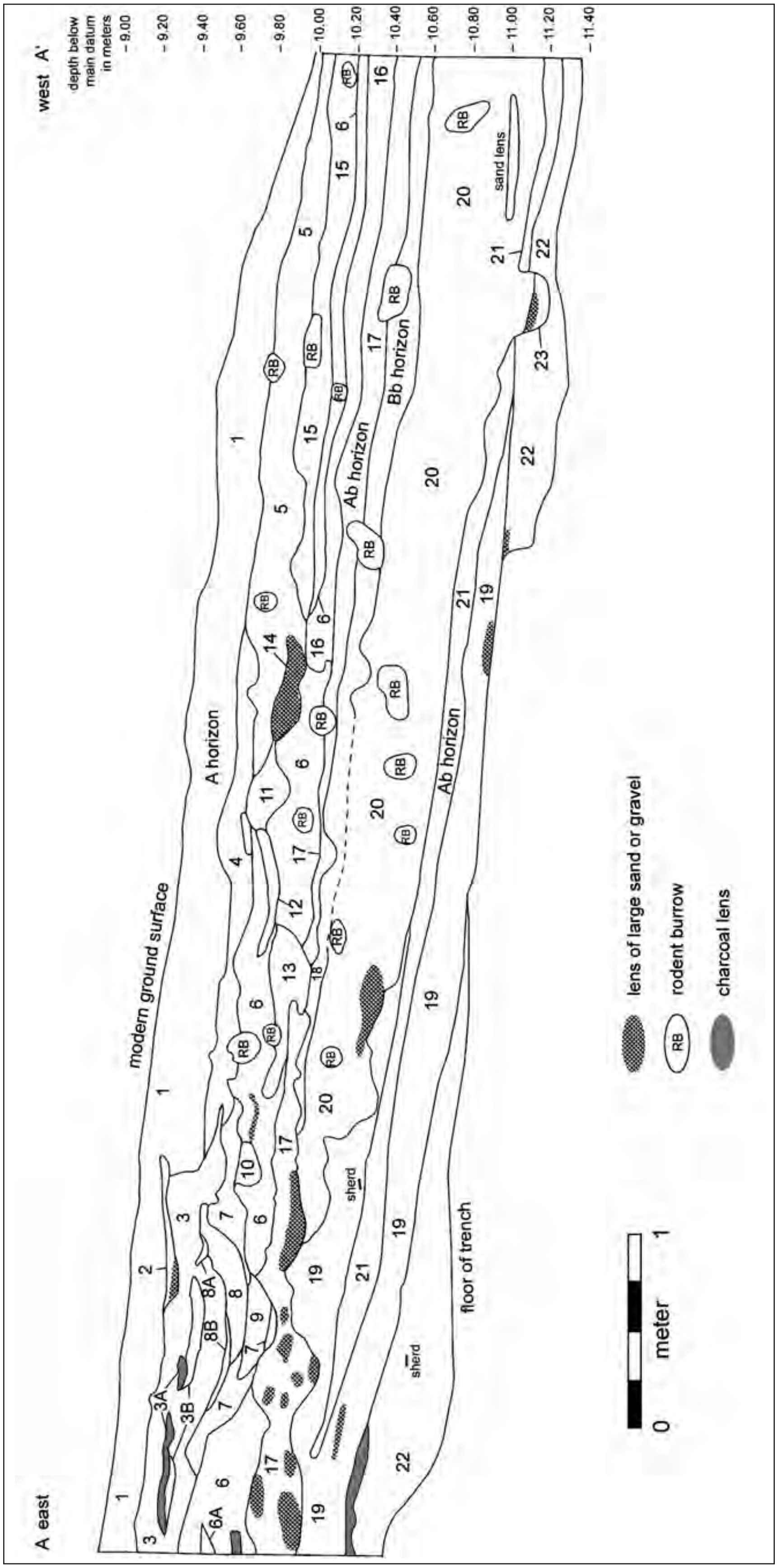


Figure 6.2. Profile of south wall of Backhoe Trench 1 at Hilltop Pueblo, LA 66288.

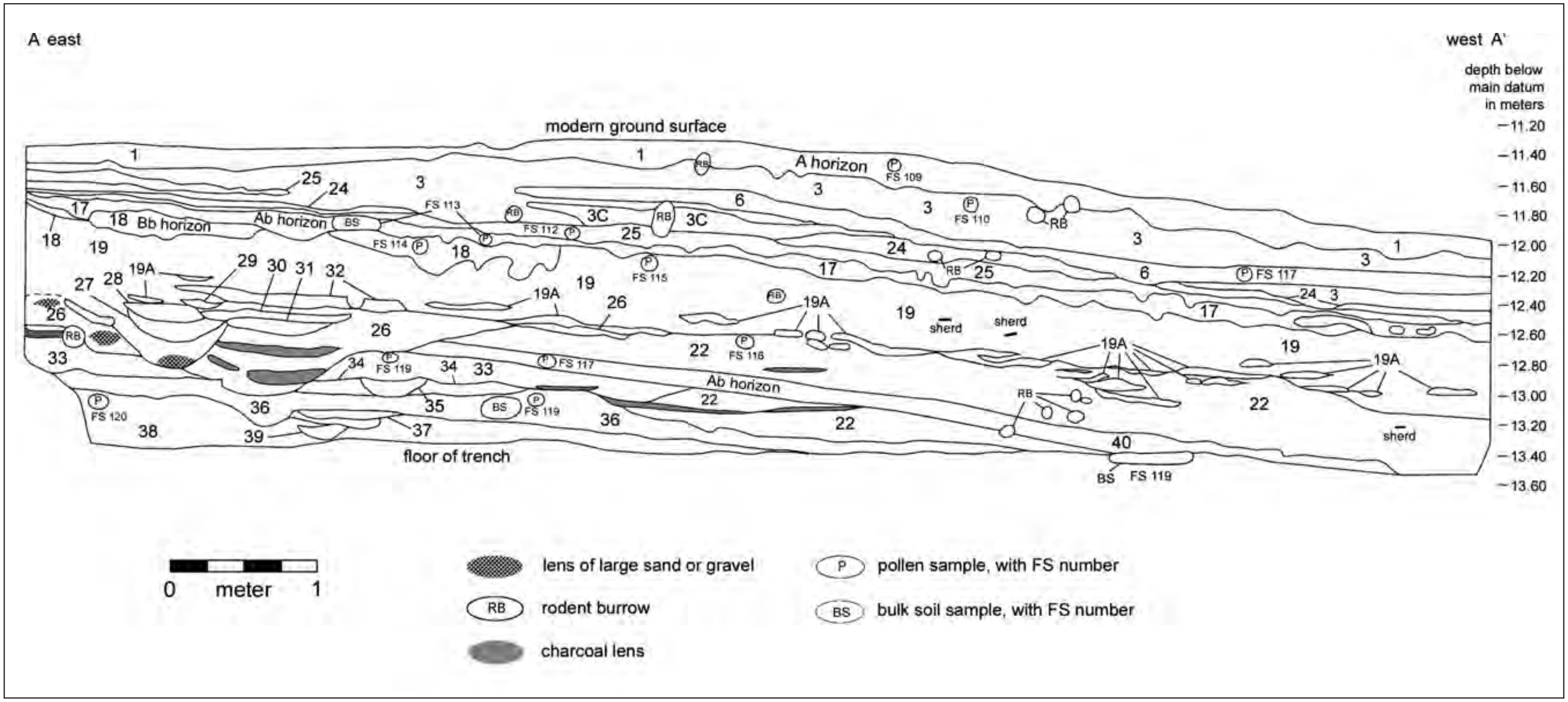


Figure 6.3. Profile of south wall of Backhoe Trench 1 at Hilltop Pueblo, LA 105710.

decayed plant parts, and formed as organic material with sand from the underlying strata and probably with eolian sand and colluvial, slopewash sands from the terrace. Prehistoric artifacts were present in low frequencies, as were modern road-trash artifacts. Charcoal flecks were present but may not have been cultural in origin.

In the LA 66288 profile (Fig. 6.2), Stratum 1 was 20 to 40 cm thick, while in the LA 105710 profile (Fig. 6.3), it was 10 to 20 cm thick. In both profiles, Stratum 1 overlay Stratum 3. However, in the LA 66288 profile, Stratum 3 had been cut, probably by water erosion. Stratum 1, or the material that became Stratum 1, filled that cut, as did Stratum 4. Probably for that reason, Stratum 1 was thinner in the LA 105710 profile, since Stratum 3 was apparently not disturbed in that area. A sample of the uppermost portion of Stratum 1 was collected as a control for pollen studies (Appendix 1 presents the results of pollen analyses). In this discussion, we are particularly concerned with the presence of domestic plant pollen in assessing use of the terrace base for farming during the occupation of Hilltop Pueblo. The only domestic species represented in the samples is corn (*Zea mays*). Although several species of economically significant plants were represented in pollen samples from the LA 105710 profile, we cannot be sure that they were used by local residents of whatever period. Corn pollen, found in the control sample in a fairly high concentration (43 grains/g), was probably deposited from historic/modern cornfields downwind (west) of the site.

A second sample of Stratum 1, taken from lower in the stratum than the control sample, also contained corn pollen (16 grains/g). Although lower in concentration than the control sample, the second Stratum 1 sample contained a higher corn pollen concentration than any other subsurface sample.

Stratum 2. Stratum 2, observed only in the LA 66288 profile (Fig. 6.2), was a small deposit (70 cm long in the profile) of pale brown, small to large alluvial sands. It represented the fill of a small channel that ran northeast-to-southwest across the top of Stratum 3. The larger sands were sorted in the deepest part of the channel deposit.

Stratum 3. Stratum 3 consisted of light yellowish brown, loose, very fine sand. Lensing and laminations were absent, and the sand was mottled in appearance. These characteristics could suggest that the stratum was eolian rather than colluvial or alluvial in origin. However, the presence of artifacts in Stratum 3 argued against this notion. Stratum 3 was 25 to 40 cm thick. In the LA 66288 profile (Fig. 6.2), Stratum 3 filled two small channels, one above Stratum 8 and the other cut into the top of Stratum 7. In turn, Stratum 3 was cut by a large channel that removed most of the stratum and cut into Stratum 5. Part of that channel was filled by Stratum 4 and then by Stratum 1. Much smaller channels were cut during deposition of Stratum 3 and filled with Substrata 3A and 3B, each with charcoal lensing. Another channel was cut into the top of Stratum 3 and filled by Stratum 2. Stratum 3 extended the length of the LA 105710 profile (Fig. 6.3), although it may have been disturbed by alluvial processes, evidenced by Stratum 25. Substratum 3C was the fill of a channel or other alluvial disturbance at the bottom of Stratum 3. The matrix of Substratum 3C appeared identical to that of Stratum 3, except that it was divided into three lenses of very light, fine sand. Each lens had a base of darker small sand, suggesting some sorting during deposition. This indicates that a channel was cut into Stratum 3 that then filled with Stratum 3C. A sample of Stratum 3 sediment contained a very low concentration of corn pollen (3 grains/g).

Stratum 4. Stratum 4 was observed only in the LA 66288 profile (Fig. 6.2). This alluvially deposited layer of pale brown, laminated, small sands was 4 to 22 cm thick and represented the fill of a wide erosion channel that cut Strata 3, 5, 6, 7, and 11. Laminations were weakly present in small lenses rather than in well-defined striations filling the entire channel. A few small gravels were present, as were prehistoric artifacts. The shape of the top of Stratum 4 suggested that it, too, was cut by erosion before the terrace base deposit was stabilized through plant growth and Stratum 1 began to form.

Stratum 5. Stratum 5 was also observed only in the LA 66288 profile (Fig. 6.2). It ranged from 15 to 28 cm thick and consisted of a matrix of light yellowish brown, small sands mixed with medium and large sands and small to medium gravels that contained prehistoric artifacts. The large sands and gravels were well rounded. This stratum represented the fill of a wide, shallow erosional channel that truncated Stratum 11 and cut through Stratum 15, which probably once reached to or near Stratum 11. A subsequent erosional episode cut the eastern side of Stratum 5, creating another shallow channel that was filled by Stratum 4.

Stratum 6. Stratum 6 was a deposit of light yellowish brown, colluvially deposited, small sands extending across both profiles (Figs. 6.2 and 6.3). Laminations were weakly present in small lenses rather than in well-defined striations. The exception to this was Substratum 6A, a small channel deposit at the east end of the LA 66288 profile consisting of small sands in well-defined laminations (Fig. 6.2). Prehistoric artifacts and charcoal flecks were present in Stratum 6, as were small charcoal lenses. In the western half of the LA 66288 profile (Fig. 6.2), Stratum 6 was thinner than in the eastern half. This fact, and the continuity of breaks between Strata 6 and 14, 16 and 5, and 6 and 15 may indicate that Stratum 6 was, at one time, considerably thicker across its length, equivalent to its thickness at the eastern edge of the profile. Stratum 6 was also a long, thin deposit in the LA 105710 profile (Fig. 6.3). Further, the LA 105710 profile shows that Stratum 6 was deposited in that area at the same time as Stratum 3. Certainly, the discontinuities of Stratum 6 in the LA 66288 profile and its irregular relationships with Strata 11, 12, and 13 (Fig. 6.2) show that it was subjected to several erosional events and processes. That it was thinner in the LA 105710 profile may also reflect the fact that this profile was farther from the actual terrace than the LA 66288 profile (Fig. 6.1), and the processes by which Stratum 6 was deposited and modified produced a thinner layer of material at this greater distance. No corn pollen was found in a sample of Stratum 6 sediment.

Stratum 7. Stratum 7 was a thin (5 to 15 cm), alluvially deposited layer of light yellowish brown, weakly laminated, small sands observed only in the LA 66288 profile (Fig. 6.2). Laminations occurred as small lenses rather than as well-defined striations. Large sands were occasionally present, as were charcoal flecks; artifacts were not obviously present. Stratum 7 represented the fill of an erosional channel that cut into the top of Stratum 6, and was subsequently cut and filled by Strata 9, 8, and 3.

Stratum 8. Stratum 8 was a thin (3 to 13 cm), alluvially deposited layer of pale brown, well-sorted, well-laminated small sands observed only in the LA 66288 profile (Fig. 6.2). Charcoal flecks were present, but artifacts were not obviously associated with this stratum. Stratum 8 represented the fill of a small erosional channel cut into Stratum 7, which was subsequently cut and then filled by Stratum 3. Included with Stratum 8 were Substrata 8A and 8B. Substratum 8A consisted of the weakly laminated fill of a very small channel that cut the upper west side of Stratum 8. Substratum 8B was a deposit of laminated small sands and small gravels that represented the fill of a very small channel or depression in the top of Stratum 8.

Stratum 9. Also observed only in the LA 66288 profile (Fig. 6.2), Stratum 9 consisted of well-sorted, well-laminated, very pale brown, small sands representing the fill of a small erosional channel. Neither charcoal nor artifacts were present. The channel cut through and was then partially covered by Stratum 7. It was also covered by Stratum 8.

This series of channel deposits—Strata 7, 9, and 8—represent an erosional episode that cut through Stratum 6 and into Stratum 17. It was initially filled at least partially by Stratum 7, which was then cut and partially filled, first by Stratum 9 and then by Stratum 8 and Substratum 8A. A depression remained, which was filled by Stratum 3 and Substratum 3B.

Stratum 10. Stratum 10, observed only in the LA 66288 profile (Fig. 6.2), was a small deposit of alluvially deposited, yellow, weakly laminated, small sands representing the fill of a very small erosional channel cut into the top of Stratum 6. Large sands were present, but charcoal and artifacts were apparently not.

Stratum 11. Like Stratum 10, Stratum 11 was the fill of a small erosional channel cut into the top of Stratum 6, observed only in the LA 66288 profile (Fig. 6.2). It consisted of yellowish brown, moderately laminated, small sands. The shape of the stratum suggested that the channel was originally deeper, that subsequent erosion on the west side removed part of Stratum 11, and that Stratum 11 was subsequently covered at least in part by Stratum 5. Subsequent erosional processes also seem to have moved sediment from Stratum 6 across part of Stratum 11.

Stratum 12. Stratum 12, observed only in the

LA 66288 profile (Fig. 6.2), represented the fill of a small erosional channel cut into Stratum 6. It consisted of a thin (4 to 8 cm) deposit of small to medium, pale brown, alluvial sands. Weak laminations were present but the sands were not sorted. No cultural materials were observed. The shape of Stratum 12 suggested that the channel also cut into the east side of the Stratum 11 channel. Subsequent colluvial processes apparently moved material from Stratum 6 back over Stratum 12.

Stratum 13. Stratum 13 represented the fill of a small erosional channel observed only in the LA 66288 profile (Fig. 6.2). The channel cut through Strata 6 and 17 and was filled with small to medium, pale brown, laminated, sorted sands containing charcoal flecks. The shape of Stratum 13 suggested that it was originally thicker. Erosion appeared to have removed part of Stratum 13 and covered it with materials from Stratum 6.

Stratum 14. Stratum 14, observed only in the LA 66288 profile (Fig. 6.2), consisted of a deposit of light yellowish brown, alluvially deposited, well-sorted, strongly laminated, small to large sands and small gravels. The medium to large sands and small gravels were largely restricted to the bottom half of the deposit and to a lens at the top of the west side of the deposit. Small sands were found in the top half of the east side and beneath the large sand and gravel lens on the west side. Stratum 14 represented the fill of a small erosional channel that probably formed soon after Stratum 5 began to be deposited, since this channel cut into the bottom of Stratum 5 and the top of Stratum 6. Stratum 14 was subsequently covered by Stratum 5. The erosional event that created the wide channel filled by Stratum 5 left a depression or channel between Strata 6 and 11 on the east and Stratum 15 on the west. Stratum 14 was the fill of a small channel within that depression.

Stratum 15. Observed only in the LA 66288 profile (Fig. 6.2), Stratum 15 consisted of a thin (8 to 15 cm) layer of pale brown, weakly laminated, small sands. Laminations were found in small lenses, sometimes with sands lighter in color than the surrounding matrix. Medium and large sands were occasionally present but were not sorted. Charcoal flecks were present, as were prehistoric artifacts, but they appeared to be more common near rodent burrows.

Stratum 15 was not a channel deposit but appears to represent colluvial slope wash from the terrace. It was laid down over Stratum 6 and probably started in the vicinity of Stratum 14, where Stratum 6 was thicker than in the western third of the profile. Stratum 15 was cut by erosion near its eastern side, and the cuts were filled by Strata 5 and 14.

Stratum 16. Stratum 16, observed only in the LA 66288 profile (Fig. 6.2), consisted of a deposit of pale brown, loose, dry, small sands. Small lenses were only occasionally present, and the deposit had a mixed appearance. These characteristics suggested that Stratum 16 may have been eolian rather than alluvial or colluvial in origin. Small pockets of lensed, laminated sands may be locations of erosion affecting the eolian sand. Stratum 6 was apparently cut by erosion, and Stratum 16, if it was eolian in origin, blew up against that cut. Subsequent erosion seems to have removed part of Stratum 16, the remainder of which was covered by colluvial material from Stratum 6.

Stratum 24. Observed only in the LA 105710 profile (Fig. 6.3), Stratum 24 was a thin (4 to 10 cm), colluvial, slope-wash deposit consisting of pale brown, laminated, small sands. A few charcoal flecks were present, but since no artifacts were observed, the charcoal may not be cultural in origin. The shape of the deposit showed that, on the east, it was cut by an erosional episode that resulted in a shallow channel or depression filled by Substratum 3C. On the west side, erosional channels divided Stratum 24 into thin, separated deposits; gaps between them were filled with Stratum 6. Stratum 24 was on top of the remarkably flat upper surface of Stratum 25. The erosional episodes that disturbed the eastern and western sides of Stratum 24 apparently did not disturb Stratum 25.

Stratum 25. Stratum 25 was a deposit of laminated, light yellowish brown, small sands running across most of the LA 105710 profile (Fig. 6.3). Laminations were strongly present, suggesting that a number of colluvial slope-wash episodes created this stratum on top of Stratum 17. The top of Stratum 25 was remarkably flat, with very few undulations, indicating considerable stability following deposition. The exception to this statement was an area near the east end of the profile, where an erosional event left a small depression or channel that was filled by Stratum 24 as it flowed over Stratum 25. Corn pollen was found in a low to trace concentration (3 grains/g) in a sample of Stratum 25 sediment.

Stratum 17. Stratum 17 was a buried A (Ab) soil horizon observed in both profiles (Figs. 6.2 and 6.3). It consisted of brown to dark brown, loose, small sand mixed with organic material from plants. Although the stratum was 60 to 70 cm below modern ground surface and the strata above it contained no roots, Stratum 17 contained a large number of rootlets, and many small root lines were visible.

Stratum 17 ran the entire length of the LA 66288 profile (Fig. 6.2). However, in the east half it was severely impacted by erosion. In the eastern 2 m of the profile, the dark, organic-rich soil was jumbled with colluvial or alluvial deposits of medium to large sands and gravels. In that area, Stratum 17 had a very mottled appearance, with dark soil pockets mixed with small pockets of lensed small sands and pockets of large sands and gravels. Stratum 17 was also cut by the same event that resulted in the channel that filled with Stratum 13. However, to the west of Stratum 13, Stratum 17 was relatively undisturbed.

In the east half of the LA 105710 profile (Fig. 6.3), the upper surface of Stratum 17 was remarkably flat, suggesting considerable stability in that ground surface. The west half of the upper surface of Stratum 17 was more undulating, suggesting less stability and more erosional activity. At the western end of the profile, Stratum 17 was apparently disturbed by an erosional episode that resulted in the inclusion of some lensed and laminated sands in the stratum, with a mixed, mottled appearance similar to that of the eastern portion of the stratum in the LA 66288 profile (Fig. 6.2). No domestic plant pollen was found in a sample of Stratum 17 soil.

Stratum 18. Stratum 18 consisted of brown to dark brown, loose, small sand mixed with organic material. It was not as dark as Stratum 17, suggesting that it did not contain as much organic material as Stratum 17. Artifacts and charcoal were present. Stratum 18 may have been an incipient B (Bb) soil horizon that was forming beneath Stratum 17 before the stable surface was covered, plant growth stopped, and the formation of soil horizons halted. In both profiles (Figs. 6.2 and 6.3), Stratum 18 occurred under the relatively undisturbed portions of Stratum 17, but it was not present beneath the disturbed portions. This may indicate that the same processes that disturbed Stratum 17 impacted Stratum 18, or that disturbance prohibited the stability needed for formation of a B horizon. Alternately, Stratum 18 may be a lower portion of Stratum 17, with decreasing amounts of organic material—and, hence, lighter soil—with increased depth below the former ground surface. No domestic plant pollen was found in a sample of Stratum 18 soil.

Stratum 19. Stratum 19 was a thick layer of colluvial, slope-wash sediment. In the LA 66288 profile (Fig. 6.2), Stratum 19 consisted of a matrix of loose, yellowish brown, small sands, with medium to large sands and small gravels. The sands were not sorted, and very weak lamination was present in the form of occasional thin lenses of small sand. Charcoal flecks were present throughout but did not appear to cluster or concentrate except near the western side of the profile, where they occurred as sand lenses. Sherds and chipped stone artifacts were present. Stratum 21 formed on the upper surface of Stratum 19. Subsequent erosion removed part of Stratum 21, and Stratum 19 material from upslope was redeposited over the remaining Stratum 21. Much of the redeposited layer of Stratum 19 was then apparently removed by erosion that re-exposed the top of Stratum 21. Stratum 20 replaced the portion of Stratum 19 removed during this process.

In the LA 105710 profile (Fig. 6.3), Stratum 19 was a thick deposit of loose, small sands that, unlike the LA 66288 profile, included almost no large sands or small gravels. This was probably because the LA 105710 profile was farther from the terrace slope and larger materials were not transported that far, except under more extreme alluvial conditions. Lamination of the small sands was very weak and consisted of small sand lenses. No domestic plant pollen was found in a sample of Stratum 19 sediment.

Stratum 20. Stratum 20 was observed only in the LA 66288 profile (Fig. 6.2). Like Stratum 19, Stratum 20 was a thick, colluvial slope-wash layer consisting of a loose, small sand matrix with medium to large sands and small gravels. Some cobbles were also present, as were artifacts. Charcoal was present throughout, most commonly as small lenses and concentrations of flecks. Lamination of sands was weak, but lensing was more common than in Stratum 19. Lensing and lamination were more common near the bottom of Stratum 20, directly above Stratum 21, suggesting some sorting of materials. Conversely, sands and gravels were more mixed in the upper two-thirds of Stratum 20. Larger gravels and cobbles appeared more frequently in the upper two-thirds of the stratum, indicating differing intensities of colluvial action during deposition. Stratum 20 filled the missing slope created by an erosional process or event that cut Stratum 19 and exposed Stratum 21. The relatively flat upper surface of Stratum 20 suggested subsequent stability, which allowed for deposition of materials that formed the soil horizons identified as Strata 17 and 18.

Stratum 22. Stratum 22 was a colluvial slopewash deposit that consisted of a matrix of pale brown, fine sand containing some large sands and small gravels. Lensing was present, primarily in pockets, but lamination was weak. Charcoal flecks were present throughout, and pockets of flecks were present but not common. Artifacts were also present. Stratum 22 was separated from Stratum 19, which was immediately above it, by a thin (0.5 to 1 cm) lens of laminated small sand. That lens probably represented a low-energy alluvial episode that deposited sands on top of the relatively stable upper surface of Stratum 22. The LA 105710 profile (Fig. 6.3) suggested that the episode may have been variable in energy. The break between Strata 22 and 19 was represented by a series of small sorted sand lenses, identified as Substratum 19A. They did not constitute a single layer of material but rather the fill of a series of small, shallow depressions, indicating that the depositional episode disturbed the top of Stratum 22 and, in fact, happened during deposition of Stratum 19, since it also disturbed lower portions of that stratum. No domestic plant pollen was found in a sample of Stratum 22 sediment.

Stratum 22 was at the bottom of the LA 66288 profile (Fig. 6.2). The presence of charcoal and artifacts showed that the stratum, encountered about 1.3 m below modern ground surface, did not predate the occupation of Hilltop Pueblo. A small deposit of Stratum 22 near the bottom center of the LA 105710 profile (Fig. 6.3) probably represented the original deposit. An erosional episode removed much of the stratum. Based on its size in the LA 66288 profile, it was fairly thick. That episode created a depression or channel that was subsequently filled by Stratum 33. Stratum 40 formed over Stratum 33 and the remnant of Stratum 22, after which an erosional event or episode redeposited Stratum 22 material from upslope over Stratum 40. Another significant erosional event cut the eastern side of the profile, leaving a channel that filled with Stratum 26, which contained several charcoal lenses. The eastern side of that channel was cut by another event, leaving a smaller channel that filled, in order, with Strata 19, 27, and 28. A smaller event left a shallow channel that filled with Strata 31 and 30, after which another event left a shallow channel that filled with Stratum 32. Following this, a combination of alluvial and colluvial processes cut through Stratum 32, modified the top of Stratum 22, and redeposited Stratum 19 material from upslope over the tops of Strata 32, 36, and 22, including depositing pockets of Substratum 19A.

Stratum 21. Stratum 21 was a thin (8 to 9 cm), colluvial slope-wash deposit of pale brown, small sands containing some large sands and gravels. It was observed in the LA 66288 profile (Fig. 6.2). The small sands were lensed but only weakly laminated, and lensing was not consistent throughout but occurred in pockets. Still, lensing was more common than in Strata 19 or 20. Charcoal was present throughout as flecks, but it did not occur in pockets or concentrations. Artifacts were present.

Stratum 21 was darker than Strata 19 and 20 and appeared to contain more rootlets. The darker color may indicate that it had a higher charcoal content, but the presence of rootlets suggested that Stratum 21 was an incipient A horizon. Stratum 21 was found within Stratum 19 and beneath Stratum 20. As discussed earlier, Stratum 21 formed on top of Stratum 19 during a period of stability allowing plant growth and the beginning of topsoil formation. Subsequently, erosion removed part of Stratum 21 and redeposited Stratum 19 material from upslope over the top of Stratum 21. Another event or longer episode removed much of the redeposited Stratum 19 material, which was replaced by Stratum 20. Based on the relatively consistent thickness of Stratum 21, that event or episode did not remove much of Stratum 20, although a small channel was cut through Stratum 21 that filled with Strata 23 and 20.

Stratum 40. Seen in the LA 105710 profile (Fig. 6.3), Stratum 40 was a thin, colluvial slope- wash deposit of pale brown, small sands. The sands were lensed in pockets, but only weakly laminated. Charcoal and artifacts were present. Stratum 40 was darker than adjacent strata and appeared to contain more rootlets. It formed after Stratum 22 was deposited and disturbed, and Stratum 33 was deposited. Stratum 40 was relatively consistent in thickness in both profiles, lending support to the notion that it was a relatively stable deposit, and based on its color, that it was an A horizon topsoil layer. These characteristics led to the initial identification of Stratum 40 as Stratum 21 in the LA 105710 profile (Stratum 40 is identified as Stratum 21 in Appendix 1). The two strata were very similar in appearance and in the circumstances of their formation, in that both apparently formed on top of relatively stable colluvial deposits (Stratum 21 over Stratum 19, Stratum 40 over Strata 22 and 33), after which erosion covered the incipient soil horizons with redeposited layers of the sediments beneath them. However, the consistent placement of Strata 21 and 40 within Strata 19 and 22, respectively, showed that Strata 21 and 40 were not the same horizons. They did point to periods of stability following deposition of Strata 19, 22, and 33. It is likely that Stratum 21 also formed on top of Stratum 19 in LA 105710, but was removed by the same or similar erosional processes that disturbed Stratum 19 in LA 66288.

A sample of Stratum 40 was submitted for radiocarbon dating of the rootlets and decayed plant material it contained (FS 64; Beta-163882). Charcoal in the sample was removed during processing. The resulting material yielded a two-sigma measured radiocarbon age of B.P. 670 ± 40, a two-sigma conventional age of B.P. 750 ± 40, and a two-sigma calibrated age of A.D. 1220–1300 (B.P. 730 to 650). Its calibration curve intercept date was A.D. 1270 (B.P. 680). These dates are impossible to reconcile with the dates obtained from artifacts recovered from the Hilltop Pueblo site, since the site does not appear to have a component dating to the Coalition period (see Chapter 19). Further, it is older by over 100 years than a sample of charcoal collected from Stratum 36, which was below Stratum 40 (Fig. 6.3; see discussion of Stratum 36). Potential explanations for this discrepancy can come from two directions. In one, there was a geomorphological situation involving deposition of older sediments, containing natural materials apparently dating to the thirteenth century, over younger sediments containing cultural materials dating to the fourteenth century. There is no evidence to support this situation in that the description of Stratum 40 does not point to different processes of origin than those seen in the other major strata crossing the profiles. The other possible explanation is that the radiocarbon dates were affected by different carbon (C3 and C4) pathways of the plants whose decayed remains comprised the datable organic material in the sediment sample submitted for dating. Since there is no evidence to support the first explanation, the second seems likely (pers. comm., P. McBride and M. Toll, 2002). However, using information available from data recovery, we cannot resolve the obvious problem of the Stratum 40 radiocarbon dates.

It is interesting, in this regard, that corn pollen was found in a low concentration (6 grains/g) in a sample of Stratum 40. Although low in comparison to other species represented in the sample, this is the highest concentration of corn pollen found below Stratum 1. It is unlikely that the corn pollen in Stratum 40 resulted from the colluvial processes that moved artifacts and other materials from the terrace slope to the terrace base area, since corn pollen was not found in a sample of Stratum 33, which was below Stratum 40, or from samples of Strata 22 and 19 taken above Stratum 40. On the other hand, since Stratum 40 was an A horizon, showing that the sediment was stable for long enough to allow growth of a plant community, it is more likely that Stratum 40 was used for prehistoric corn farming. However, that farming activity was probably not associated with Hilltop Pueblo, which was apparently abandoned before deposition of Stratum 40 (see discussion of Stratum 36). It is possible, although not demonstrable, that Stratum 40 was farmed by residents of Nute Pueblo, which is about 200 m west of LA 66288 and LA 105710. Alternatively, the pollen in Stratum 40 may have been blown from farm fields immediately upwind (west) of the sites. In either case, the farming probably postdated occupation of Hilltop Pueblo, but not Nute Pueblo. Incidentally, this may help explain why neither Harrington's or Morley's informants knew of or showed them Hilltop Pueblo. If Hilltop Pueblo was occupied early in the Classic period, as might be indicated by the radiocarbon date from Stratum 36 (see the discussion of Stratum 36), and Nute was occupied later in or throughout the Classic period, the collective memory of Hilltop Pueblo may have been lost or subsumed with that of Nute Pueblo.

Stratum 23. Stratum 23 was observed only in the LA 66288 profile (Fig. 6.2). It consisted of light yellowish brown, small to large sands in a laminated deposit that filled the lower half of a small channel that cut through Stratum 20 and into Stratum 22. The larger sands were sorted and appeared in the upper half of the stratum.

Stratum 33. Observed only in the LA 105710 profile (Fig. 6.3), Stratum 33 was a relatively thick (10 to 19 cm) deposit of light yellowish brown, alluvially deposited, lensed, and well-laminated small sands. Charcoal flecks were present throughout, and some lenses within the matrix had tiny charcoal flecks mixed with the sands, creating the impression that this stratum was somewhat darker than neighboring strata. Artifacts were not observed

Stratum 33 filled a large, shallow erosional channel that cut and removed portions of Stratum 22 at the east end of the profile. The top of Stratum 33 was altered, probably by sheet erosion, to slope down to the west. Stratum 40 formed on this slope, after which Stratum 22 materials from upslope were redeposited over Stratum 40. Stratum 33 was also cut by a large channel that filled with Stratum 26 (see discussion of Stratum 22). No domestic plant pollen was found in a sample of Stratum 33 sediment.

Stratum 26. Stratum 26 filled a large erosional channel observed only at the east end of the LA 105710 profile (Fig. 6.3). The matrix was light yellowish brown, small sands. Some large sands and small gravels were present in small pockets on the east end of the profile. Thin lenses of small sand and thicker lenses of well-laminated sands were present. Charcoal flecks were present throughout. A small lens of charcoal and sorted sand was present at the east end of the profile, and two lenses of charcoal flecks mixed with small sand were present within the channel. Artifacts were present. The erosional channel filled by Stratum 26 cut through Strata 22, 40, 28, and 33, and into Stratum 35. It may have followed a small channel cut into Stratum 37 that was filled with Stratum 35. Stratum 26 was, in turn, cut by two or three erosional channels (see Stratum 22 discussion).

Stratum 27. Stratum 27 filled a small erosional channel observed only in the LA 105710 profile (Fig. 6.3). It consisted of pale brown, loose, small sands. Some lensing occurred on the east side of the channel, and lamination was weakly present. With the sand lenses were lenses of tiny charcoal flecks.

An erosional channel cut into Stratum 26, the fill of a larger channel on the east side of the profile. The channel filled with Stratum 19 material as it was being deposited. Stratum 27 was the lower fill of a small channel that cut into the Stratum 19 channel fill.

Stratum 28. Stratum 28 was the upper fill of the small erosional channel in the LA 105710 profile whose lower fill was Stratum 27 (Fig. 6.3). Stratum 28 consisted of pale brown, fine sand that was very weakly laminated. Some lensing was present but not prevalent. The shape of the top of this stratum suggested that it was the final fill material of the small channel. Stratum 28 was cut by an erosional event that created a shallow channel to the west. That channel was filled by Strata 30 and 31.

Stratum 31. Stratum 31 was the lower fill of a shallow erosional channel in the LA 105710 profile (Fig. 6.3), the upper fill of which was Stratum 30. Stratum 31 consisted of pale brown, small sands containing medium and large sands and small gravels. The medium sands were not sorted, but the large sands and gravels were sorted into small pockets at the bottom of the stratum.

Stratum 30. Stratum 30 was the upper fill of the small erosional channel in the LA 105710 profile (Fig. 6.3) whose lower fill was Stratum 31. It consisted of light yellowish brown, weakly sorted, laminated, small sands. The sorted sands occurred as small lenses within the laminated matrix. The erosional channel cut into Stratum 26 and cut the west side of the small channel filled by Strata 19, 27, and 28. Stratum 30 intersects Strata 27 and 28.

Stratum 32. Stratum 32, observed in the LA 105710 profile (Fig. 6.3), consisted of light yellowish brown, well-laminated, small sands that appeared to represent the fill of a shallow channel or depression. Small lenses of dark sand, perhaps containing ash or tiny charcoal flecks, were present. Early in the deposition of Stratum 19 over Strata 26, 19a, 27, 28, and 22, an erosional event created the shallow channel or depression that filled with Stratum 32. The eastern side of Stratum 32 may have been cut later and replaced by Stratum 19 materials. A U-shaped break in the stratum resembled a rodent burrow but did not have the other characteristics of a burrow (such as very loose, jumbled fill, sometimes with a different color from surround strata). It may actually have been created by alluvial action.

Stratum 34. Stratum 34 was also observed only in the LA 105710 profile (Fig. 6.3). It consisted of light yellowish brown, weakly sorted, weakly laminated, alluvially deposited, small sands. Sorting occurred as small lenses. Neither charcoal nor artifacts were observed. The shape of Stratum 34 suggested that it was the lower fill of a broad, shallow channel whose upper fill was Stratum 33. The east side of Stratum 34 was cut by the large channel that filled with Stratum 26. Stratum 34 was also cut by a small channel that filled with Stratum 35.

Stratum 35. Stratum 35 was the fill of a small channel that cut through Stratum 34 in the LA 105710 profile (Fig. 6.3). The matrix was pale brown, loose, small sand, containing some medium sands. Large sands and small gravels were also present but were sorted into a small pocket at the bottom of the channel. Neither charcoal nor artifacts were observed.

Stratum 36. Stratum 36 was a long stratum of variable thickness (9 to 22 cm) that ran along the eastern two-thirds of the LA 105710 profile (Fig. 6.3). It consisted of pale brown, small sands mixed with medium sands and charcoal flecks. Charcoal was much more common in Stratum 36 than in any other stratum in either profile, and, though scattered throughout the stratum, was also consolidated in lenses of sorted sand. Near the middle of the profile, where Stratum 36 dropped to the floor of the trench, charcoal was more concentrated, particularly along the bottom of the stratum. In fact, for about 2 m west of the point at which Stratum 36 dropped below the trench, there was a charcoal and ash deposit some 2 cm thick on the trench floor, representing the charcoal that occurred along the bottom of the stratum in the profile. Artifacts were only occasionally evident in Stratum 36, but charcoal and ash were plentiful. Although this was not a cultural deposit—witness the lensing and lamination that pointed to its colluvial, slope-wash origins—it was, with Stratum 21 (and 26?), the stratum that yielded the most artifacts during auger testing (Wiseman and Ware 1996) and hand excavations (see discussion of excavation units). Stratum 36 was cut by an erosional episode that created a channel that filled with Stratum 34 (and 33?). It was also cut by erosional activity that was followed by deposition of Stratum 22. Corn pollen was found in a low concentration (5 grains/g) in a sample of Stratum 36 sediment.

A sample of Stratum 36 sediment was submitted for radiocarbon dating of the charcoal and ash it contained (FS 119; Beta-163883). Its two-sigma measured radiocarbon age was B.P. 490 ± 60, its two-sigma conventional age was B.P. 570 ± 60, and its two-sigma calibrated age was A.D. 1290–1440. Its calibration curve intercept date was A.D. 1400 (B.P. 550). The conventional and calibrated ages place the materials early in the Classic period. They represent an "average" age for the burned materials contained in the Stratum 36 sample and reflect the Classic period occupation of Hilltop Pueblo. They should not, however, be taken to demonstrate conclusively that Hilltop Pueblo, itself, dates to the Early Classic period, since the sample may have included burned materials subject to "old wood" dating problems. Because Stratum 36 represents colluvial redeposition of discarded material from the pueblo, and because the goal for dating this sample was only to establish association of Stratum 36 with the pueblo, the various burned materials in the sample were not differentiated prior to processing for radiocarbon dating.

Stratum 37. Stratum 37 was fill in a small erosional channel in the LA 105710 profile (Fig. 6.3). It consisted of light yellowish brown, laminated, small sands with lenses of sorted, medium sands. Neither charcoal nor artifacts were observed. Apparently, a small channel was cut into the top of Stratum 38 and was partially filled by Stratum 36. Stratum 37, the upper fill of that channel, was subsequently covered by more Stratum 36 material.

Stratum 38. Stratum 38, which was at the bottom of the LA 105710 profile (Fig. 6.3), consisted of pale brown, weakly laminated, small sands. Small lenses of weakly sorted sands were also present. Charcoal flecks were infrequent. No artifacts were observed. The top of Stratum 38 was relatively flat, suggesting some stability to the deposit prior to deposition of Stratum 36. A small channel was cut into Stratum 38 and filled by Stratum 39. A second small but broader channel that cut into the top of Stratum 38 was filled by Stratum 36. A portion of that fill was then cut and replaced by Stratum 37. A trace concentration of corn pollen (1 grain/g) was found in a sample of Stratum 38 sediment.

Because Stratum 38 contained only a few charcoal flecks and few if any artifacts, and because Stratum 36, which was immediately above Stratum 38, contained charcoal, ash, and artifacts and yielded Classic period radiocarbon dates, it is likely that Stratum 38 was the natural ground surface during occupation of Hilltop Pueblo. If so, then Stratum 36 represented colluvial redeposition of discarded artifacts and other materials from the terrace edge and slopes during and immediately after occupation of the pueblo.

Stratum 39. Stratum 39 filled a small channel in the LA 105710 profile (Fig. 6.3) that was cut during the deposition of Stratum 38. The matrix consisted of mixed small, medium, and large sands. No sorting or lamination was present. Neither charcoal nor artifacts were observed.

Discussion

The stratigraphic record defined in the LA 66288 and LA 105710 profiles reveals a long sequence of natural sediment and soil strata in the terrace base area. Of the 40 strata described from the two profiles, most (n=31) were the result of localized alluvial events or episodes that created erosional channels crossing the terrace base area. Strata 2, 4, 5, 7–16, 20, and 23 were found only in the LA 66288 profile (Fig. 6.2), while Strata 24 through 40 were found only in the LA 105710 profile (Fig. 6.3). This left seven strata common to both profiles: Strata 1, 3, 6, 17, 18, 19, and 22. However, since the profiled trench at LA 66288 was not as deep as the profiled trench at LA 105710, three strata found only at the latter—Strata 36, 38, and 40—were not recorded at the former but were, based on their natures, probably common to both.

Of these 11 strata, four (Strata 1, 17, 21, and 40) were A soil horizons, three of which (Strata 17, 21, and 40) were buried (Ab) horizons, while Stratum 1 was the modern topsoil. The four A horizons formed on relatively stable strata that resulted from colluvial slope-wash processes moving sediments and associated cultural materials down from the terrace slopes below Hilltop Pueblo. None of the strata recorded in the two profiles were clearly eolian in origin, a conclusion based on the presence of artifacts and charcoal in most strata. Most strata were alluvial in nature, representing the fill of numerous small channels crossing the terrace base. The larger strata reflected periods of time when local (at least) conditions encouraged colluvial processes and the development of slope-wash deposits.

Excavation Units in the Terrace Base Deposit

Six 1 m by 1 m grid units were excavated in the terrace base deposit, three at LA 66288 and three at LA 105710 (Fig. 6.1). The placement of units was based on the results of auger testing at the sites (Wiseman and Ware 1996). Auger test locations that revealed comparatively higher quantities of artifacts and charcoal were selected for examination through excavation. The six units were excavated prior to excavation of the backhoe trenches. Consequently, soil and sediment strata had not been defined, and excavations were conducted in arbitrary 10 cm levels. Elevations were maintained relative to the arbitrary elevation of the main datum.

LA 66288 Excavation Units

Unit 526N/483E, on the bank of an arroyo, was excavated to 1.3 m below modern ground surface (13 levels). Comparison of the elevations of levels in this unit with the LA 66288 profile (Fig. 6.2) suggests correlations between excavation levels and strata defined in the profile. Of 968 artifacts recovered from this unit (Table 6.2), 276 (28.5 percent) came from Levels 7, 8, and 9, which probably corresponded to Strata 17 and 18 (upper Ab

Table 6.2. Artifact frequency by excavation unit level for Hilltop Pueblo (count and row percentage)

Site	Excavation Unit	Excavation Levels																Total
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
LA 66288	515N/479E	2	46	23	53	32	106	161	45	15	15	51	62	74	29	109	129	952
		0.2%	4.8%	2.4%	5.6%	3.4%	11.1%	16.9%	4.7%	1.6%	1.6%	5.4%	6.5%	7.8%	3.0%	11.4%	13.6%	100.0%
	526N/483E	0	1	12	25	30	75	61	88	141	47	76	152	168	92	-	-	968
		0.0%	0.1%	1.2%	2.6%	3.1%	7.7%	6.3%	9.1%	14.6%	4.9%	7.9%	15.7%	17.4%	9.5%	-	-	100.0%
	540N/470E	3	5	6	4	54	41	25	35	37	45	22	28	64	36	54	49	508
		0.6%	1.0%	1.2%	0.8%	10.6%	8.1%	4.9%	6.9%	7.3%	8.9%	4.3%	5.5%	12.6%	7.1%	10.6%	9.6%	100.0%
LA 105710	468N/501E	0	6	8	6	3	0	4	1	7	5	12	0	13	0	68	-	133
		0.0%	4.5%	6.0%	4.5%	2.3%	0.0%	3.0%	0.8%	5.3%	3.8%	9.0%	0.0%	9.8%	0.0%	51.1%	-	100.0%
	488N/499E	0	6	13	12	1	11	27	6	26	7	-	55	76	87	135	-	462
		0.0%	1.3%	2.8%	2.6%	0.2%	2.4%	5.8%	1.3%	5.6%	1.5%	-	11.9%	16.5%	18.8%	29.2%	-	100.0%
	491N/498E	0	9	10	0	7	3	19	17	13	21	19	0	0	46	103	51	318
		0.0%	2.8%	3.1%	0.0%	2.2%	0.9%	6.0%	5.3%	4.1%	6.6%	6.0%	0.0%	0.0%	14.5%	32.4%	16.0%	100.0%

and Bb horizons); 488 (50.4 percent) came from Levels 10 through 13, which probably corresponded to Stratum 20.

Unit 540N/470E, the northernmost unit excavated at LA 66288, was excavated to 1.5 m below modern ground surface (15 levels). Of 508 artifacts recovered from this unit (Table 6.2), 72 (14.2 percent) came from Levels 7 and 8, which probably corresponded to Strata 17 and 18 (upper Ab and Bb horizons); 195 (38.4 percent) came from Levels 9 through 13, which probably corresponded to Stratum 20; 54 (10.6 percent) came from Level 14, which probably corresponded to Stratum 21 (lower Ab horizon); and 49 (9.6 percent) came from Level 15, which probably corresponded to Stratum 22.

Unit 515N/479E, the southernmost unit excavated at LA 66288, was also excavated to 1.5 m below modern ground surface (15 levels). This unit was about 1 m lower in elevation than the other two units: Unit 515N/479E ranged from 10.55 to 12.00 m below datum, while Unit 526N/483E ranged from 9.43 to 10.70 m below datum, and Unit 515N/479E ranged from 9.75 to 11.30 m below datum. The upper surface of the LA 66288 profile ranged from 9.00 to 10.00 m below datum. Consequently, we cannot directly compare the elevations of Unit 515N/479E with those of the profile. However, we may be able to postulate correlations between levels in this unit and soil and sediment strata, based on patterns observed in the other two units. Specifically, of 952 artifacts recovered from Unit 515N/479E, 327 (34.4 percent) came from Levels 5 through 8, which probably corresponded to Strata 17 and 18 (upper Ab and Bb horizons); 231 (24.3 percent) came from Levels 9 through 13, which probably corresponded to Stratum 20; 109 (11.5 percent) came from Level 14, which may have corresponded to Stratum 21 (lower Ab horizon); and 129 (13.6 percent) came from Level 15, which may have corresponded to Stratum 22.

LA 105710 Excavation Units

Comparison of levels in the three LA 105710 excavation units with strata defined in the LA 105710 profile (Fig. 6.3) suggests possible correlations, although differences between the elevations of the units and the profile preclude more direct comparisons, which are possible with two unit levels and strata at LA 66288.

Unit 468N/501E, the southernmost unit excavated at LA 105710—and thus the most distant from Hilltop Pueblo—was excavated to 1.4 m below modern ground surface (14 levels). Of 133 artifacts recovered from this unit, only 7 (5.3 percent) came from Level 8, which may correspond to Stratum 17 (upper Ab horizon); 30 (22.6 percent) came from Levels 9 through 12, which may correspond to Stratum 19; and 68 (51.1 percent) came from upper portions of Levels 13 and 14, which may correspond to the upper portion of Stratum 22. Because Stratum 40 (lower Ab horizon in the LA 105710 profile) was within Stratum 22 (Fig. 6.3), it is unlikely that any of the artifacts were recovered from Stratum 40, which would probably have been encountered at about Level 16 or 17.

Unit 488N/499E was also excavated to 1.4 m below modern ground surface (14 levels). Of 462 artifacts recovered, only 26 (5.6 percent) came from Level 8, probably corresponding to Stratum 17 (upper Ab horizon); 138 (29.9 percent) came from Levels 9–12, which probably corresponded to Stratum 19; and 222 (48.1 percent) came from Levels 13 and 14, probably corresponding to the upper portion of Stratum 22.

Unit 491N/498E was excavated to 1.5 m below modern ground surface (15 levels). Of 318 artifacts recovered from this unit, only 13 (4.1 percent) came from Level 8, probably corresponding to Stratum 17; 40 (12.6 percent) came from Levels 9–12, probably corresponding to Stratum 19; and 200 (62.9 percent) came from Levels 13 through 15, probably corresponding to Stratum 22.

Discussion

Several observations can be made based on information gathered from the six excavation units. First, far fewer artifacts were recovered from the LA 105710 units (Table 6.2), probably reflecting the relative distance of those units from Hilltop Pueblo. Second, and despite the different numbers of artifacts, there is an overall pattern in which artifact frequencies are generally highest in the lowest levels and decrease with proximity to the modern ground surface. This probably reflects decreased numbers of artifacts on the terrace slope through time: during and just after occupation of Hilltop Pueblo, more artifacts were available to be affected by alluvial and colluvial processes and events revealed in the trench profiles. Consequently, we should expect there to be higher artifact frequencies associated with natural sediment deposition that occurred during and just after occupation of the pueblo than with deposition that occurred later. This overall pattern is more characteristic of the LA 105710 assemblages than of the LA 66288 assemblages. Excavation units at LA 105710 yielded 79.0 to 83.6 percent of their artifacts from Stratum 17 and below. Only 4.1 to 5.6 percent of those artifacts came from Stratum 17, while 12.6 to 29.9 percent came from Stratum 19, and 48.1 to 62.9 percent came from Stratum 22. Again, this probably reflects relative distance from the pueblo trash deposits.

Third, the LA 66288 assemblages also show the overall pattern of more artifacts from lower levels. However, they also show more variation, in the form of some higher artifact counts in the upper and intermediate levels. The LA 66288 units yielded 72.8 to 83.8 percent of their artifacts from Stratum 17 and below, a range of values that is wider but essentially comparable to those from the LA 105710 units. However, in contrast to the LA 105710 units, the LA 66288 units yielded 14.2 to 34.4 percent of their assemblages from Stratum 17. This situation probably reflects the relative proximity of those units to Hilltop Pueblo; more artifacts were discarded on the terrace slope just below the pueblo during its occupation and were available to be redeposited at the terrace base by alluvial and colluvial events and processes. Consequently, we should expect both higher artifact frequencies in the LA 66288 units and less discrepancy in artifact frequencies between upper and lower excavation levels than in the LA 105710 units.

Features in the Terrace Base Deposit

Two features were identified and excavated in the LA 105170 portion of the Hilltop Pueblo site. Both were exposed in Backhoe Trench 1: Feature 2 was at the east end of the trench, and Feature 3 was found along the north wall of the trench (Fig. 6.1).

Feature 2. Feature 2 was a shallow basin hearth, approximately pear-shaped in outline (Fig. 6.4). Because it was exposed in the backhoe trench, only about half of its east-west width was available for excavation. It measured 43 cm north-south by 21 cm east-west; its original east-west width was probably about 40 cm. Although Feature 2 was 8 cm deep in its center, it was only about half full (3 to 4 cm) of a matrix consisting of very loose, ashy sand containing bits of charcoal. This suggests that Feature 2 was used only once, a conclusion supported by the fact that its sides were not significantly baked. No artifacts were directly associated with this feature.

Feature 2 was constructed by digging a shallow basin in the sand of Stratum 19. The basin was not lined with mud or rocks. No surface could be defined within the stratum, showing that Feature 2 was made and used while Stratum 19 was being deposited but that it was not associated with use of a stabilized surface in the terrace base area.

Table 6.3 lists the types of wood charcoal recovered from a flotation sample of Feature 2 fill. Most of the wood burned in Feature 2 could only be identified as coming from the families Rosaceae (Rose family; otherwise unidentifiable) and Salicaceae (probably cottonwood or willow). Because of the very small amounts of charcoal recovered from Feature 2, none was submitted for radiocarbon dating.

Table 6.4 lists the other plant remains recovered from a flotation sample of Feature 2 fill. The assemblage is dominated by burned *Amaranthus* seeds, suggesting that the primary purpose of the fire in Feature 2 was preparation of *Amaranthus*, probably for consumption. A few burned *Portulaca* seeds were also recovered, as were a few Monocotyledonae stem fragments. The latter may be from corn plants, but certain identification could not be made.

Feature 3. Feature 3 was also a shallow basin hearth, approximately oval or circular in outline (Fig. 6.5). Because it was also exposed in the backhoe trench, only about half of its north-south width was present at excavation. It measured 40 cm east-west by 20 cm north-south; its original north-south width was probably about 40 cm. Although it was 10 cm deep at its center, Feature 3 contained a 3 to 4 cm thick deposit of ash mixed with loose, small sand. The thin deposit suggested that Feature 3 was only used once. The fire was hot enough to burn but not bake the sides of the pit. The deposit contained charcoal bits and

Figure 6.4. Feature 2 at LA 105710, a shallow simple hearth.

Table 6.3. Wood charcoal in flotation samples from the LA 105710 component of Hilltop Pueblo

Category	Taxon	Feature 2 (FS 144)	Feature 3 (FS 145)
Conifers	*Juniperus*	1	-
		<0.1 g	-
Nonconifers	*Atriplex/Sarcobatus*	-	130
		-	4.9 g
	Cercocarpus	-	9
		-	0.1 g
	Rosaceae	18	10
		0.1 g	0.2 g
	Salicaceae	18	1
		0.1 g	<0.1 g
	Unknown nonconifer	6	4
		<0.1 g	0.1 g
Total		45	154
		0.2 g	5.3 g

Table 6.4. Plant remains in flotation samples from the LA 105710 component of Hilltop Pueblo*

Category	Taxon	Feature 2 (FS 144)	Feature 3 (FS 145)
Cultural, annual noncultivars	*Amaranthus*	200 121.2	-
	Portulaca	11 6.7	-
Cultural, annual cultivars	*Zea mays*	-	9.5 cob fragments, +++ cupules, 1.0 kernel, 2.9 kernel fragments
Other annuals	Monocotyledonae	+ stem	-
	Unidentifiable	1 0.6	-
	Unknown plant part	1 0.6	-
Perennials	*Sphaeralcea*	-	1 1.0

* Except for *Zea mays* , numbers in each cell are by count and abundance per liter. Plant remains are all carbonized, and seeds unless indicated otherwise. For *Zea mays* , + = less than 10/liter; +++ = 25 to100/liter.

Figure 6.5. Feature 3 at LA 105710, a shallow simple hearth.

corncob fragments. No artifacts were directly associated with the feature.

Feature 3 was constructed by digging a shallow basin into the sand of Stratum 22. The basin was not lined with mud or rocks. During investigation of the feature, a possible surface was identified around the feature. Consequently, an area 8.75 m east-west by 4.5 to 5 m north-south was removed by backhoe to expose the feature and the area around it. However, no ground or use surface was actually present, and no other features were observed. Feature 3 was made and used while Stratum 22 was being deposited. Its elevation placed it near but above Stratum 40 (lower Ab horizon), suggesting that the terrace base area was in use not long after colluvial processes began to cover Stratum 40 with Stratum 22 material.

Table 6.3 lists the types of wood charcoal recovered from a flotation sample of Feature 3 fill. Most of the wood burned in Feature 3 was either *Atriplex* (greasewood) or *Sarcobatus* (saltbush). A few fragments of *Cercocarpus* (mountain mahogany) and Rosaceae charcoal were also recovered. The greasewood/saltbush charcoal was submitted for radiocarbon dating (FS 145; Beta-167116). Its two-sigma measured radiocarbon age was B.P. 410 ± 50, its two-sigma conventional age was B.P. 620 ± 50, and its two-sigma calibrated age was B.P. 670 to 530 (A.D. 1280–1420). Its calibration curve intercept dates were B.P. 640 (A.D. 1310), B.P. 590 (A.D. 1360), and B.P. 560 (A.D. 1390). The conventional and calibrated ages, including the intercept dates, place the materials early in the Classic period, while the measured age is later in the Classic period.

The primary purpose of the fire in Feature 3 was probably processing corn for consumption. Burned cob fragments, cupules, a kernel, and kernel fragments comprise almost all the assemblage. One *Sphaeralcea* (globemallow) seed was also present (Table 6.4).

Addressing the Research Issues

Wiseman and Ware (1996:56–58) present six research issues to be addressed by data recovered from the portions of the Hilltop Pueblo site within project limits. These issues focus on identification of the terrace base deposits and definition of prehistoric use of the terrace base area.

Research Issue 1: Genesis and Structure of the Dune

Testing investigations at the base of the terrace at LA 66288 and LA 105710 revealed the presence of sandy deposits thought to represent a sand dune: "Local topographic conditions, wind patterns, and land-use problems (overgrazing/ farming) have resulted in the accumulation of a major eolian sand deposit (i.e., a single large dune) piled at the base of the high terrace east of U.S. 285" (Wiseman and Ware 1996:21). Those deposits yielded artifacts and charcoal during testing, and indicated to the investigators that the deposits were perhaps contemporaneous with Hilltop Pueblo and were used by pueblo occupants. Wiseman and Ware (1996:56) argue, "One key to understanding prehistoric use of the dune of the south area of LA 66288 and the north end of LA 105710 lies in the origin and structure of the dune. Only by learning how the dune formed and the details of the internal structure and relationships can we correlate the deposits and the cultural materials in them."

Wiseman and Ware (1996:56) are particularly concerned with (1) whether the eolian processes presumed to have formed the "dune" resulted from denudation of agricultural areas upwind of the site; (2) whether the "dune" offered prehistoric farmers an additional or alternative location for farming, and if so, (3) whether the need for an additional or alternative farming location resulted from population increase (whether by growth or expansion is not specified), the need to replace farming locations because of wind erosion, or "general denudation of the landscape" (natural, assisted by human activities, or both).

However, our investigations at the Hilltop Pueblo site show that the terrace base deposits were not eolian in origin—that is, the deposit was not a dune. As discussed earlier, most (n=29) of the 40 strata defined in the two backhoe trench profiles were alluvial in nature and represent the fill of numerous small channels that cut different parts of the terrace base area. Four strata were topsoil (A) horizons: three were buried (Ab), and one was the modern topsoil. The three topsoil horizons formed on the tops of large, thick, colluvial strata that remained stable long enough for plants to grow, die, and decay, adding organic material to the sandy sediments and encouraging soil formation. The oldest Ab horizons (Strata 21 and 40) were not old enough for underlying B horizons to begin forming before they were covered by colluvial sediments (Stratum 19 over Stratum 21 in the LA 66288 profile, Stratum 22 over Stratum 40 in the LA 105710 profile). A Bb horizon (Stratum 18) had begun to form in places beneath the third Ab horizon (Stratum 17), showing a longer period of stability and soil formation on top of Stratum 19. Most erosional episodes that resulted in the many small channels in the eastern halves of the profiles took place after formation of Stratum 17. Beneath Stratum 17, most strata run the lengths of the profiles, and there is less evidence of the kinds of erosional events and channels seen above Stratum 17. Stratum 17 reflects this long period of relative stability as plant growth stabilized and held a ground surface, allowing formation of soil, including a B horizon. The remaining strata resulted from colluvial slope wash that moved artifacts and charcoal from the terrace slope, redepositing them at the base of the terrace.

The colluvial and alluvial origins of the soils and sediments in the terrace base deposit explain three characteristics of the strata. First, the gravels in most of the strata, which would not be expected in eolian deposits, were derived from terrace gravels. Second, artifacts were present in most of the strata. Only a few of the small channel strata appeared not to contain artifacts, and that may have been because they were recorded in profile rather than during excavation. Third, the frequency of artifacts was generally higher in lower excavation levels in the terrace base area, reflecting decreasing numbers of artifacts available for redeposition through time. This was most evident in the LA 105710 excavation units, which were farther from the pueblo than the LA 66288 units. Although the pattern is also seen in assemblages from the LA 66288 units, those units yielded many more artifacts than the LA 105710 units and yielded more artifacts from upper levels, reflecting the presence of more artifacts on the terrace slope nearer the pueblo. The higher number of artifacts in lower levels shows that the terrace slope was not the scene of consistent artifact disposal through time. Rather, the terrace base deposits, with the possible exceptions of Strata 36 and 38, reflect natural processes and events that occurred after occupation of the pueblo.

Research Issue 2: Prehistoric Pathways

Wiseman and Ware (1996:56) contend, "It is a virtual certainty that the dune that constitutes the south area of LA 66288 and the north end of LA 105710 was used as a major pathway between Hilltop Pueblo and the fields and water of the Ojo Caliente Valley." Since we have established that the terrace base deposits investigated during this project postdate the pueblo, it seems unlikely that our investigations would have revealed an actual path. The backhoe trench profiles did reveal several small, shallow, probably linear depressions that could fit Wiseman and Ware's description of a path. But, as discussed earlier, those depressions were erosional channels that cut across the deposits. This does not preclude the presence of paths used by Hilltop Pueblo occupants, but, if present, they were below the levels investigated during this project, associated with a surface contemporaneous with the pueblo, which we did not identify with certainty during our investigations (perhaps the top of Stratum 38?). There is no evidence in the portions of LA 66288 and LA 105710 included in the Hilltop Pueblo site of the trail that follows the eastern slope of the river valley (LA 118549). That trail enters LA 105710 at its southern end but was not discerned within that site or LA 66288.

Research Issue 3: Outdoor Activity Area

Wiseman and Ware (1996:57) state, "The quantities of cultural debris (sherds and lithic debitage) demonstrated by the surface and subsurface evidence are too great for us to believe that it all derives from random, unintentional scattering of trash from the pueblo." They then argue, "If we are correct in assuming that the cultural materials are the product of trash accumulation in the vicinity of activity areas, then we should be able to find other evidence of these activities, such as hearths, structural remains (ramada postholes, pits, compacted use-surfaces, and the like)." As we have seen, however, the strata comprising the terrace base deposit probably postdate occupation of Hilltop Pueblo, and artifacts accumulated in the strata as a result of natural events and processes. Two simple hearths, Features 2 and 3, were found in the LA 105710 portion of the site. However, these features also probably postdate occupation of the pueblo, since they were found in colluvial strata (Strata 19 and 22, respectively) above a buried A horizon (Stratum 40) that formed well after strata that may have been associated with occupation of the pueblo (Strata 38 and 36). No evidence of artifacts, use-surfaces, or structural remains were found near the features, which were each probably used only once. Obviously, someone stopped on the terrace base deposit during the Early Classic period, as Strata 22 and 19 were being deposited, for activities that involved one-time uses of small, simple hearths, probably for food preparation. What other activities were performed there at those times cannot be determined. Strata 22 and 19 did not yield corn pollen, so there is no evidence that the strata were farmed. Nor can we determine how commonly the terrace base area was used, and for what purposes, after Stratum 40 was no longer used for farming. It is possible that activity areas and features actually associated with Hilltop Pueblo are present below the terrace base deposit, but if so, our investigations did not reveal evidence of them.

Research Issue 4: Fieldhouses

In addition to pathways and activity areas, Wiseman and Ware (1996:57) suggest that the terrace base area might have been the location of fieldhouses: "The quantities of cultural debris indicate various uses of the dune. These activities might have involved the construction of more substantial structures than ramadas or shades. If one or more fieldhouses were built and used on the dune, we should be able to find and excavate the remains." By implication, these suspected fieldhouses would have been associated with Hilltop Pueblo, although Wiseman and Ware do not speculate as to why pueblo residents would have built fieldhouses less than 100 m from their homes at the pueblo. Even Nute Pueblo, about 200 m to the east, was probably too close to have contributed fieldhouses at LA 66288 or LA 105710. In any case, since most of the terrace base deposit postdates the occupation of Hilltop Pueblo, evidence of fieldhouses or other structures contemporaneous with the pueblo should not be expected and was not found.

Research Issue 5: Gardens

The potential presence of fieldhouses would suggest the associated presence of garden/farming locations at the Hilltop Pueblo site. Wiseman and Ware (1996:57) argue that the best evidence of gardening at the site would be the presence and changing concentrations of cultigen pollen. They advocate systematic horizontal and vertical soil sampling to examine the distribution of cultigen pollen. However, their approach to this research issue is predicated on the notion that the terrace base area was a dunal deposit and the location of activities associated with the occupation of Hilltop Pueblo.

Again, since data recovery investigations revealed that the terrace base deposit was not dunal in nature, and that it largely postdated occupation of Hilltop Pueblo, there is little possibility that investigations would reveal prehistoric gardens associated with the pueblo. Further, both testing and data recovery showed that the terrace base deposit was deep, and comparison of Figures 6.2 and 6.3 show that, while the major strata were present in both profiles, most of the 40 strata identified resulted from events specific to the two profiles. Consequently, since it would have been difficult or impossible to consistently control which strata were sampled, and many samples would have been collected from noncultural contexts, we did not conduct systematic soil sampling across the sites. Instead, sediment and soil samples for pollen analysis were collected from strata in the LA 66288 and LA 105710 Backhoe Trench 1 profiles. Only samples from the LA 105710 profile were submitted for analysis (Appendix 1; Figs. 6.2 and 6.3).

The only cultigen pollen identified in the samples was from corn (*Zea mays*). Corn pollen was recovered from, in descending order, the control sample and Strata 1, 3, 25, 40, 36, and 38. Pollen from four nondomestic but possibly economic plants—wild buckwheat, unidentified cactus, cholla cactus, and prickly pear cactus—was recovered from, in descending order, the control sample and Strata 1, 6, 25, 17, 22, 40, 36, and 38 (Holloway 1999; Appendix 1). Pollen from economic plants, both domestic and nondomestic, make up only small fractions of the spectra recovered from any of the samples.

Analysis of the pollen spectra suggests to Holloway (Appendix 1) that "a juniper dominated assemblage in association with *Pinus* was likely present during the time period represented by Strata 1–15," that is, the uppermost strata in the profiles (Figs. 6.2 and 6.3). Corn pollen in Strata 1, 3, and 25 likely reflect late historic and modern farming immediately upwind of the sites, since there is no historic evidence of recent farming on the sites (see Chapter 25). This would explain why corn pollen concentrations in the control and Stratum 1 samples were considerably higher than in samples from lower strata. Additionally, pollen spectra below Stratum 1 have suffered from weathering that impacted preservation. Holloway (Appendix 1) states,

> Concentration values decrease to below 1,000 grains/g in the upper strata (through Stratum 25). The concentration values increase in Stratum 17, which is expected given the interpretation of this stratum as a buried A horizon. These again decrease gradually and remain below 1,000 grains/g from Stratum 22 through the bottom. Thus, there are apparently two sections of the profile containing very low pollen concentration values separated by increased values in the area of the buried A horizon.

Although Holloway's interpretation is that the values were uniformly low ("below 1,000 grains/g") in the lower half of the profile, the concentration values were actually below 1,000 grains/gram in the Stratum 22, 33, and 38 samples. In contrast, the concentration values in Strata 40 and 36 are 1,153 and 1,188 grains/gram, respectively. As discussed earlier, Stratum 40 was a buried A horizon, while Stratum 36 was probably formed by colluvial processes during or soon after occupation of Hilltop Pueblo. It is interesting, then, that Strata 40 and 36 were also the lower strata that yielded corn pollen.

Stratum 40 was an A horizon, showing stability and soil formation, that yielded corn pollen in relatively high concentration values. This strongly suggests that the horizon was farmed. However, as discussed in the description of Stratum 40, farming on Stratum 40 was probably not associated with the occupation of Hilltop Pueblo and may have occurred during the later or longer occupation of Nute Pueblo. If Stratum 40 was farmed, then we may presume that gardens of some sort were present. However, none of the backhoe trench profiles, including the two shown in Figures 6.2 and 6.3, revealed any evidence of farming features. This may indicate that prehistoric farming associated with Stratum 40 was relatively more informal than that associated with the many large, complex farming sites described in this report. On the other hand, it may only indicate that our data recovery activities did not encounter farming features. In either case, we were not able to determine whether farming occurred on Stratum 40 until analysis of a soil sample revealed the presence of corn pollen.

Research Issue 6: Dating the Prehistoric Occupations

Wiseman and Ware (1996:57–58) place a high priority on dating the terrace base deposits with both relative and absolute methods. In this chapter, we have described the sequence of deposition and modification of natural sediment and soil strata comprising the terrace base deposit. With that description we are able to examine the timing of events and processes represented in the sequence. As discussed earlier, a radiocarbon date from Stratum 36 points, through deposition of trash on the terrace slope and natural redeposition of trash in the terrace base area, to occupation of Hilltop Pueblo during the Classic period. Based on the Stratum 36 date, it is possible that Hilltop Pueblo was occupied early in the period, but that cannot be confidently determined because the context of the dated charcoal is one of deposition and redeposition following burning; thus, it is an indirect context for dating the pueblo itself. Still, the nature of Stratum 36, in combination with the radiocarbon date, indicate that the stratum was deposited during or shortly after occupation of the pueblo. Assuming this to be the case, the sediment and soil strata above Stratum 36 must date after that time.

A soil sample from Stratum 40 provided a problematic radiocarbon date that is actually older than the date from Stratum 36, which was below Stratum 40. The available data do not allow us to resolve this apparent paradox, although it seems likely that the problem involves the plant remains contained in the Stratum 40 sample.

A radiocarbon date from Feature 3, which was in Stratum 22 above Stratum 40, suggests that little time passed while strata between Strata 36 and 22 were being deposited. This included formation of Stratum 40. There is no indication from pollen spectra that the terrace base deposit was used for farming at the time that either Feature 2 or Feature 3 was used. Consequently, we cannot know why the features were created or what activities may have taken place in their vicinities. Clearly, however, they were created not long after Hilltop Pueblo was abandoned, probably during occupation of nearby Nute Pueblo.

Analysis of ceramic artifacts from the Hilltop Pueblo site (Chapter 19) revealed that Biscuit B sherds significantly outnumber Biscuit A sherds (see Table 19.1). Since Biscuit B is presumed to have been introduced in the fifteenth century after introduction of Biscuit A in the late fourteenth century, assemblages dominated by Biscuit B should date after about A.D. 1400. This may correspond with the Stratum 36 radiocarbon date, which extends to A.D. 1420 (one sigma, calibrated) or A.D. 1440 (two sigma, calibrated), and whose intercept date is A.D. 1400. The Feature 3 radiocarbon date, on the other hand, extends to A.D. 1400 (one sigma, calibrated) or A.D. 1420 (two sigma, extended), with intercept dates at A.D. 1310, 1360, and 1390. Since Feature 3 must be younger than the materials in Stratum 36 (based on stratigraphy, even though the radiocarbon dates are essentially identical), we can assert (if not demonstrate) the following:

1. Stratum 36 should date after about A.D. 1375, based on the presence of Biscuit A sherds in the assemblage.

2. Stratum 36 should date after about A.D. 1400, based on the presence of Biscuit B sherds in the assemblage.

3. Feature 3 should date before about A.D. 1420, based on the two-sigma calibrated radiocarbon date.

4. If Stratum 36 dates after about A.D. 1400 and Feature 3 dates before about A.D. 1420, then (a) Stratum 36 was probably deposited between about A.D. 1400 and 1420, indicating that Hilltop Pueblo was abandoned near the turn of the fifteenth century; and (b) no more than about two decades is represented in the colluvial deposits between Stratum 36 and the placement of Feature 3 in Stratum 22. Included in that time period is the stabilization, formation, and covering of Stratum 40, an A horizon that was farmed by nearby Puebloan residents, probably from Nute Pueblo.

5. The terrace base deposit was no longer farmed after the covering of Stratum 40, between about A.D. 1400 and 1420, until the historic period.

Clearly, the data available from our investigations allow us to raise but not to confirm or deny these assertions.

During the early deposition of Stratum 19 in the LA 105710 profile (Fig. 6.3), there was a significant erosional period that resulted in the cutting and filling of one large and several small channels in the eastern third of the profile. The erosional events that occurred in that period cut the lower portion of Stratum 19, Strata 22, 40, 33, 34, and the upper surface of Stratum 36, and created Strata 26 through 32. The deposition of Stratum 19 continued after this erosional period, covering the large and small channels; that the upper surface of Stratum 19 became stable enough to allow formation of Strata 17 and 18; and that the subsequent strata were largely present across the length of the profile indicate that the erosional period represented by Strata 26–32 was relatively intense and short-lived compared to the colluvial processes that deposited the major strata.

A later erosional period was seen in the eastern half of the LA 66288 profile (Fig. 6.2). This period occurred after formation of Strata 17 and 18 in the upper portion of Strata 19 and 20. The events of this period cut through Strata 5, 15, 6, and 16, and into the upper surface of Stratum 17, and created numerous large and small channels that filled with Strata 7–13. Like the earlier erosional period seen in the LA 105710 profile, the period represented in the LA 66288 profile was apparently relatively intense and short-lived, and it was followed by a renewal of the colluvial processes that deposited Stratum 3 over the erosional channels. Stratum 3 was later cut by erosional events that resulted in deposition of Strata 4 and 2. Finally, the sequence was covered by Stratum 1.

That the two major erosional periods were not seen in both profiles suggests that they were localized within the terrace base area. Similar localized episodes may have cut the terrace base numerous times during the approximately six centuries represented by the profiles (assuming that Stratum 36 was deposited during the fourteenth century, as may be indicated by the radiocarbon date). Whether those erosional periods were related to human activities on or near the terrace base or to natural environmental events and processes cannot be determined from the available evidence. However, the radiocarbon date from Feature 3, which was used after formation of Stratum 40 during deposition of Stratum 22, shows that the earlier erosional event, in the LA 105710 profile, occurred after about A.D. 1420. The later erosional period occurred well after the formation of Stratum 17, which did not yield corn pollen and, therefore, may date after abandonment of Nute Pueblo and before European occupation of the Gavilan area in the 1700s. It was covered by Stratum 3, which did yield corn pollen and was probably late historic in age. Under these circumstances, we can suggest that the later erosional period probably occurred during the historic period, although we cannot determine whether that happened early or late in the period.

Summary

Investigations at LA 66288 and the prehistoric component of LA 105710 were limited to deposits at the base of the gravel terrace on which Hilltop Pueblo is located. Testing in the terrace base area had suggested that the deposits were eolian in origin and, thus, dunal in nature. However, examination of long, deep backhoe trenches excavated across the terrace base revealed that the deposits resulted from colluvial and alluvial events and processes. Those events and processes created a series of sediment strata, some of which remained exposed and stable long enough to allow formation of soil horizons before being covered by subsequent sediment strata.

The data recovery plan specified six research issues to be addressed by investigations at the Hilltop Pueblo site. All were predicated on the supposition that the terrace base deposits were dunal and had been present during the occupation of Hilltop Pueblo. Based on that supposition, the research issues focused on identification of prehistoric activities assumed to have been performed by Hilltop Pueblo residents in the terrace base area, and features or structures that might have been associated with those activities. Specifically, the issues involved the identification of Puebloan pathways, outdoor activity areas, fieldhouses, and gardens, and dating the prehistoric use of the terrace base. However, because the terrace base deposits were not dunal and largely postdated the occupation of Hilltop Pueblo, the search for and identification of activities and features associated with the pueblo could be expected to yield negative results, and such was the case. The evidence of prehistoric farming of Stratum 40, one of the buried A horizons, and the presence of two small, isolated hearths show that the terrace base area was, indeed, the location of prehistoric activities. However, those activities were probably performed by residents of nearby Nute Pueblo, after Hilltop Pueblo was no longer occupied.

Ceramic types recovered from the Hilltop Pueblo site and radiocarbon dates obtained from redeposited trash and from one of the hearth features suggest that Hilltop Pueblo was occupied early in the Classic period and probably abandoned in the first quarter of the A.D. 1400s. Although the study of natural stratigraphy, redeposited ceramic artifacts, and radiocarbon dates from contexts not directly associated with Hilltop Pueblo provides, at best, a tenuous basis for proposing dates for the pueblo, it does allow a hypothesis that could be tested by investigations of the pueblo itself and may help explain why Hilltop Pueblo was not identified as an ancestral Tewa site by early twentieth-century informants.

Chapter 7. LA 105703

James L. Moore

LA 105703 is a large farming site on land administered by the USDI Bureau of Land Management. It occupies an irregular rectangular area bounded by a low terrace edge on the west and arroyos formed by intermittent drainages on the north (except for one feature) and south. The east boundary of the site is formed by the edge of the farming features and the base of a higher terrace. This site is not typical of the other fields examined during this study. Rather than being situated on top of a high terrace overlooking the river valley, it sits on an eroded, low-lying terrace remnant on the east edge of the Ojo Caliente Valley. These boundaries define the extent of a continuous scatter of farming features through this area, but it is unlikely that they replicate any important aspects of the prehistoric land tenure system.

LA 105703 measures 340 m north-south by 228 m east-west and covers 43,760 sq m (4.37 ha). The U.S. 285 right-of-way runs through the site, truncating several features. About 22 percent of the site extends into the right-of-way, mostly on the east side of the highway, though a few features were defined on the west side. In-field pottery analysis indicated that LA 105703 was used during the Classic period.

Vegetation is moderate on the site, and the plant cover of on- and off-feature areas is generally similar. However, distinct differences noted in a few places are discussed in individual feature descriptions. Grasses, the most common plants, include grama, three-awn, and muhly. Other common plants include rabbitbrush, sagebrush, snakeweed, narrowleaf yucca, prickly pear, barrel cactus, and cholla. Small juniper and piñon trees are growing all through the site area and have spread onto most of the farming features.

Field Procedures

Detailed mapping was restricted to the section of site that extends into the U.S. 285 right-of-way and an adjacent 25+ m wide zone except where the right-of-way widens in the north part of the site. This comprises a sample of about 36 percent of LA 105703, and all cultural features within this zone were mapped and recorded in detail. Several features were partly or wholly within project limits, including six gravel-mulched fields (Features 2, 8, 18, 20, 21, and 22) and eight borrow pits (Features 4 ,5, 6, 7, 12, 16, 17, and 19). The archaeologists concentrated on describing surface features in the mapped area and sample excavation of fields within project limits. The latter focused on Features 2, 8, 18, 21, and 22, each of which was sampled by as few as one or as many as eight excavation units. Since excavation of borrow pits would have provided little information that was not available from surface examination, no subsurface studies were conducted in those features. All cultural materials noted on the surface within the highway right-of-way were collected for analysis, as were artifacts encountered in excavation units. These materials are summarized later in this chapter. Artifacts noted elsewhere on the surface of features in the detailed mapping zone were inventoried by feature and are summarized in those discussions.

Features

Twenty-three features were at least partly mapped and described (Fig. 7.1). Field limits were often difficult to define in the mapped area, though outside that zone some fields are better delineated. A combination of colluvial and eolian processes has caused soil to build up against alignments that face the terrace interior, obscuring those edges in many places. Eolian deposits also cover much of the surface of the fields, especially where they are anchored by vegetation. This made it difficult to discern many alignments and to define the full extent of others. Several fields seem to overlie others, and it is possible that some materials used to build later features were salvaged from earlier fields, further obscur-

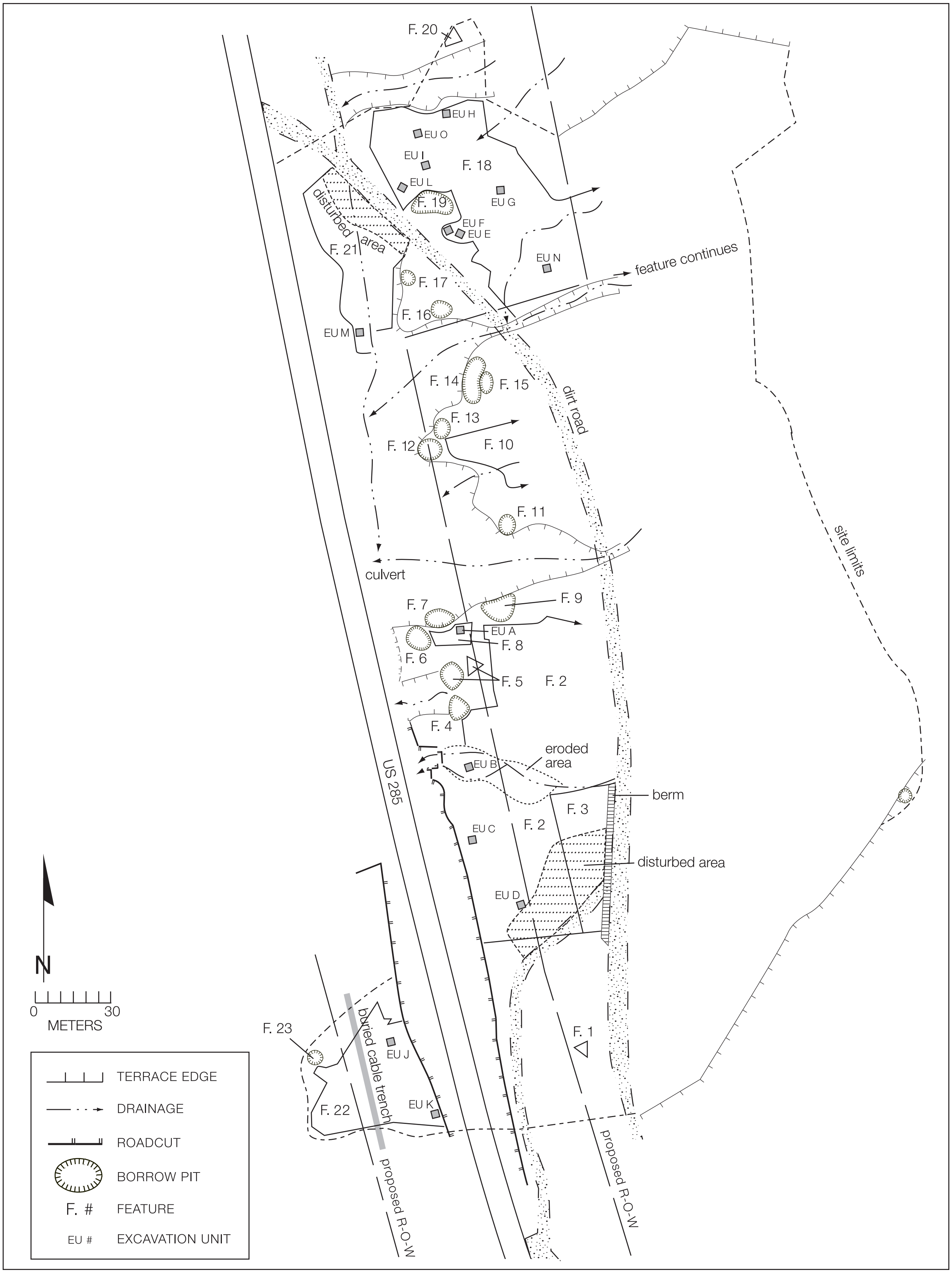


Figure 7.1. Plan of LA 105703.

ing alignments. Livestock grazing has also caused damage, displacing elements in cobble alignments and blurring feature edges. Along the terrace edge this seems to have exacerbated damage caused by erosion.

LA 105703 has sustained quite a bit of modern damage, though most features seem remarkably intact. Several dirt roads cross the site, one of which bisects it and has been graded, forming a berm along its west side that probably covers parts of farming features. The east edge of this road is incised into the terrace, affecting features bordering it on that side. It was not possible to determine whether several features are truncated by the road or originally extended across it. Other tracks remain unimproved, but traffic over them has obscured or damaged alignments and field surfaces. A considerable amount of modern trash has been dumped on the site surface, and dumping continued to occur while we were conducting our fieldwork. A zone next to Feature 22 was bladed for a billboard, and a buried telephone cable also crosses this feature. The U.S. 285 right-of-way passes through the site from north to south, truncating Features 2 and 22. Finally, grading along the east edge of the highway may have removed part of Feature 21, though erosion could also have been responsible for this damage.

Feature 1

Feature 1 consists of a series of cobble alignments that measure 4.5 by 4.1 m and cover 9 sq m (Fig. 7.2). Since this field was in the detailed examination zone, it was completely mapped. From the surface this feature appears to contain no artificial fill, but this was difficult to substantiate because it is at the base of a shallow slope adjacent to a gully and is badly eroded. Most alignments are covered by colluvial sands and silts that washed in from uphill. An undetermined portion of this feature was concealed in this way.

Alignments, a single element high and wide, were built with locally obtained cobbles and small boulders (10–20 cm long cobbles predominate). The few small boulders are 35–50 cm long. Elements were mostly placed end-to-end, though some side-by-side placement also occurs. Most elements were set on their broadest surfaces, but a few were set upright. Surface indications suggest that alignments in this feature were arranged in a gridded pattern, forming multiple compartments.

As noted earlier, this feature did not seem to have been artificially mulched. Feature fill consists of a silty sand containing 40–50 percent gravels and pea gravels. Whether this represents materials deposited by erosion or artificial fill was impossible to determine from surface examination alone. Since the alignments are a single element high, the fill is probably 8 to 10 cm thick. Vegetational density is not visibly different from adjacent areas that did not contain farming features. No cultural materials were noted on the surface of Feature 1.

Feature 2

Feature 2 is a large, irregular, gravel-mulched plot that measures 96.5 by 55 m and covers roughly 3,479 sq m (Fig. 7.2). Since this field was partly outside the detailed examination zone, the entire feature was not mapped. However, only a small part of the northwest corner of this feature was outside that area, so most of it is shown in Figure 7.2. Since Feature 2 extends into project limits, three excavation units were used to examine it. The measurements supplied for this feature were estimated from what remains of it. A dirt road truncates Feature 2 on the east side (Fig. 7.1), so we are uncertain whether it once extended across the road into an unmapped area that contains many alignments. In addition, the feature is truncated on the southwest by the U.S. 285 roadcut and on the south by extensive gullying that has obscured or removed much of the boundary alignment in that area. A small gully that runs east-west through the approximate center of Feature 2 has obscured or removed alignments and fill in that area, and erosion along a large gully that forms its north edge has removed much of the boundary alignment in that area as well. Perhaps 40–50 percent of the remaining surface of this feature is obscured by sediments that have infiltrated the mulch and are anchored by vegetation.

Boundary and interior subdividing alignments are a single element high and wide. They were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 10–25 cm long; the small boulders that occur are 25–40 cm long. Building

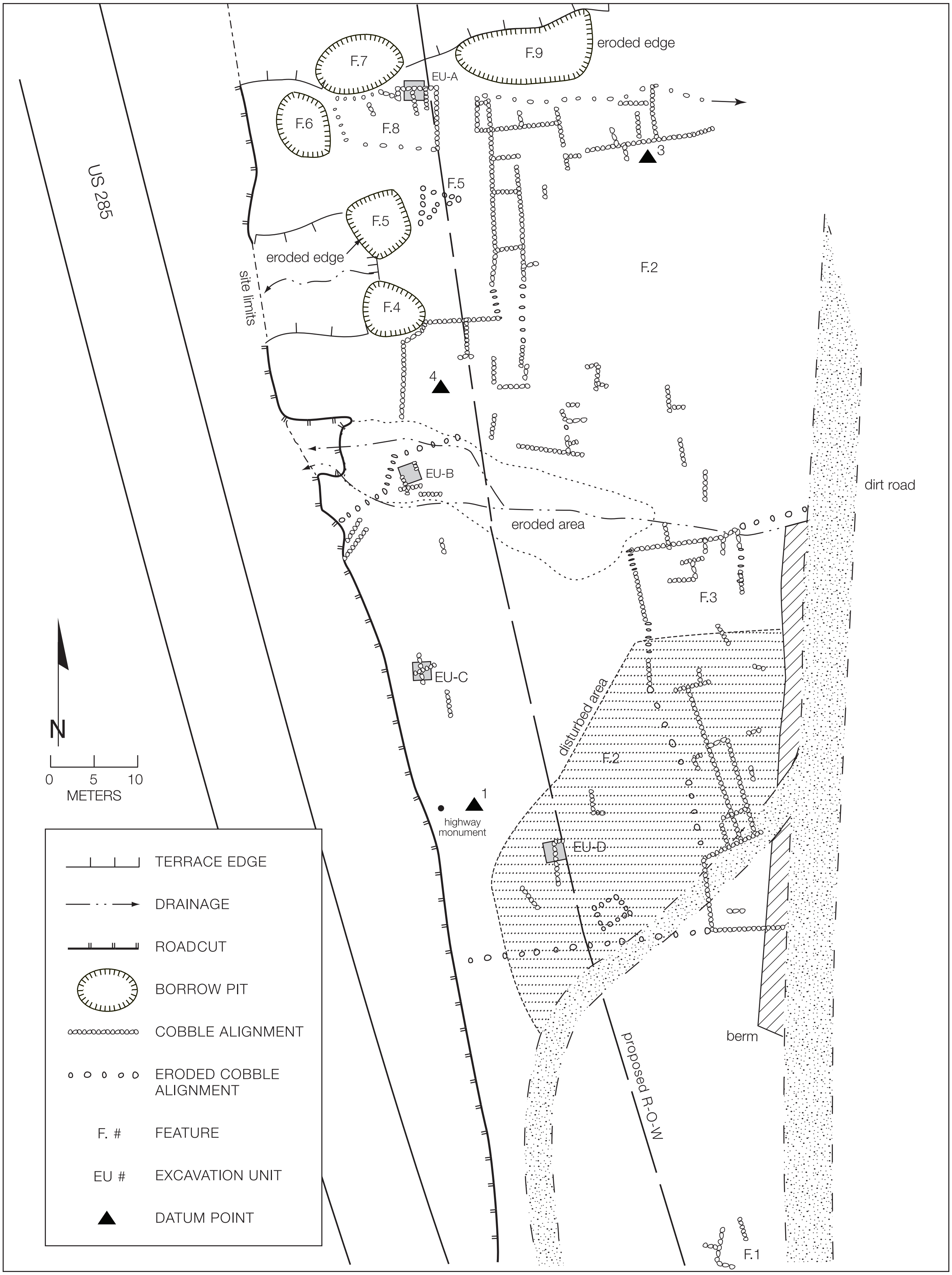


Figure 7.2. Features 1 through 9, LA 105703.

elements were mostly placed end-to-end, though some were placed side-to-side. While most elements were set on their broadest surfaces, uprights also occur. The north part of the feature appears to be subdivided into multiple compartments, and most or all of the rest of the field was probably also subdivided in this way. Most interior alignments are now concealed by sediments. Some areas contain large, noncontiguous, evenly spaced elements that are sometimes bordered by alignments. These larger elements are occasionally arranged in discernible patterns, though more often any patterning has been obscured by the buildup of sediments.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 12 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Since the alignments are a single element high, the mulch is probably 5–10 cm thick and seems to contain more pea gravels than do similar features at sites investigated further south in the valley. No differences were noted in on- and off-feature gravel or vegetational densities.

Surface artifacts in the right-of-way were collected. Cultural materials noted on the surface of the feature outside the right-of-way were inventoried and left in place. Chipped stone artifacts were common (136 were recorded). Gray rhyolite dominated this assemblage, comprising 72 core flakes, 35 angular debris, 8 cores, and 1 tested cobble. Other materials were less abundant and included andesite (2 cores, 1 angular debris), red rhyolite (2 core flakes), massive quartz (1 core flake, 1 angular debris), quartzite (1 core flake, 1 tested cobble), and Pedernal chert (1 core flake). While chipped stone debris was distributed across the feature, it tended to occur in clusters suggestive of individual chipping episodes. The only temporally diagnostic artifacts recorded were 2 Biscuit A bowl sherds, 1 Biscuit B bowl sherd, and 1 Biscuit B jar sherd. Though a considerable amount of historic trash is present, it was not recorded because it is of recent derivation and in some cases was discarded while investigations at the site were ongoing.

Feature 3

Feature 3 is a rectangular gravel-mulched plot that measures 44 by 12.5 m and covers at least 696 sq m (Fig. 7.2). Since this field was in the detailed examination zone, it was completely mapped. The east side of the feature is truncated by an improved dirt road, and grading has thrown up a berm on the west side of the road that probably covers part of Feature 3. It was impossible to determine how far east this field may once have extended. Only about 20–30 percent of the feature surface is obscured by sediments that have infiltrated the gravel mulch and are anchored by vegetation.

Boundary and interior subdividing alignments, a single element high and wide, were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 10–25 cm long; the small boulders that occur are 25–40 cm long. Elements in boundary alignments were mostly set end-to-end on their broadest surfaces, though some side-by-side placement also occurs. Conversely, most elements in interior subdividing alignments were set side-by-side on their broadest surfaces, but some uprights were also noted. Surface indications suggest that the interior of this feature is subdivided into multiple compartments. Numerous cobbles and small boulders occur in areas where alignments were not defined, and their patterning suggests that they represent the visible elements of alignments that are mostly concealed by sediments.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 12 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Since the alignments are only one element high, the mulch is probably 10–12 cm thick. Feature 3 appears to have been built on top of the east edge of Feature 2 and is distinctly mounded 10–12 cm above the adjacent surface of that earlier field, suggesting sequential construction. No variation in surface gravel or vegetational densities were noted between on- and off-feature areas.

All cultural materials seen on the feature surface were inventoried. Only chipped stone artifacts were found, including gray rhyolite (22 core flakes, 5 angular debris, 1 core), red rhyolite (1 core flake, 2 angular debris), and andesite (1 tested cobble). No temporally diagnostic artifacts were noted.

Feature 4

Feature 4 is an oval terrace-edge borrow pit measuring 8.6 by 5.9 m, with a maximum depth of 0.93 m (Fig. 7.2). It is near Feature 2 and was probably the source of some of the materials used to build that gravel-mulched field. This pit is cut into a fairly steep slope and appears to have been enlarged by erosion.

Feature 5

Feature 5 is an oval terrace-edge borrow pit measuring 8.7 by 5.9 m, with a maximum depth of 0.75 m (Fig. 7.2). It is near Feature 2 and was probably the source of some of the materials used to build that gravel-mulched field. This pit is cut into a fairly steep slope and appears to have been somewhat enlarged by erosion. Just east of Feature 5 and in possible association is a cluster of cobbles that appears to be a stockpile of building materials.

Feature 6

Feature 6 is a round terrace-edge borrow pit measuring 7.1 by 6.9 m, with a maximum depth of 0.91 m (Figs. 7.2 and 7.3). It is near Features 2 and 8 and was probably the source of some of the materials used to build those gravel-mulched fields. This pit may have been partly filled by sediments washing in from the adjacent terrace top, though the depth of any such deposits was undetermined.

Feature 7

Feature 7 is an oval terrace-edge borrow pit measuring 7.2 by 6.8 m, with a maximum depth of 1.34 m (Fig. 7.2). It is near Features 2 and 8 and was probably the source of some of the materials used to build those gravel-mulched fields. This pit may have been partly filled by sediments washing in from the adjacent terrace top, but the depth of those deposits was undetermined.

Feature 8

Feature 8 is a small rectangular gravel-mulched plot that measures 12.0 by 7.0 m and covers about 64 sq m (Fig. 7.2). This field is almost completely within the right-of-way, so the entire feature was mapped, and one excavation unit was used to examine its structure. Perhaps 50 to 60 percent of

Figure 7.3. Feature 6, a terrace-edge borrow pit at LA 105703.

the field surface is covered by sediments that have infiltrated the mulch and are anchored by vegetation. Boundary and interior alignments are mostly covered by eolian sediments, and elements in boundary alignments on the south, west, and north sides have been displaced by erosion.

Excavation showed that boundary and interior alignments are a single element high and wide. They were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 10–25 cm long. A few small boulders were also used; they are 25–30 cm long. Building elements were usually placed end-to-end and on their broadest surfaces, though occasional cobbles were placed upright or sideways. Most visible cobbles are patterned in a way that suggests they are parts of alignments, though an area in the southeast corner of the feature may contain a pattern of noncontiguous, evenly spaced elements.

The mulch is composed of unsorted gravels and pea gravels, though small cobbles up to 10 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Since the alignments are a single course high, the mulch is probably 8–10 cm thick. No differences in on- and off-feature gravel and vegetational densities were noted.

Feature 9

Feature 9 is a large, oval, terrace-edge borrow pit measuring 7.6 by 6.7 m, with a maximum depth of 0.94 m (Fig. 7.2). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Features 2 and 8 and was probably the source of some of the materials used to build one or both of those gravel-mulched fields. The southeast side of this feature may have been somewhat enlarged by erosion, and sediments have built up in the bottom of the pit to an undetermined depth. No artifacts were found in association with this feature.

Feature 10

Feature 10 is an irregularly shaped gravel-mulched plot that measures about 35 by 20.5 m and covers roughly 537 sq m (Fig. 7.4). Since this field was partly outside the detailed examination zone, the entire feature was not mapped. Only the western 60 percent fell within the mapping zone, so the full extent of the feature was estimated by pacing. Perhaps 40–50 percent of its surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation. The east edge of this feature (which is outside the detailed examination zone) is covered by an earth berm related to maintenance of an adjacent dirt road. Thus, it was not possible to determine whether that edge was truncated by the road or originally continued across it into an area that contains more gravel-mulched plots.

Boundary and interior subdividing alignments are a single element high and wide (Figs. 5.2 and 7.5); they were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 12–25 cm long. Small boulders were also commonly used as elements in alignments; they are 25–50 cm long. Most elements were placed end-to-end and set on their broadest surfaces, though interspersed with these in some alignments are occasional elements set sideways or upright. This feature is well preserved and highly subdivided. In areas that are partly covered by sediments, the patterning of elements that do not visibly abut other elements suggests that they represent buried alignments rather than noncontiguous, evenly spaced large elements. However, the latter pattern may occur in a few places. A small rock pile at the southeast edge of the feature seems to be a materials stockpile.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 10 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Since the alignments are a single element high, the mulch is probably 5–12 cm thick. No mounding above the terrace was seen, but a difference in surface gravel densities was noted between on- and off-feature areas. Where not obscured by sediments, gravels cover 80–90 percent of the feature surface. In adjacent off-feature areas, surface gravel density is only 50–60 percent. No similar variation in vegetative density was noted.

All cultural materials seen on the surface of this feature were inventoried. Gray rhyolite,

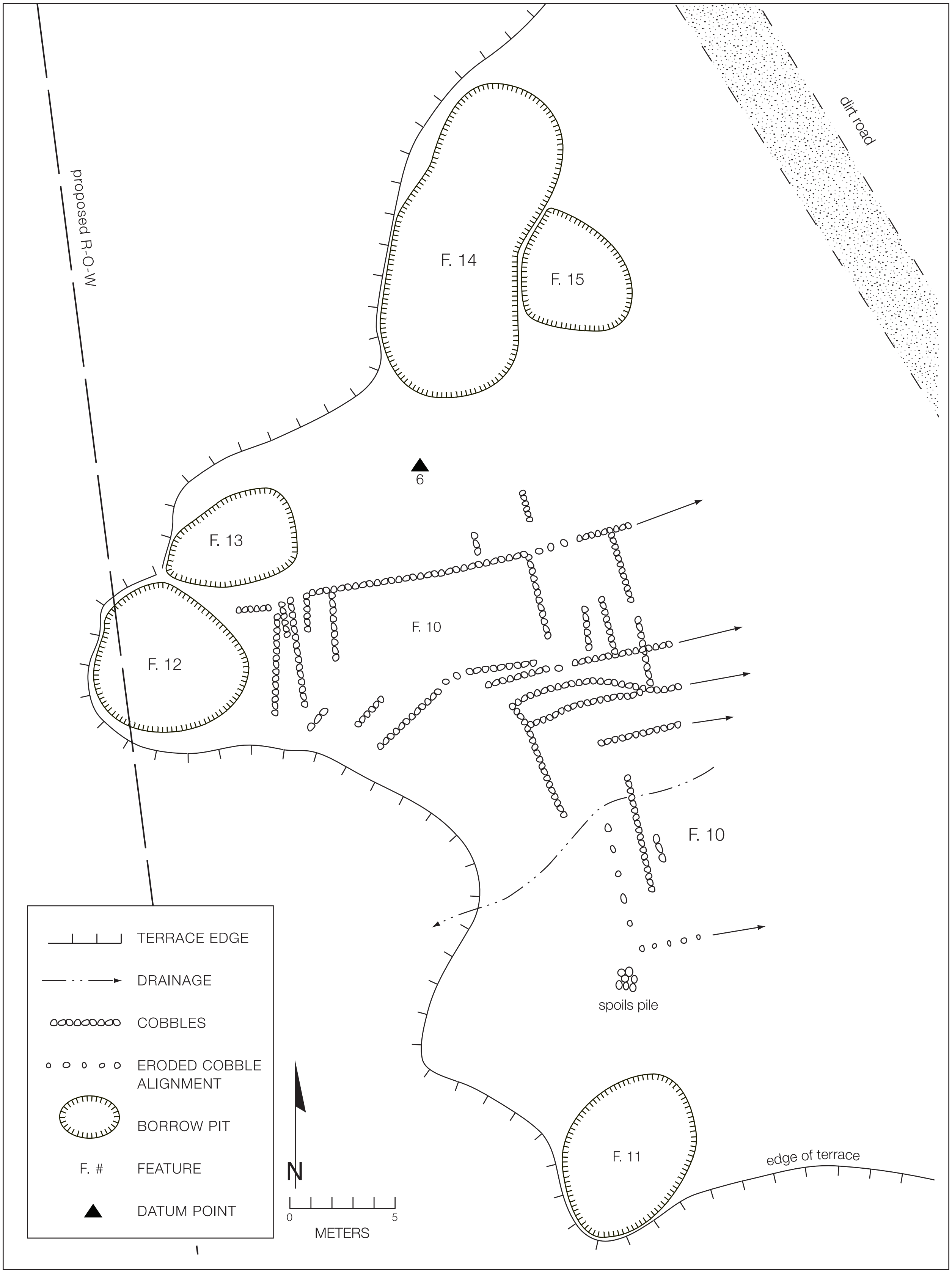


Figure 7.4. Features 10 through 15, LA 105703.

Figure 7.5. Cobble alignments and mulched surface in Feature 10, LA 105703.

which dominated this assemblage, comprised 89 core flakes, 58 angular debris, and 5 cores. Other materials included andesite (4 core flakes, 3 cores, 1 tested cobble), red rhyolite (6 core flakes, 5 angular debris), and massive quartz (5 core flakes, 7 angular debris). While chipped stone artifacts are scattered across the surface of the feature, they tend to cluster in areas, suggesting discrete chipping stations. No temporally diagnostic artifacts were noted.

Feature 11

Feature 11 is a large, oval, terrace-edge borrow pit measuring 8.9 by 6.1 m, with a maximum depth of 0.76 m (Figs. 5.4 and 7.4). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Feature 10 and was probably the source of some of the materials used to build that gravel-mulched field. The lower part of this feature is filled with cobbles and small boulders, which may have been sorted out of the gravels and discarded as too large for mulch. Nine pieces of chipped stone were found in the bottom of this feature and appear to represent a small chipping station. Materials noted included gray rhyolite (four core flakes, three angular debris, one core), and quartzite (one tested cobble).

Feature 12

Feature 12 is a large, nearly round terrace-edge borrow pit measuring 9.3 by 8.9 m, with a maximum depth of 0.27 m (Fig. 7.4). This feature extends into the right-of-way and was mapped but not excavated. It is next to Feature 10 and may have been a source of some of the materials used to build that gravel-mulched field. Though not shown on the feature map, this pit is slightly lobed on its northeast side, and the lobe is separated from the main pit by a low berm of cobbles and small boulders. This configuration is evidence of two episodes of use. The first episode created the main part of the borrow pit, and the lobe and berm were created by the second use. The berm appears to represent spoils discarded while obtaining gravel for mulch.

Feature 13

Feature 13 is an oval terrace-edge borrow pit measuring 7.4 by 6.8 m, with a maximum depth of 0.35 m (Fig. 7.4). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Feature 10 and may have been a source of some of the materials used to build that gravel-mulched field. It was dug so close to Feature 12 that the two pits became joined and together resemble an 8. This pit has been partly filled by eolian and colluvial sediments to a depth of perhaps 10–20 cm, and larger elements discarded as spoils are scattered across the bottom of the feature. No cultural materials were found in association.

Feature 14

Feature 14 is a very large terrace-edge borrow pit measuring 18.6 by 6.7 m, with a maximum depth of 0.42 m (Fig. 7.4). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Feature 10 and may have been a source of some of the materials used to build that gravel-mulched field. From the surface appearance of this feature, it seems to be a series of four linked borrow pits. Feature 15 represents a more distinct fifth pit. Each pit is separated from adjacent pits by low mounds of cobbles and gravels, which represent the eroded edges of borrow areas. With Feature 15, then, this complex probably represents at least five distinct episodes of use. There appears to be 10–20 cm of sediments built up in the bottom of this feature. All cultural materials visible on the surface were inventoried. They are dominated by gray rhyolite (28 core flakes, 10 angular debris, 1 core). Other materials in the chipped stone assemblage are red rhyolite (2 core flakes, 1 angular debris) and quartzite (1 core flake). These materials occurred in several clusters, suggesting the presence of discrete chipping stations. Temporally diagnostic artifacts included 2 Biscuit A bowl sherds and 6 Biscuit B bowl sherds.

Feature 15

Feature 15 is a small oval terrace-edge borrow pit measuring 6.1 by 3.6 m, with a maximum depth of 0.63 m (Fig. 7.4). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Feature 10 and may have been a source of some of the materials used to build that gravel-mulched field. As noted in the discussion of Feature 14, this borrow pit is one of a series of linked pits indicative of at least five episodes of use. Since it was the most distinct of the linked borrow pits, it was given a separate feature number and was probably used after Feature 14. There seems to be 20–30 cm of sediments built up in the bottom of this pit. The small array of surface artifacts noted is comprised of chipped stone and includes gray rhyolite (one core flake, one angular debris, one core) and andesite (two core flakes).

Feature 16

Feature 16 is an oval terrace-edge borrow pit measuring 8.6 by 7.7 m, with a maximum depth of 0.58 m (Fig. 7.6). It is in the right-of-way and was mapped but not excavated. This borrow pit is near Feature 18 and was probably a source of some of the materials used to build that gravel-mulched field. The center of the pit contains a pile of cobbles and gravels that may represent spoils, but which is partly obscured by 10–20 cm of sediments that have built up in the bottom of the feature.

Feature 17

Feature 17 is an oval terrace-edge borrow pit measuring 7.8 by 4.8 m, with a maximum depth of 0.39 m (Fig. 7.6). It is in the right-of-way and was mapped but not excavated. This borrow pit is near Feature 18 and was probably a source of some of the materials used to build that gravel-mulched field. Eolian and colluvial sediments have built up to an undetermined depth in the bottom of this feature.

Feature 18

Feature 18 is a large series of connected features, some of which are of quite intricate construction. It measures about 70 by 67.5 m and covers roughly 2,715 sq m (Fig. 7.6). Since this field was partly

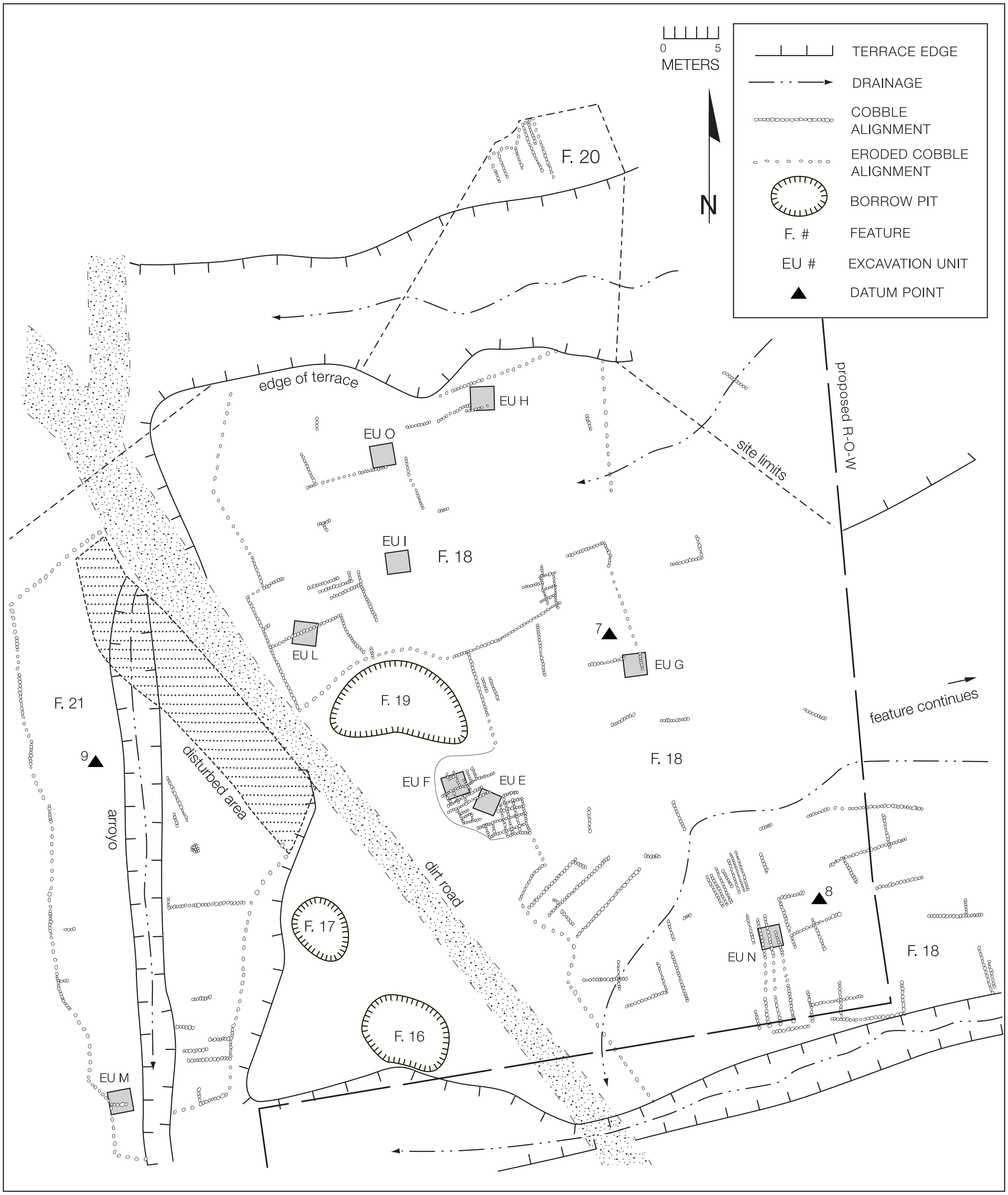


Figure 7.6. Features 16 through 21, LA 105703.

outside the detailed examination zone, all of it was not mapped. On the north, the feature extends to the south edge of a large arroyo, which has truncated several alignments. An improved dirt road forms the west boundary of the feature but does not seem to have damaged it. The south boundary is a large gully, which may have truncated part of the feature. The southeast sector of Feature 18 extends another 40 m east along this gully. Over two-thirds of the feature was mapped, and seven excavation units were used to examine it. This level of effort was needed because of the large expanse of feature in the right-of-way and the great diversity of construction techniques noted during surface examination.

Unfortunately, many internal subdividing alignments have been covered by eolian and colluvial sediments, though this was less of a problem in the southern third and west-central section of the feature. The southern third of the feature contains numerous parallel alignments that run perpendicular to a hillslope. In places alignments also run parallel to the slope, suggesting that at least part of this area was subdivided into small rectilinear plots. The west-central section of the feature is intricately gridded into numerous small cells resembling a checkerboard. As discussed later, excavation showed that this pattern is more widespread than suggested by our mapping of surface alignments.

Nearly all boundary and interior subdividing alignments are a single element high and wide. They were built with locally obtained cobbles and small boulders. The only known exception to this is a 4 m length of alignment at the southeast edge of the feature outside the detailed examination zone, which appears to be two to three elements wide and may be a checkdam. Cobbles predominate in all alignments, and most are 10–25 cm long. Small boulders are common in the south and east sections of the feature; most are 25–35 cm long, though some range up to 40 cm long. These larger elements are rare in the checkerboard area. Surface indications suggested that most elements were set end-to-end, though in places a few elements were set sideways. Most elements were placed on their broadest surfaces except in the checkerboard area, where upright placement predominates. The area north of Feature 19 around EU-L contains a series of patterned, evenly spaced large cobbles and small boulders.

The mulch is mostly composed of gravels and pea gravels, though small cobbles up to 12 cm long occur. Their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Small cobbles were the main material used for mulching in some areas, as detailed in the discussions of excavation units. Since the alignments are a single element high, most of the mulch is probably 5–12 cm thick. No differences were noted in on- and off-feature gravel or vegetational densities. All artifacts seen on the surface of the feature within the right-of-way were collected. No effort was made to inventory materials outside this zone, since the surface collection inside construction limits was considered to be representative.

Feature 19

Feature 19 is a large, oval, terrace-edge borrow pit measuring 14.9 by 9.8 m, with a maximum depth of 0.65 m (Fig. 7.6). It is near Feature 18 and was probably the source of some of the materials used to build that gravel-mulched field. This feature has been slightly damaged by a dirt road that runs along its west edge.

Feature 20

Feature 20 is a small irregularly shaped gravel-mulched plot that measures 5.5 by 5 m and covers about 19 sq m (Fig. 7.6). This field is within the right-of-way, so the entire feature was mapped. About 80 percent of its surface is covered by sediments that have infiltrated the mulch and are anchored by vegetation. Feature 20 is slightly mounded above the adjacent terrace surface, though the mounding is only 5–8 cm high in the center of the feature, where it is best preserved. The south edge of the plot has been removed by a small active gully. Because of the small size of this feature and its badly deteriorated condition, it was not excavated.

Boundary and interior subdividing alignments are a single element high and wide. They were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 10–25 cm long. The few small boulders used in this feature are up to 30 cm long. Elements in all alignments were set end-to-end and on their broadest surfaces. The configuration of the remaining alignments suggests that this feature was originally rectangular with boundary alignments on all four sides. The interior of the feature was subdivided into multiple elongated cells by interior subdividing alignments running north to south.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 8 cm long also occur. The mulch appears to be about 10 cm thick in a cross section of the feature in an arroyo wall. Cobbles are more common in the cross section than was evident from the surface, suggesting that only larger rocks were sorted out for use as building elements. No variation in surface gravel or vegetational densities were noted between on- and off-feature areas.

Feature 21

Feature 21 is an irregularly shaped gravel-mulched plot that measures 55.0 by 24.5 m and covers roughly 820 sq m (Fig. 7.6). This field has been disturbed by construction of a dirt road and erosion. Some parts have been removed and others covered by sediments, so these measurements are incomplete. Mechanical disturbance associated with construction and maintenance of the dirt road has removed the northeast quarter of the feature. A gully subdivides the field into east and west sectors and removed the central portion of the feature. About 40–50 percent of the mulch surface in the east sector is obscured by eolian and colluvial sediments that have infiltrated the mulch and are anchored by vegetation. About 60–70 percent of the mulch surface in the west sector is similarly covered. This field was within project boundaries, and a single excavation unit was used to examine its structure and fill.

Boundary and interior subdividing alignments are a single element high and wide. They were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 8–25 cm long. Small boulders were only rarely used in the construction of this feature; they are 25–40 cm long. Most elements in the east sector were set end-to-end, though some were set sideways. While both types of placement occur in the same alignment, no cases were noted where sideways placement predominated, though only end-to-end placement occurred in several alignments. Most elements seem to have been set on their broadest surfaces. Occasional upright placement occurred but did not dominate any alignments. Few alignments were visible in the west sector of the feature because of sedimentation, but those that could be seen contain elements that were predominantly set sideways, especially in the west boundary alignment. End-to-end placement occurs in other alignments but does not dominate them. All elements were set on their broadest surfaces; no uprights were observed in this zone.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Some variation in the size and frequency of cobbles in the mulch was seen between the east and west sectors of the feature. Cobbles were much more abundant and larger in the east sector than in the west. This was especially true of an area at the base of the terrace below two borrow pits, Features 16 and 17. While the greater frequency of cobbles in this area could be attributed to discard while sorting through materials from the borrow pits, this is unlikely. Cobbles in the east sector mulch, which are up to 12–15 cm long, appeared to be components of the mulch rather than spoils. Most cobbles in the west sector mulch are only 5–8 cm long. Excavation suggested that the mulch was 5–7 cm thick in this feature. Vegetation seemed to be slightly denser on the feature than on the adjacent unmulched surface.

Feature 22

Feature 22 is a large, irregular, gravel-mulched plot that measures 39.5 by 38.0 m and covers roughly 936 sq m (Fig. 7.7). This field extends into the construction zone and was completely mapped. Two excavation units were used to examine the structure and fill of this feature. The east edge of Feature 22 is truncated by U.S. 285, and it is unknown how far it originally extended in that direction. A buried cable trench has been cut through the approximate center of the remaining section of the feature and has damaged that area. In addition, the southwest corner of the feature was bladed to facilitate construc-

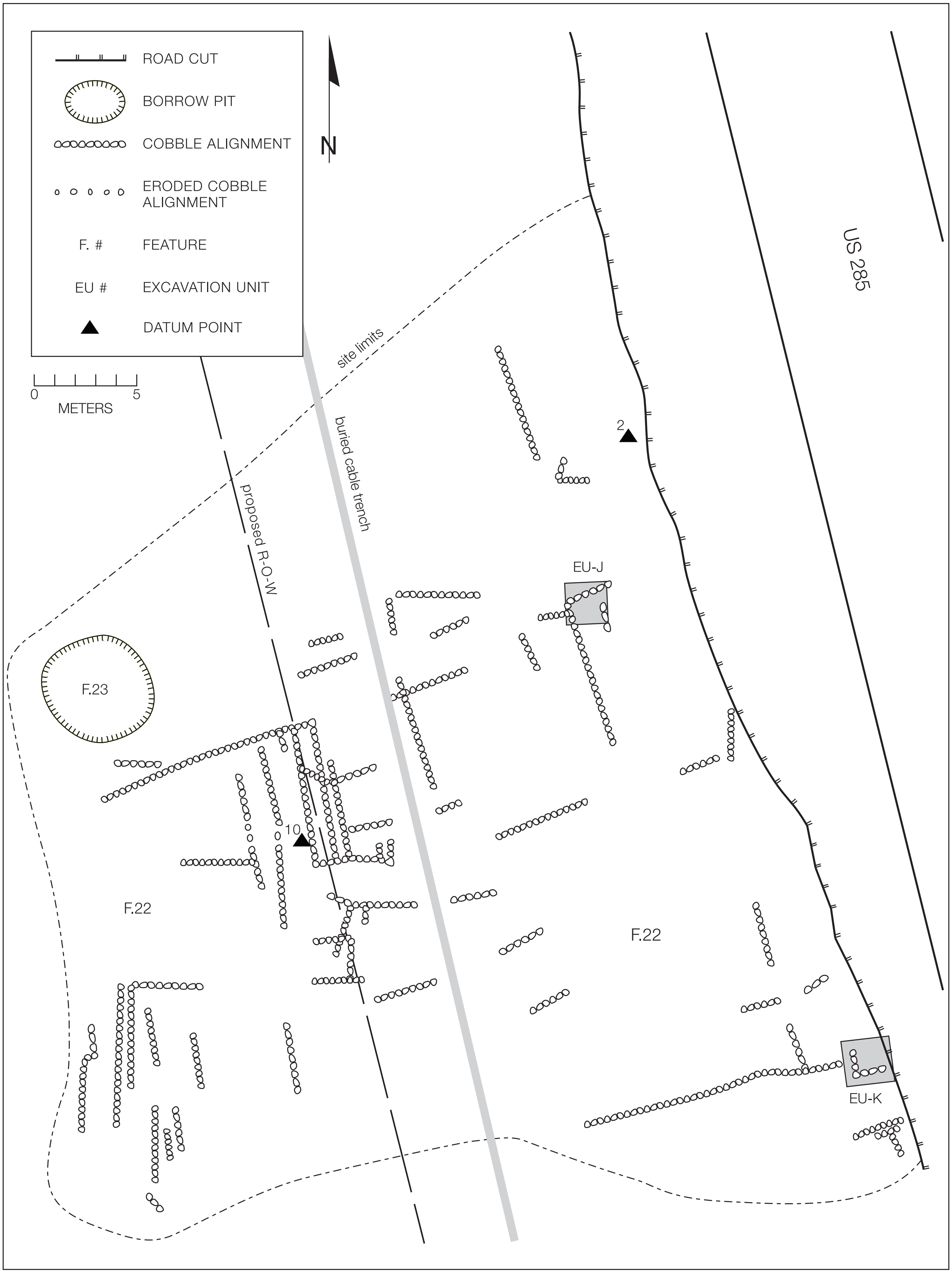


Figure 7.7. Features 22 and 23, LA 105703.

tion of a billboard. About 50–75 percent of the feature surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation.

Boundary and interior subdividing alignments are a single element high and wide. They were built with locally available cobbles and small boulders. Cobbles predominate in all alignments, and most are 10–25 cm long; the few small boulders that were used are 25–45 cm long. Most alignments contain a mixture of elements set end-to-end or sideways. Upright placement is common and mixed with elements set on their broadest surfaces. Upright placement tends to predominate in alignments where elements were mostly set sideways. The distribution of visible alignments in this field suggests that it was divided into multiple cells, many of which seem to have been quite small.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 10 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. The mulch was 13–17 cm thick in the excavation unit and is probably of a similar depth elsewhere in the feature. Vegetational density was not noticeably heavier on the feature than in adjacent off-feature areas.

Feature 23

Feature 23 is a round terrace-edge borrow pit that is 5.5 m in diameter, with a maximum depth of about 0.25 m (Fig. 7.7). It is near Feature 22 and was probably the source of some of the materials used to build that gravel-mulched field. Sediments have filled the bottom of this feature to an unknown depth. No cultural materials were found in association with this feature.

Discussion of Surface Information

As noted above, LA 105703 is atypical of the fields examined during this project in that it was built along the edge of a low eroded terrace on the east side of the Rio Ojo Caliente, rather than on a high terrace. The location of the other fields on the higher terrace was probably a precaution against cold air drainage through the valley bottom. LA 105703 may not have been sited as advantageously to avoid that danger, but an important aspect of site location was apparently the presence of abundant gravels and cobbles for building features. Some of the most intricate farming features examined during this study were found at LA 105703. The west-central section of Feature 18 contains an area that was subdivided into a checkerboard of small cells. A somewhat lusher growth of vegetation occurred in an adjacent area directly southwest of the checkerboard and may indicate the location of a seep. If so, this part of the feature may have been used to grow plants that required more water than the usual crops grown in mulched fields. As discussed below, excavation showed that this pattern of small cells was more widespread than surface indications suggested and was mulched in a variety of ways. Again, this may indicate that a different type of crop was usually planted in these fields.

Some evidence of multiple construction episodes was noted at LA 105703. Feature 3 was built on the back edge of Feature 2 and is mounded above the surface of that earlier field. Several borrow pits are also configured in a way that suggests they were used as sources of building materials on multiple occasions. This is especially true of Features 12 and 13, which appear to encroach upon one another, and Features 14 and 15. A possible stockpile of building materials between Features 2 and 5 indicates that some areas may have still been under construction at the time of abandonment.

Farming features were not restricted to the detailed examination zone. Alignments continued to the east, outside the mapped area. They included a few contour terraces in the northeast section of the site near the base of a hill. A few checkdams were also noted, crossing shallow drainages uphill from the detailed examination area. Features are better preserved and more visible in upslope areas because they have not been subjected to the same degree of erosion and sedimentation.

Table 7.1 presents basic information on the chipped stone assemblage collected from the construction zone at LA 105703. A total of 1,058 chipped stone artifacts were recovered from the surfaces of 12 features. The largest percentage came from Feature 18 (34.9 percent), followed by

Table 7.1. Chipped stone artifacts collected from features within the highway right-of-way at LA 105703 (material type by morphology)

Feature No.	Material Type	Angular Debris	Core Flakes	Cores	Hoes
2	Chert	-	2	-	-
	Rhyolite	44	85	7	-
	Andesite	-	1	-	-
	Quartzite	1	2	-	-
	Massive quartz	1	3	-	-
3	Rhyolite	1	1	-	-
6	Rhyolite	1	3	1	-
7	Rhyolite	6	4	1	-
12	Rhyolite	15	17	-	-
	Quartzite	1	-	-	-
14	Rhyolite	6	19	2	-
	Quartzite	-	1	-	-
16	Rhyolite	4	14	3	-
17	Rhyolite	4	9	3	-
18	Chert	-	2	-	-
	Pedernal chert	-	1	-	-
	Obsidian	-	1	-	-
	Rhyolite	98	218	31	2
	Andesite	1	6	1	-
	Welded tuff	2	1	-	-
	Quartzite	-	3	-	-
	Massive quartz	-	2	-	-
19	Rhyolite	11	16	-	-
21	Pedernal chert	-	1	-	-
	Igneous undifferentiated	-	1	-	-
	Rhyolite	69	128	12	-
	Andesite	2	2	-	-
	Welded tuff	-	1	-	-
	Quartzite	-	2	1	-
	Massive quartz	-	2	-	-
22	Pedernal chert	-	1	-	-
	Rhyolite	49	114	6	-
	Andesite	3	1	1	-
	Quartzite	-	2	-	-
	Massive quartz	-	2	-	-

Feature 21 (20.9 percent), Feature 22 (16.9 percent), and Feature 2 (13.8 percent). These four gravel-mulched fields were largely within the highway right-of-way. Other fields that barely extended into the right-of-way and borrow pits tended to produce few chipped stone artifacts. Overall, the assemblage was heavily dominated by a variety of rhyolites, which comprise 94.9 percent of the chipped stone artifacts collected from feature surfaces. Other than Pedernal chert and obsidian, which together comprised only 0.4 percent of the assemblage, materials reduced at LA 105703 were available on-site in gravel deposits. The only formal tools recovered were two crudely chipped hoes. Otherwise, only reduction debris (core flakes, angular debris, and cores) was recovered, suggesting that raw-material quarrying and initial reduction were important activities. This possibility is addressed in greater detail in a later chapter. Since these artifacts were collected from feature surfaces, they were produced after the fields were built and while they were still in use, or after they were abandoned.

Twenty-nine sherds were also recovered during surface collection, all biscuit wares. Over a third were recovered from Feature 18, including nine Biscuit B sherds and one unpainted biscuit ware sherd. Slightly more than a quarter of the pottery came from Feature 16, which yielded six Biscuit B sherds and two unpainted biscuit ware sherds. Three Biscuit B and one Biscuit A sherds were recovered from the surface of Feature 2, and four Biscuit B sherds were found on Feature 21. An undifferentiated biscuit ware sherd was recovered from Feature 12, and two unpainted biscuit ware sherds were found on Feature 8. Biscuit B is by far the dominant type in this assemblage, comprising 75.9 percent. Only a single Biscuit A sherd (3.4 percent) was identified.

In addition to the assemblage of cultural materials that was collected within project limits, a surface inventory was conducted in the area upslope from Feature 18. Chipped stone artifacts dominated this assemblage, and the most common material was gray rhyolite, most of which occurred in clusters of from two to eight artifacts, suggesting numerous discrete chipping episodes. They included 120 core flakes, 28 angular debris, 23 cores, and 1 tested cobble. Other chipped stone materials inventoried were red rhyolite (6 core flakes, 1 angular debris, 5 cores), andesite (3 core flakes, 1 core), massive quartz (1 core flake, 3 angular debris, 3 cores), and chert (1 core flake). Pottery was comparatively scarce through the same zone and included 2 Biscuit B sherds (1 bowl, 1 jar) and an unidentified biscuit ware bowl sherd.

Results of Excavation

Fourteen 2 by 2 m excavation units were used to examine subsurface deposits and construction techniques in five features at LA 105703. Except for Feature 20, all gravel-mulched fields that extended into construction limits were examined. As noted earlier, Feature 20 was not examined in this detail because of its small size and badly deteriorated condition. When possible, excavation was conducted in natural stratigraphic units.

Three basic soil strata were defined in excavation units. Stratum 1 was comprised of the eolian and colluvial sediments that partly covered most features, Stratum 2 was the layer of mulch, and Stratum 3 was the original terrace surface. Excavation generally halted when Stratum 3 was encountered. More detailed descriptions of strata are included in the discussions of individual excavation units.

Feature 2

Three excavation units were used to examine parts of Feature 2 that extended into the right-of-way. EU-B was placed in an eroded zone near the west-central section of the boundary alignment. The other units were placed in the southwest section of the feature: EU-C near the edge of the U.S. 285 roadcut, and EU-D adjacent to a disturbed area near the right-of-way edge (Fig. 7.2).

Even though EU-B was placed in an eroded area, preservation was very good. Stratum 1 was a thin mantle of brown sandy loam with an average thickness of 1.8 cm. Stratum 2 contained a matrix of unsorted pea gravels, gravels, and small cobbles infiltrated by dark brown sandy soil. The layer of mulch was 10.0 to 15.5 cm thick and had a mean thickness of 13.3 cm. A sample taken from the mulch yielded corn and cotton pollen. A lateral fragment of a rhyolite core flake in Stratum 2 was the only artifact recovered from EU-B.

With the mulch removed, a series of cobble alignments was revealed in EU-B (Figs. 7.8 and 7.9). These interior subdividing alignments appear to form small rectangular cells in this part of the feature. Parts of at least six cells were encountered in EU-B (Fig. 7.8). The only cell that was completely exposed measured 1.25 m east-west by 0.85 m north-south. As Figure 7.8 shows, most cobbles were placed end-to-end, though a few were set sideways. Most cobbles were also placed on their broadest surfaces, though a few were set upright, especially in the northwest corner of the excavation unit. All exposed alignments were one element high and wide.

EU-C was placed near the edge of the U.S. 285 roadcut in an area thought to contain two perpendicular interior subdividing alignments (Fig. 7.2). Stratum 1 was a relatively thin layer of tan sandy loam containing 20–30 percent pea gravels that ranged from 1–7 cm thick and averaged 2.9 cm. Two chipped stone artifacts were recovered from Stratum 1: a rhyolite core flake and a multidirectional rhyolite core. Stratum 2

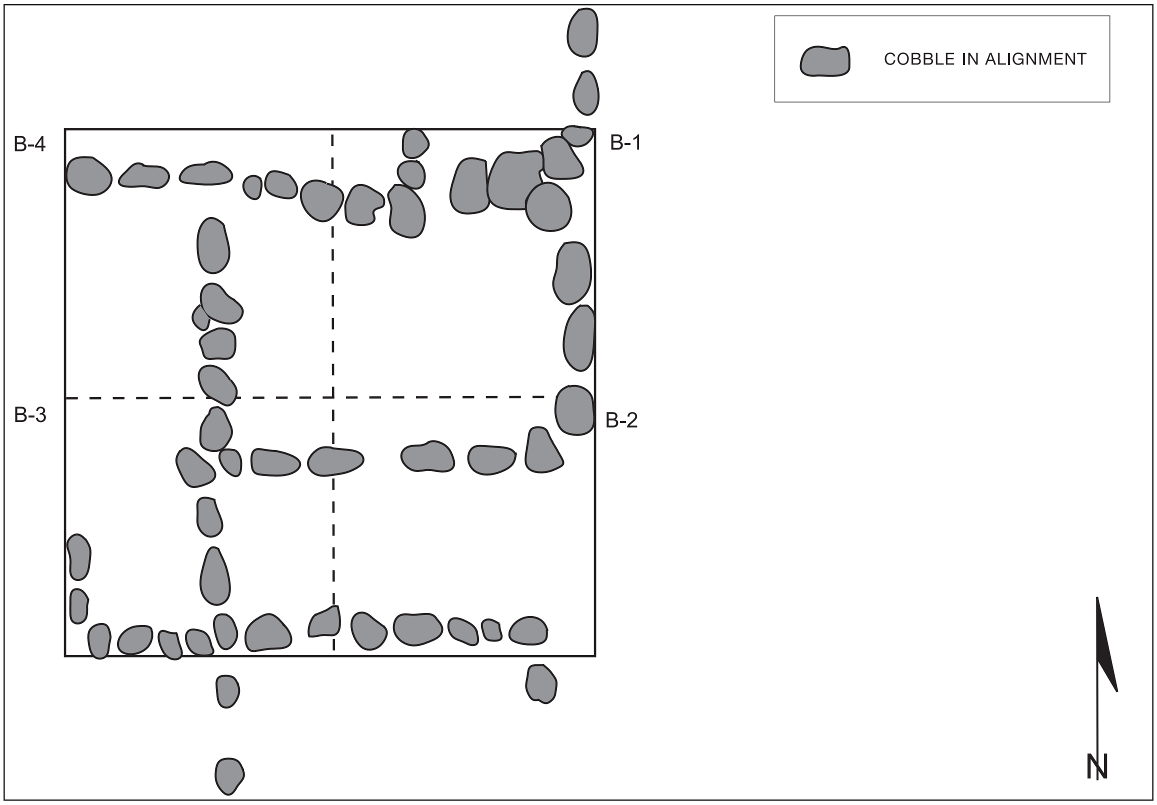


Figure 7.8. Postexcavation plan of EU-B in Feature 2, LA 105703.

Figure 7.9. Cobble alignments in EU-B after excavation, looking west.

was a matrix of pea- to fist-sized gravels and cobbles that were infiltrated by dark tan sandy soil. The layer of mulch was 2–11 cm thick and had a mean thickness of 6.4 cm. A sample taken from the mulch yielded high concentrations of corn and cotton pollen (see Appendix 1). Other artifacts recovered from this stratum included five rhyolite flakes, two pieces of rhyolite angular debris, and two undifferentiated biscuit ware sherds.

Removal of the mulch revealed a series of cobbles placed in no discernible pattern (Figs. 7.10 and 7.11). Indeed, about a quarter of the cobbles were removed during excavation because they were floating in the gravel mulch (Fig. 7.10). Since no alignments were identified in this excavation unit, no discrete cells were identified.

EU-D was placed near the edge of the right-of-way in a part of Feature 2 that contained surface evidence of two perpendicular and intersecting cobble alignments (Fig. 7.2). This area had also sustained damage from vehicular traffic, and preservation seemed to be moderate. Stratum 1 was a thin layer of brown loamy sand containing quite a few pea gravels; it ranged from 0 to 3 cm thick, with a mean thickness of 1.0 cm. Stratum 2 was a matrix of unsorted pea gravels, medium- to large-sized gravels, and cobbles that had been infiltrated by a tan loamy sand. The layer of mulch was 3 to 9 cm thick, with a mean thickness of 5.6 cm. A sample taken from the mulch yielded no pollen from domesticated plants. A piece of rhyolite angular debris was the only artifact recovered from this layer.

Removal of the mulch revealed two probable interior subdividing alignments (Fig. 7.12). These alignments were perpendicular to one another and appear to have originally met near the northwest corner of Grid D-1. However, vehicular traffic over this area moved several elements, disrupting the joint between these alignments. Numerous cobbles that form no discernible pattern were also exposed, especially in Grids D-1 and D-2. These cobbles appear to have been used as mulch rather than as building elements.

Feature 8

One excavation unit was used to examine the section of Feature 8 that extends into the right-of-way (Fig. 7.1). EU-A was placed along the north edge of the feature to expose a section of the north boundary alignment and an interior subdividing alignment that were visible from the surface. Stratum 1 was a thin mantle of dark tan loamy sand containing about 15 percent pea gravels, which probably represent the top of the mulch. It was 0–3 cm thick across the excavation unit and averaged 1.2 cm. One rhyolite core flake was recovered from Stratum 1. Stratum 2 was a matrix of medium to large gravels and some small cobbles that had been infiltrated by a dark tan loamy sand. A sample taken from the mulch yielded a high concentration of corn pollen. A single rhyolite core flake was also recovered from this stratum.

Removal of the mulch revealed several cobble alignments as well as numerous cobbles that did not appear to form alignments and were probably part of the mulch (Figs 7.13 and 7.14). The north boundary alignment was somewhat disarticulated and ran through the north third of Grids A-1 and A-3, extending to the west outside the excavated area. The natural terrace surface was encountered during excavation on the north side of this alignment, indicating that our assessment of its function was correct. An interior subdividing alignment ran north-south through the west edge of Grids A-3 and A-4. Two other possible interior subdividing alignments were noted during excavation that were not visible from the surface. One paralleled the north boundary alignment and ran east-west along the north edge of Grid A-2, extending into Grid A-3. The second paralleled the definite interior subdividing alignment and ran north-south along the east edge of Grid A-3. Two cobbles in the south-central part of Grid A-3 may have been the remains of a short alignment that once connected the two north-south interior subdividing alignments. These results suggest that this part of Feature 8 may have been subdivided into a series of small cells. Most cobbles in the alignments were set end-to-end on their broadest surfaces, though a few examples of sideways placement were also noted.

Feature 18

Eight excavation units were used to examine parts of Feature 18 that extended into the construction zone. EU-E through EU-G were placed

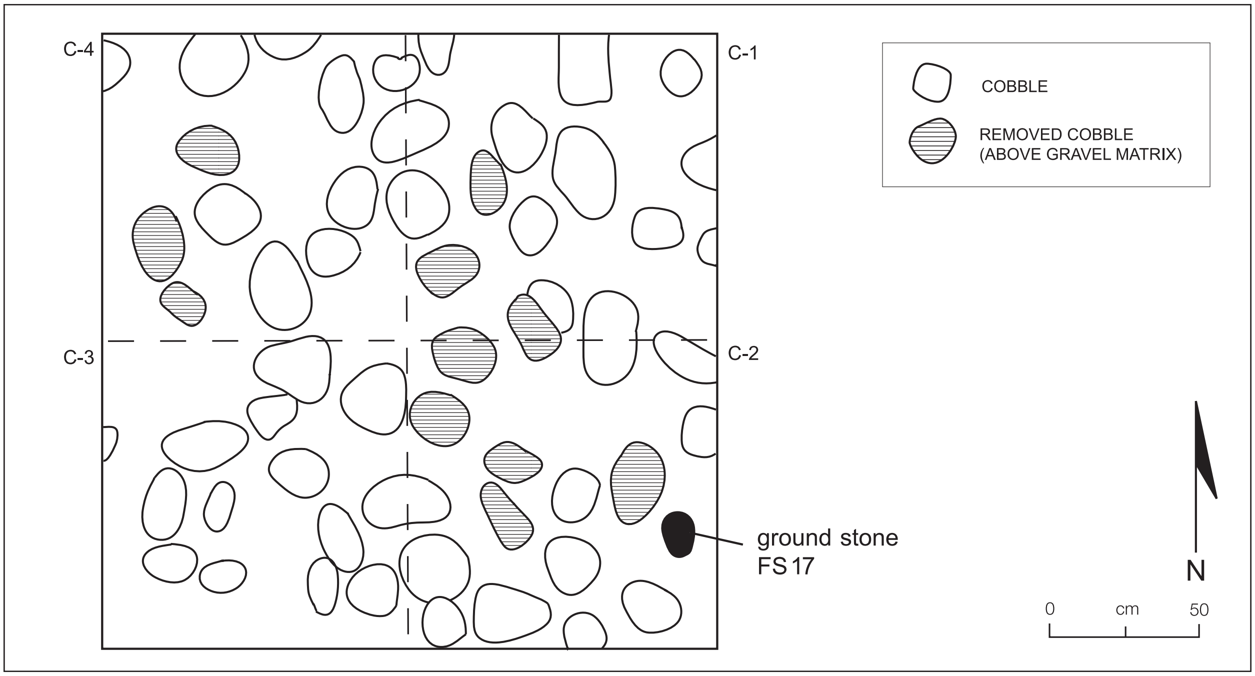


Figure 7.10. Postexcavation plan of EU-C in Feature 2, LA 105703.

Figure 7.11. EU-C in Feature 2 at LA 105703, looking west.

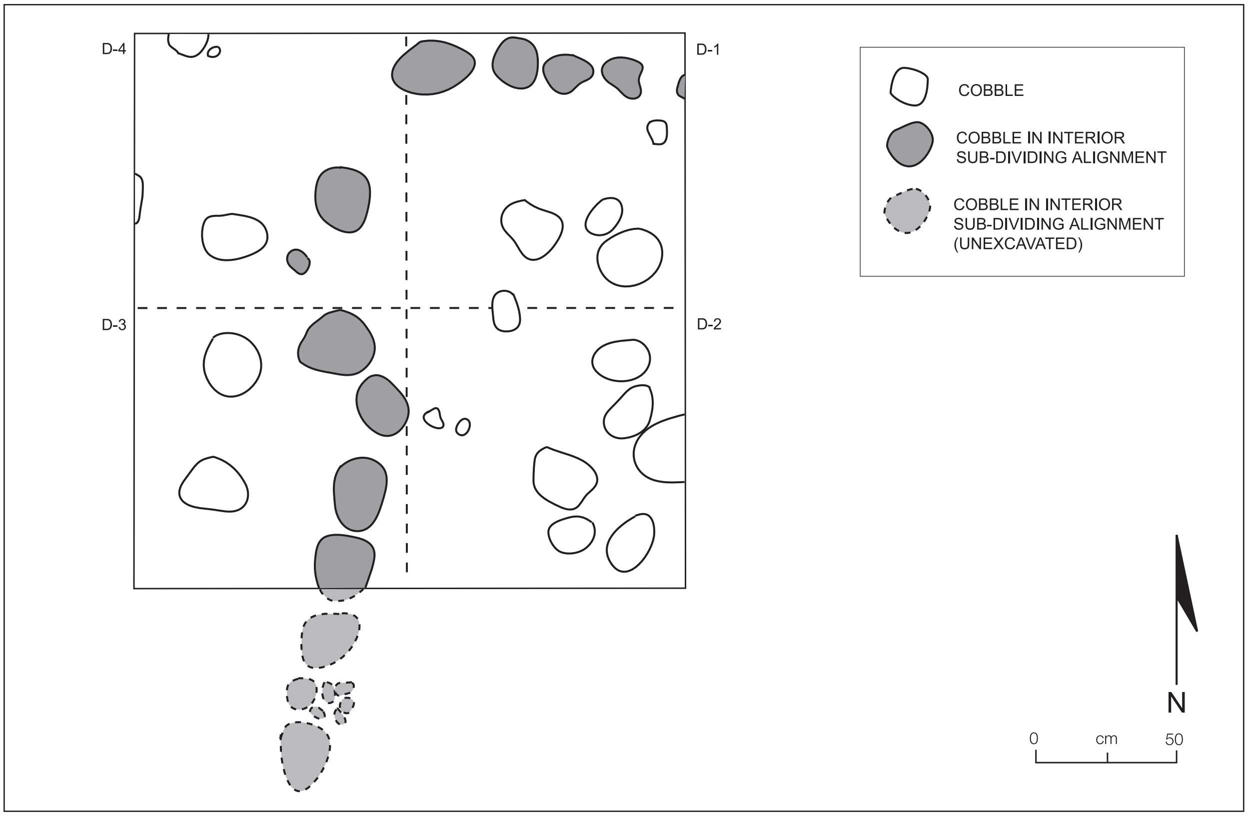


Figure 7.12. Postexcavation plan of EU-D in Feature 2, LA 105703.

in the central part of the feature and allowed us to examine the most intricately gridded section of Feature 18. The north part of the feature was the most heavily sedimented section; consequently few good alignments were visible in that area, and EU-H, EU-I, EU-L, and EU-O were used to examine the structure and fill of that part of the feature. EU-N was used to investigate a series of parallel alignments in the south part of the feature (Fig. 7.6).

EU-E was excavated in the west-central part of the feature in an area that from surface inspection seemed likely to contain an intricate system of small cobble-bordered cells. Stratum 1 was a very thin layer of dark tan loamy sand containing 10–15 percent pea gravels ranging from 0 to 2 cm thick and averaging 0.5 cm. Stratum 2 was a matrix of unsorted pea gravels and small- to medium-sized gravels above a layer of intentionally placed cobbles. The gravel layer was 5–9 cm thick, with a mean thickness of 8 cm. The cobble layer was not removed from most of the excavation unit and added another 3–7 cm to the thickness of the mulch. Underlying the mulch was a sterile sand that constituted the original terrace surface. A sample taken from the mulch yielded a low to moderate concentration of corn pollen. Two Biscuit B sherds were recovered from Stratum 2.

Removal of the mulch revealed an intricately constructed section of farming plot (Figs. 7.15 and 7.16). Four complete and five or six partial cells were exposed. The cells were about 50 cm wide and 50–55 cm long with walls formed of upright cobbles and boulders. The floor of each cell was lined with a layer of cobbles a single element deep placed on their broadest surfaces with spaces between. Gravel mulch was then applied, covering the cobble mulch and filling the spaces between them. Much of the cobble base course was removed from cells in Grids E-1 and E-2 before we realized what it was. Since elements used to build alignments were predominantly set upright, the cobble mulch probably represents a base course for drainage, and the gravels represent the main layer of mulch, which was applied right after the base course was laid. Otherwise, cobbles in the interior subdividing alignments

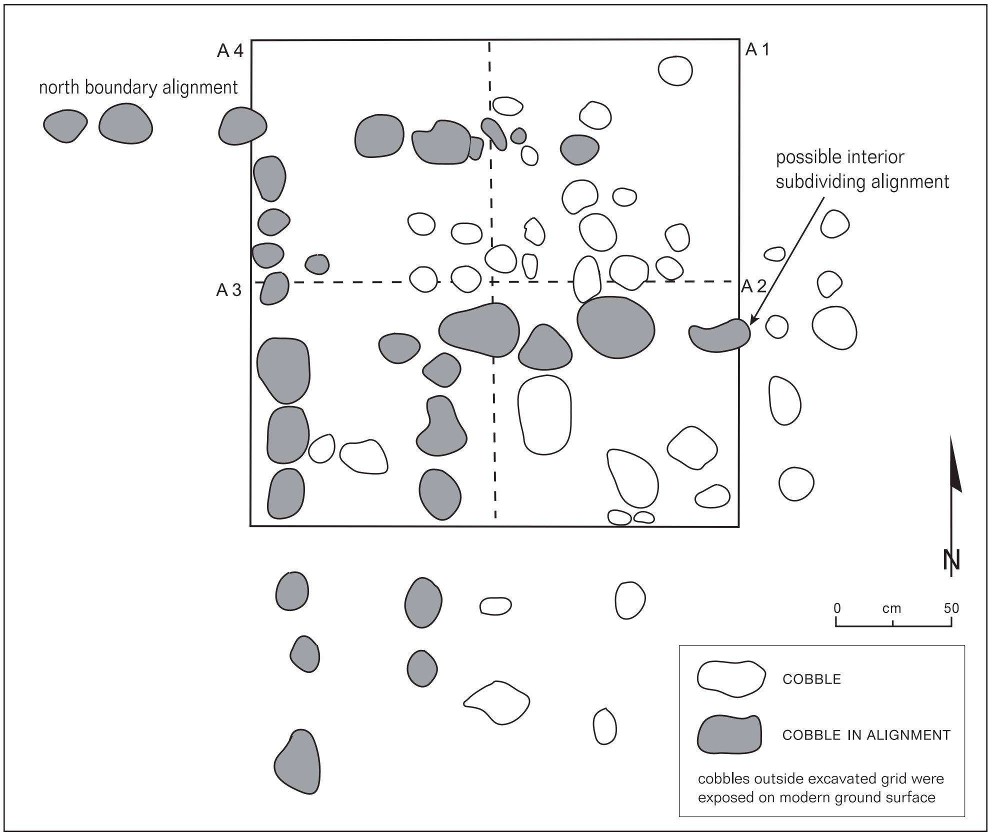


Figure 7.13. Postexcavation plan of EU-A in Feature 8, LA 105703.

Figure 7.14. EU-A in Feature 8 at LA 105703, looking south.

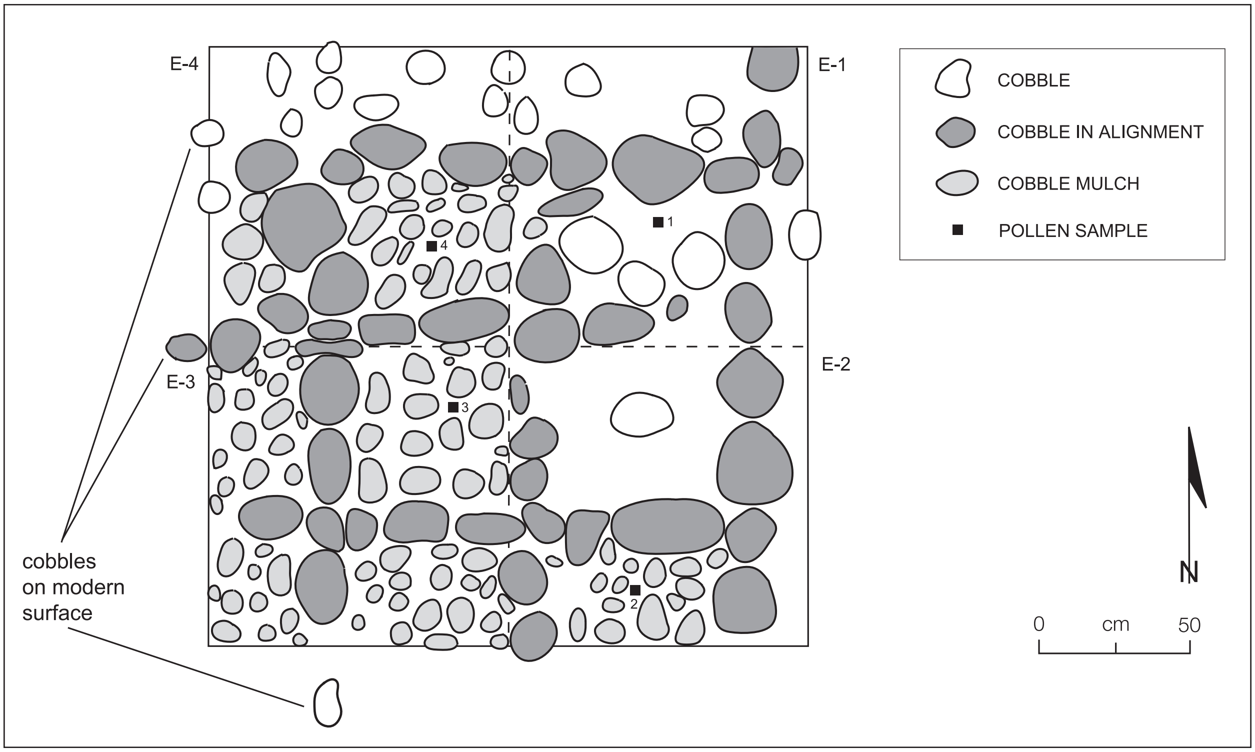


Figure 7.15. Postexcavation plan of EU-E in Feature 18, LA 105703.

Figure 7.16. EU-E in Feature 18 at LA 105703, looking northeast.

would be unsupported and prone to collapse. Thus, only one construction and use episode appears to be represented.

EU-F was excavated almost directly northwest of EU-E to help investigate the same set of features (Fig. 7.6). Stratum 1, a thin layer of dark tan loamy sand containing numerous pea gravels and a few larger gravels, was 0–5 cm thick and averaged 1.9 cm. A rhyolite core flake was collected from the surface of this stratum, and two Biscuit B sherds and a piece of rhyolite angular debris were recovered by screening. Stratum 2 was essentially the same as defined in EU-E. It consisted of two layers: pea gravels and gravels overlying a layer of cobbles that lined the original terrace surface. Together these layers were 5–20 cm thick, with a mean thickness of 10.3 cm. A sample taken from the mulch contained a low to moderate concentration of corn pollen. Four rhyolite core flakes and three rhyolite angular debris were also recovered from this layer.

When the mulch was removed, an intricate section of farming plot identical in construction to the section uncovered in EU-E was exposed (Figs. 7.17 and 7.18). Two complete and nine partial cells were found. The fully exposed cells were 80 cm long by 50–70 cm wide; partly exposed cells were 40–50 cm wide. The floor of each cell was lined with a layer of cobbles a single element deep placed on their broadest surfaces. Spaces were left between cobbles in some cells, while in others they were closely packed together (Fig. 7.17). Part of the cobble mulch was removed from the northeast quarter of the excavation unit to expose the terrace surface. Most elements were set end-to-end and upright, though a few were placed sideways and upright (Fig. 7.18). As noted above, this type of construction suggests that the cobble mulch represents a base course for drainage, and the gravels represent the main layer of mulch that was probably applied immediately after the base course was laid. Thus, only one construction and use episode appears to be represented.

EU-G was used to examine the south end of a fairly long alignment in the east-central part of Feature 18 (Fig. 7.6). Elements were widely spaced in most of this alignment. We were uncertain whether this meant that much of it was sedimented over, or had been displaced, or represented a series of large evenly spaced elements. Stratum 1 was a fairly thick layer of tan sandy loam and duff from nearby trees, which also contained some pea gravels. This layer was 0–10 cm thick and had a mean thickness of 4.1 cm. Two rhyolite core flakes were recovered from Stratum 1. Stratum 2 was a matrix of pea gravels, gravels, and cobbles that had been infiltrated by a dark brown loamy sand. The layer of mulch was 4–18 cm thick and averaged 9.9 cm. Besides a rhyolite core flake and a rhyolite angular debris, a peach pit was recovered from this layer. Since the pit was not exposed in situ, we are uncertain whether it came from the upper part of the unit, which would connote fairly recent deposition, or was from deeper in the stratum. A sample taken from the mulch yielded a high corn pollen concentration.

Excavation in this unit exposed a possible north-south trending cobble alignment (Figs. 7.19 and 7.20). Other cobbles exposed in this unit were floating in the gravel mulch and were undoubtedly part of the mulch. Some elements in the section of interior subdividing alignment that was uncovered seem to have been displaced, and the alignment does not extend completely across the excavation unit. This may indicate a greater degree of displacement than at first seemed possible, or that the alignment was never continuous.

EU-H was excavated in the north sector of Feature 18 to examine a short segment of interior subdividing alignment visible from the surface (Fig. 7.6). Stratum 1 was a moderately thin layer of dark tan loamy sand containing some pea gravels and occasional gravel. It was 0–6 cm thick with a mean thickness of 2.2 cm. Stratum 2 was a matrix of pea gravels and gravels that had been infiltrated by a dark tan loamy sand. The layer of gravel mulch was 2–8 cm thick and averaged 3.4 cm. It was underlain by a layer of small- to medium-sized cobbles that was a single element thick north of the interior subdividing alignment and up to two elements thick on the south side (Figs. 7.21 and 7.22). Cobbles in this layer of mulch looked like they were poured in rather than placed and were tightly packed, with no dominant orientation. A sample taken from the mulch yielded a moderate corn pollen concentration. A rhyolite core flake was also recovered from this layer.

Removal of the gravel mulch revealed a sec-

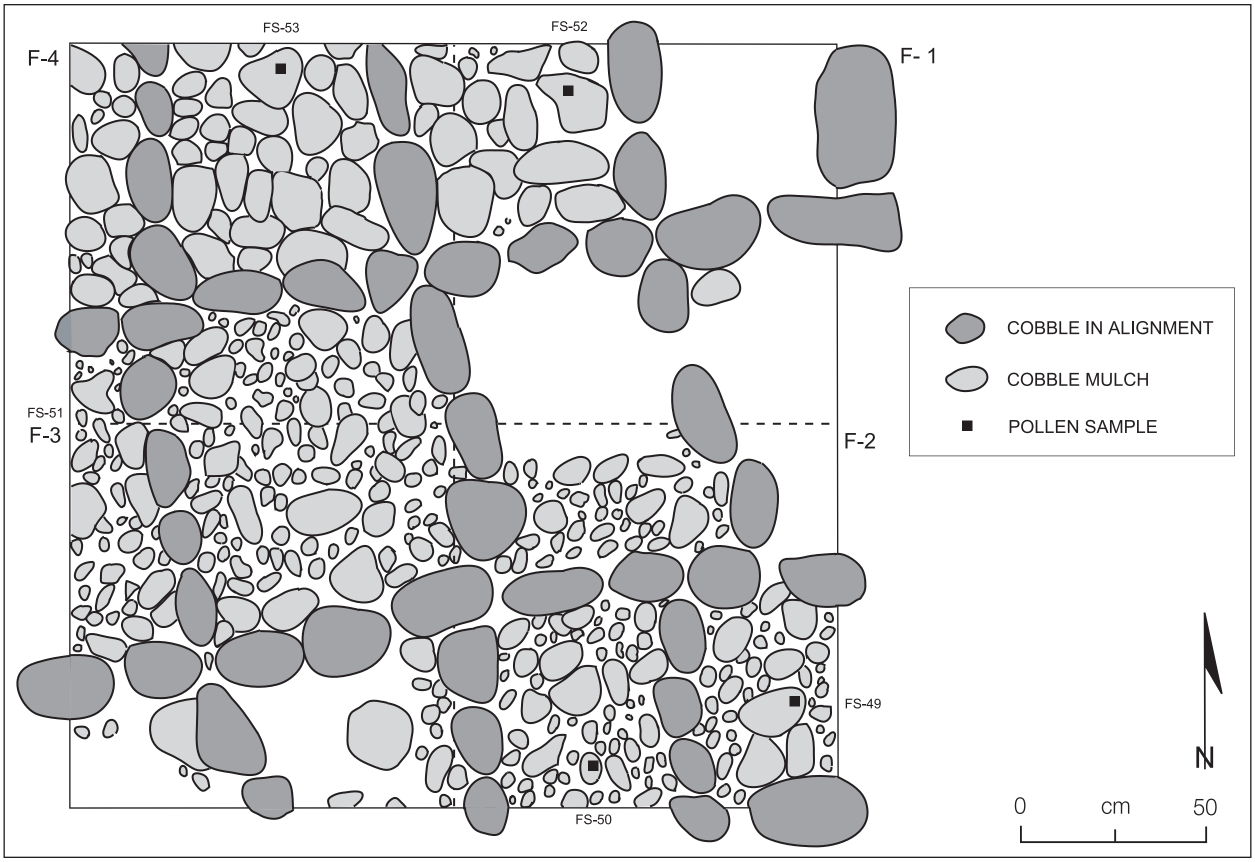


Figure 7.17. Postexcavation plan of EU-F in Feature 8, LA 105703.

Figure 7.18. EU-F in Feature 18 at LA 105703, looking west.

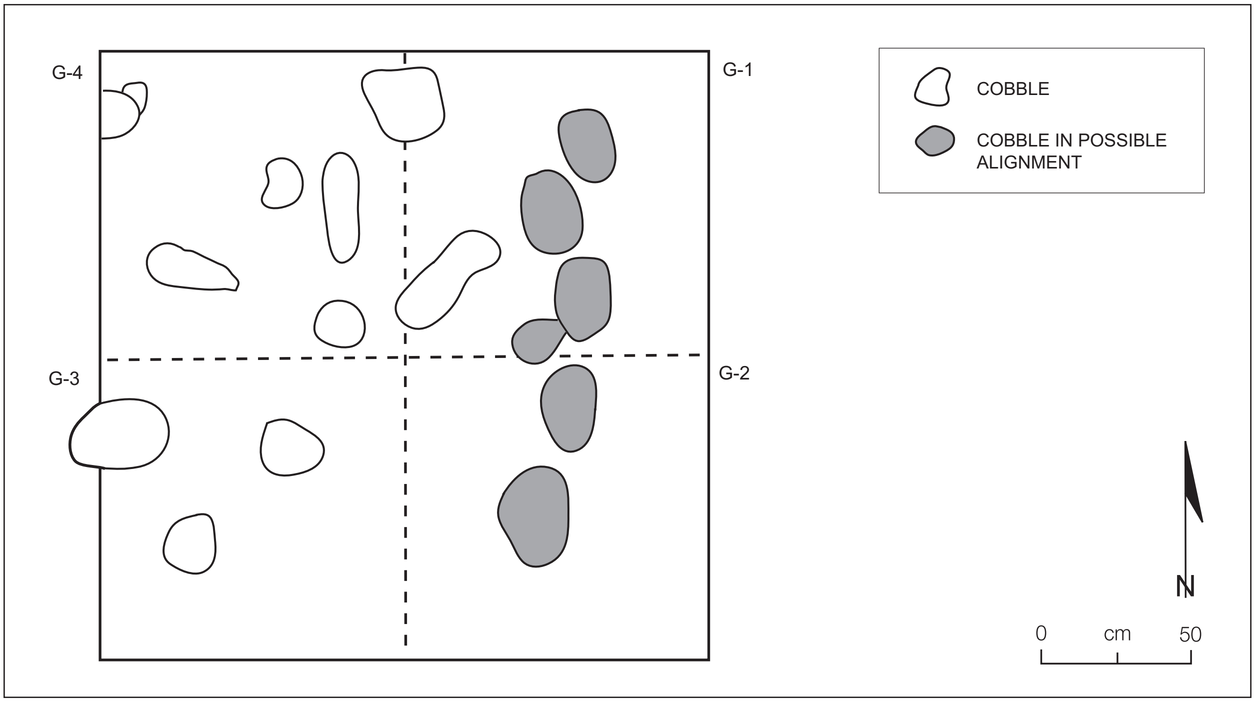


Figure 7.19 Postexcavation plan of EU-G in Feature 18, LA 105703.

Figure 7.20. EU-G in Feature 18 at LA 105703, looking north.

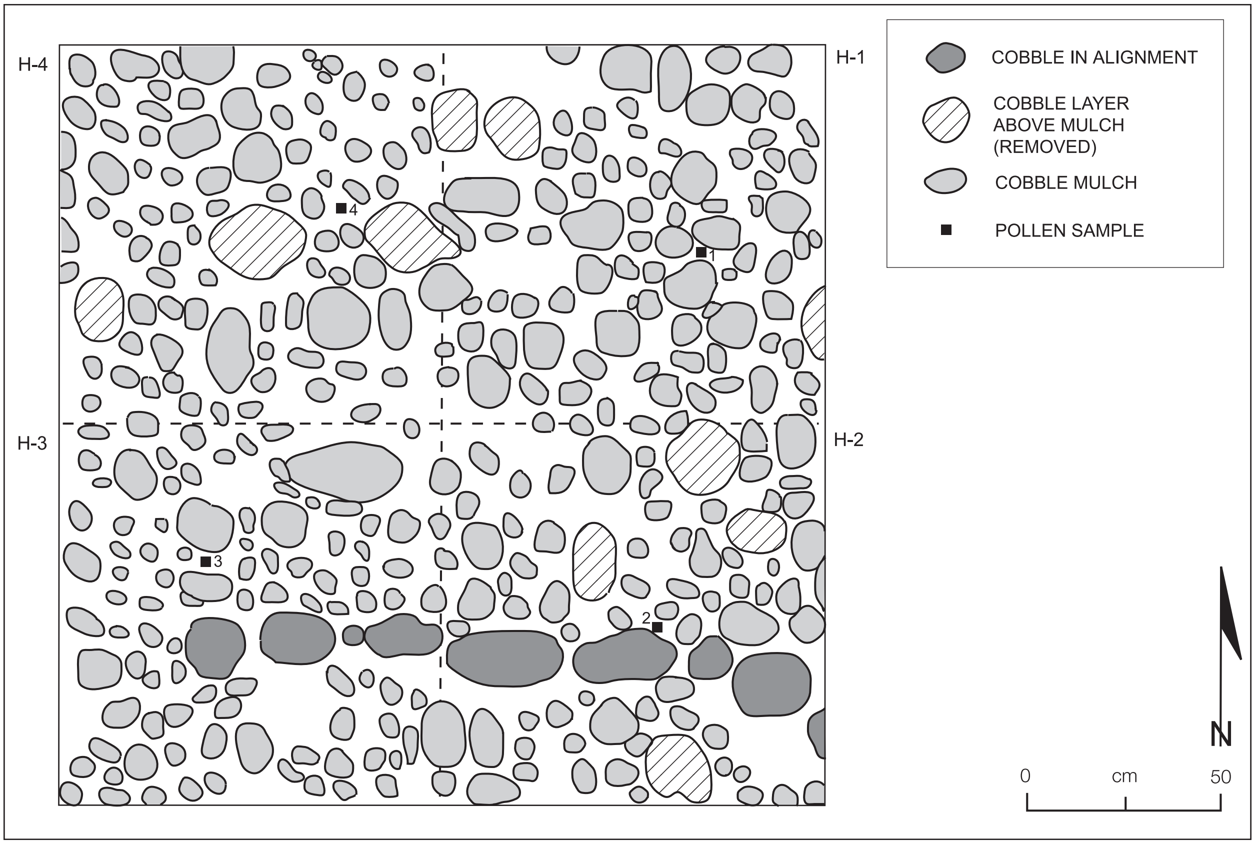


Figure 7.21. Postexcavation plan of EU-H in Feature 18, LA 105703.

Figure 7.22. EU-H in Feature 18 at LA 105703, looking east.

tion of interior subdividing alignment running east-west through Grids H-2 and H-3, though some elements appeared to be missing from its west end (Fig. 7.21). The remainder of this excavation unit was covered by cobble mulch (Fig. 7.22), and some cobbles also occurred as floaters in the upper layer of mulch.

EU-I was placed in the north-central section of Feature 18 to investigate an area with no surface indications of alignments (Fig. 7.6). Stratum 1 was a moderate to thick layer of tan sandy loam containing some pea gravels. It was 0–7 cm thick, with a mean thickness of 2.8 cm. An undifferentiated biscuit ware sherd and a piece of rhyolite angular debris were the only artifacts recovered from this layer. Stratum 2 was a matrix of pea gravels, gravels, and small cobbles that had been infiltrated by a brown sandy loam. The gravel mulch was 2–11 cm thick, averaging 7.2 cm. It was underlain by a layer of cobbles through much of the unit, which averaged 7.5 cm thick. Thus, the entire mulch layer had a mean thickness of 14.7 cm. A pollen sample taken from the mulch yielded a low concentration of corn pollen. Two Biscuit B sherds and a piece of rhyolite angular debris were also recovered from this unit.

Excavation exposed at least one east-west trending alignment and a pavement of cobble mulch in this unit (Fig. 7.23). Elements in the definite interior subdividing alignment were mostly set end-to-end, though some sideways placement also occurred. All elements in this alignment were set upright. Again, this type of construction suggests that the cobble mulch was a base course for drainage and that the gravels represent the main layer of mulch, which was probably applied immediately after the base course was laid. Thus, only one construction and use episode appear to be represented. While excavators thought they noted several other alignments in this unit, examination of excavation notes and drawings suggest that only the alignment shown in Figure 7.23 was definite, and that others probably represented cobble floaters in the gravel mulch.

EU-L was placed in the northwest part of Feature 18 to study an area where two cobble-bordered plots were suggested by surface inspection (Fig. 7.6). Stratum 1 was a thin to moderately thick layer of tan sandy loam containing some pea gravels. It was 0–5 cm thick, with an average thickness of 2.2 cm. One rhyolite core flake was recovered from this layer. Stratum 2 was a matrix of unsorted pea gravels and gravels that had been infiltrated by a dark tan loamy sand. The

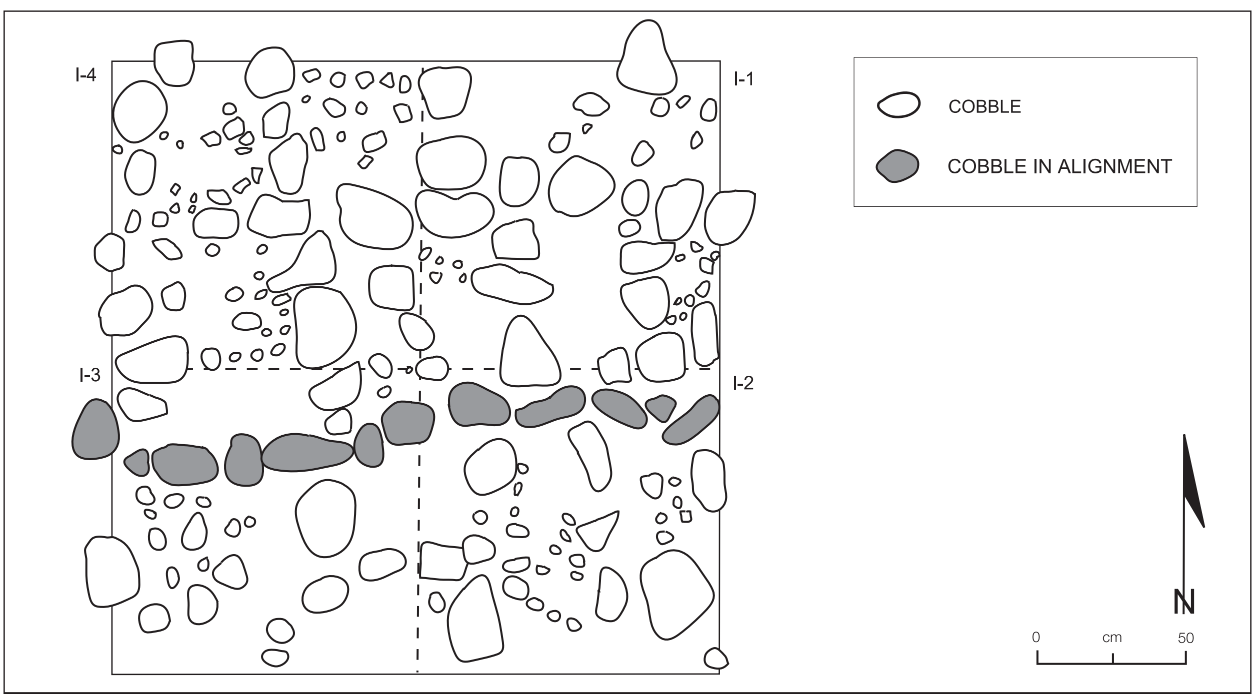


Figure 7.23. Postexcavation plan of EU-I in Feature 18, LA 105703.

gravel-mulch layer was 1–12 cm thick, with a mean thickness of 6.5 cm. A cobble mulch underlying the gravel mulch consisted of 6–8 cm long cobbles that were set on their broadest surfaces in a layer a single element thick. The cobble layer was an average of 8.0 cm thick and with the gravel layer comprised a mulch that averaged 14.5 cm thick. A soil sample from the mulch yielded no pollen from domesticated species. Eight rhyolite core flakes and three rhyolite angular debris were recovered from this layer.

Excavation in this unit exposed a pattern of noncontiguous, evenly spaced large cobbles and small boulders, forming at least four east-west trending alignments (Figs. 7.24 and 7.25). These elements formed a series of open cells that measured 40–50 cm on a side. Six complete and at least six partial cells were exposed in this excavational unit. The function of the larger evenly spaced elements is unknown, but they may simply have served to demarcate boundaries between crop rows. As Figure 7.25 shows, the evenly spaced boulders and cobble mulch were set on the same surface.

EU-N was placed in the south section of Feature 18 to examine a series of what appeared to be parallel interior subdividing alignments (Fig. 7.6). Visible elements were widely spaced, and most alignments seemed to be covered by sediments. Stratum 1 was a thin mantle of tan loamy sand containing some pea gravels, which probably represented the top of the mulch. This layer was 1–5 cm thick across the excavation unit and averaged 2.5 cm. Stratum 2 was a matrix of unsorted pea gravels, gravels, and small cobbles that had been infiltrated by a tan loamy sand. A sample taken from the mulch yielded a high concentration of corn pollen. No artifacts were recovered from either stratum in this excavational unit.

No alignments were exposed as the mulch was removed from this unit. Instead, a series of patterned but noncontiguous and evenly spaced large cobbles/small boulders was found (Figs. 7.26 and 7.27). These elements formed a series of open cells that measured about 80 cm long and wide. Three complete and at least four partial cells were exposed. The function of the larger evenly spaced elements is not known, but they may have been used to demarcate boundaries between crop rows.

EU-O was placed 8 m west of EU-H in the north part of Feature 18 to investigate an alignment that was defined from surface observation (Fig. 7.6). Stratum 1 was a moderately thick layer of tan sandy loam containing a few pea gravels. It was 2–5 cm thick, with a mean thickness of 3.3 cm. Stratum 2 was a matrix of unsorted pea gravels, gravels, and small cobbles that had been infiltrated by a dark tan sandy loam. This layer of mulch was 2–13 cm thick and averaged 6.9 cm. Excavation ended on top of a layer of cobble mulch, which was 5–7 cm thick. Both layers of mulch together probably averaged 12–14 cm thick. A sample taken from the mulch yielded no pollen from domesticated plants, and no artifacts were recovered from this unit.

Excavation in this unit exposed at least one cobble alignment and a series of noncontiguous, evenly spaced large cobbles/small boulders (Figs. 7.28 and 7.29). An interior subdividing alignment ran east-west through the south half of Grids O-2 and O-3 (Fig. 7.28). As can be seen in Figure 7.29, most cobbles in this alignment were set end-to-end and upright. This probably indicates that the cobble and gravel-mulch layers were laid at the same time, otherwise the unsupported cobbles in this alignment would have collapsed. North of the interior subdividing alignment was a series of noncontiguous, evenly spaced large elements forming a series of open cells that measured 50–70 cm on a side. Four complete and at least six partial cells were exposed. Directly south of the interior subdividing alignment was a series of smaller cobbles that seemed to form a second alignment that was not visible from the surface (Fig. 7.28). This alignment could simply be a section of mulch where cobbles were set in a fairly standard pattern, creating a false alignment. Then again, it could be evidence of an earlier field that was covered when this section of Feature 18 was built. While the former is more likely, the latter cannot be completely discounted. The cobble mulch was a single element thick, and nearly all cobbles were set on their broadest surfaces and packed fairly tightly.

Feature 21

One excavation unit was used to examine Feature 21 (Fig. 7.6). EU-M was placed in the southwest part of the feature to investigate short sections of

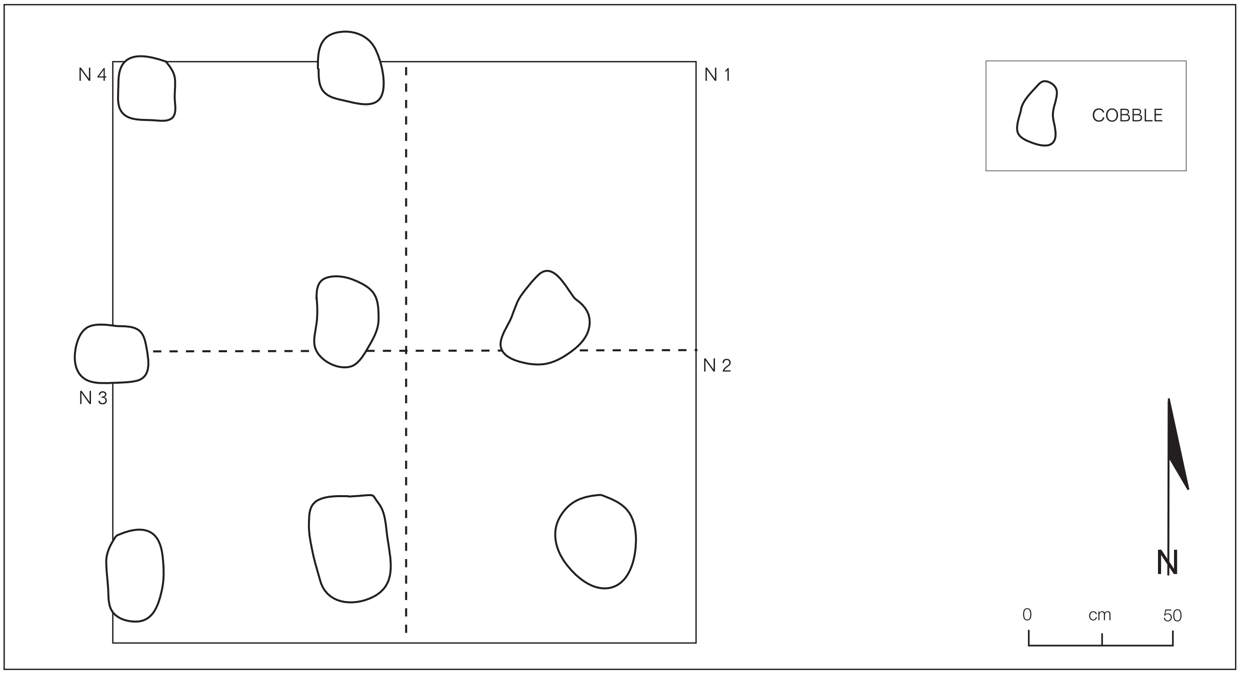


Figure 7.24. Postexcavation plan of EU-L in Feature 18, LA 105703.

Figure 7.25. Patterned boulders and cobble mulch. EU-L in Feature 18, LA 105703, looking east.

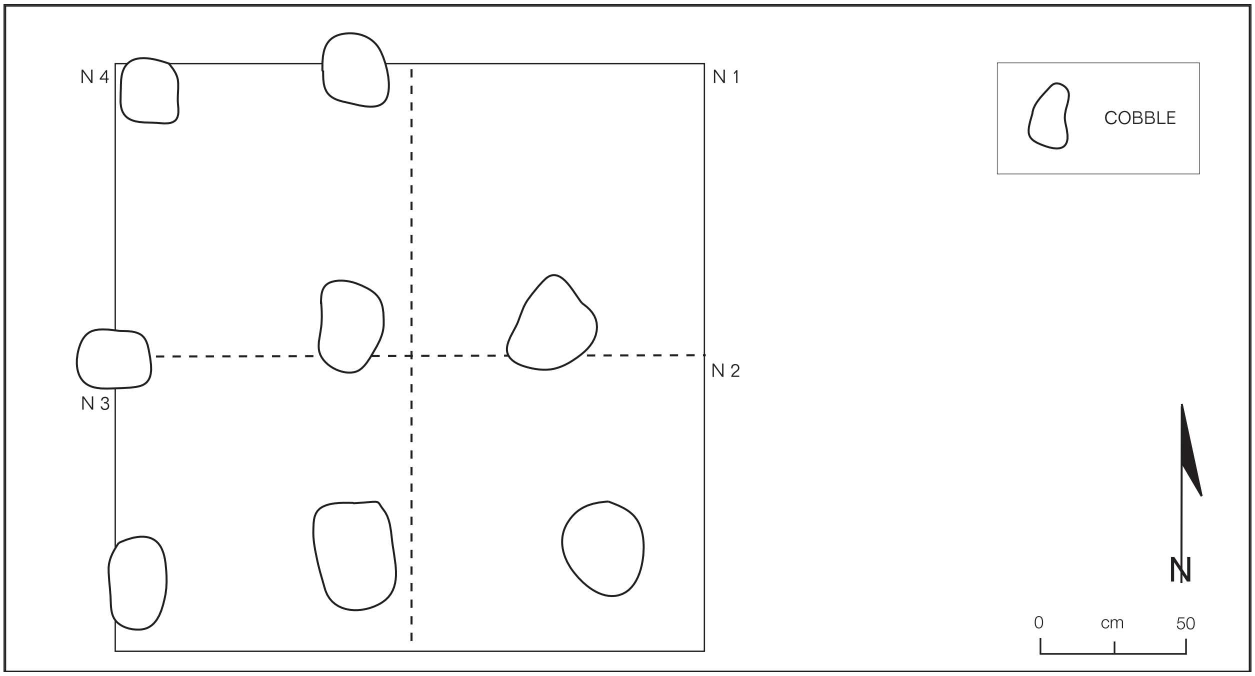


Figure 7.26. Postexcavation plan of EU-N in Feature 18, LA 105703.

Figure 7.27. EU-N in Feature 18 at LA 105703, looking south.

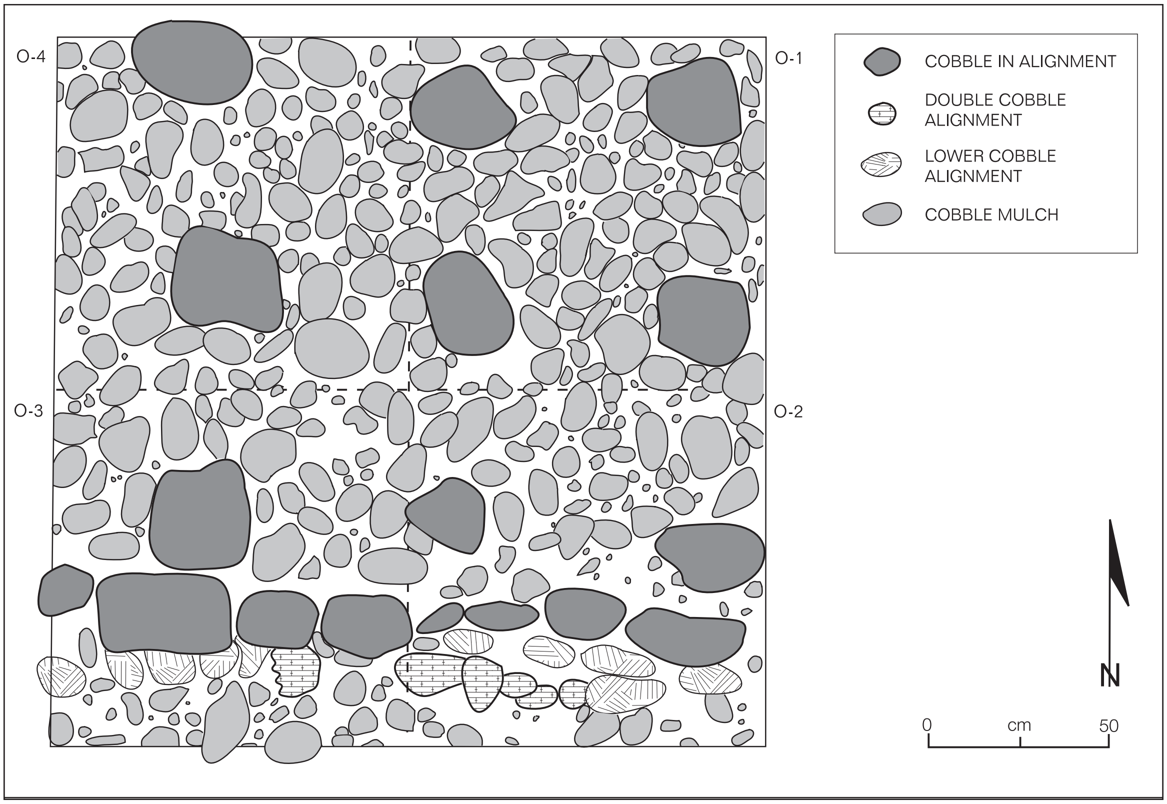


Figure 7.28. Postexcavation plan of EU-O in Feature 18, LA 105703.

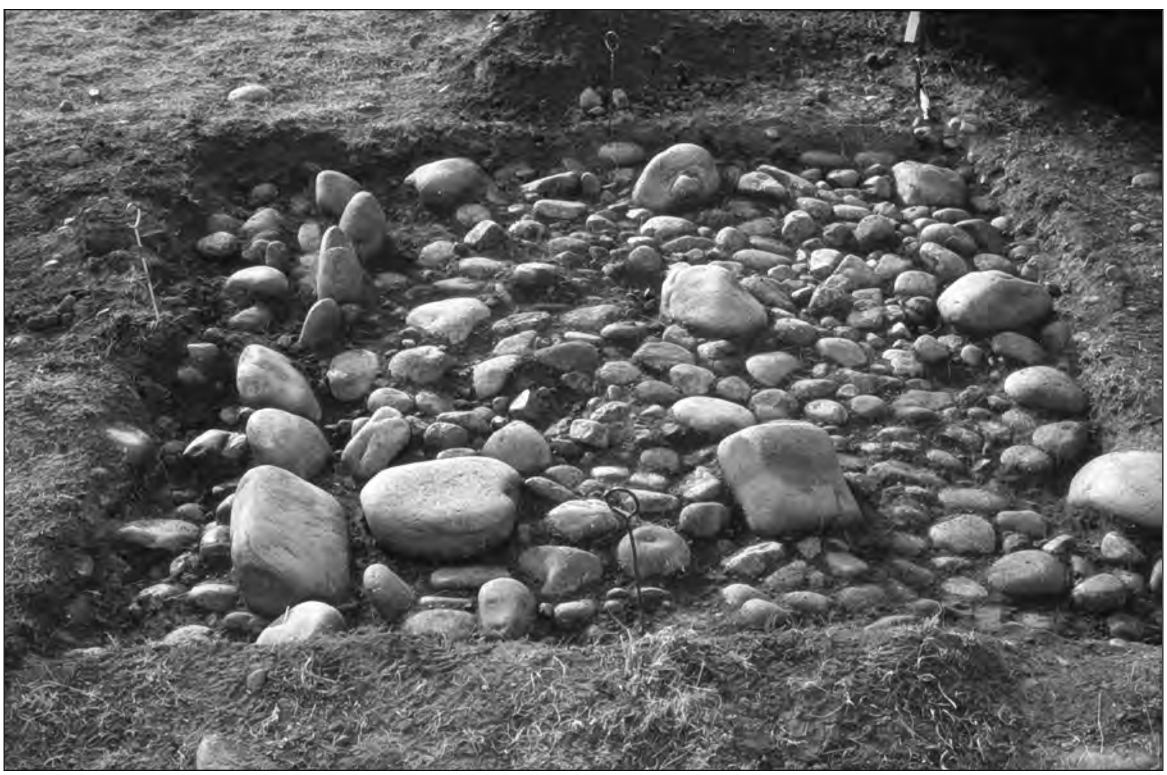


Figure 7.29. Interior subdividing alignment to the right and patterned, noncontiguous, evenly spaced boulders to the left. EU-O in Feature 18, LA 105703, looking west.

a boundary alignment and an interior subdividing alignment that were defined from surface indications. Stratum 1 was a thin layer of dark tan sandy loam containing a moderate amount of pea gravels. It was 0–4 cm thick, with a mean thickness of 0.8 cm. An undifferentiated biscuit ware sherd and a rhyolite core flake were recovered from this layer. Stratum 2 was a matrix of unsorted pea gravels, gravels, and small cobbles that had been infiltrated by a dark tan sandy loam. This layer of mulch was 4–17 cm thick, with an average thickness of 9.75 cm. A sample taken from the mulch yielded a moderate concentration of corn pollen. Other cultural materials recovered included an undifferentiated biscuit ware sherd and a unidirectional rhyolite core.

Excavation in this unit uncovered a partly disarticulated boundary alignment running through the north half of Grids M-1 and M-4 (Figs. 7.30 and 7.31). No sign of the interior subdividing alignment that was defined from surface observation was found, and it is likely that what was originally thought to be the alignment was actually a series of small cobbles floating in the gravel mulch that only seemed to be aligned. Though no evidence of a cobble mulch layer was found, small cobbles were very common in the gravel mulch, indicating that only larger elements were sorted out for use as building elements.

Feature 22

Two excavation units were used to investigate parts of Feature 22 that extend into the right-of-way (Fig. 7.7). EU-J was placed in the north-central part of the feature a few meters west of the edge of U.S. 285. EU-K was directly adjacent to the roadcut in the south part of the feature.

EU-J was excavated in an area where two perpendicular interior subdividing alignments were indicated by surface observation (Fig. 7.7). Stratum 1 was a very thin mantle of dark tan sandy loam which contained about 10 percent pea gravels. This stratum was 0–3 cm thick and had a mean thickness of 0.3 cm. Stratum 2 varied through this unit. To the north and west of the alignments in Grids J-1, J-3, and J-4, it was a matrix of unsorted pea gravels, gravels, and small cobbles that was infiltrated by a brown sandy loam. To the south and east of the alignments in Grids J-1, J-2, and J-3, this matrix overlay a cobble mulch layer. Overall, Stratum 2 was 2–14 cm thick, with a mean thickness of 8.2 cm. A sample from the mulch yielded a moderate to high corn pollen concentration and three pieces of rhyolite angular debris.

Removal of the mulch exposed two perpendicular alignments that met just northwest of the center of the unit and were a single element high and wide (Figs. 7.32 and 7.33). Most cobbles were set sideways on their broadest surfaces, though a few were placed end-to-end. At 8–10 cm long, elements in the cobble mulch were mostly smaller than those used in the alignments. They appeared to have been poured into the plot in a haphazard fashion, with no attention paid to orientation. The results of excavation in this unit were interesting, since it represents the juxtaposition of two different methods of mulching: gravel mulch, and layered cobble and gravel mulch.

EU-K was used to investigate two perpendicular alignments that were identified from surface observation (Fig. 7.7). Excavation showed that these alignments were actually part of a boundary alignment at the south edge of the feature. Stratum 1 was a fairly thick layer of light gray brown gravelly sandy loam. It was 2–11 cm thick, with a mean thickness of 6.8 cm. This layer of soil was thicker outside the feature in Grid K-3. Five rhyolite core flakes and six pieces of rhyolite angular debris were recovered from this soil layer. Stratum 2 was confined to the area within the feature. It was a matrix of unsorted medium to large gravels, at the base of which was a thin layer of medium-grained sand and pea gravels that appeared to have been intentionally placed. Below these materials was a layer of cobble mulch, and excavation ended at the top of that mulch. The gravel-mulch layer was 3–15 cm thick, with an average thickness of 6.7 cm. Elements in the cobble mulch were predominantly placed on their broadest surfaces, so that the layer was probably 3–5 cm thick. This suggests that the entire mulch layer was 10–12 cm thick. A sample taken from the mulch yielded a moderate concentration of corn pollen. Two Sapawe Micaceous sherds, one micaceous utility sherd, four rhyolite core flakes, three pieces of rhyolite angular debris, and a multidirectional rhyolite core were recovered from this layer.

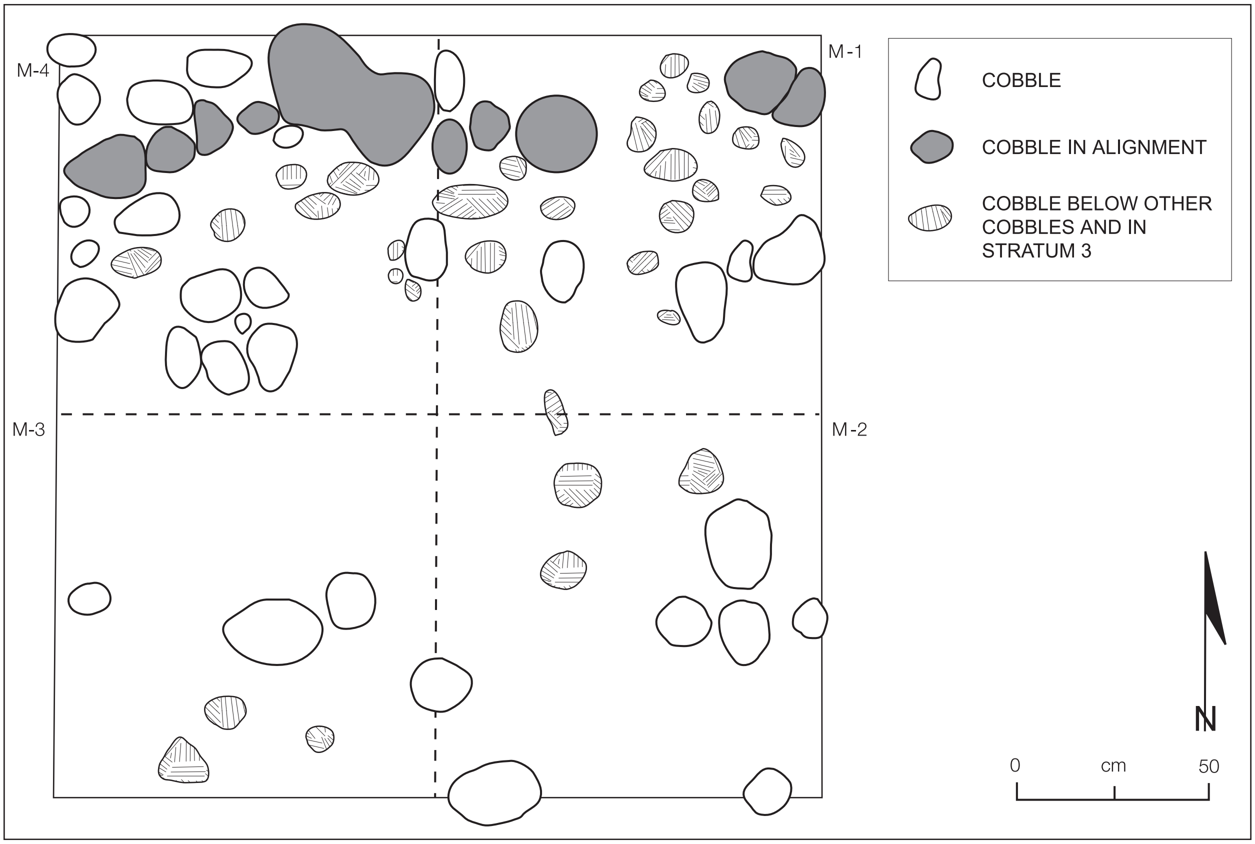


Figure 7.30. Postexcavation plan of EU-M in Feature 21, LA 105703.

Figure 7.31. EU-M in Feature 21 at LA 105703, looking south.

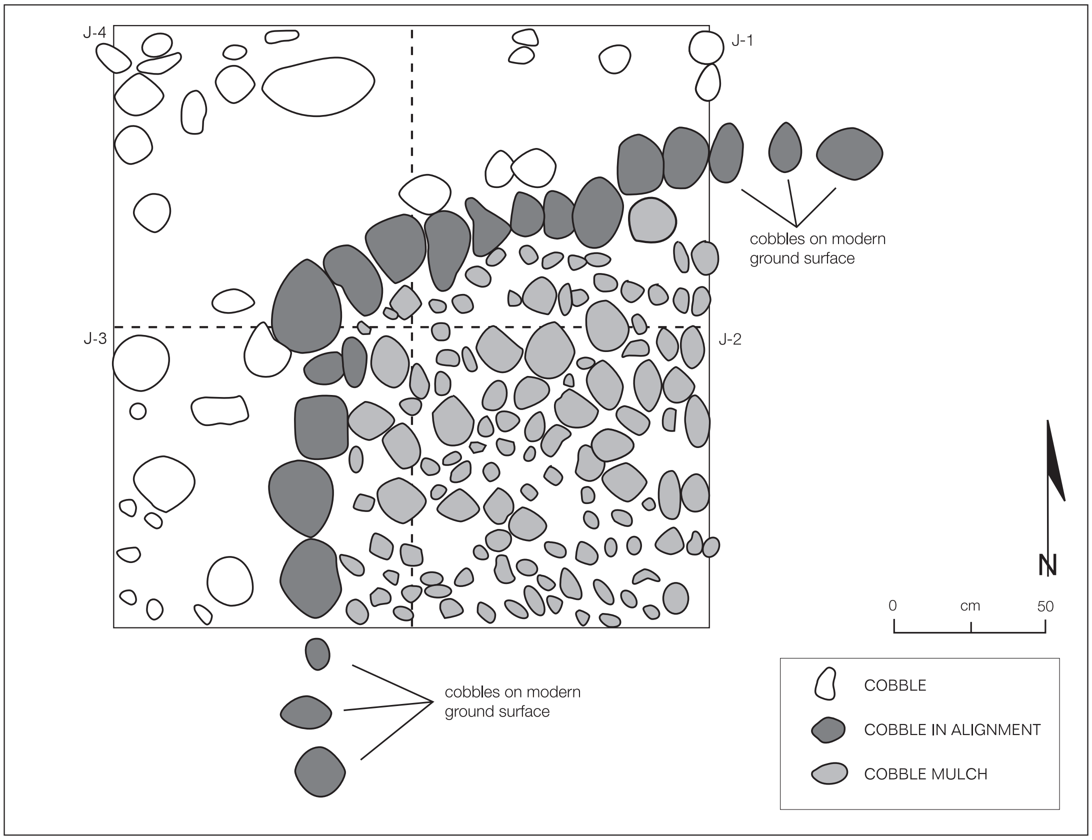


Figure 7.32. Postexcavation plan of EU-J in Feature 22, LA 105703.

Figure 7.33. EU-J in Feature 22 at LA 105703, looking east.

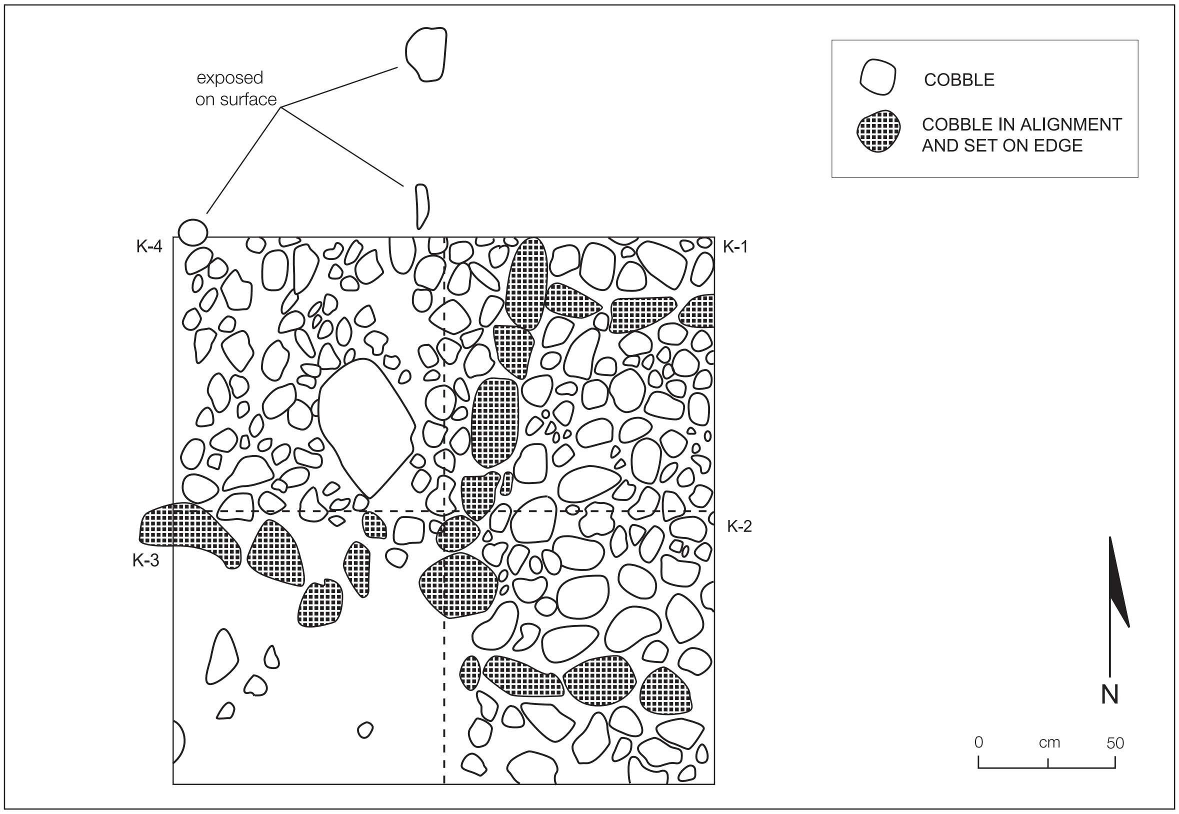


Figure 7.34. Postexcavation plan of EU-K in Feature 22, LA 105703.

Figure 7.35. EU-K in Feature 22 at LA 105703, looking south.

Removal of the gravel mulch exposed several alignments, showing that this area at the south edge of Feature 22 was subdivided into smaller cells (Figs. 7.34 and 7.35). Distinct differences were seen in the matrix within the feature and outside it: the soil outside the feature contained fewer and smaller gravels and pockets of red clay. Most cobbles in the alignments were set end-to-end, though a few were set sideways; all were placed upright (Fig. 7.34). Part of the boundary alignment was displaced, creating a small break in the northwest part of Grid K-3. Parts of at least three cells were exposed and seemed much larger than those that were seen in other features, with a length of up to 1.3 m and a width of at least 80 cm. A boulder was set into the matrix in Grid K-4, but its function was uncertain.

Summary

LA 105703 contained one of the largest expanses of farming features available for investigation during this project. More excavation units were dug at this site than at any of the others, producing data that were both comparable with and quite different from those acquired at other sites. LA 105703 is atypical in that it is not situated at the edge of a high terrace. However, it is in an area that contains important prerequisites for field construction: an abundant and easily accessed source of gravels and cobbles, and a wide expanse of flat surface. Evidence of two domesticated crops was found in pollen samples from LA 105703. Both corn and cotton were grown there, perhaps together in the same plots or sequentially in plots, since cotton pollen never occurs without corn pollen. However, some excavation units only yielded corn pollen, suggesting that this plant was monocropped.

Five gravel-mulched fields were investigated, three by multiple excavation units. Excavation in Features 2, 18, and 22 showed that those fields were more intricately built than suggested by surface indications. Sections of each of these features were subdivided into small cells. Feature 18 demonstrated a particularly complex construction style. Most elements in internal subdividing alignments in EU-E, EU-F, and EU-I were set upright, and there was evidence of two layers of mulch: a layer of predominantly pea gravels and gravels over a layer of cobbles. This pattern of intricately subdivided cells with two layers of mulch also occurred in Feature 22 but was found nowhere else in the study area.

A second configuration encountered in Feature 18 consisted of a series of large cobbles or small boulders set in a noncontiguous pattern of evenly spaced elements. This configuration was found in EU-I, EU-N, and EU-O. In the latter case, it was accompanied by two layers of mulch—gravels in an upper layer and cobbles in a lower layer. Features were configured in a more normal pattern elsewhere on the site, and elements occurred in contiguous alignments, mostly set on their broadest surfaces. Mulch consisted of unsorted pea gravels, gravels, and small cobbles.

Quite a bit of evidence of sequential feature construction was found at LA 105703. The most obvious was the relationship between Features 2 and 3, in which the latter had been partly built over the former and was mounded above its surface. Feature 18 provided other evidence of this process, though it was more indirect. Because Feature 18 was large and so much of it was within project limits, we were able to investigate numerous areas and found quite a bit of variation in structure. That variation suggests that Feature 18 was built over a period of time in stages rather than in a single episode. Its genesis was probably a series of individual features that eventually grew together as construction continued, acquiring the appearance of a single coherent system when, in actuality, several individual fields probably continued to be represented.

Artifacts were recovered from both strata encountered within excavation units. Materials found in Stratum 1 postdate the construction and probably the use of farming features at this site. Artifacts from Stratum 2 came from the materials used to build the farming features and therefore predate their construction, or they were deposited as the features were in use or being built. Thus, the occurrence of Biscuit B sherds in three excavation units is important and points toward construction during the Late Classic period.

Chapter 8. LA 105704

James L. Moore

LA 105704 is a small farming site on land administered by the USDI Bureau of Land Management. The site is roughly oval and bounded on the west by U.S. 285 and on the east by a slope. This site is atypical of the area in that it is small and discrete, containing only a few features. It measures 74 m north-south by 38 m east-west and covers 2,812 sq m (0.28 ha). About 53 percent of the remaining section of site extended into the right-of-way. We were uncertain whether LA 105704 originally extended further west, since none of the features identified there seemed to have been truncated by highway construction. However, the absence of borrow pits in this area suggests that part of the site was removed during earlier highway construction. In-field pottery analysis indicated that LA 105704 was used during the Classic period.

Vegetative cover is moderate on the site, and the plant cover is similar in on- and off-feature areas. Grasses are the most common plants and include grama, three-awn, and muhly. Other common plants include rabbitbrush, sagebrush, snakeweed, narrowleaf yucca, prickly pear, barrel cactus, and cholla. Small juniper and piñon trees are growing across the site area and have spread onto the farming features.

Field Procedures

A detailed map of the entire site was prepared. All associated features are within the proposed right-of-way, and only a diffuse artifact scatter continues outside project boundaries. Data recovery concentrated on the surface description of features and sample excavation of selected areas within features. Excavation focused on Features 1 and 2. Feature 1 was sampled with two excavation units, and Feature 2 by one excavation unit. All cultural materials noted on the surface within the highway right-of-way were collected for analysis, as were artifacts encountered in excavation units. These materials are summarized later in this chapter.

Features

Four features were mapped and described (Fig. 8.1). Field limits were difficult to identify in many cases because of the amount of damage caused by erosion. A combination of colluvial and eolian processes have caused soil to build up against alignments that face the terrace interior, obscuring those edges in many places. Eolian deposits also cover much of the surface of the fields, especially where they are anchored by vegetation. This made it difficult to discern many alignments and define the full extent of others. Livestock grazing may also have caused damage, displacing elements in cobble alignments and blurring feature edges. Along the terrace edge this seems to have exacerbated damage caused by erosion.

LA 105704 has also sustained quite a bit of modern damage, though the prehistoric features were fairly intact. An unimproved dirt road runs along the east side of the site and may have truncated the east edge of Feature 1. The west edge of the terrace was removed during an earlier highway construction phase and, as noted above, we were uncertain whether sections of the features were removed at that time. Modern trash was also noted on the surface of the site.

Feature 1

Feature 1 is a small irregularly shaped gravel-mulched plot that measures 15 by 12 m and covers roughly 160 sq m (Fig. 8.1). Since this field was in the detailed examination zone, it was completely mapped. The southeast part of the feature was truncated by an unimproved dirt road, and it is uncertain how much of the field extended into that zone. About 60–70 percent of the surface of this feature is obscured by sediments that have infiltrated the mulch and are anchored by vegetation. Feature 1 is currently separated from Feature 2 by a small incised gully, and it is possible that they were once parts of the same field.

Boundary and interior subdividing align-

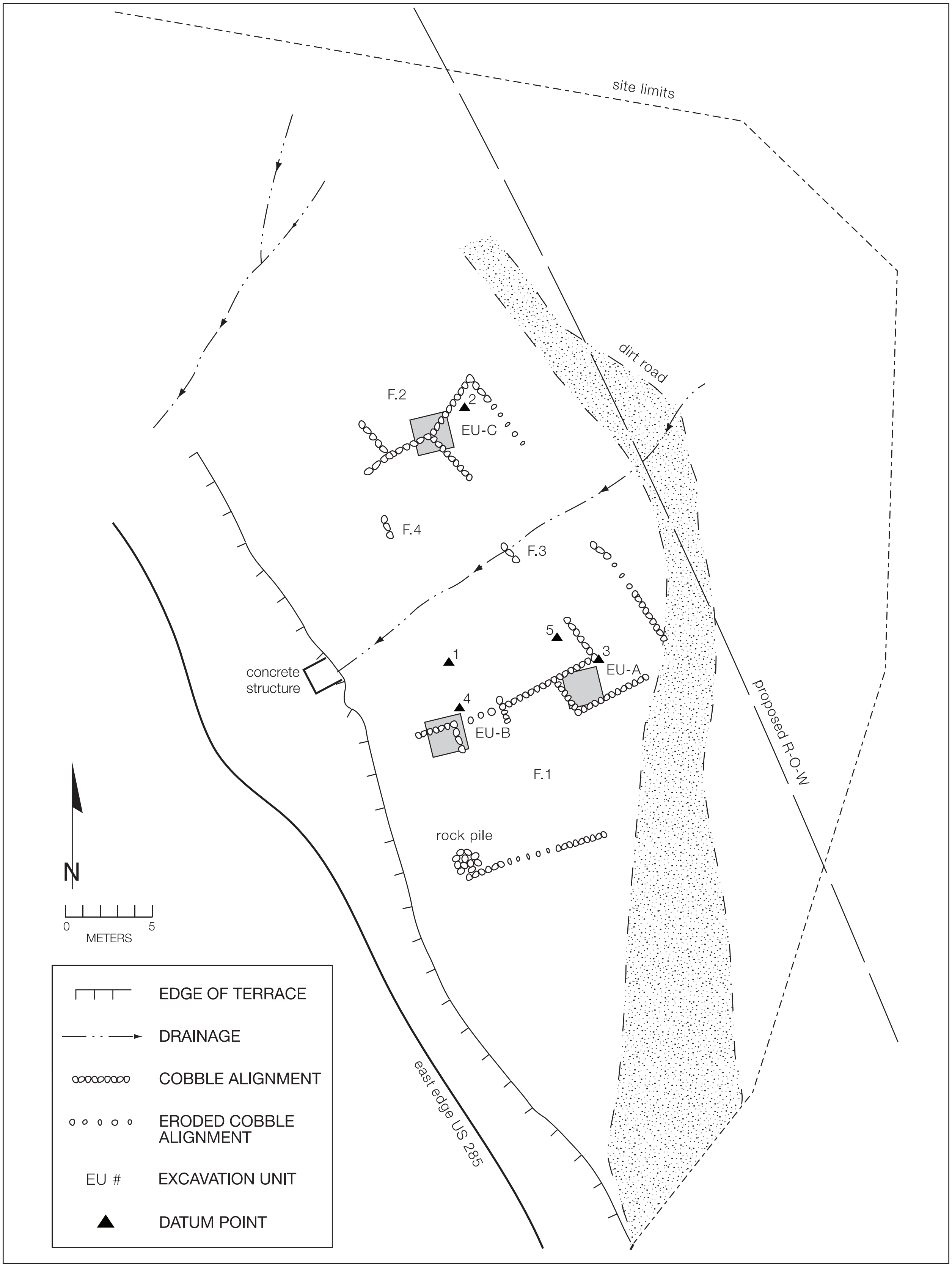


Figure 8.1. Plan of LA 105704.

ments are a single element high and wide. They were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 10–25 cm long. The few small boulders that occur are 25–30 cm long. Most elements in alignments were set end-to-end and on their broadest surfaces, though sideways placement was also common. Surface indications suggested that this feature was subdivided into several smaller compartments. The mulch is mostly composed of unsorted pea gravels and gravels, though small cobbles were also common, and their frequency on the surface suggests that only larger elements were sorted out for use as building elements. Since the alignments are only a single element high, the mulch is probably 10–15 cm thick. No variation in surface vegetation or gravel densities was noted between on- and off-feature areas.

Feature 2

Feature 2 is a small irregularly shaped gravel-mulched plot that measures 8 by 6 m and covers about 48 sq m (Fig. 8.1). Since this field was in the detailed examination zone, it was completely mapped. The east edge of the feature may have been truncated by an unimproved dirt road, and it is uncertain whether the field extended into that zone. About 60–70 percent of the surface of this feature is obscured by sediments that have infiltrated the mulch and are anchored by vegetation. Feature 2 is currently separated from Feature 1 by a small incised gully, and it is possible that they were once parts of the same field.

Boundary and interior subdividing alignments are a single element high and wide. They were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 10–25 cm long. The few small boulders that occur are 25–30 cm long. Most elements in alignments were set end-to-end and on their broadest surfaces, though sideways placement was also common. Surface indications suggested that this feature was subdivided into several smaller compartments. The mulch is mostly composed of unsorted pea gravels and gravels, though small cobbles are also common, and their frequency on the surface suggests that only larger elements were sorted out for use as building elements. Since the alignments are only a single element high, the mulch is probably 10–15 cm thick. No variation in surface vegetation or gravel densities was noted between on- and off-feature areas.

Feature 3

Feature 3, which appears to be a checkdam, is a short alignment of cobbles crossing an incised gully between Features 1 and 2 (Fig. 8.1). The alignment is 1.0 m long and is two elements wide and one high. The intact nature of the feature, its position uphill from a concrete drainage structure, and its presence in a modern gully suggests that it is a historic feature and not associated with the prehistoric fields.

Feature 4

Feature 4 is a short alignment of cobbles crossing a shallow incised gully at the south edge of Feature 2, which appears to be a checkdam (Fig. 8.1). The alignment is 1.1 m long and consists of a linear alignment of three cobbles, with a possible intersecting alignment represented by a cluster of three small cobbles on the east side near the center of the main alignment. This feature is situated just above the head of a small erosional channel, and its placement suggests two possible functions: it could be a historic checkdam, similar to Feature 3, or it could be a section of the west wall of a large cell in Feature 2. While the latter is more likely, the former cannot be ruled out.

Surface Information

LA 105704 seemed to contain only one or two small farming plots of limited size. These features were on a low, relatively level hilltop, and little room was available for other features. Surface examination of the part of the site outside project limits showed that it contained a low-density artifact scatter. Fourteen artifacts were inventoried in that area. The only sherd found was from a Biscuit A bowl. The remaining artifacts were chipped stone dominated by rhyolite (6 core flakes, 1 angular debris, 1 tested cobble), followed by quartzite (3 core flakes, 1 biface), and andesite (1 core flake). Another 19 artifacts were collected from the portion of LA 105704 within the right-of-way (Table 8.1). Nearly three-quarters of this small assemblage is comprised of rhyolite, a somewhat higher proportion than in the area inventoried outside the right-of-way. Other materials were represented by only one or two specimens apiece, and no pottery was recovered from this area.

Table 8.1. Chipped stone artifacts collected within highway right-of-way at LA 105704 (material type by morphology)

Material Type	Angular Debris	Core Flakes	Cores
Gabbro	-	-	2
Rhyolite	1	7	6
Andesite	-	1	-
Quartzite	-	-	1
Massive quartz	-	-	1

Results of Excavation

Three 2 by 2 m excavation units were used to examine subsurface deposits and construction techniques in the gravel-mulched farming plots at LA 105704. Three basic soil strata were defined in excavation units. Stratum 1 represents the eolian and colluvially deposited sediments that mostly covered both features. The layer of mulch contained by these features was designated Stratum 2. Stratum 3 was the original terrace surface, and excavation generally halted when this layer was encountered. However, since this was the first site where excavations were conducted in farming features during this project, we were still getting a feel for excavation techniques and the stratigraphy that was encountered. For this reason, Stratum 1 and the upper part of Stratum 2 were usually removed together as the first 10 cm excavation level at LA 105704. Thus, depth measurements for these strata are combined.

Feature 1

Two excavation units were used to examine Feature 1 (Fig. 8.1). EU-A was placed in the east-central part of the feature, overlapping a possible boundary alignment and two probable interior subdividing alignments. EU-B was placed in the west-central part of the feature, where two perpendicular interior subdividing alignments intersected.

EU-A, placed in a part of Feature 1 that was partly disturbed by an unimproved dirt road and erosion, intersected parts of three alignments (Fig. 8.1). Stratum 1 was a fairly thin layer of light brown silty sand containing up to 10 percent pea gravels; it was 2–4 cm thick. Stratum 2 was a matrix of unsorted pea gravels, gravels, and small to large cobbles that was infiltrated by brown silty sand. Together, these strata were 4–14 cm thick, with a mean thickness of 7 cm. Thus, Stratum 2 was up to 10 cm thick and averaged 3–5 cm. A sample taken from the mulch yielded a low corn pollen concentration. No artifacts were recovered from this excavation unit.

With the mulch removed, sections of three alignments and a scatter of large cobbles were exposed (Fig. 8.2). The alignments appeared to be partly disarticulated interior subdivisions forming three sides of a cell that was originally at least 2 m to a side. Small cobbles were removed with the rest of the mulch during excavation. The smaller cobbles and a few larger ones were floating in the gravel matrix of Stratum 2, indicating that they were components of the mulch. Thus, not all large cobbles had been sorted out before this material was used to mulch the field. All exposed alignments were a single element high and wide, as suggested by surface indications.

EU-B was placed near the edge of U.S. 285 on the west side of the feature (Fig. 8.1). Stratum 1 was a thin layer of light brown sandy loam containing a fair amount of pea gravels. Quite a bit of juniper duff was noted on the surface. Stratum 2 was a matrix of unsorted pea gravels, gravels, and small cobbles that was infiltrated by a light brown sandy loam. Together, these strata were 4–10 cm thick, with a mean thickness of 7 cm. Thus, the mulch was probably 5–6 cm thick. A sample taken from the mulch yielded a low to moderate corn pollen concentration. No associated artifacts were recovered from this excavation unit.

Excavation revealed a section of interior subdividing alignment running east-west through the center of Grids B-1 and B-4, with a jumble of cobbles to either side (Fig. 8.3). No evidence of the perpendicular alignment that was defined from surface observations was found. Cobbles in the east-west alignment were partly disarticulat-

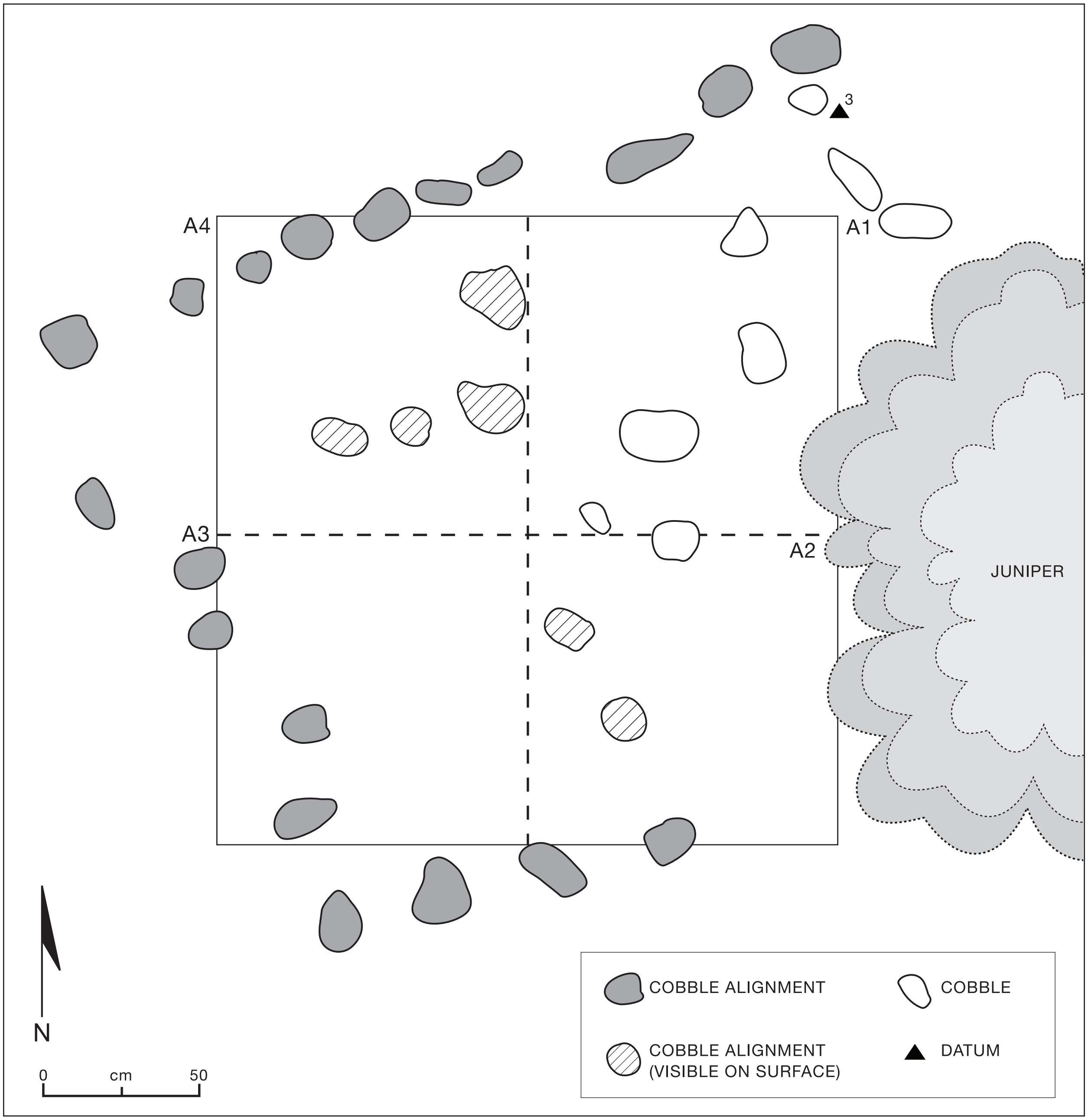


Figure 8.2. Postexcavation plan of EU-A in Feature 1, LA 105704. Shaded rocks are in alignments.

ed, especially in the west part of Grid B-4. Small cobbles were removed with the rest of the mulch during excavation. The smaller cobbles and some larger ones were floating in the gravel matrix of Stratum 2, indicating that they were components of the mulch. Thus, not all large cobbles had been sorted out before this material was used to mulch the field. The alignment was a single element high and wide, as suggested by surface indications. Most elements were set end-to-end, though a few were placed sideways.

Feature 2

One excavation unit was used to examine Feature 2 (Fig. 8.1). EU-C was placed in the central part of the feature to examine the intersection of two perpendicular interior subdividing alignments. Stratum 1 was a thin layer of light brown sandy loam containing some pea gravels. Stratum 2 was

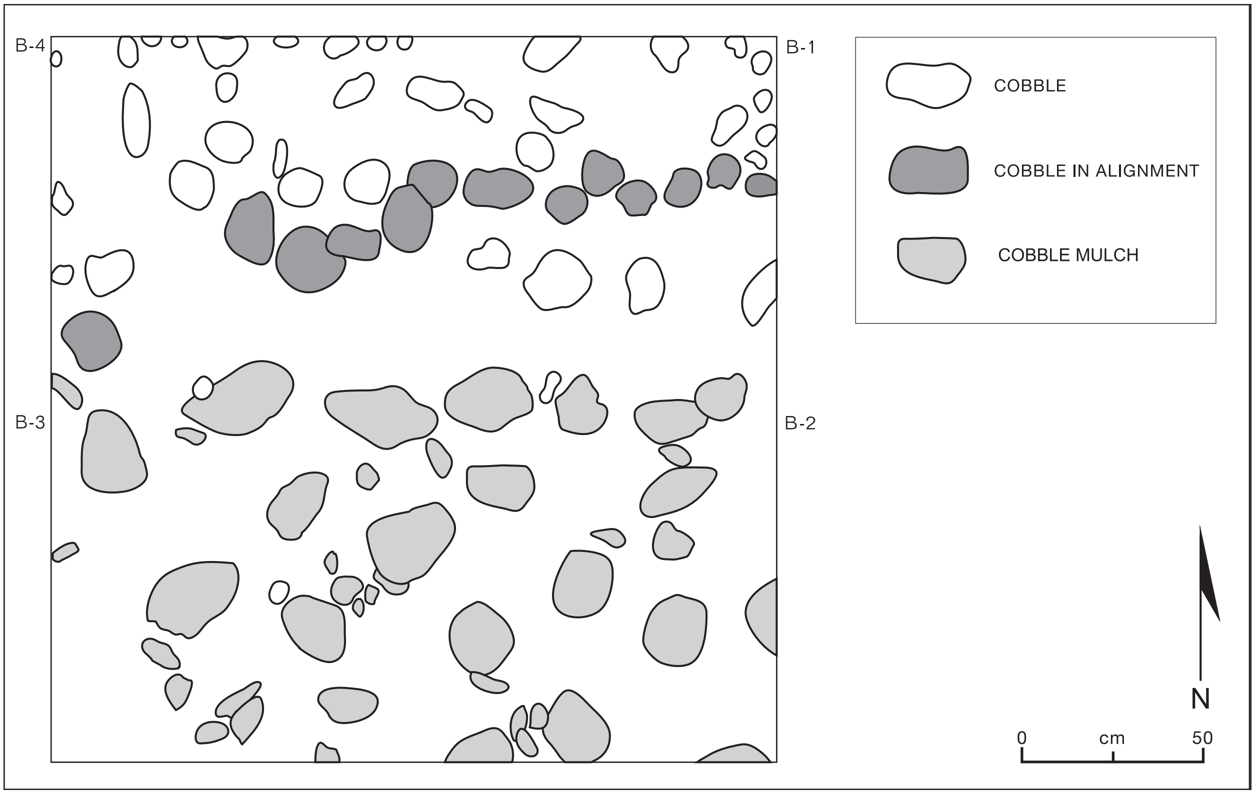


Figure 8.3. Postexcavation plan of EU-B in Feature 1, LA 105704. Shaded rocks are in alignments.

a matrix of unsorted pea gravels, gravels, and cobbles that was infiltrated by a light brown sandy loam. Together these strata were 6–23 cm thick, with a mean thickness of 14.4 cm. Thus, the layer of mulch was probably 10–12 cm thick. A sample taken from the mulch yielded a high corn pollen concentration. No artifacts were recovered from this excavation unit.

With the mulch removed, sections of two perpendicular interior subdividing alignments were exposed (Fig. 8.4). A southwest-northeast trending alignment ran from the west edge of Grid C-3 to the northeast corner of Grid C-1, and a southeast-northwest trending alignment ran from the southwest corner of Grid C-2 to the northeast corner of Grid C-3, intersecting the other alignment at that point. These alignments appear to have divided this part of Feature 2 into three fairly large cells, one on the north side of the southwest-northeast trending alignment, and two on its south side. A number of other cobbles that did not appear to be parts of any alignments were also exposed, some of which were floating in the gravel matrix. Thus, only larger cobbles appear to have been separated out for use as building stones when this feature was being constructed. Most elements in the exposed sections of alignments were set end-to-end and on their broadest surfaces, though there were a few examples of sideways placement.

Summary of Findings

LA 105704 was the smallest, worst-preserved, and probably most atypical of the sites examined during this study. The remains of two small gravel-mulched fields were found at this site, as well as two probable historic checkdams. Though the latter could not be directly dated, their positions across shallow gullies that were both actively cutting and that appeared to have developed fairly recently argued against a prehistoric origin. This site was probably larger originally, but much of it seems to have been removed by earlier episodes of road construction. This may have contributed to the apparent atypical location of LA 105704. It may have originally been set near the edge of a

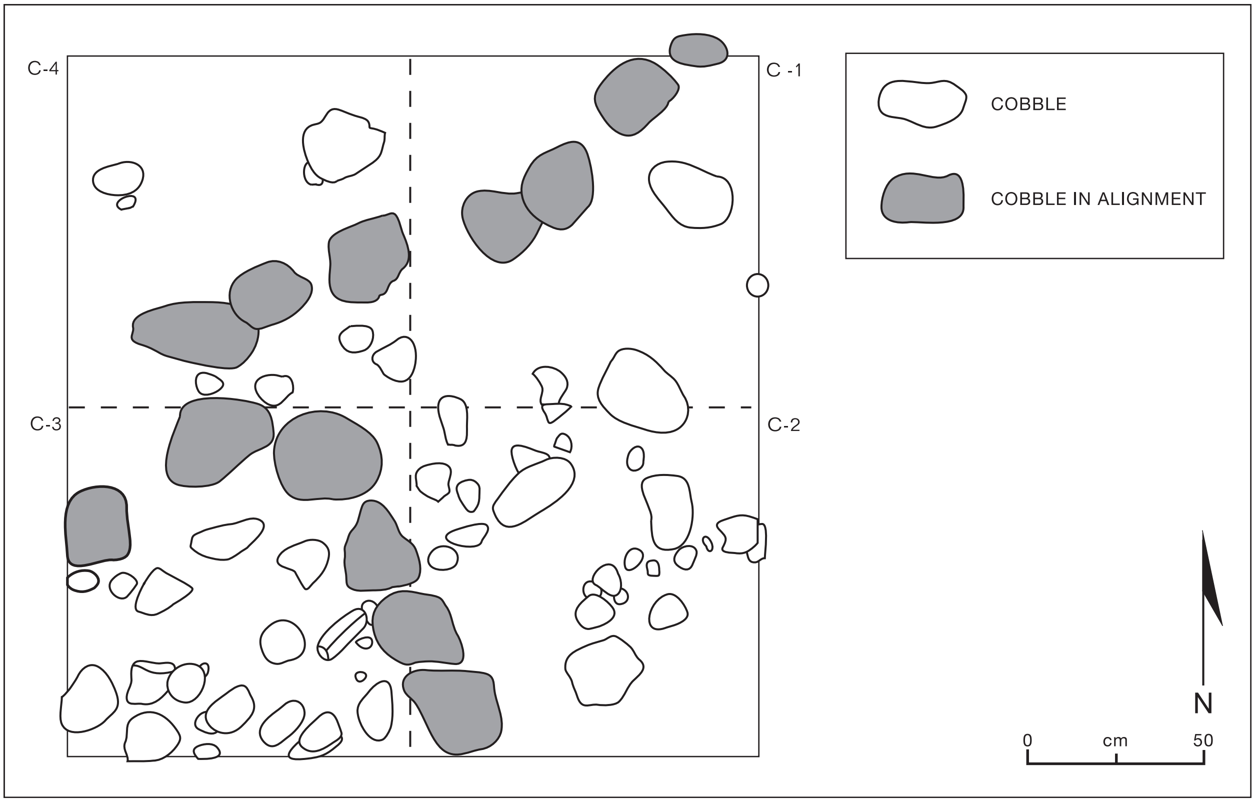


Figure 8.4. Postexcavation plan of EU-C in Feature 2, LA 105704. Shaded rocks are in alignments.

small section of relatively flat terrace top, bounded on the west by the terrace edge and on the east by a slope up to a higher section of terrace. The terrace edge is now gone, and with it any evidence of the borrow pits used to obtain materials for feature construction.

Excavation showed that some alignments defined during surface inspection did not really exist, and others that were not visible from the surface did. Both features were essentially built in the same fashion and seem to have been subdivided into fairly large cells. Mulch consisted of an unsorted mixture of pea gravels, gravels, and small cobbles. Corn pollen was recovered from all three excavation units, suggesting that these features may have been monocropped.

Chapter 9. LA 105705

James L. Moore

LA 105705 is a large farming site on State Trust land administered by the New Mexico State Land Office. It occupies a roughly C-shaped area bounded by the main terrace edge overlooking the Ojo Caliente Valley on the west and arroyos formed by intermittent tributary drainages on the north and south. The east boundary of the site is formed by the edge of the farming features, and intermittent drainages separate this site from LA 105708 to the south and LA 105706 to the north (Fig. 9.1). These arbitrary boundaries were used to maintain the original numbering system and restrict LA 105705 to a manageable size. It is unlikely that they replicate the prehistoric land tenure system.

LA 105705 measures 225 m north-south by 312 m east-west and covers about 45,500 sq m (4.55 ha). The site may have extended slightly further to the west, but that area is within the current U.S. 285 right-of-way and has been removed. Only about 7 percent of the site extends into the right-of-way, comprising a narrow sliver along its west edge. In-field pottery analysis indicated that LA 105705 was used during the Classic period.

Vegetation is moderate on the site, and the plant cover is generally similar in on- and off-feature areas. However, distinct differences were noted in a few places and are discussed in individual feature descriptions. Grasses are the most common plants and include grama and muhly. Other common plants include rabbitbrush, snakeweed, prickly pear, barrel cactus, and cholla. Small junipers occur at the terrace edge but have not spread onto field surfaces. Free-growing lichens were noted on several fields, but they are not as common as on some of the other sites that were investigated.

Field Procedures

Detailed mapping was restricted to the section of the site that extended into the U.S. 285 right-of-way and an adjacent 25+ m wide zone. This area comprises a sample of about 21 percent of the site, and all cultural features within this zone were mapped and recorded in detail. An eroded borrow pit (Feature 14) was the only feature that extended into project limits. Since excavation of this feature would have provided few data that were not available from surface examination, no subsurface studies were conducted, and work focused on the description and photographing of surface features in the mapped area. All cultural materials noted on the surface within the highway right-of-way were collected for analysis. Artifacts noted elsewhere on the surface in the detailed mapping zone were inventoried by feature and are summarized in those discussions.

Features

Seventeen features were partly mapped and described (Fig. 9.1). The locations of eight additional terrace-edge borrow pits are shown on the site plan, but since they were outside the detailed examination zone, they were not described in detail or assigned feature numbers. With one exception, feature limits are fairly well defined. That exception is Feature 11, which has suffered considerable damage from the construction of a water storage facility. A corral to the east of that facility obscures part of the surface of LA 105705, but damage is probably minimal since that area does not appear to have been bladed. A combination of colluvial and eolian processes has caused soil to build up against alignments that face the interior of the terrace, obscuring those boundaries in many places. Eolian deposits also cover much of the surface of the fields, especially where they are anchored by vegetation. This made it difficult to discern many alignments and to define the full extent of others. Livestock grazing has also caused damage, displacing elements in cobble alignments and blurring feature edges. Along the terrace edge this seems to have exacerbated damage caused by erosion. Other surface disturbances include a trail (LA 118549) that runs along the west edge of the site next to U.S. 285 and extends into site limits near Features 13 and

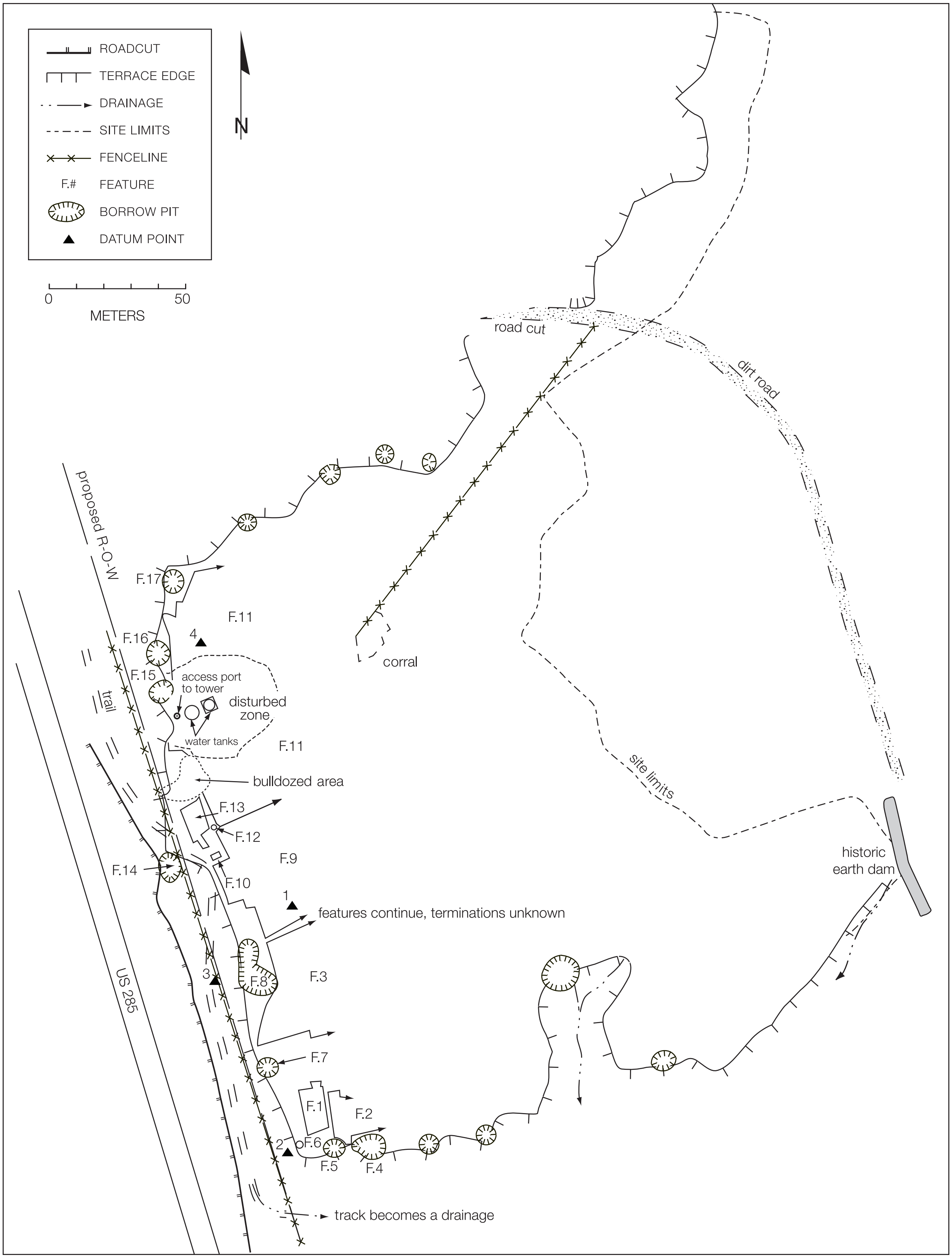


Figure 9.1. Plan of LA 105705.

14. An unimproved dirt road crosses the north part of the site, providing access to the terrace top from U.S. 285. The southeast section of the site has been slightly disturbed by construction of a modern earth dam.

Feature 1

Feature 1 is a small rectangular gravel-mulched plot that measures 18.2 by 8.8 m and covers 129.4 sq m (Fig. 9.2). Since this field was in the detailed examination zone, the entire feature was mapped. Perhaps 50–60 percent of its surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation.

Boundary and interior subdividing alignments are a single element high and wide. They were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 12–25 cm long. The few small boulders noted were 25–35 cm long. Though most elements in boundary alignments were placed sideways, some were set end-to-end. Most elements were also placed on their broadest surfaces, though occasional uprights occur. Interior subdividing alignments were built in a similar fashion, though there seemed to be more of a mix of end-to-end and sideways placement. Surface indications suggest that the interior of the feature was highly subdivided, though only a few of these alignments were actually visible.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 10 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Since the alignments are a single element high, the mulch is probably 8–10 cm thick. There is also a distinct

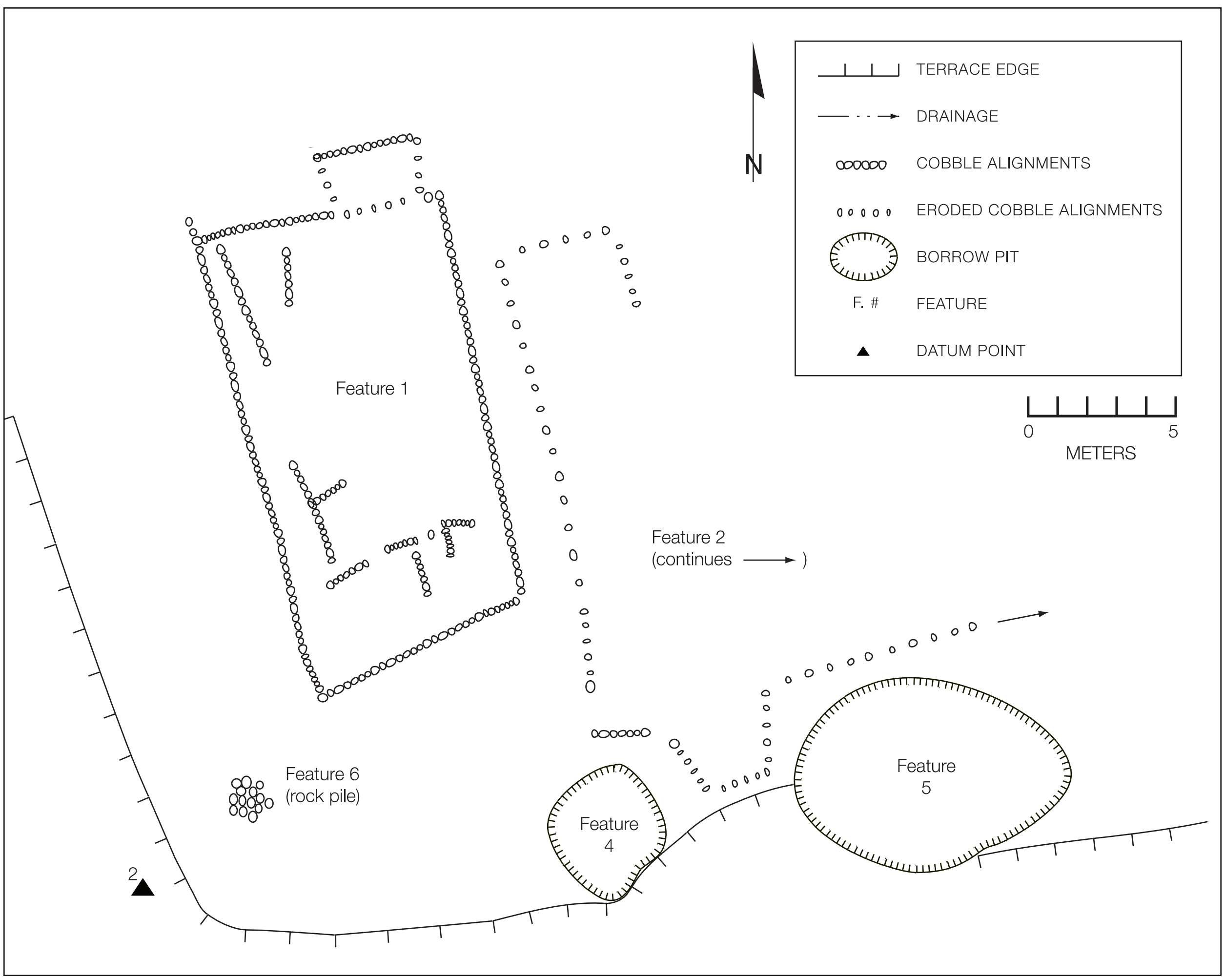


Figure 9.2. Features 1, 2, 4, 5, and 6 at LA 105705.

mounding to Feature 1, particularly on the west side, where it is 5–10 cm higher than the terrace. The mounding is not quite as distinct on the east side, where it is only 2–4 cm high in places. No differences in vegetative density were noted between on- and off-feature areas.

All cultural materials noted on the surface of this feature were inventoried. They totaled 19 chipped stone artifacts and 1 sherd. All chipped stone artifacts were gray rhyolite; they included 13 core flakes, 3 angular debris, and 3 cores. The only cluster of artifacts noted contained 9 pieces of debitage and 2 cores. The remaining chipped stone artifacts were scattered across the feature. The single sherd was a fragment of a Biscuit A bowl.

Feature 2

Feature 2 is a large, irregularly shaped gravel-mulched plot that measures approximately 76 by 36 m and covers roughly 2,700 sq m (Fig. 9.2). Since this field was mostly outside the detailed examination zone, the entire feature was not mapped. Only the west 14 m fell within the mapping zone, so the full extent of the feature was estimated by pacing. The section of feature that was mapped in detail is poorly preserved and has been heavily affected by sedimentation and livestock grazing. Perhaps 50–60 percent of its surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation.

Boundary and interior subdividing alignments are a single element high and wide. They were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 10–25 cm long. The few small boulders noted are 25–35 cm long. Elements in the west half of the feature were predominantly placed side-by-side and on their broadest surfaces, though occasional uprights occur. End-to-end placement predominates in the east half of the feature, though some elements were placed sideways. Again, though most rest on their broadest surfaces, some elements were placed upright.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 8 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Since the alignments are a single element high, the mulch is probably 8–12 cm thick. No mounding was visible in the part of the feature within the detailed examination zone because of sedimentation and livestock-caused damage. A distinct difference was noted in surface gravel densities between on- and off-feature areas. Where not obscured by sediments, gravels cover 70–80 percent of the feature surface. In adjacent off-feature areas, surface gravel densities are only 20–30 percent. No variation in vegetative density was noted between on- and off-feature areas.

All cultural materials noted on the feature were inventoried. Only 21 chipped stone artifacts were recorded, and no clusters of artifacts were defined. Gray rhyolite predominated, including 11 core flakes, 5 angular debris, and 1 core. Other materials were scarcer and included andesite (2 core flakes), Pedernal chert (1 angular debris), and red rhyolite (1 core flake). No temporally diagnostic artifacts were found on this feature.

Feature 3

Feature 3 is a large, irregularly shaped gravel-mulched plot that measures approximately 34 by 26 m and covers roughly 600 sq m (Fig. 9.3). Since this field was partly outside the detailed examination zone, the entire feature was not mapped. Only the west 75 percent fell within the mapping zone, so the full extent of the feature was estimated by pacing. Perhaps 60–70 percent of its surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation.

Boundary and interior subdividing alignments are a single element high and wide. They were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 15–25 cm long. Small boulders are also relatively common, particularly in boundary alignments. They measure 25–45 cm long. Building elements were usually placed side-by-side, though some cobbles were placed end-to-end. While most elements were set on their broadest surfaces, upright cobbles are also common. Indeed, it is possible that the latter predominate, since sediments conceal most internal alignments. Cobbles have been displaced by grazing livestock, particularly in the west part of the south boundary alignment and around Feature 8.

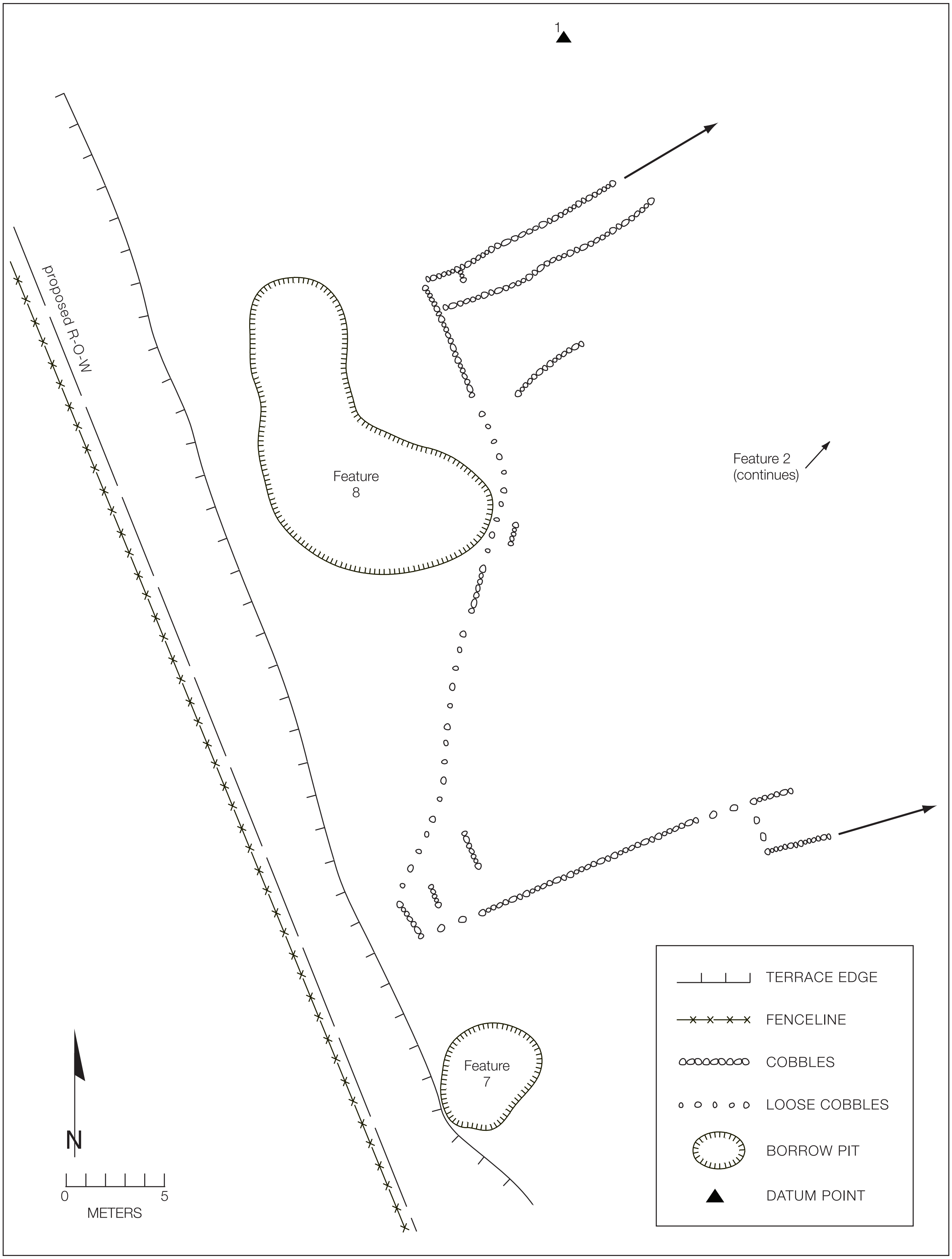


Figure 9.3. Features 3, 7, and 8 at LA 105705.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 10 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Since the alignments are a single element high, the mulch is probably up to 15 cm thick, and the feature is mounded above the terrace to that height along its south, west, and north edges. The east edge of the feature is indistinct because of heavy sedimentation. A difference in surface gravel densities was noted between on- and off-feature areas. Where not obscured by sediments, gravels cover 50–80 percent of the feature surface. In adjacent off-feature areas, surface gravel densities are only 20–30 percent. No variation in vegetational density was noted between on- and off-feature areas.

All cultural materials noted on the surface of the feature were inventoried. Chipped stone artifacts were common, and a total of 107 were recorded. Gray rhyolite dominated this assemblage, comprising 64 core flakes, 20 angular debris, and 4 cores. Other materials were less abundant and included andesite (10 core flakes, 2 angular debris, 1 core), massive quartz (1 core flake, 1 angular debris), and red rhyolite (1 core flake, 1 angular debris, 2 cores). Most chipped stone occurred in clusters of 3–30 artifacts, especially in the southwest corner of the feature. The only temporally diagnostic artifact noted was a Biscuit B sherd from an unidentified vessel.

Feature 4

Feature 4 is a small round terrace-edge borrow pit measuring 10.85 by 9.0 m, with a maximum depth of 1.3 m (Fig. 9.2). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Feature 2 and was probably the source of some of the materials used to build that gravel-mulched field. Some sediments have built up in the south end of the pit, though the terrace slope drops steeply away in that area. No associated cultural materials were noted.

Feature 5

Feature 5 is an oval terrace-edge borrow pit measuring 6.3 by 5.9 m, with a maximum depth of 1.0 m (Fig. 9.2). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Feature 2 and was probably the source of some of the materials used to build that gravel-mulched field. Sediments have not filled the interior of this feature to any appreciable extent, mostly because the terrace slope drops steeply away on its south end. No associated cultural materials were noted.

Feature 6

Feature 6 is a small rock pile near the intersection of the west and south edges of the terrace (Fig. 9.2). Though outside construction limits, it was in the detailed examination zone and was mapped. This feature measures 2.2 by 1.3 m and stands about 0.17 m high. Cobbles were used to construct this feature and average 30 by 20 by 10 cm in size. The rock pile may originally have stood higher, but it has collapsed and spread as elements became dislodged (Fig. 9.4). Three chipped stone artifacts were the only cultural materials noted near this feature.

The function of this feature cannot be defined for certain, though we can hazard a few guesses. If it is indeed associated with other prehistoric features on the site, as seems likely, it may represent a material stockpile or boundary marker. Similar rock piles were observed in adjacent areas outside project limits. However, they do not always occur directly adjacent to fields or borrow pits as would be expected if they served as stockpiles. Indeed, Feature 6 is nearly 10 m away from the nearest borrow pit, so a stockpile function seems unlikely. It could also represent the remains of a shrine, though this function is similarly difficult to verify. However, as discussed in a later chapter, rock piles were (and are) often used as shrines, and we feel that Feature 6 likely served this function.

Feature 7

Feature 7 is a small oval terrace-edge borrow pit measuring 5.1 by 4.2 m, with a maximum depth of 0.63 m (Fig. 9.3). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Feature 3 and was probably the source of some of the materials used to build that gravel-mulched field. Some sediments have built up along the

Figure 9.4. Feature 6, a partly disarticulated rock pile at LA 105705.

southwest rim of the pit, though the terrace slope drops steeply away in that area. No associated cultural materials were noted.

Feature 8

Feature 8 is a medium-sized kidney-shaped terrace-interior borrow pit measuring 17.5 by 11.5 m, with a maximum depth of 0.62 m (Fig. 9.3). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Features 3 and 9, and it was probably the source of some of the materials used to build one or both of those gravel-mulched fields. Sediments have built up to an undetermined thickness in the bottom this pit. Five chipped stone artifacts (four gray rhyolite, one andesite) were noted in association.

Feature 9

Feature 9 is a large irregularly shaped gravel-mulched plot that measures about 40 by 26 m and covers roughly 890 sq m (Fig. 9.5). Since this field was partly outside the detailed examination zone, the entire feature was not mapped. Only the west 75 percent fell within the mapping zone, so the full extent of the feature was estimated by pacing. Perhaps 60–70 percent of its surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation. The east boundary alignment is very indistinct because of this process and colluviation. In addition, the north edge of the feature is covered by part of Feature 11, so that boundary is also uncertain.

Boundary and interior subdividing alignments are a single element high and wide. They were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 12–20 cm long, though some are as long as 25 cm. A few small boulders were also used, and they are 25–35 cm long. Building elements were usually placed side-by-side and upright, though occasional cobbles were placed end-to-end on their broadest surfaces. An intricately subdivided area in the west-central part of the feature especially demonstrates these characteristics. Indeed, it is likely that most, if not all, of the feature was originally subdivided in this way, but most interior alignments are concealed by sediments.

The mulch is mostly composed of unsorted

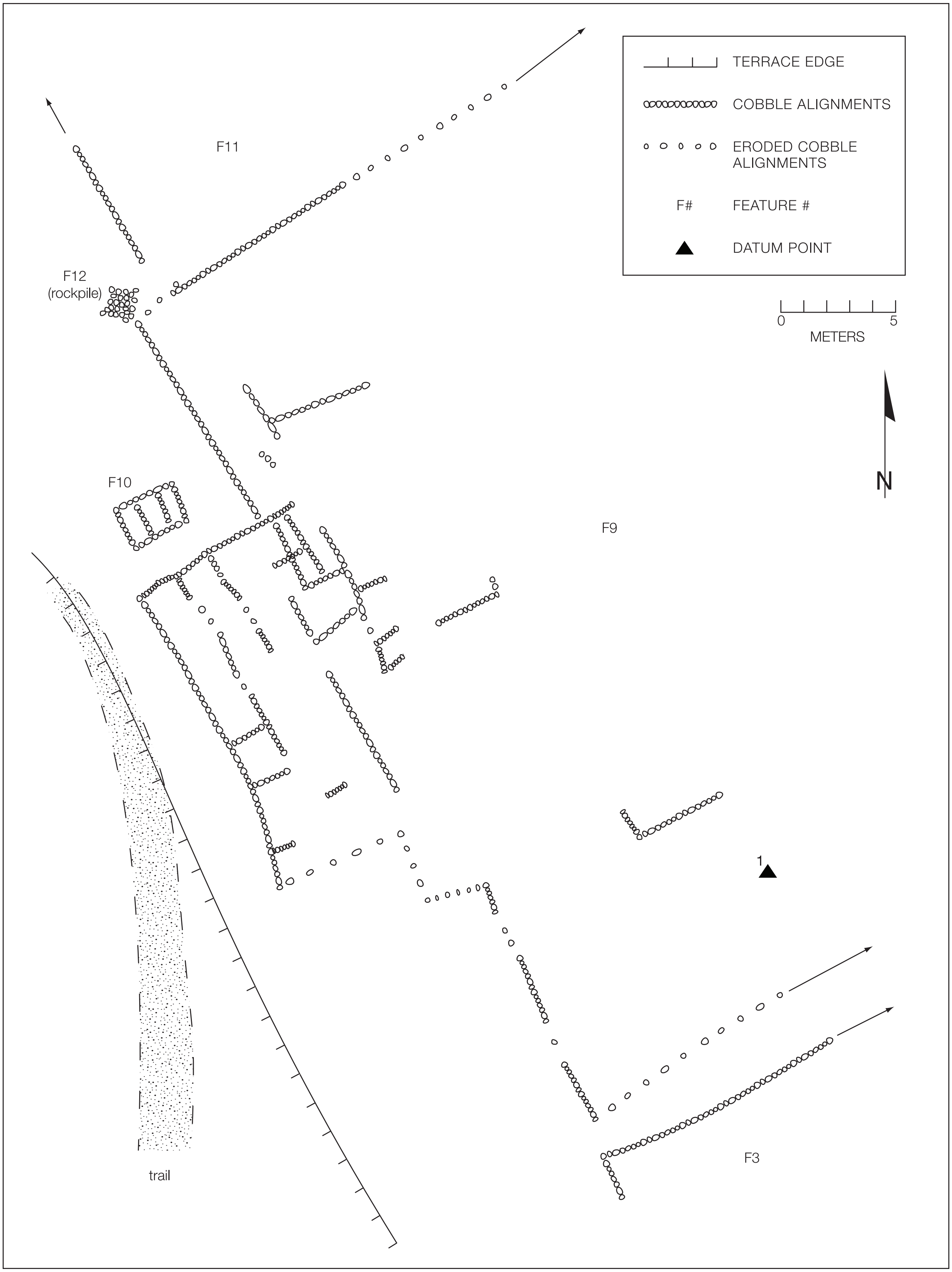


Figure 9.5. Features 9, 10, and 12 at LA 105705.

gravels and pea gravels, though small cobbles up to 10 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Since the alignments are a single element high, the mulch is probably 8–12 cm thick. No mounding above the terrace was seen, but a difference in surface gravel densities was noted between on- and off-feature areas. Where not obscured by sediments, gravels cover 70–80 percent of the feature surface. In adjacent off-feature areas, surface gravel densities are only 10–20 percent. No similar variation in vegetative density was noted between on- and off-feature areas.

All cultural materials noted on the surface of the feature were inventoried. Only 11 pieces of chipped stone were found, dominated by gray rhyolite (seven core flakes, one angular debris, one core), though a few andesite artifacts were also noted (one core flake, one angular debris). No temporally diagnostic materials or clusters of artifacts were found.

Feature 10

Feature 10 is a small rectangular gravel-mulched plot that measures 2.9 by 2.0 m and covers 5.8 sq m (Fig. 9.5). Since this feature was in the detailed examination zone it was completely mapped. About 70 percent of its surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation.

Boundary and interior subdividing alignments are a single element high and wide. They were built with locally obtained cobbles. Most cobbles are 12–20 cm long, but some are as long as 25 cm. About 90 percent of the building elements were placed side-by-side, and the rest were placed end-to-end. Similarly, about 90 percent of elements are upright, but some were occasionally set on their broadest surfaces.

The mulch is mostly composed of unsorted gravels and pea gravels, but some small cobbles up to 8 cm long also occur. Since the alignments are a single element high, the mulch is probably 8–12 cm thick. The feature is mounded 2–5 cm above the terrace, and a difference in surface gravel densities was noted between on- and off-feature areas. Where not obscured by sediments, gravels cover 50–70 percent of the feature surface. In adjacent off-feature areas, surface gravel densities are only 10–20 percent. Vegetation is slightly denser on the feature than in nearby areas.

Four pieces of chipped stone were the only cultural materials noted on the surface of this feature. All were gray rhyolite (three core flakes, one angular debris). No temporally diagnostic artifacts were found.

Feature 11

Feature 11 is a large, irregularly shaped gravel-mulched plot that measures about 95 by 25 m and covers roughly 2,300 sq m (Fig. 9.6). Since this field was partly outside the detailed examination zone, the entire feature was not mapped. The central sector of the feature was badly damaged during construction of a water storage facility, and blading has removed part of the west boundary alignment and adjacent interior subdividing alignments in the south sector. The central sector has been entirely removed by mechanical equipment or is obscured to the point that no alignments are now visible.

Only the west 80 percent of Feature 11 was in the detailed examination zone, so its full extent was estimated by pacing. Perhaps 50–60 percent of the surface in the south sector and 60–70 percent in the north sector is obscured by sediments that have infiltrated the mulch and are anchored by vegetation. The east boundary alignment is very indistinct because of this process and colluviation. The south edge of the feature overlaps the north part of Feature 9 and is mounded 5–8 cm above that feature. This suggests sequential construction in which Feature 11 was built later than Feature 9, perhaps after the earlier feature was no longer productive and was abandoned. Otherwise, it is unlikely that Feature 11 would have partly covered Feature 9. A slight mounding was also visible in the north sector of the feature, where the mulched surface is 3–5 cm higher than the terrace.

Boundary and interior subdividing alignments are a single element high and wide and were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 12–25 cm long. A few small boulders were also used and are 25–35 cm long. Building elements were usually placed side-by-side and on their broadest surfaces in the south

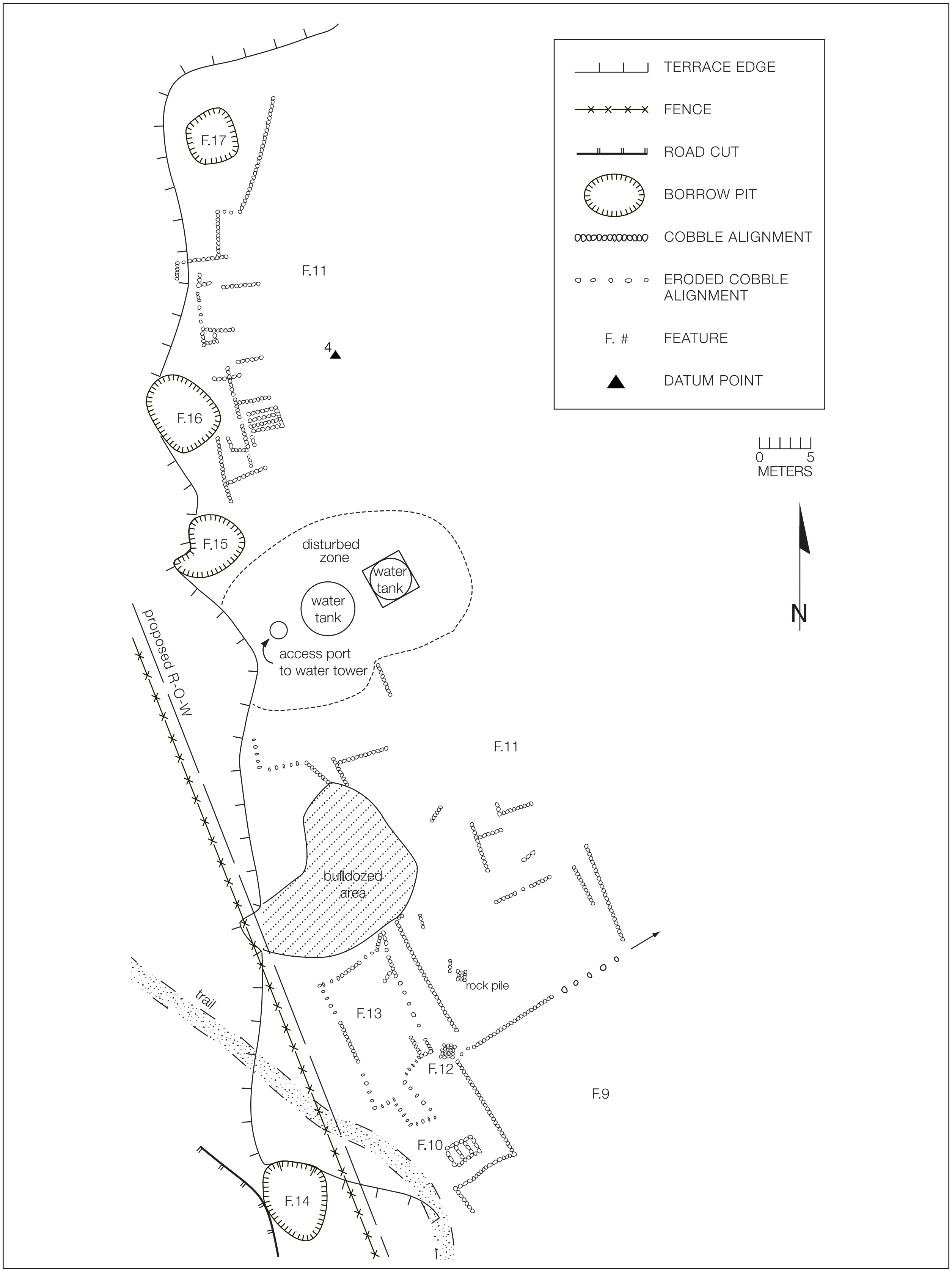


Figure 9.6. Features 11 through 17 at LA 105705.

sector, though some were set end-to-end. In contrast, cobbles were mostly placed end-to-end in the north sector, and upright elements are common and may predominate in that area. However, side-by-side placement also occurs. An intricately subdivided section is built mostly of cobbles set side-by-side and upright. Within the detailed examination zone there are visual differences between the north and south sectors that seem indicative of separate features. However, there is less disturbance outside this zone on the east side of the feature, and in that area there is no evidence of a break that would denote the existence of more than one field.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 8 cm long also occur. Their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Since the alignments are a single element high, the mulch is probably 5–10 cm thick. A difference in surface gravel densities was noted between on- and off-feature areas. Where not obscured by sediments, gravels cover 60–70 percent of the feature surface. In adjacent off-feature areas, surface gravel densities are only 25–30 percent. No variation in vegetative density was noted between on- and off-feature areas.

A small rock pile is near the southwest corner of Feature 11 (Fig. 9.7), but it was difficult to determine what it represents. While it may be a stockpile of construction materials, its presence on the surface of a feature on which construction seems to have been completed is inconsistent with this function. It more likely represents a boundary alignment or the remains of a shrine.

Only cultural materials within the detailed examination zone were inventoried. Artifacts were sparse in this area. They included five gray rhyolite core flakes, two andesite core flakes, and one gray rhyolite core. Only three flakes were in the south sector (two rhyolite, one andesite); the remaining artifacts were in the north sector. Cultural materials were widely scattered, and no temporally diagnostic materials or clusters of artifacts were observed.

Feature 12

Feature 12 is a small rock pile between three gravel-mulched fields (Features 9, 11, and 13). Though this feature was outside construction limits, it was in the detailed examination zone and was mapped (Fig. 9.5). It measures 2.0 by 1.6 m and stands only a single element high. This feature contains 20–30 cobbles which are mostly 15–25 cm long (Fig. 9.8). The rock pile may once have stood higher, but this is unlikely. No associated artifacts were noted.

The function of this feature cannot be defined for certain, but it probably represents a material stockpile, especially since it is next to three gravel-mulched fields. While it is also possible that this feature represents the remains of a shrine or boundary marker, this is less likely, since there is no evidence that it was ever more than a single element high, which might preclude its use for either of those functions. However, since some shrines consist of small cobble pavements, this possibility cannot be ruled out.

Feature 13

Feature 13 is a small irregularly shaped gravel-mulched plot that measures 17.4 by 6.8 m and covers 92.7 sq m (Fig. 9.6). Since this feature was in the detailed examination zone it was completely mapped. This plot is not well preserved, and its north boundary is indistinct because of mechanical disturbance caused by construction of a water storage facility. About 50–60 percent of its surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation. Most boundary alignments and interior subdividing alignments are indistinct because of this process and colluviation.

Boundary alignments and the few visible interior subdividing alignments are a single element high and wide, and were built with locally obtained cobbles and small boulders. Cobbles were used to construct all alignments, and most are 12–20 cm long. Though too few segments are visible to be certain, a side-by-side and upright placement of building elements appears to dominate, though end-to-end placement also occurs, and many elements were placed on their broadest surfaces.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 8 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Since the

Figure 9.7. Small rock pile associated with Feature 11 at LA 105705.

Figure 9.8. A probable materials stockpile, Feature 12, LA 105705.

alignments are a single element high, the mulch is probably 5–10 cm thick. This feature is mounded 3–5 cm above the terrace, and a difference in surface gravel densities was noted between on- and off-feature areas. Where not obscured by sediments, gravels cover 60–75 percent of the feature surface. In adjacent off-feature areas, surface gravel densities are only 20–30 percent. Vegetation on the feature seemed slightly denser than in adjacent off-feature areas.

All cultural materials noted on the surface of the feature were inventoried. They included one gray rhyolite core flake, one andesite core flake, and one gray rhyolite core. No temporally diagnostic materials or clusters of artifacts were found.

Feature 14

Feature 14, an oval terrace-edge borrow pit measuring 10.9 by 9.9 m, has a maximum depth of 0.83 m (Fig. 9.6) and is within construction limits. This borrow pit is near several gravel-mulched fields (Features 9, 10, 11, and 13) and was probably the source of some of the materials used to build one or more of them. It is cut into a fairly steep slope and appears to have been enlarged by erosion. This was the only feature at LA 105705 that extended into the right-of-way. Cultural materials noted on the surface included one piece of chipped stone and three fragments of amethyst glass.

Feature 15

Feature 15 is an irregularly shaped terrace-edge borrow pit measuring 8.2 by 7.1 m, with a maximum depth of 0.63 m (Fig. 9.6). Though Feature 15 was outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Feature 11 and was probably the source of some of the materials used to build that gravel-mulched field. There seemed to be a buildup of sediments in the bottom of this pit, and it was slightly damaged during construction of an adjacent water storage facility. No associated cultural materials were noted.

Feature 16

Feature 16 is an oval terrace-edge borrow pit measuring 9.2 by 6.8 m, with a maximum depth of 0.52 m (Fig. 9.6). Though Feature 15 was outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Feature 11 and was probably the source of some of the materials used to build that gravel-mulched field. Sediments have built up to an undetermined depth in the bottom of this pit. The only associated cultural materials were two pieces of chipped stone.

Feature 17

Feature 17 is a small oval terrace-edge borrow pit measuring 5.5 by 4.6 m, with a maximum depth of 0.22 m (Fig. 9.6). Though Feature 17 is outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Feature 11 and was probably the source of some of the materials used to build that gravel-mulched field. Sediments have built up to an undetermined depth in the bottom of this pit. No associated cultural materials were noted.

Discussion of Surface Information

A few topics remain to be discussed concerning LA 105705, including its basic configuration, the distribution of cultural materials across the site, and the presence of unrecorded features nearby. Although only one terrace-interior borrow pit was mapped, several others occur but were outside the detailed examination zone. All are next to gravel-mulched fields, and it is likely that those features were the last to be constructed. While gravel mulching dominates at this site, the corral (Fig. 9.1) sits upon a feature that may be cobble mulched, or that at least contains a much larger proportion of cobbles than any of the described fields. Interestingly, many gridded plots seem to be separated by "aisles" that are clear of mulch. Only where Feature 11 covers Feature 9 was any overlapping noted. This may indicate that LA 105705 was not used as long or as intensively as many of the other farming sites examined during this study. It may also be important that the trail (LA 118549) ascends to the top of the terrace at LA 105705, providing direct access to those farming features.

Pottery was rare at LA 105705. Only five sherds were observed on the surface, including a Biscuit A bowl sherd from Feature 1 and a Biscuit B sherd from a vessel of indeterminate form from Feature 3. Three additional sherds were noted during the recording of transects across the remainder of the site, including two Biscuit B bowl sherds and an unidentified biscuit ware sherd from an indeterminate vessel type.

Conversely, 160 chipped stone artifacts were recorded outside the detailed examination zone, and 25 were collected within project limits. Gray rhyolite dominated the recorded assemblage and included 78 core flakes, 8 angular debris, and 14 cores. Other materials in the recorded assemblage were red rhyolite (10 core flakes, 1 angular debris, 2 cores), andesite (36 core flakes, 1 angular debris, 2 cores), massive quartz (4 core flakes), obsidian (1 biface), Pedernal chert (1 projectile point), silicified wood (1 core flake), and quartzite (1 core flake). An inventory of the chipped stone artifacts recovered from the surface of LA 105705 is provided in Table 9.1. Rhyolites also dominate this small assemblage, comprising 64 percent. Andesite is second in abundance at 20 percent, followed by quartzite at 16 percent.

Table 9.1. Chipped stone artifacts collected within highway right-of-way at LA 105705 (material type by morphology)

Material Type	Angular Debris	Core Flakes	Cores
Rhyolite	5	8	3
Andesite	-	4	1
Quartzite	1	2	1

While these assemblages are discussed in more detail in a later chapter, a few notes concerning their distribution are in order. The collection zone within the right-of-way was limited to an area at the top of the terrace slope between the existing roadcut and the east edge of the right-of-way. This did not include the trail (LA 118549), which was collected separately. Most of the artifacts recovered from this area were found in the uppermost 5 m wide transect at the edge of the right-of-way. Very few artifacts were found on the slope below this level. Most artifacts recorded during transecting occurred in small clusters near the terrace edge, apparently indicating the locations of individual chipping episodes. In general, the further we were from the terrace edge, the fewer artifacts we noted. An exception was the zone directly northeast of the corral, where an area between the northern intermittent drainage and farming features contained nearly 25 percent of the recorded artifacts, including the only formal tools (a biface fragment and an unidentified projectile point. While no hearths or pottery were noted in that area, it is possible that it represents a small occupational zone associated with the fields. However, this is much less certain than at other sites examined during this study.

In general, then, most chipped stone artifacts on the surface of LA 105705 occurred near the edge of the terrace. While some chipped stone artifacts were noted on individual features in the detailed examination zone, they were not necessarily in direct association. The distribution of these artifacts suggests that, with the exception of the possible occupation area, most are related to a series of chipping episodes, possibly unassociated with farming activities. Thus, it is not certain whether most chipped stone artifacts represent procurement activities conducted by people farming this area or are indicative of a later use.

Finally, during cursory examination of a small, high terrace to the east, we found a probable small garden plot situated in a nearly level portion of the terrace slope, and a field on top. The latter measures about 12–15 m on a side and is gravel mulched. This feature may have been noted during Bugé's (1984) study of the area.

Chapter 10. LA 105706

James L. Moore

LA 105706 is a large farming site on State Trust land administered by the New Mexico State Land Office. It occupies the end of a terrace finger overlooking the Ojo Caliente Valley and is irregularly shaped. The terrace edge comprises the west boundary of the site, while the east perimeter is formed by the edge of the farming features. On both the north and south it is bounded by intermittent drainages; the north drainage forms an arbitrary boundary with LA 105707 (Fig. 10.1). Unrecorded farming features occur on another small terrace finger across the drainage to the south, but they are not contiguous with those at LA 105706 and are outside project limits, so they were not examined. These arbitrary boundaries were used to maintain the original numbering system and restrict LA 105706 to a manageable size. It is unlikely that they replicate the prehistoric land tenure system.

The site measures 295 m north-south by 120 m east-west and covers about 23,120 sq m (2.31 ha). It may once have extended slightly further west, but that area is within the current U.S. 285 right-of-way and has been removed. Only about 0.5 percent of LA 105706 extends into the right-of-way, comprising a narrow sliver along the west edge of the site. In-field pottery analysis indicated that LA 105706 was used during the Classic period.

Vegetation is moderate on the site, and the plant cover is generally similar between on- and off-feature areas. Grasses are the most common plants and include grama and muhly. Other common plants are rabbitbrush, snakeweed, prickly pear, and cholla. Small junipers occur at the terrace edge and in some borrow pits but have not spread to field surfaces. Snakeweed seemed more common in off-feature areas, particularly in small unincised drainages.

Field Procedures

Detailed mapping was restricted to the section of the site that extends into the U.S. 285 right-of-way and an adjacent 25 to 30 m wide zone. This area comprises a sample of about 10 percent of the site, and all cultural features within this zone were mapped and recorded in detail. Two borrow pits (Features 1 and 2) are the only features that extend into project limits. Since excavation of these features would have provided few data that were not available from surface examination, no subsurface studies were conducted, and data recovery focused on the surface description and photographing of features in the mapped area. All cultural materials noted on the surface within the highway right-of-way were collected for analysis. These materials are summarized later in this chapter. Artifacts noted elsewhere on the surface in the detailed mapping zone were inventoried by walking transects across the surface and are summarized later in this chapter.

Features

Four features were at least partly mapped in detail and described (Fig. 10.1). The locations of eight additional terrace-edge borrow pits are shown on the plan, but since they were outside the mapped area, they were not described in detail or assigned feature numbers. Most feature perimeters are fairly well defined, but some field boundaries are partly obscured. A combination of colluvial and eolian processes have caused soil to build up against alignments that face the interior of the terrace, obscuring those boundaries in many places. Eolian deposits also cover much of the surface of the fields, especially where they are anchored by vegetation. This made it difficult to discern many alignments and to define the full extent of others. Livestock grazing has likewise caused damage, displacing elements in cobble alignments and blurring feature edges. Along the terrace edge this seems to have exacerbated damage caused by erosion. Other surface disturbances include a trail (LA 118549) that runs along the west edge of the site next to the U.S. 285 road-cut.

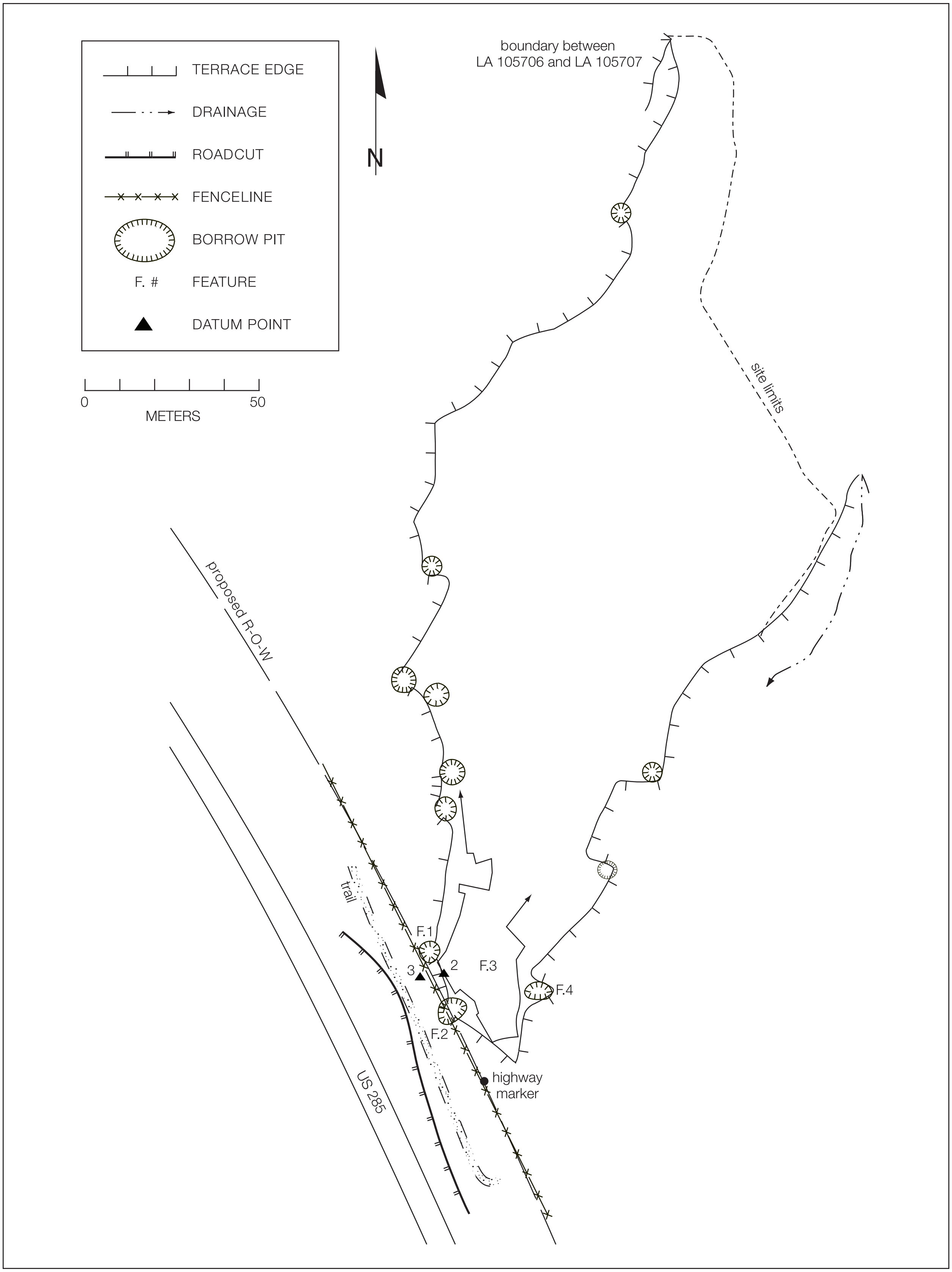


Figure 10.1. Plan of LA 105706.

Feature 1

Feature 1 is an oval terrace-edge borrow pit measuring 7.5 by 5.6 m, with a maximum depth of 1.2 m (Fig. 10.2). Less than 5 percent of Feature 1 was within project boundaries, and it was completely mapped. This borrow pit is next to Feature 3 and was probably the source of some of the materials used to build that gravel-mulched field. Sediments have built up in the bottom of the pit to an undetermined depth. No associated cultural materials were noted.

Feature 2

Feature 2 is an oval terrace-edge borrow pit measuring 10.2 by 8.0 m, with a maximum depth of 1.8 m (Fig. 10.2). About half of Feature 2 was within project boundaries, and it was completely mapped. This borrow pit is next to Feature 3 and was probably the source of some of the materials used to build that gravel-mulched field. This pit is somewhat eroded, and there did not appear to be much buildup of sediments in the bottom of the feature. No associated cultural materials were noted.

Feature 3

Feature 3 is a large gravel-mulched plot that measures about 65 by 24 m and covers a minimum of 1,860 sq m. (Fig. 10.2). Since this field was partly outside the detailed examination zone, the entire feature was not mapped. The full extent of the feature was estimated by pacing, and only the west 48 percent fell within the mapping zone. About 50–60 percent of the surface of Feature 3 is obscured by sediments that have infiltrated the mulch and are anchored by vegetation.

Boundary and interior subdividing alignments are a single element high and wide. They were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 10–25 cm long. Small boulders, 25–50 cm long, are also rather common. Though most elements in boundary and interior subdividing alignments were placed end-to-end, some were set sideways. Most elements were also placed on their broadest surfaces, though occasional uprights were noted. Surface indications suggest that the interior of the feature was highly subdivided, though only a few alignments were clearly visible. Large cobbles and small boulders were evenly spaced across much of the feature but do not occur as continuous alignments. They resemble the pattern of noncontiguous, evenly spaced large elements seen in parts of Feature 18 at LA 105703 and probably functioned similarly.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 10 cm long also occur. Their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Since the alignments are a single element high, the mulch is probably 10–15 cm thick. The feature is slightly mounded above the terrace, but in most places this is no more than 2–5 cm. No differences in vegetative density were noted between on- and off-feature areas. Cultural materials associated with this feature were not inventoried separately.

Feature 4

Feature 4 is an oval terrace-edge borrow pit measuring 9.1 by 4.3 m, with a maximum depth of 1.7 m (Fig. 10.2). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Feature 3 and was probably the source of some of the materials used to build that gravel-mulched field. This pit is somewhat eroded, and there did not appear to be much buildup of sediments in its bottom. No associated cultural materials were noted.

Surface Information

The farming features at this site cover the end of a narrow terrace finger and form part of a string of farming features extending from at least LA 105707 on the north to beyond LA 105708 on the south, broken only by deeply incised drainages tributary to the Rio Ojo Caliente. A brief reconnaissance on top of a higher terrace to the east showed that it was also used for farming and that similar features are common there. Those features may have been noted during Bugé's (1984) study of the area.

Only terrace-edge borrow pits were observed

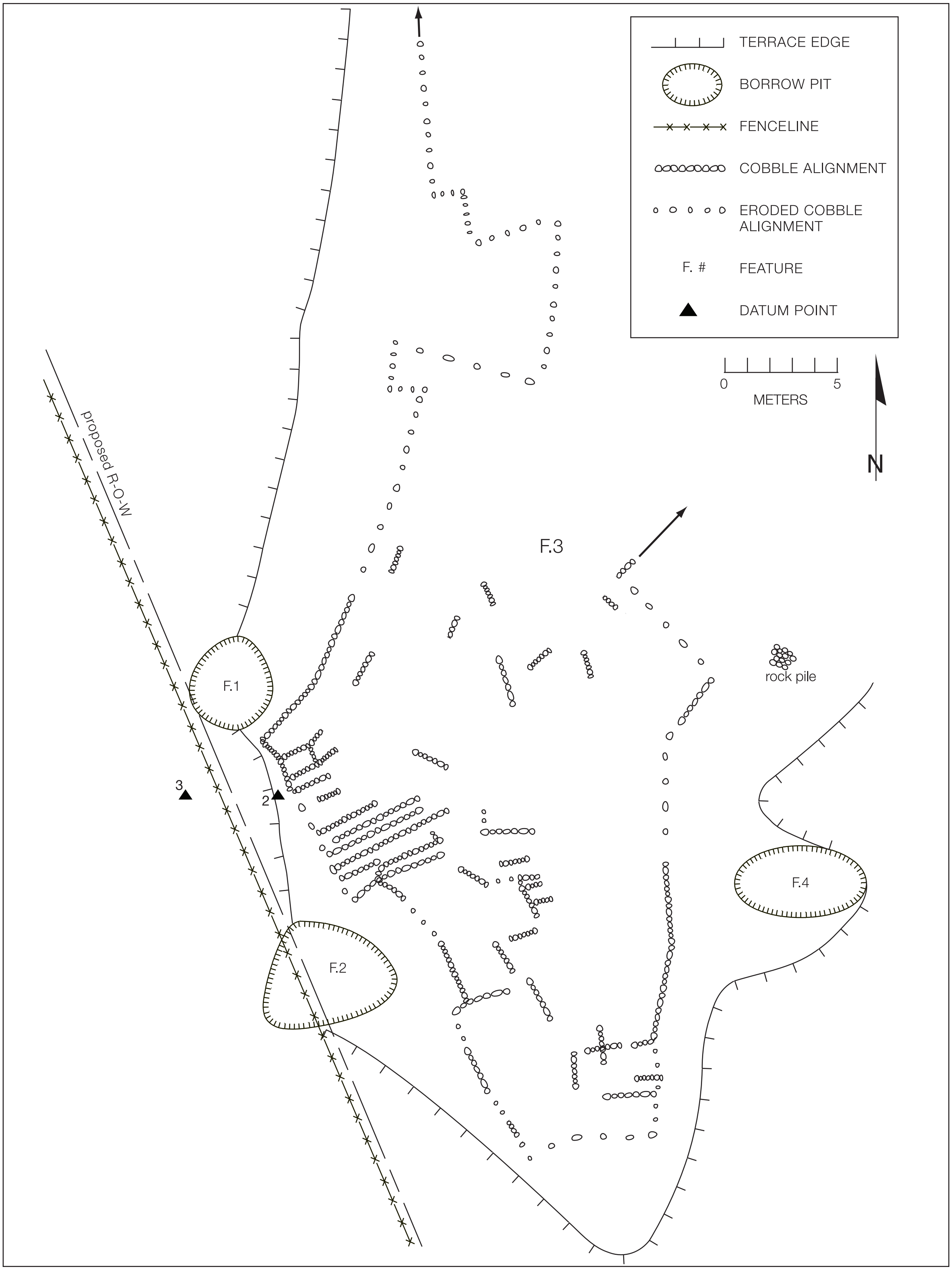


Figure 10.2. Features 1 through 4, LA 105706.

at LA 105706, and there was no evidence of a superimposition of fields, as is common elsewhere in the project area. This could indicate that the site saw a more limited duration of use. Of course, it must be remembered that the definition of these features as a single coherent entity is entirely arbitrary. Thus, we cannot be certain whether they represent an isolated landholding or were associated with other features in a more complex land tenure system. It should also be noted that the trail (LA 118549) does not ascend to the top of the terrace in this area.

A 1.4 by 1.2 m rock pile just outside the east boundary of Feature 3 and north of Feature 4 may represent an associated stockpile of building materials (Fig. 10.3). Conversely, it could also be the remains of a collapsed rock-pile shrine. The location and configuration of the rock pile provide no clue as to which possibility (if either) may be correct, so no conclusion concerning its actual function can be ventured.

Pottery was rare at LA 105706. Only six pieces were observed on the surface. Most were fragments of bowls and included 3 Biscuit A sherds and 1 Biscuit B sherd. A single fragment of a Biscuit B jar was also noted, as was a piece of an indeterminate Biscuit B vessel. Conversely, 65 chipped stone artifacts were recorded while walking transects across the site. Gray rhyolite dominated this assemblage and included 43 core flakes, 2 angular debris, and 6 cores. Other materials observed were red rhyolite (4 core flakes, 1 core), andesite (3 core flakes), Pedernal chert (1 angular debris), quartzite (1 core flake, 1 angular debris, 1 core), and massive quartz (2 core flakes). Most chipped stone artifacts occurred near the terrace edge, which borders the farming features on three sides. In addition, 7 chipped stone artifacts were collected within project limits (Table 10.1); rhyolite comprises a slight majority of these artifacts, followed closely by massive quartz. The collection zone within the right-of-way was limited to an area at the top of the terrace slope between the existing roadcut and the east edge of the right-of-way. This did not include the trail (LA 118549), which was collected separately. Most artifacts recovered from this area were found in the highest 5 m wide transect, at the edge of the right-of-way; few were found on the slope below this level. Many chipped stone artifacts occurred in small clusters near the terrace edge. The distribution of these artifacts suggests that most are related to a series of chipping episodes, possibly unassociated with farming activities. Thus, it is not certain whether most chipped stone artifacts represent procurement activities conducted by people farming this area or are indicative of a later use.

Figure 10.3. Rock pile between Features 3 and 4, LA 105706.

Table 10.1. Chipped stone artifacts collected within the highway right-of-way at LA 105706 (material type by morphology)

Material Type	Angular Debris	Core Flakes	Cores
Rhyolite	-	3	1
Massive quartz	1	1	1

Chapter 11. LA 105707

James L. Moore

LA 105707 is a large farming site on State Trust land administered by the New Mexico State Land Office. It occupies a roughly C-shaped area bounded by the main terrace edge overlooking the Ojo Caliente Valley on the west and arroyos formed by intermittent tributary drainages on the north and south (Fig. 11.1). The east boundary of the site is formed by the edge of the farming features, and an intermittent drainage separates it from LA 105706 to the south. Though the terrace north of LA 105707 is outside project limits, reconnaissance in that area indicated that farming features also occur there and are separated from LA 105707 by a drainage. These arbitrary boundaries were used to maintain the original numbering system and restrict LA 105707 to a manageable size. It is unlikely that they replicate the prehistoric land tenure system.

The main section of LA 105707 is roughly rectangular, with a long narrow finger extending north. It measures 458 m north-south by 160 m east-west and covers about 38,740 sq m (3.87 ha). The site may once have extended slightly further west, but that area is within the current U.S. 285 right-of-way and has been removed. Only about 1.1 percent of this site extends into the right-of-way, comprising a narrow sliver along its west edge. In-field pottery analysis indicated that LA 105707 was used during the Classic period.

Vegetation is moderate on the site, and plant cover is generally similar between on- and off-feature areas. However, distinct differences were noted in a few places and are discussed in feature descriptions. Grasses are the most common plants and include grama and muhly. Other common plants include rabbitbrush, snakeweed, sage, prickly pear, and cholla. Small junipers and piñons occur mostly at the terrace edge, though a few junipers have established themselves on field surfaces and within borrow pits. Free-growing lichens are common on the surfaces of several fields.

Field Procedures

This was the first extensive farming site to be examined during this project, and the original data recovery plan called for each site to be completely mapped in detail (Wiseman and Ware 1996). However, as work proceeded it became obvious that to do so would consume far more time than was available for the project as a whole. Thus, the data recovery plan was altered, and detailed mapping was limited to parts of sites within the right-of-way and an adjacent zone extending about 25 m beyond the right-of-way edge. Because data recovery at LA 105707 was already in progress at the time of this decision, a more extensive zone was examined in detail, comprising an area within the right-of-way and an adjacent 160 m wide zone. This provided a sample of about 69 percent of the site. Two borrow pits (Features 2 and 14) are the only features that extend into project limits. Since excavation of these features would have provided few data that were not available from surface examination, no subsurface studies were completed, and data recovery focused on the surface description and photographing of features in the mapped area. All cultural materials noted on the surface within the highway right-of-way were collected for analysis. These materials are summarized later in this chapter. Artifacts noted elsewhere on the surface in the detailed mapping zone were inventoried by feature and are summarized in those discussions.

Features

Twenty-four features were mapped in detail and described (Fig. 11.1). Parts of the site outside the mapped area contain gravel-mulched fields and terrace-edge borrow pits. Feature limits are fairly well defined, but some field boundaries are partly obscured. A combination of colluvial and eolian processes have caused soil to build up against alignments that face the interior of the

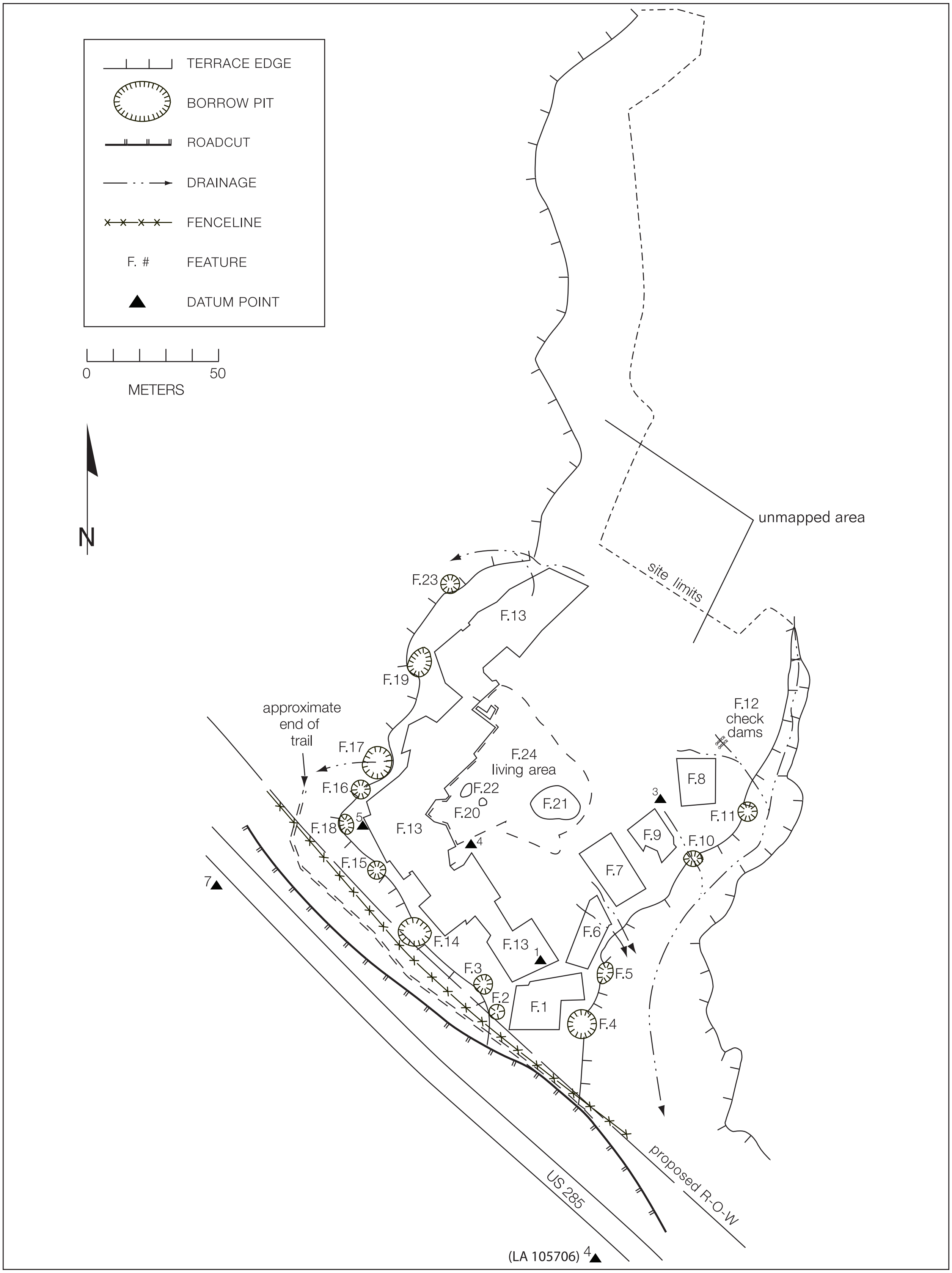


Figure 11.1. Plan of LA 105707.

terrace, obscuring those boundaries in many places. Eolian deposits cover much of the surface of the fields, especially where they are anchored by vegetation. This made it difficult to discern many alignments and to define the full extent of others. Livestock grazing has also caused damage, displacing elements in cobble alignments and blurring feature edges. Along the terrace edge this seems to have exacerbated damage caused by erosion. Other surface disturbances include a trail (LA 118549) that runs along the west edge of the site next to the U.S. 285 roadcut.

Feature 1

Feature 1 is an L-shaped gravel-mulched plot that measures 30.2 by 22.2 m and covers 533.8 sq m (Fig. 11.2). Since this field was in the detailed examination zone, it was completely mapped. Much of its surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation.

Boundary and interior subdividing alignments are a single element high and wide, and were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 10–25 cm long; the few small boulders noted were 25–40 cm long. Elements in alignments were placed side-by-side or end-to-end, and both techniques were sometimes used in the same alignment. Most elements were set on their broadest surfaces. Surface indications suggest that the interior of the feature was highly subdivided, though only a few internal alignments were clearly visible.

The mulch is mostly composed of unsorted

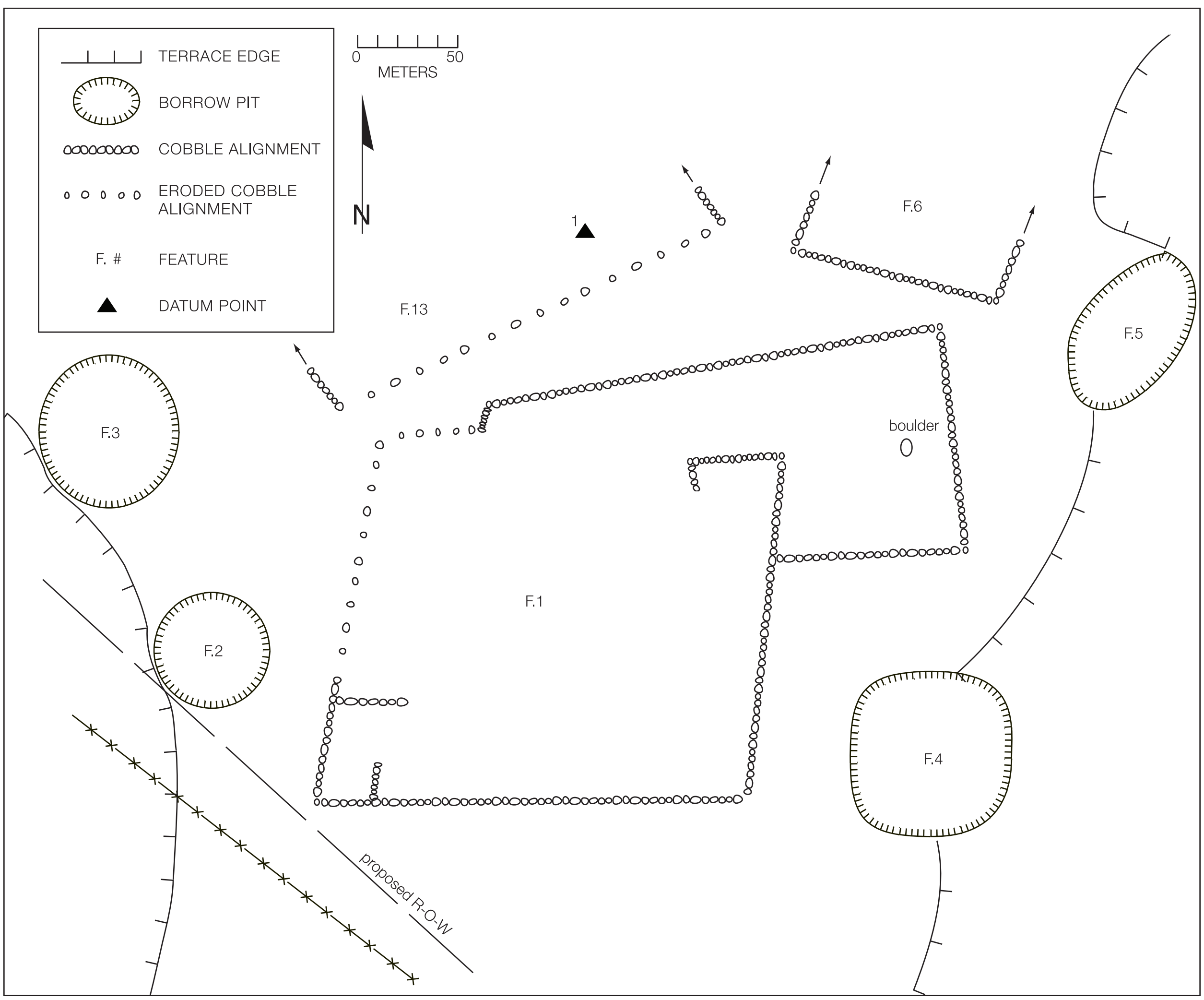


Figure 11.2. Features 1 through 5, LA 105707.

gravels and pea gravels, though small cobbles up to 8 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Since the alignments are a single element high, the mulch is probably up to 10 cm thick. There is also a distinct mounding to this feature, and its surface is 5–10 cm higher than the adjacent terrace. No differences in gravel or vegetative density were noted between on- and off-feature areas.

All cultural materials noted on the surface of this feature were inventoried. They included four core flakes (two gray rhyolite, one andesite, one Pedernal chert) and a two-holed shell button. The latter was of historic derivation and thus of much later date than the feature. No other temporally diagnostic artifacts were found on the surface of this feature.

Feature 2

Feature 2 is a round terrace-edge borrow pit measuring 9.1 m in diameter, with a maximum depth of 0.3 m (Fig. 11.2). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Feature 1 and was probably the source of some of the materials used to build that gravel-mulched field. Sediments have built up in the bottom of the pit to an undetermined depth. Two pieces of chipped stone were noted in the feature, but no temporally diagnostic artifacts are present.

Feature 3

Feature 3 is an oval terrace-edge borrow pit measuring 8.9 by 7.2 m, with a maximum depth of 0.4 m (Fig. 11.2). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Feature 1 and was probably the source of some of the materials used to build that gravel-mulched field. Sediments have built up in the bottom of the pit to an undetermined depth. Four pieces of chipped stone were noted in the feature, but no temporally diagnostic artifacts are present.

Feature 4

Feature 4 is an oval terrace-edge borrow pit measuring 12.5 by 10.0 m, with a maximum depth of 1.0 m (Fig. 11.2). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Feature 1 and was probably the source of some of the materials used to build that gravel-mulched field. Sediments have built up in the bottom of the pit to an undetermined depth. Two pieces of chipped stone were noted in the feature, but no temporally diagnostic artifacts are present.

Feature 5

Feature 5 is an oval terrace-edge borrow pit measuring 10.1 by 6.7 m, with a maximum depth of 0.4 m (Fig. 11.2). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Feature 1 and was probably the source of some of the materials used to build that gravel-mulched field. Sediments have built up in the bottom of the pit to an undetermined depth. Two pieces of chipped stone were noted in the feature, but no temporally diagnostic artifacts are present.

Feature 6

Feature 6 is a rectangular gravel-mulched plot with a possible extension to the north that is separated from the main feature by a gully and is of undetermined shape. The main part of the feature measures 25.3 by 14.6 m and covers 369.4 sq m (Fig. 11.3). If the eroded section to the north is indeed part of this feature, its total measurements are 40.6 by 14.6 m, and it covers 596.2 sq m. Since this field was in the detailed examination zone, it was completely mapped. Much of its surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation.

Boundary and interior subdividing alignments are a single element high and wide. They were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments and are 10–25 cm long; the few small boulders noted are 35–40 cm long. Elements in alignments were placed side-by-side or end-to-end, and both techniques were used in the same alignment in some cases. Most elements were also set on their broadest surfaces. Surface indications suggest that the interior of the feature was subdi-

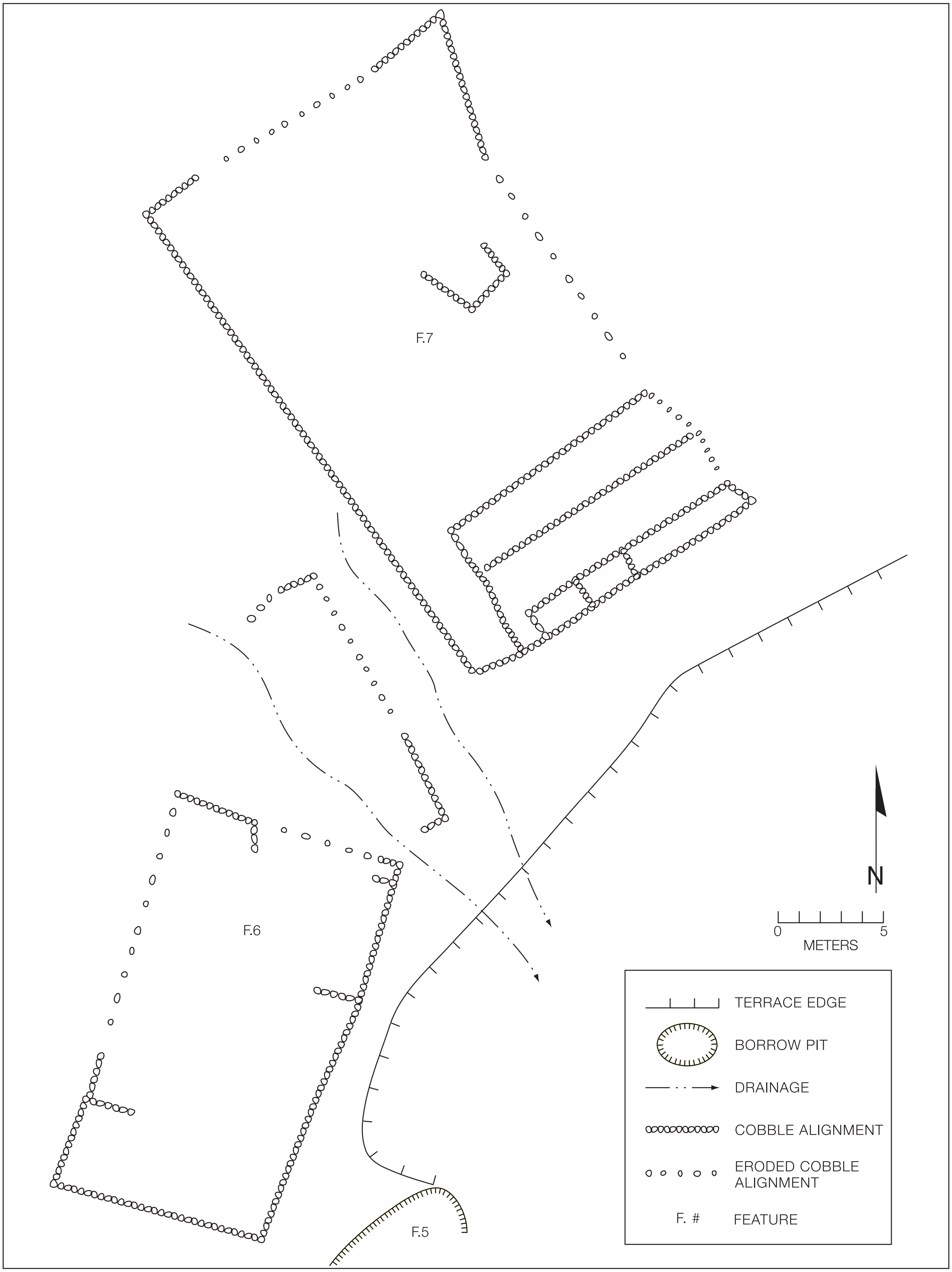


Figure 11.3. Features 6 and 7, LA 105707.

vided, though only a few internal segments were clearly visible.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 8 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Where the mulch is not concealed by sediments, gravels cover 50–80 percent of the surface. This feature is distinctly mounded, particularly along the east edge, where it is 10–15 cm higher than the terrace, and the gravel-mulch layer is probably of an equivalent depth. The vegetative cover is slightly denser on the feature than it is in nearby off-feature areas.

All cultural materials noted on the surface of this feature were inventoried. They included six gray rhyolite core flakes, one gray rhyolite core, and two andesite core flakes. Ceramic artifacts included a Biscuit B sherd and a small fragment of a Glaze Red rim, both from unidentifiable types of vessels.

Feature 7

Feature 7 is a rectangular gravel-mulched plot that measures 35.0 by 21.6 m and covers 721.0 sq m (Fig. 11.3). Since this field was in the detailed examination zone it was completely mapped. About 50–60 percent of its surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation.

Boundary and interior subdividing alignments are a single element high and wide, and were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 15–25 cm long; the few small boulders noted were 25–35 cm long. Elements were predominantly placed end-to-end, though in some areas side-by-side placement was mixed in. Most elements were also set on their broadest surfaces. Surface indications suggest that the feature interior is heavily subdivided, though internal alignments were clearer in some areas than in others.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 8 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Since all observed alignments are a single element high, the layer of mulch is probably 8–12 cm thick. Gravels cover 60–90 percent of the feature surface where not obscured by sediments. In adjacent off-feature areas, surface gravel densities are only 10–40 percent. The vegetative cover is also somewhat denser on the feature than it is in nearby off-feature areas.

All cultural materials noted on the surface of this feature were inventoried. Chipped stone artifacts were relatively common, but no temporally diagnostic materials were found. Gray rhyolite dominated the assemblage and included 35 core flakes, 8 angular debris, and 1 core. The only other material recorded was andesite, which was represented by 2 core flakes.

Feature 8

Feature 8 is a nearly square gravel-mulched plot that measures 19.4 by 17.2 m and covers 333.7 sq m (Fig. 11.4). Since this field was in the detailed examination zone, it was completely mapped. Except for the southeast third of the feature, the surface is almost completely obscured by eolian and colluvial sediments that are anchored by vegetation. In addition, most of the east boundary alignment and adjacent interior subdividing alignments are almost completely covered by colluvial deposits.

Boundary and interior subdividing alignments are a single element high and wide and were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 15–25 cm long. Few small boulders were noted. Elements were predominantly placed end-to-end, though in some areas side-by-side placement was mixed in. Most elements were also set on their broadest surfaces. Surface indications suggest that the feature interior may be heavily subdivided, though subdividing alignments are most obvious along the east edge.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 10 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Even though no mounding was noted, since all observed alignments are a single element high, the layer of mulch is probably 8–12 cm thick. Where not obscured by sediments, gravels cover

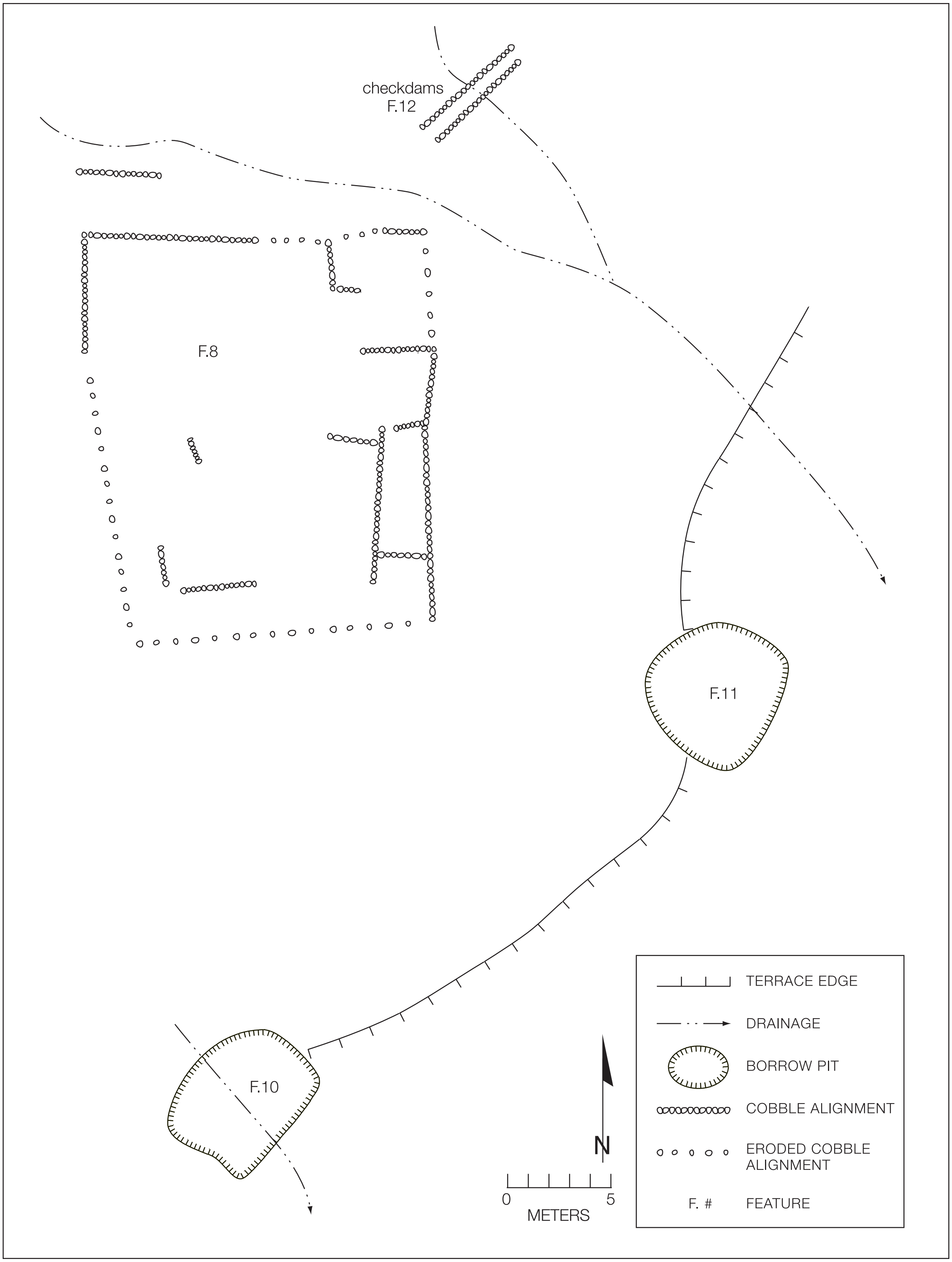


Figure 11.4. Features 8, 10, 11, and 12, LA 105707.

50–90 percent of the feature surface. The vegetative cover is somewhat different on the feature than it is in nearby off-feature areas, which contain a heavier growth of snakeweed and less grass.

All cultural materials noted on the surface of this feature were inventoried. Chipped stone artifacts were not particularly common, consisting of seven gray rhyolite core flakes. Eight sherds were also noted, including seven fragments of the same Biscuit A bowl and one sherd from an unidentified biscuit ware vessel.

Feature 9

Feature 9 is an irregularly shaped gravel-mulched plot that measures 19.0 by 15.0 m and covers at least 213 sq m (Fig. 11.5). Since this field was in the detailed examination zone, it was completely mapped. Though some boundaries are indistinct, this is one of the best preserved and most intact features at the site. About 40–60 percent of its surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation.

Boundary and interior subdividing alignments are a single element high and wide and were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 15–25 cm long; the few small boulders noted were 30–40 cm long. Elements were mostly placed end-to-end, though side-by-side placement was also common. Most elements were set on their broadest surfaces. Surface indications suggest that the feature interior is heavily subdivided. Many elements in boundary alignments are visibly displaced by erosion, giving those edges a choppy appearance.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 10 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. The feature surface is mounded 10–15 cm higher than the adjacent terrace, so the layer of mulch is at least that thick. Where not obscured by sediments, gravels cover 60–90 percent of the field surface. This is a much denser gravel cover than on the adjacent terrace, where gravels cover only 10–15 percent of the surface (Fig. 11.6). Vegetation is also visibly denser on the field.

All cultural materials noted on the surface of this feature were inventoried. Chipped stone artifacts were not common; materials included gray rhyolite (three core flakes, one angular debris), andesite (one core, one core flake), and red rhyolite (one core flake). No sherds or other temporally diagnostic materials were noted.

Feature 10

Feature 10 is an oval terrace-edge borrow pit measuring 7.8 by 6.4 m, with a maximum depth of 0.7 m (Figs. 11.4 and 11.5). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Feature 9 and was probably the source of some of the materials used to build that gravel-mulched field. Sediments have built up in the bottom of the pit to an undetermined depth. One piece of chipped stone was noted in the feature, but no temporally diagnostic artifacts are present.

Feature 11

Feature 11 is a round terrace-edge borrow pit measuring 7.5 by 7.4 m, with a maximum depth of 0.6 m (Fig. 11.4). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Feature 8 and was probably the source of some of the materials used to build that field. Sediments have built up in the bottom of the pit to an undetermined depth. Three pieces of chipped stone were noted in the feature, but no temporally diagnostic artifacts are present.

Feature 12

Feature 12 consists of at least two possible alignments spanning a minor drainage north of Feature 8 that appear to represent the remains of a series of checkdams (Fig. 11.4). The possible dams have been breached, and many elements are scattered by erosion or covered by colluvium and do not form coherent alignments. Elements used to build the feature consist of large cobbles and small boulders 20–60 cm long. The best-preserved alignments are 5.4 and 6.2 m long, and extend for 2–3 m along the gully. No associated artifacts were noted. Though the lack of tempo-

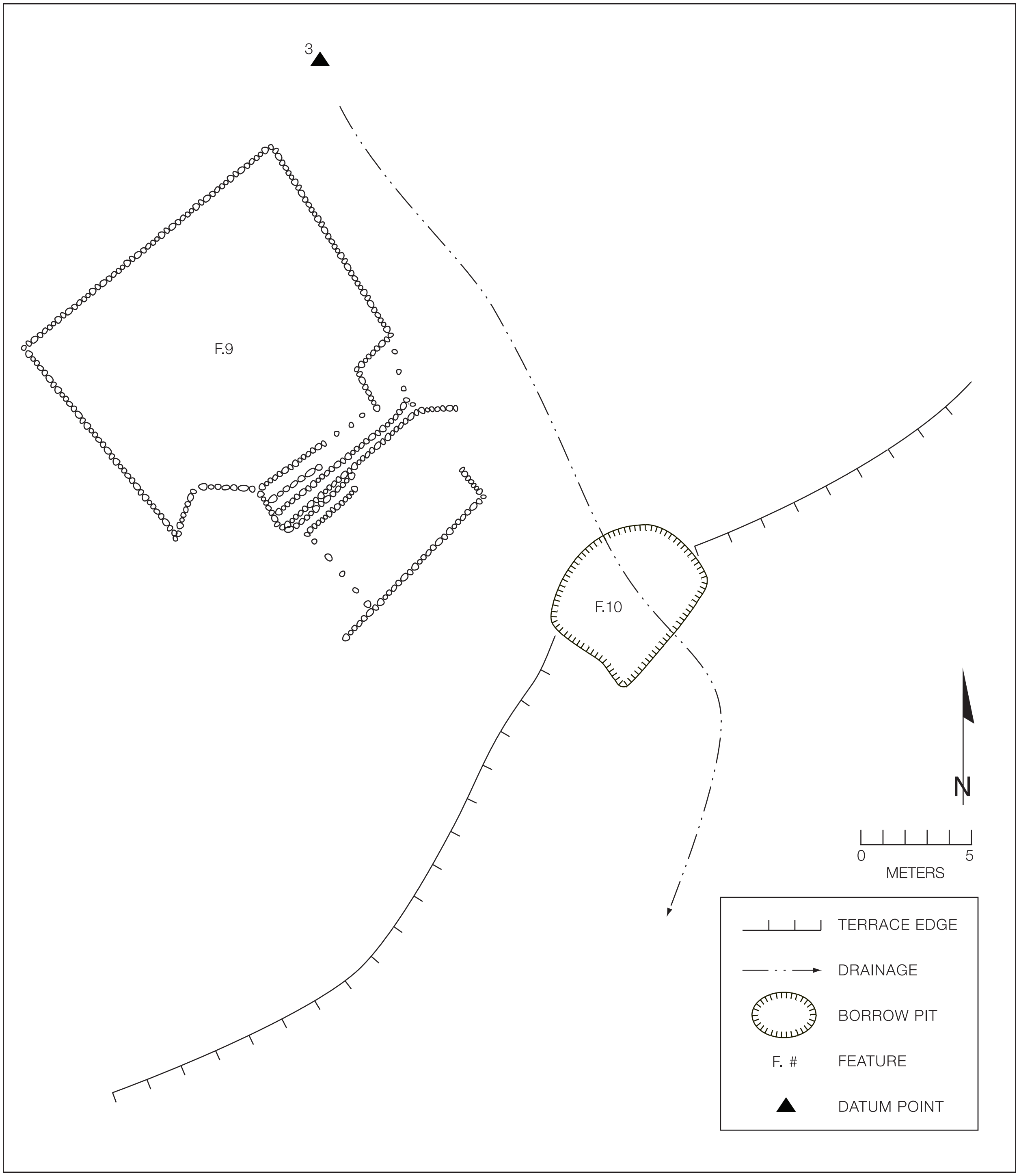


Figure 11.5. Features 9 and 10, LA 105707.

Figure 11.6. Feature 9, LA 105707, showing contrast between densities of gravel and vegetation on the field and the adjacent terrace surface.

rally diagnostic materials precludes assigning a date to this feature, it is probably associated with other farming features at the site and thus of Classic period affinity.

Feature 13

Feature 13 is an irregularly shaped gravel-mulched field that measures 150 by 132 m and covers 5,066.5 sq m (Fig. 11.7). Since this field was in the detailed examination zone, it was completely mapped. Feature 13 is very large and complex, and preservation varies from excellent to poor. Several individual plots are probably represented, which grew together by accretion or were so closely placed that erosion has blurred their boundaries and erased distinctions between them. About 50–60 percent of the field surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation.

Boundary and interior subdividing alignments are a single element high and wide and were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 15–25 cm long. Small boulders are also common, and most are 30–40 cm long, though some larger boulders also occur. Most elements were placed end-to-end, though side-by-side placement was common. Most elements were set on their broadest surfaces, but uprights also occur. Surface indications suggest that the feature interior is heavily subdivided. The outer perimeter of this field follows the terrace edge rather closely, usually 4–6 m away. Vegetation is visibly denser on the field surface and is dominated by grasses. While grasses also dominate on the terrace, snakeweed is much more common there than on the field.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 10 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. The feature surface is mounded 8–12 cm higher than the terrace in places, indicating that the layer of mulch is at least that thick. Where not obscured by sediments, gravels cover 60–90 percent of the field surface, but density varies across the feature and is heavier in areas next to the terrace edge. Colluvium has built up behind alignments adja-

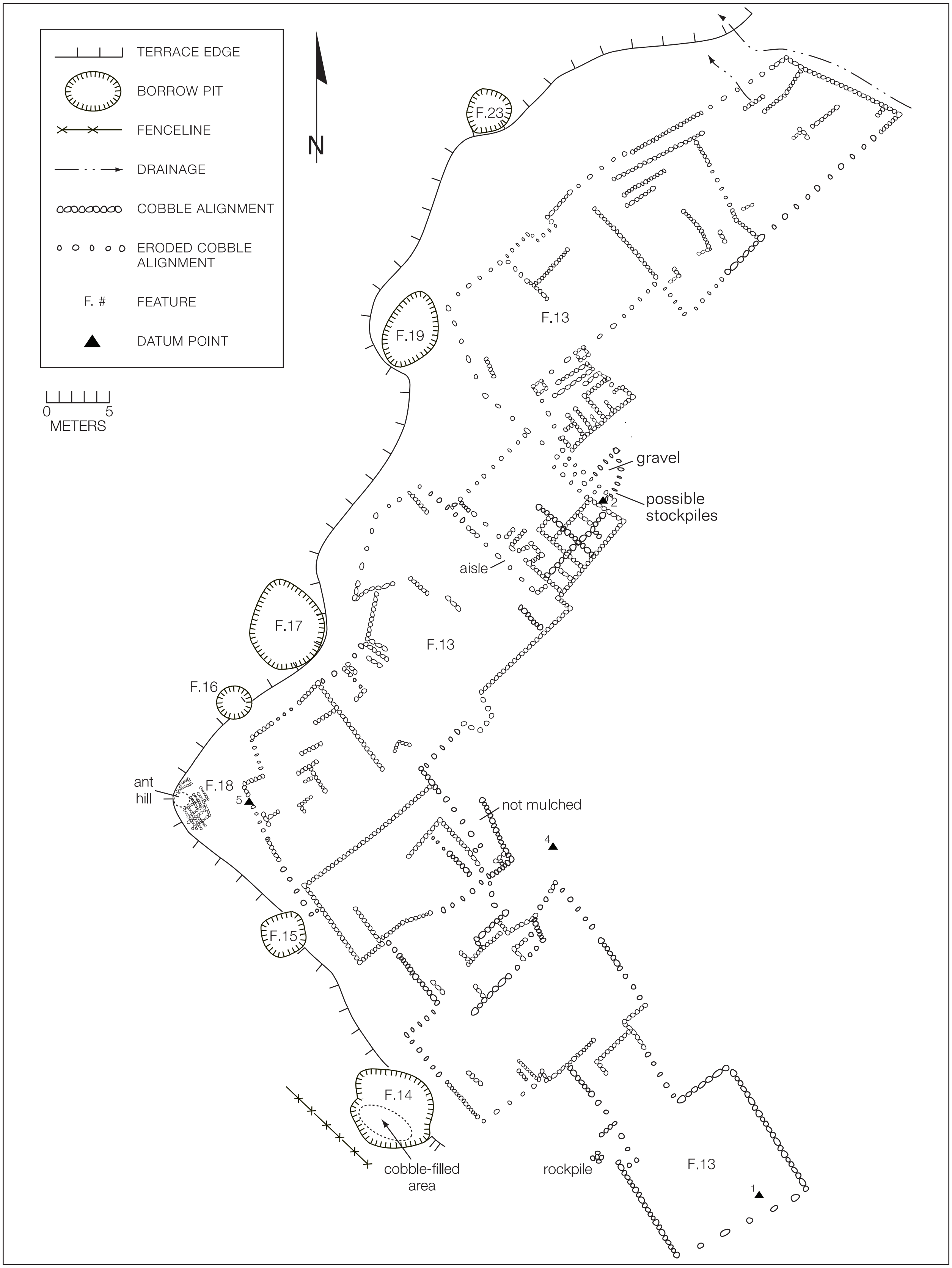


Figure 11.7. Features 13 through 19 and 23, LA 105707.

cent to the terrace interior, partly obscuring them, and in many cases it spills over onto the field. This is a much denser gravel cover than is visible in the zone between terrace and feature edges. It is possible that this discrepancy was caused by raking the area outside the field to obtain gravels for mulching, but it is more likely that it simply represents the original density of gravels on the terrace. Indeed, in areas away from fields there is little surface gravel to be seen. In addition, evidence of both eolian and colluvial deposition was noted on and around the fields. Thus, even if the terrace were raked to obtain gravels for mulching, this probably could not be distinguished from surface indications alone.

Because of the size of this feature, several observations were made that were not possible at other plots. An unmulched area in the south leg of the feature (Figs. 11.7 and 11.8) may represent a planned extension of the field that was never completed. A narrow "aisle" in the northeast-southwest leg may represent a break in the feature. However, two adjacent gravel-mulched plots meet at the south end of the aisle, so the feature was considered continuous. Still, it is possible that the aisle represents a boundary between plots. An area east of the aisle but not directly adjacent to it seems to contain stockpiles of materials consisting of separate concentrations of cobbles and gravels (Fig. 11.9). This may be another planned extension that was never completed. Directly north of the stockpiles is a well-preserved area that seems to represent a later addition to the field. It partly overlays another plot, and its surface is mounded 5–10 cm higher than that of the earlier plot. This is the only area at LA 105707 where evidence of sequenced field construction is obvious. The juxtaposition of the later plot and stockpiles is probably significant, though it is impossible to determine any direct connection at this level of examination.

All cultural materials noted on the surface of this feature were inventoried. The chipped stone assemblage, dominated by gray rhyolite, included 70 core flakes, 16 angular debris, and 10 cores. Other materials included red rhyolite (4 core flakes, 3 angular debris), andesite (12 core flakes, 1 core), and Pedernal chert (2 core flakes, 1 angular debris). Sherds were not as common as chipped stone and included 6 Biscuit A bowl sherds, 4 Biscuit B bowl sherds, and 2 sherds from unidentified biscuit ware bowls. The Biscuit A sherds were mostly clustered together, as were the Biscuit B sherds, suggesting that they represent two vessels.

Feature 14

Feature 14 is a large double terrace-edge borrow pit measuring 12.6 by 12.2 m, with a maximum depth of 1.2 m (Fig. 11.7). It extends up to and slightly within project limits but was not excavated because the area available for detailed examination was too small to provide any data that could not be obtained from surface examination. Since this feature was in the detailed examination zone, it was completely mapped. It sits next to Feature 13 and was probably the source of some of the materials used to build that gravel-mulched field. From the way this borrow pit is configured, it is likely that the lower or southwest section was excavated first. The larger upper section was subsequently used to procure materials for construction of nearby fields, and rejected cobbles and small boulders were tossed into the lower pit, nearly filling it (Fig. 11.10). Sediments have built up in the upper section to an undetermined depth. No associated cultural materials were noted.

Feature 15

Feature 15 is a nearly round terrace-edge borrow pit measuring 5.8 by 5.2 m, with a maximum depth of 0.6 m (Fig. 11.7). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Features 13 and 18 and was probably the source of some of the materials used to build one or both of those gravel-mulched fields. Sediments have built up in the bottom of the pit to an undetermined depth. One piece of chipped stone was noted in the feature, but no temporally diagnostic artifacts are present.

Feature 16

Feature 16 is a small, shallow, nearly round terrace-edge borrow pit measuring 4.6 by 4.1 m, with a maximum depth of 0.3 m (Fig. 11.7). Though outside construction limits, it was in the detailed examination zone and was mapped.

Figure 11.8. Alignments in an unmulched area of Feature 13, LA 105707. Note the lack of surface gravel in comparison with mulched fields like Feature 9 (Fig. 11.6).

Figure 11.9. Cobble stockpile in Feature 13, LA 105707.

Figure 11.10. Looking downslope at Feature 14, showing the pile of discarded cobbles and boulders in the lower section.

This borrow pit is next to Features 13 and 18, and it was probably the source of some of the materials used to build one or both of those gravel-mulched fields. Sediments have built up in the bottom of the pit to an undetermined depth. Four pieces of chipped stone were noted in the feature, but no temporally diagnostic artifacts are present.

Feature 17

Feature 17 is a large oval terrace-edge borrow pit measuring 12.5 by 9.7 m, with a maximum depth of 1.2 m (Fig. 11.7). Though outside construction limits, it was in the detailed examination zone and was mapped. This pit is next to Feature 13 and was probably the source of some of the materials used to build that gravel-mulched field. Sediments have built up in the bottom of the pit to an undetermined depth. Two pieces of chipped stone were noted in the feature, but no temporally diagnostic artifacts are present.

Feature 18

Feature 18 is a small irregularly shaped gravel-mulched plot that measures 7.4 by 3.8 m and covers about 28 sq m (Fig. 11.7). Since this field was in the detailed examination zone it was completely mapped. While some boundary alignments are indistinct, and the gravel shield from a large anthill covers part of its surface, this is one of the best preserved features at LA 105707. About 40–50 percent of its surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation.

Boundary and interior subdividing alignments are a single element high and wide. They were built with locally obtained cobbles, most of which are 15–20 cm long. Elements were mostly placed end-to-end, though some side-by-side placement also occurs. While most elements were set on their broadest surfaces, many were set upright. Surface indications suggest that the feature interior is heavily subdivided into small cells measuring 0.8–1.0 m long by 0.4–0.5 m wide (Fig. 11.11).

The mulch is mostly composed of unsorted

Figure 11.11. Small cobble-bordered cell in Feature 18, LA 105707.

gravels and pea gravels, though small cobbles up to 10 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. The feature surface is mounded 5–10 cm higher than the terrace, indicating that the layer of mulch is at least that thick. Where not obscured by sediments, gravels cover 60–80 percent of the field surface, and vegetation is visibly denser than on the adjacent terrace surface (Fig. 11.12).

All cultural materials noted on the surface of this feature and directly adjacent to it were inventoried. Chipped stone artifacts were rather common, though gray rhyolite was the only material type represented, and included 11 core flakes, 5 angular debris, and 1 core. The only temporally diagnostic artifact noted was a Biscuit A bowl sherd.

Feature 19

Feature 19 is a large oval terrace-edge borrow pit measuring 10.9 by 8.9 m, with a maximum depth of 1.0 m (Fig. 11.7). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Feature 13 and was probably the source of some of the materials used to build that field. Sediments have built up in the bottom of the pit to an undetermined depth. Three pieces of chipped stone were noted in the feature, but no temporally diagnostic artifacts are present.

Feature 20

Feature 20 is a cluster of 20–30 cobbles measuring 2.3 by 1.6 m, which appears to be related to the use of a thermal feature (Fig. 11.13). Most of the cobbles are quartzite, though some rhyolite elements also occur. Many cobbles are partly oxidized, while others exhibit heat-spalling and thermal cracking. There is no real structure to this feature, and it is uncertain whether it represents a deflated hearth or roasting pit, or discards from a similar feature. However, considering that the terrace surface appears to have been aggrading since the site was abandoned, the latter is more likely. Thus, it is possible that an undisturbed buried thermal feature is located nearby.

Figure 11.12. Feature 18 at LA 105707, showing the greater density of gravels on the field surface versus the adjacent terrace surface in the foreground.

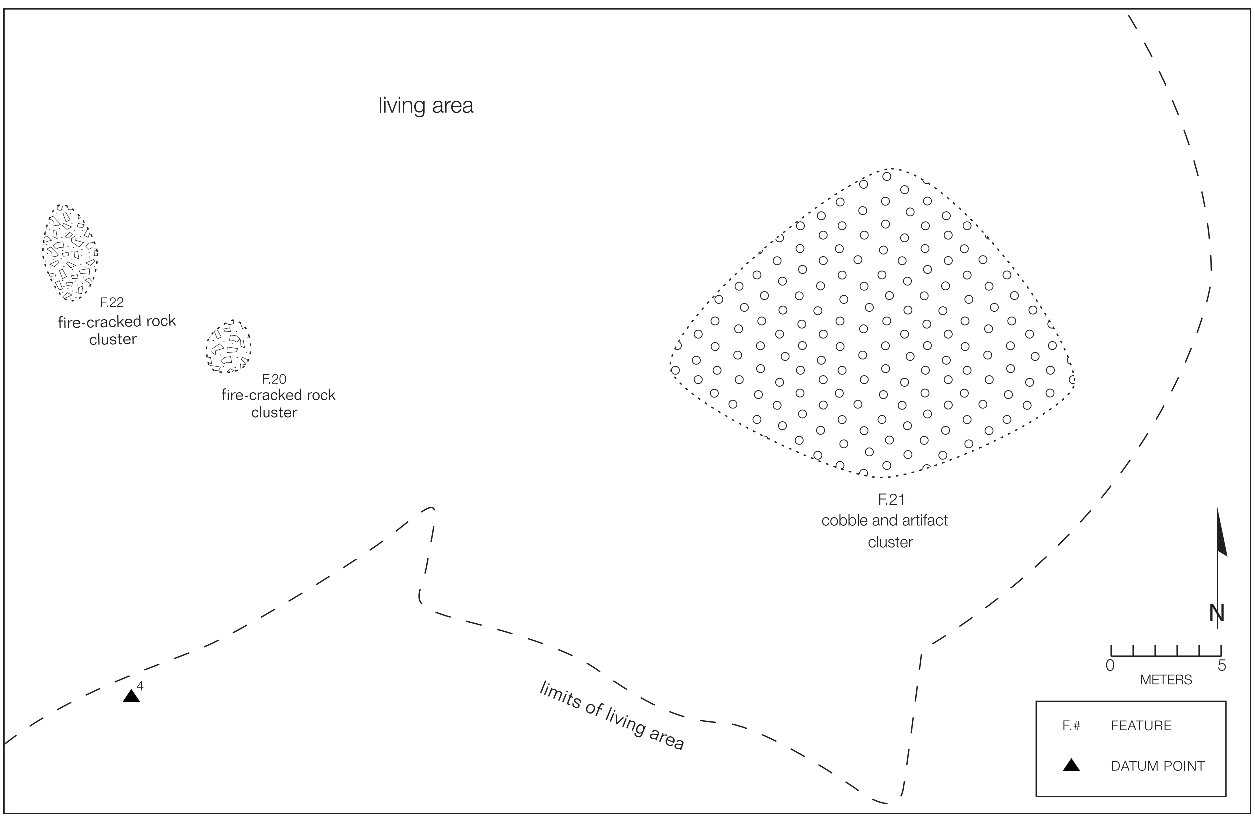


Figure 11.13. A portion of Feature 24 at LA 105707, showing the relationship between Features 20, 21, and 22.

Feature 21

Feature 21 is a rather heavy concentration of cobbles, small boulders, fire-altered rock, and chipped stone artifacts that measures 16 by 13 m (Fig. 11.13). Most cobbles and small boulders cluster in a 5 by 4 m area and include 20–30 elements 10–40 cm long. Quartzite is the most common material, but rhyolite and andesite also occur. It is possible that these materials represent the remains of one or more temporary field structures, but this was impossible to determine from surface observations alone.

The rest of the feature contains a scatter of chipped stone artifacts, cobbles, and numerous fragments of heat-spalled and cracked rock. At least two clusters of cobbles were noted; one is 1.5 m in diameter, and the other is 2.0 m in diameter (Fig. 11.14). These could be the remains of thermal features, but this is uncertain. Unfortunately, the area in which this feature occurs is one of the few parts of the terrace interior that has been actively eroded. While we can probably attribute the higher surface density of artifacts to that process, it may also have moved elements about. Thus, this area could also simply represent a discard zone. Unfortunately, Feature 21 was outside the construction zone and could not be examined in more detail, so we lack the data needed to make a more accurate assessment of its function.

As noted above, Feature 21 contains a rather heavy concentration of chipped stone artifacts, and a sample of about 50 percent was examined. Gray rhyolite, the most common material noted, comprised 123 core flakes, 40 angular debris, and 4 cores. Other materials occurred in much smaller quantities and included andesite (9 core flakes, 4 angular debris), massive quartz (1 core flake, 7 angular debris), red rhyolite (2 core flakes, 1 angular debris), quartzite (2 core flakes), Pedernal chert (1 core flake, 2 angular debris), and chert (1 core flake, 1 angular debris). An andesite mano fragment was the only piece of ground stone found in this area. It is part of a mano of indeterminate form and was ground on only one surface. No temporally diagnostic materials were found in this feature.

Figure 11.14. Probable deflated thermal feature in Feature 21, LA 105707.

Feature 22

Feature 22 is an oval cluster of 20+ pieces of fire-cracked rock measuring 4.5 by 3.0 m, which appears to be related to the use of a thermal feature (Fig. 11.13). There is no real structure to this feature, and it is uncertain whether it represents a deflated hearth or roasting pit, or discards from a similar feature. However, since the area in which it occurs has suffered from erosion, this debris probably represents the deflated remains of a thermal feature. Fifteen pieces of chipped stone were noted in the general vicinity of this feature, primarily comprised of gray rhyolite, though some andesite artifacts and a chert core flake were also noted.

Feature 23

Feature 23 is an oval terrace-edge borrow pit measuring 8.1 by 7.2 m, with a maximum depth of 0.5 m (Fig. 11.7). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Feature 13 and was probably the source of some of the materials used to build that gravel-mulched field. Sediments have built up in the bottom of the pit to an undetermined depth. Three pieces of chipped stone were noted in the feature (two rhyolite, one andesite), but no temporally diagnostic artifacts are present.

Feature 24

Feature 24 consists of a scatter of artifacts and several possible thermal features occupying a central location in the site, mostly adjacent to Feature 13. Features 20, 21, and 22 occur within Feature 24 but were recorded separately because they represent distinct clusters of cultural materials. This probable occupational zone measures 63 by 60 m and covers about 2,700 sq m (Fig. 11.1). Colluvial wash appears to have eroded the east part of the scatter (including Feature 21), but the area next to the interior edge of Feature 13 does not seem eroded and may be covered by a mantle of colluvial and eolian sediments.

Features 20 and 22 occur near one another and are surrounded by a concentration of chipped stone artifacts similar to those in Feature 21. In addition, fragments of two separate trough metates (andesite and granite) were noted nearby. Chipped stone artifacts are scattered across the rest of Feature 24, but no other concentrations of materials were noted.

A detailed inventory of all artifacts was not attempted because of time limitations and the amount of cultural materials contained by Feature 24. The 50-percent sample from Feature 21 is representative of the chipped stone artifacts that occur in the rest of this feature. However, we did examine the surface for any temporally diagnostic artifacts or tools that might be present. The only temporally diagnostic artifact found was a Biscuit A bowl sherd. Besides the metate fragments noted above, ground stone tools include a fragment of an andesite mano of undetermined form, a quartzite one-hand rocker mano, and a second fragment from the granite trough metate noted above. Chipped stone tools include a Polvadera obsidian arrow point tip, an obsidian arrow point tip, two obsidian corner-notched arrow points, an obsidian drill base, a Polvadera obsidian retouched tool that was discarded after being broken during manufacture, and a Pedernal chert biface fragment.

Surface Information

Several important aspects of LA 105707 still need to be discussed or expanded upon. Farming plots at this site tend to follow the edge of the terrace, whether adjacent to the Ojo Caliente Valley proper or along secondary drainages that have deeply dissected the terrace. Only terrace-edge borrow pits were noted; thus, there is only limited evidence of sequential field construction. This evidence consists of two areas that appear to represent uncompleted field extensions and a plot that was partly built over an earlier field. Outside the detailed examination zone, fields continue along an intermittent drainage on the northwest edge of the site, and that area contains no further evidence of sequential field construction. Since the terrace edge delimits most of LA 105707 on three sides (Fig. 11.1), it is likely that there was not enough space to expand fields beyond a certain size. If so, the paucity of evidence of sequential field construction may simply mean that limits on the amount of space available in this location were reached before it became necessary or desirable to replace or supplement existing fields with plots situated more to the interior of the terrace.

It is interesting to note that the trail (LA 118549) ascends to the terrace top at the edge of the farming features at LA 105707. Other than the fields in this location, no structures or features that might have provided an attraction for routing the trail to the top of the terrace were identified. Unfortunately, however, the tip of the terrace directly west of the trail was removed decades ago. Thus, it was not possible to determine whether any such features might have once been present in that area. At this time, we can only assume that the trail ascended to the top of the terrace at LA 105707 to provide more direct access to the farming features there.

Limited reconnaissance on top of a higher terrace northeast of LA 105707 showed that it also contains extensive farming features. Since that area is well outside the construction zone, those features were neither recorded nor assigned a site number. However, they were probably noted during Bugé's (1984) study of the region. They are similar to the features investigated during this project but do not seem to have suffered as much erosional impact.

No definite shrines were found at this site, though a few features at LA 105707 and on the high terrace to the northeast may have functioned as such. A small rock pile on the east side of the southern extension of Feature 13 may be a shrine, but it is also very near that field and could represent a stockpile of construction materials. However, when compared with the probable stockpiles mapped as part of the same feature, that function seems less likely. Several rock piles were noted on the high terrace to the northeast and could represent shrines or boundary markers. A boulder set within Feature 1 seems out of place. It resembles a similar boulder at LA 105709 (discussed in a later chapter) and may represent a small field shrine. Finally, the unusual configuration of Feature 14 may indicate some special significance. Unfortunately, there are no correlates in the literature on Pueblo shrines that was examined, so this remains speculative.

The presence of an occupational zone next to the farming features at LA 105707 is very important, since few (if any) have been noted during previous studies in this region. It is unfortunate that temporally diagnostic artifacts are rare in that area, but the few that were recorded suggest that Feature 24 was occupied while the farming features were in use. The presence of a single Biscuit A bowl sherd in Feature 24 is not highly significant, though it does provide a tentative Classic period date for the occupational zone. The presence of parts of at least two trough metates is also indicative of a Pueblo occupation, though this artifact class is not nearly as time-sensitive as pottery.

The only other temporally diagnostic artifacts found in Feature 24 were corner-notched arrow points. This style of projectile point is often associated with the Early Developmental period, and in the past the presence of such artifacts has often resulted in assignment to that temporal period. Indeed, the author used such logic to assign an Early Developmental affinity to a scatter of artifacts on a similar farming site in the Chama Valley (Moore 1992). However, the results of research near Pecos show that corner-notched projectile points were made and used by Pueblos into the early historic period (Moore 2003). Indeed, this style also remained popular into the Late Pueblo period in the Highland Mogollon region (Moore 1999a). Thus, corner-notched projectile points may have a limited utility as temporally diagnostic artifacts; they came in with the introduction of the bow, and in some areas were manufactured until replaced by metal points. Like the trough metate fragments, they are merely indicative of a Pueblo occupation in this region.

Though the evidence is slim at this point, it is likely that Feature 24 represents an occupational zone used at the same time as the fields. Rather than basing this assertion on a suite of highly sensitive temporal indicators, we base it on the proximity of Feature 24 to fields and comparisons with other sites in the project area. As discussed in more detail in a later section, similar occupational zones were identified at two to three other sites and in general display a paucity of diagnostic artifacts (though in one case pottery was common). Thus, the similarity of the occupational zone at LA 105707 to the other examples is probably a good indication that it functioned in the same way and was closely related to use of the nearby fields.

A fairly intensive use is indicated for the occupational zone. Several activities appear to have occurred there, including core reduction, tool manufacture, hunting, and vegetal food processing. The remains of at least three thermal features were documented and are probably indicative of food preparation by roasting or stone boiling. While no structures were noted, our examination was not detailed enough to define temporary field shelters. Such remains are often quite ephemeral, sometimes no more than a short cobble alignment and nearby discard zone next to a field, such as was found at LA 71189 near Pot Creek Pueblo (Moore and Levine 1994). This type of shelter would be virtually invisible on the surface. The presence of numerous unburned large cobbles and small boulders on Feature 24, often occurring in clusters, may be indicative of the presence of such structures in subsurface contexts. This possibility is strengthened by the general paucity of cobbles and boulders away from the terrace edge. Those present on the surface of Feature 24 were almost certainly moved there by the prehistoric occupants of the site. Coupled with the presence of thermal features and artifact concentrations, the existence of one or more temporary shelters used while cultivating the adjacent fields is quite likely.

In addition to the artifacts inventoried on feature surfaces, a small number of chipped stone artifacts were collected from the section of site that extends into the right-of-way (Table 11.1). Rhyolite is by far the dominant material, comprising 97 percent of this small assemblage. The only other material present is Pedernal chert, which is represented by a single artifact (3 percent). However, the presence of this artifact in the assemblage is potentially significant because Pedernal chert does not occur naturally in gravel deposits in this part of the Ojo Caliente Valley. No tools were identified among the collected artifacts.

Table 11.1. Chipped stone artifacts collected within the highway right-of-way at LA 105707 (material type by morphology)

Material Type	Angular Debris	Core Flakes	Cores
Pedernal chert	-	1	-
Rhyolite	4	25	3

Chapter 12. LA 105708

James L. Moore and Jeffrey L. Boyer

LA 105708 is a large farming site on State Trust land administered by the New Mexico State Land Office. It occupies an irregular oval area and is bounded by the main terrace edge overlooking the Ojo Caliente Valley on the west and by arroyos formed by intermittent tributary drainages on the north and south. The east boundary of the site is formed by the edge of the farming features. Intermittent drainages separate this site from LA 105705 to the north and an unrecorded series of farming features to the south that are completely outside project limits (Fig. 12.1). These arbitrary boundaries were used to maintain the original numbering system and restrict LA 105708 to a manageable size. It is unlikely that they replicate the prehistoric land tenure system.

LA 105708 measures 392 m north to south by 169 m east to west, and covers about 38,234 sq m (3.82 ha). The site may have extended further west, but that area is in the current U.S. 285 right-of-way and has been removed. Only 3.9 percent of LA 105708 extends into the right-of-way, comprising a narrow sliver along the southwest edge of the site. In-field pottery analysis indicated that LA 105708 was used during the Classic period.

Vegetation is moderate on the site, and the plant cover is generally similar between on- and off-feature areas. However, distinct differences were noted in a few places and are discussed in individual feature descriptions. Grasses were the most common plants noted, including grama, muhly, three-awn, and Indian ricegrass. Other common plants include rabbitbrush, snakeweed, cholla, prickly pear, and narrowleaf yucca. Small junipers occur at the terrace edge, but only a few have spread onto the surface of the fields. Free-growing lichens were common on some fields.

Field Procedures

Detailed mapping was restricted to the section of site that extends into the U.S. 285 right-of-way and an adjacent 25 m wide zone. This area comprises a sample of about 14 percent of the site, and all cultural features within this zone were mapped and recorded in detail. Several features were partly or wholly within project limits, including two gravel-mulched fields (Features 3 and 9) and four borrow pits (Features 8, 10, 11, and 12). Data recovery efforts concentrated on surface description of features in the mapped area and sample excavation of fields within project limits. The latter focused on Features 3 and 9, each of which was sampled by three excavation units. Since excavation of borrow pits would have provided few data that were not available from surface examination, no subsurface studies were conducted in those features. All cultural materials noted on the surface within the right-of-way were collected for analysis, as were artifacts encountered in excavation units. These materials are summarized later in this chapter. Artifacts noted elsewhere on the surface of features in the detailed mapping zone were inventoried by feature and are summarized in those discussions.

Features

Seventeen features were at least partly mapped and described (Fig. 12.1). An additional terrace-edge borrow pit is shown on the site plan, but since it was outside the detailed examination zone, it was not described or assigned a feature number. Field limits were often difficult to define in the mapped area, though outside that zone some fields are much better delineated. A combination of colluvial and eolian processes have caused soil to build up against alignments that face the terrace interior, obscuring those edges in many places. Eolian deposits also cover much of the surface of the fields, especially where they are anchored by vegetation. This made it difficult to discern many alignments and to define the full extent of others. Several fields appear to overlie others, and it is possible that some materials used to build later features were salvaged from earlier

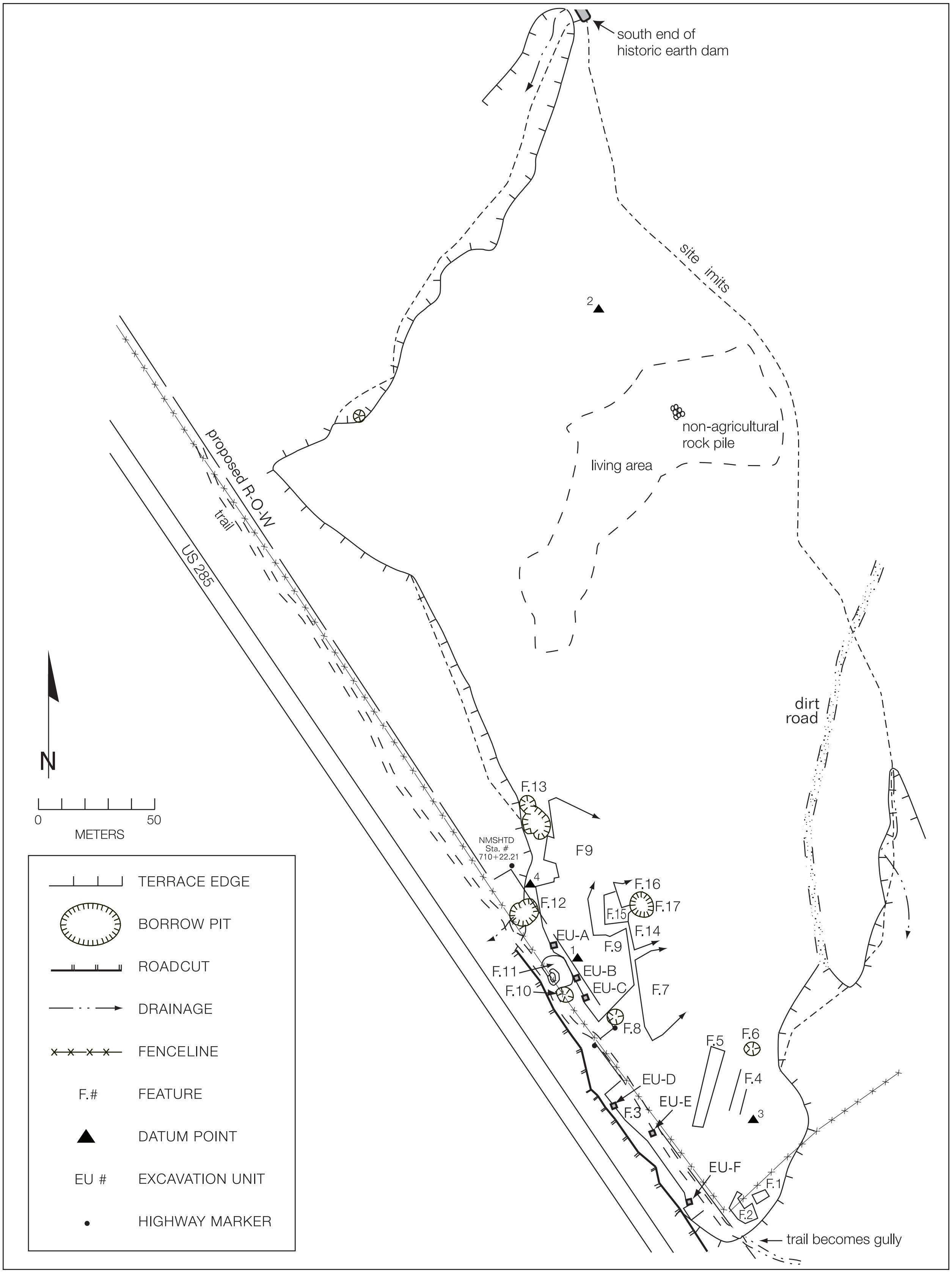


Figure 12.1. Plan of LA 105708.

fields, further obscuring alignments. Livestock grazing has also caused damage, displacing elements in cobble alignments and blurring feature borders. Along the terrace edge this seems to have exacerbated damage caused by erosion. Other surface disturbances include a trail (LA 118549) that runs along the west edge of the site next to U.S. 285 and enters the site between Features 2 and 3. An unimproved dirt road traverses the southeast section of the site, crossing several gravel-mulched fields. For the most part, this has simply obscured field surfaces rather than cutting through them.

Feature 1

Feature 1 is a small rectangular gravel-mulched plot that measures 6.2 by 4.4 m and covers 24.2 sq m (Fig. 12.2). Since this field was in the detailed examination zone it was completely mapped. About 40–50 percent of its surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation.

Boundary and interior subdividing alignments are a single element high and wide. They were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 10–25 cm long. The few small boulders that were also used are 30–45 cm long. Elements were mostly placed end-to-end, though some side-by-side placement also occurs. Most elements were set on their broadest surfaces, but a few were set upright. Surface indications suggest that the feature interior is subdivided into multiple compartments. Grasses seem denser and taller on the field, but this may be illusory because the feature is outside a fence and has not been grazed recently.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 10 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Since the alignments are one element high, the mulch is probably 8–12 cm thick. The field was not visibly mounded above the terrace surface, and no differences in gravel or vegetative density were noted between on- and off-feature areas. No cultural materials were found on the surface of this feature.

Feature 2

Feature 2 is a small irregularly shaped gravel-mulched plot that measures 13.6 by 9.7 m and covers 83.6 sq m (Fig. 12.2). Since this field was in the detailed examination zone, it was completely mapped. About 40–50 percent of its surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation.

Boundary and interior subdividing alignments are a single element high and wide, and they were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 10–25 cm long. A few small boulders were also used and are 25–35 cm long. Elements were mostly placed end-to-end, though some side-by-side placement also occurs. Most elements were set on their broadest surfaces, but a few were set upright. Surface indications suggest that the feature interior is highly subdivided into multiple compartments. Many large cobbles and small boulders embedded in the mulch may indicate a pattern of noncontiguous, evenly spaced elements. Grasses seem denser and taller on the field, but this may be illusory because the feature is outside a fence and has not been grazed recently. Most alignments on the interior side of the feature are obscured by colluvial sediments washing down a slope to the east, while elements in alignments along the terrace edge are displaced by erosion and livestock grazing.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 12 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Since the alignments are one element high, the mulch is probably 8–12 cm thick. The field was not visibly mounded above the terrace surface, and no differences in gravel or vegetative density were noted between on- and off-feature areas.

All cultural materials noted on the surface of this feature were inventoried. Gray rhyolite dominated the chipped stone (three core flakes and two angular debris). A quartzite core flake was also noted. All but one piece of angular debris clustered together in the southeast corner of the feature near the terrace edge. Four sherds from the same Biscuit A bowl were also observed.

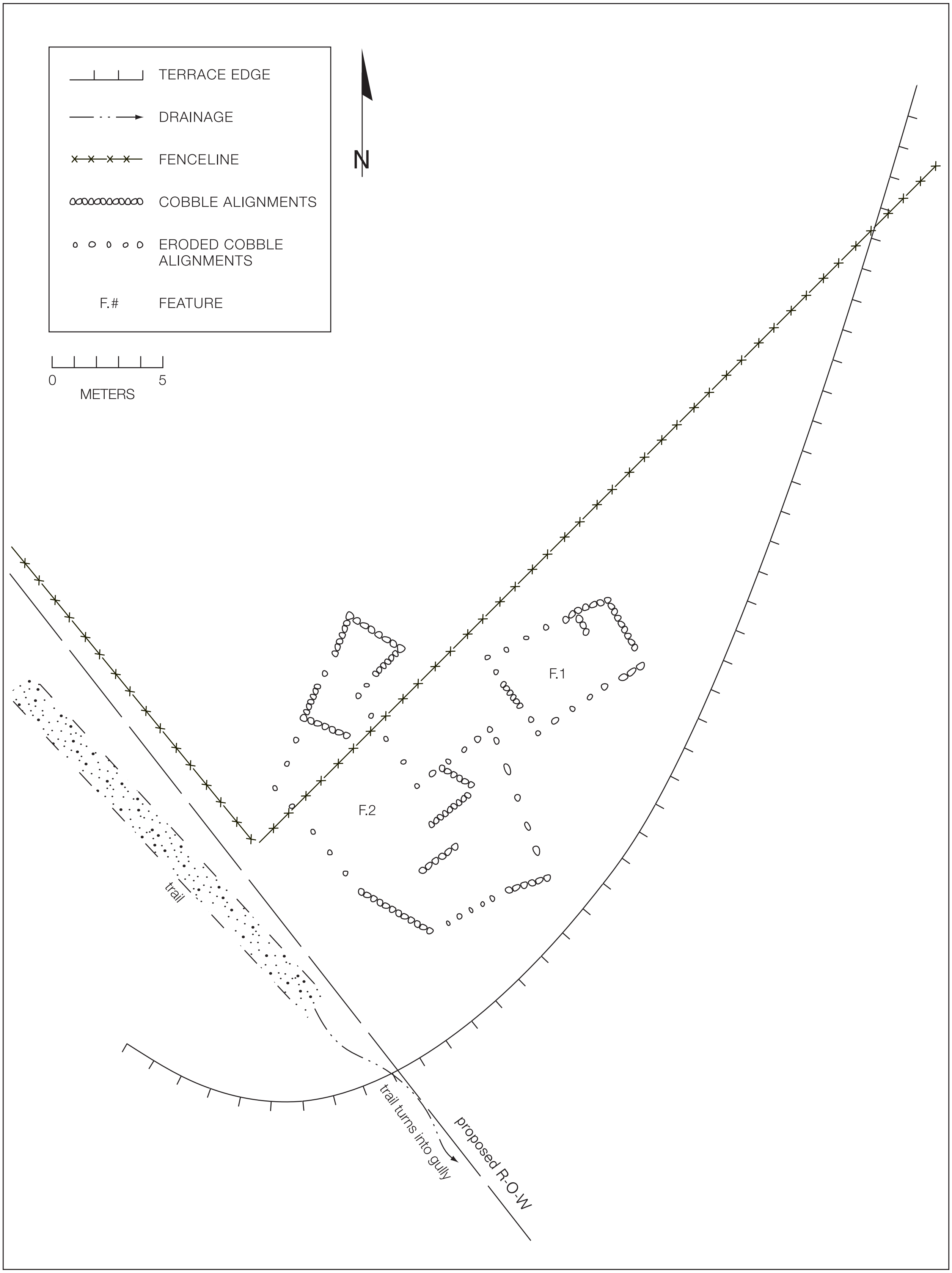


Figure 12.2. Features 1 and 2, LA 105708.

Feature 3

Feature 3 is a long, narrow gravel-mulched plot that measures 65.5 by 9.5 m and covers about 393 sq m (Fig. 12.3). Since this field was within project boundaries, it was completely mapped, and three excavation units were used to examine its structure. This feature has been severely affected by cultural activities and erosion. Although the end of the terrace was removed during an earlier episode of highway construction, Feature 3 does not seem to have been damaged. From surface indications it seemed likely that the side of the feature that faces the terrace interior was damaged by construction of a prehistoric trail (LA 118549). Soil is bermed along the west side of the trail and initially appeared to cover part of the back edge of the feature. However, excavation showed that this was unlikely and that the feature never extended as far as the trail. Erosion along the terrace edge has displaced numerous elements from alignments and spread mulch onto the adjacent terrace surface. About 60–70 percent of the feature surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation.

Boundary and interior subdividing alignments are a single element high and wide, and they were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 10–25 cm long. A few small boulders were also used and are 25–40 cm long. Elements were mostly placed end-to-end, though some side-by-side placement also occurs. Most elements were set on their broadest surfaces, but a few were set upright. Surface indications suggest that the feature interior is highly subdivided into multiple compartments at both ends. Unfortunately, the central part of the feature is so badly obscured by sediments that it was not possible to determine what the original configuration was in that area. However, the presence of many large cobbles and small boulders embedded in the mulch may indicate that a pattern of noncontiguous, evenly spaced elements prevails over much of the feature. Vegetational density is not visibly different from that of adjacent ungrazed areas that do not contain farming features.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 12 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Since the alignments are one element high, the mulch is probably 10–15 cm thick. The field is mounded 5–10 cm above the terrace surface in some places. No differences in gravel density were noted between on- and off-feature areas.

Feature 4

Feature 4 is a small contour-terrace system containing two alignments on a west-southwest-facing slope (Fig. 12.4). Since this feature was in the detailed examination zone, it was completely mapped. The alignments are relatively straight and measure 19.4 and 11.9 m long; both were built from locally obtained cobbles and small boulders. They are a single element high and wide, and are spaced about 0.4 m apart. While most elements were placed end-to-end, some were placed sideways. In most cases placement seemed dependent on element size, so that larger rocks were placed end-to-end and smaller elements sideways, perhaps to maintain an even wall thickness. Cobbles predominate in both alignments, and most are 10–25 cm long. A few small boulders were also used, and they are 25–30 cm long. Many elements are slightly displaced by erosion and livestock grazing. There may have once been more than two alignments on the slope, but good surface evidence of others was not found.

Sediments have built up behind the terrace walls and are 10–12 cm thick. Since there does not appear to be any difference between sediments behind the terrace walls and on the adjacent hill slope, it is likely that this buildup occurred naturally. No cultural materials were in obvious association with this feature.

Feature 5

Feature 5 is a long, rectangular gravel-mulched plot that measures 35.2 by 6.2 m and covers about 196.4 sq m (Fig. 12.4). Since this feature was in the detailed examination zone, it was completely mapped. About 50 percent of the surface of this feature is obscured by sediments that have infiltrated the mulch and are anchored by vegetation. In addition, colluvial wash has buried most of the

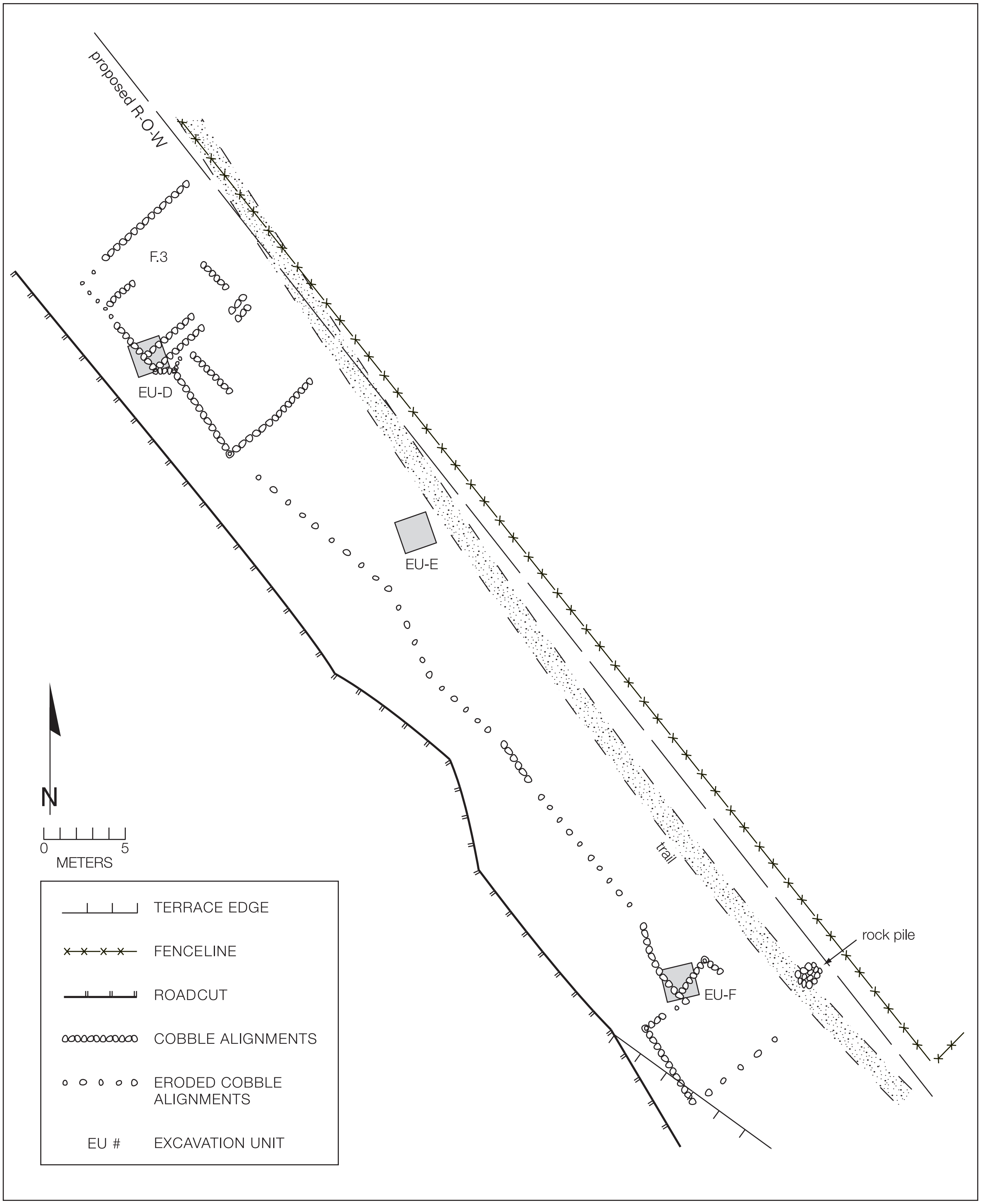


Figure 12.3. Feature 3, LA 105708.

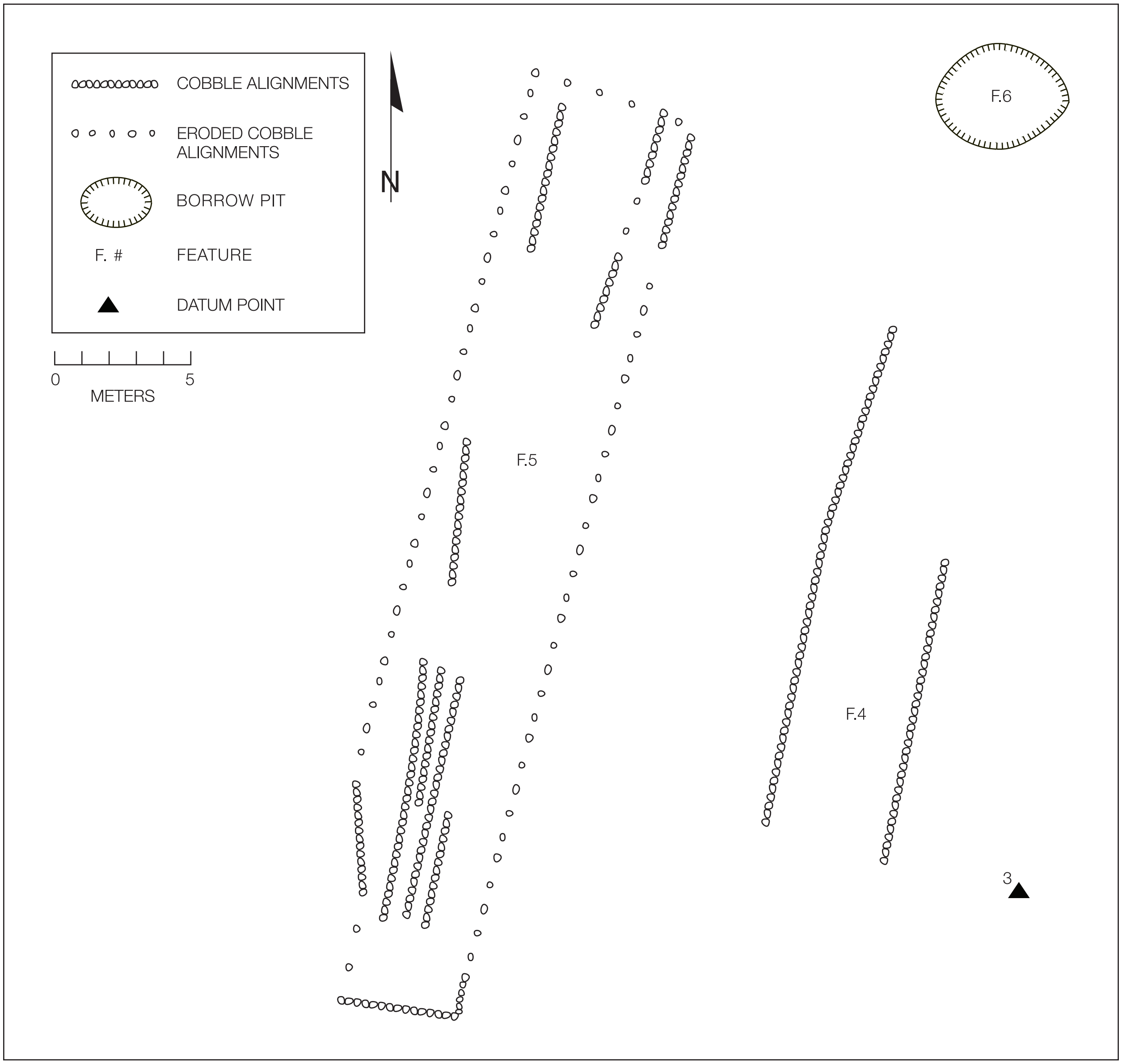


Figure 12.4. Features 4, 5, and 6, LA 105708.

east edge of the feature. A similar process has scattered elements from the west side of the feature, and in conjunction with livestock grazing appears to have contributed to the deterioration of most boundary alignments. Several interior subdividing alignments were visible, however, suggesting that the field was subdivided into many long, parallel plots.

Boundary and interior subdividing alignments are a single element high and wide, and they were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 10–20 cm long. Small boulders are also quite common in the feature, and they are 25–40 cm long. Elements were mostly placed end-to-end, though some side-by-side placement also occurs. All visible elements were set on their broadest surfaces, and no uprights were noted. Vegetation is somewhat denser on the field than in adjacent off-feature areas.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 12 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Since the alignments are one element high, the mulch is probably 8–15 cm thick. The field is not visibly mounded above the adjacent terrace surface, and no differences in gravel density were noted between on- and off-feature areas. The only artifacts noted on the surface of this feature were a gray rhyolite core and core flake. No temporally diagnostic materials were found.

Feature 6

Feature 6 is a small oval terrace-interior borrow pit measuring 5.6 by 4.1 m, with a maximum depth of 0.6 m (Fig. 12.4). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is near an unmapped gravel-mulched field and was probably the source of some of the materials used to build that feature. Sediments have built up in the bottom of the pit to an undetermined depth. No artifacts were noted in association with this feature.

Feature 7

Feature 7 is a large irregularly shaped gravel-mulched plot that measures 35.4 by about 32 m and covers roughly 1,200 sq m (Fig. 12.5). Since this field was mostly outside the detailed examination zone, the entire feature was not mapped. Only the west 13 m were in the mapping zone, so the full extent of the feature was estimated by pacing. About 40–50 percent of the surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation.

Boundary and interior subdividing alignments are a single element high and wide, and they were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 10–20 cm long. Small boulders are also common, and most are 25–35 cm long. Elements were predominantly placed end-to-end, though some side-by-side placement also occurs. Most elements were also placed on their broadest surfaces, but a few were set upright. Surface indications suggest that the feature interior is highly subdivided into compartments. Parts of the field are dotted by cobbles and small boulders set into the gravel mulch, which may indicate that a pattern of noncontiguous, evenly spaced elements prevails over much of the feature.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 12 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. This feature is distinctly mounded, particularly along the west edge, where it is 10–15 cm higher than the terrace. The gravel-mulch layer is probably of an equivalent depth. No differences in gravel or vegetative density were noted between on- and off-feature areas.

This field abuts the east edge of Feature 9, which is fairly indistinct. It is likely that Feature 7 actually overlaps Feature 9 in that area. The presence of terrace-interior borrow pits at the northeast and southeast corners of Feature 7 in addition to this overlap may be evidence of sequential construction. If so, Feature 7 was built after Feature 9, and much of the mulch for that field was probably obtained from borrow pits on the interior of the terrace rather than along its margin. Thus, this field may be part of a second tier of later features built along the interior edge of the first tier of fields, which was situated at the terrace edge.

All cultural materials noted on the surface of this feature were inventoried. Gray rhyolite dominated the chipped stone (ten core flakes, seven angular debris, one core, and one tested cobble). Other materials included andesite (three core flakes, two cores) and red rhyolite (one core flake). No temporally diagnostic materials were noted.

Feature 8

Feature 8 is an oval terrace-interior borrow pit measuring 6.6 by 5.9 m, with a maximum depth of 0.5 m (Fig. 12.5). It is partly within construction limits and was completely mapped. This borrow pit is next to Feature 9 and was probably the source of some of the materials used to build that field. Sediments have built up in the bottom of the pit to an undetermined depth. Artifacts noted in association with this feature included two pieces of chipped stone and a Biscuit B bowl sherd.

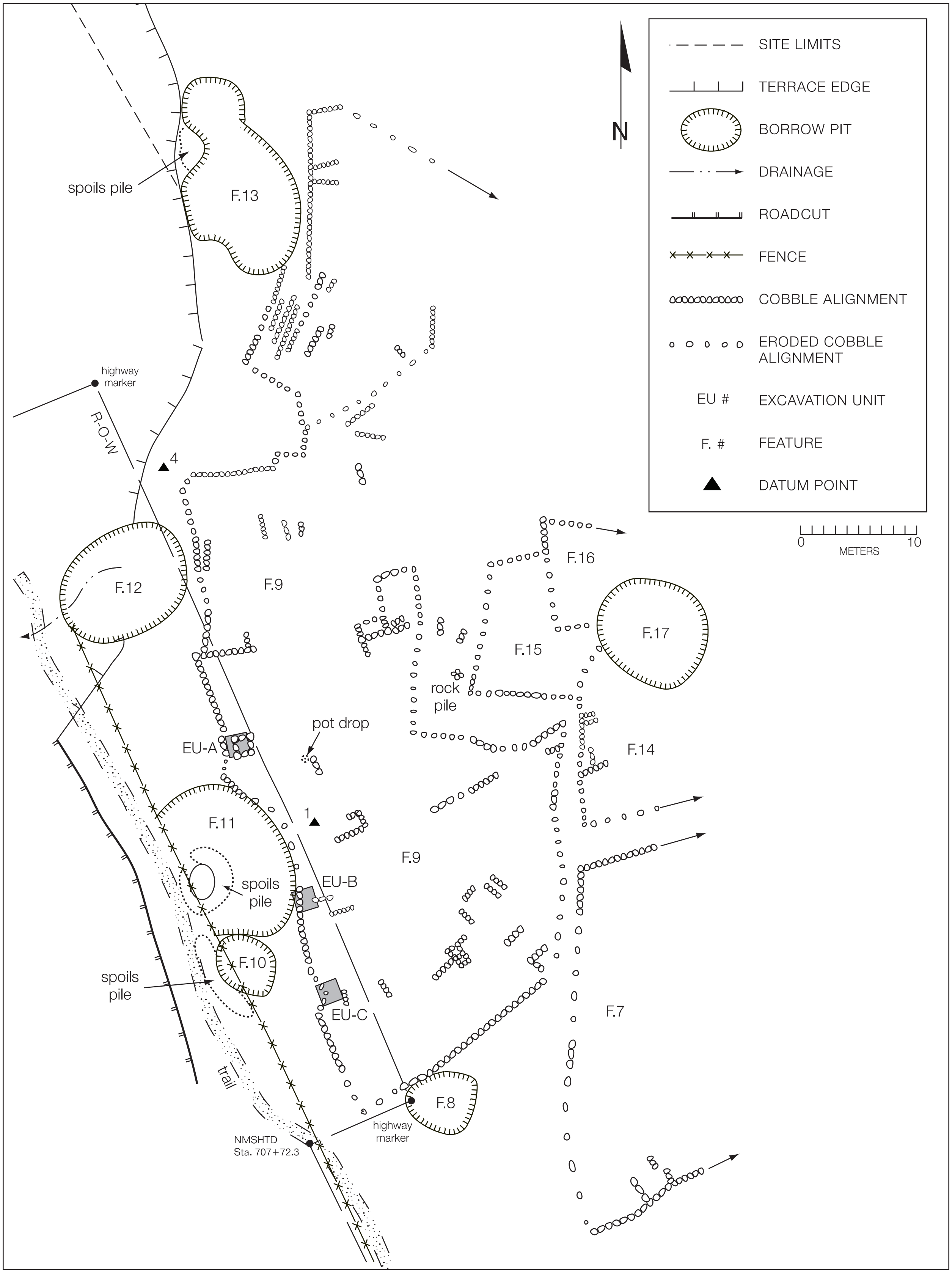


Figure 12.5. Features 7 through 17, LA 105708.

Feature 9

Feature 9 is a large irregularly shaped gravel-mulched plot that measures 98.0 by at least 28.4 m and covers a minimum of 2,800 sq m (Fig. 12.5). Since this field was partly outside the detailed examination zone, the entire feature was not mapped. However, only a small part of the north section of the feature was outside this area, so most of it is shown in Figure 12.5. Since Feature 9 extends into project limits, three excavation units were used to examine it. The east edge of this field is very indistinct but does not appear to extend under Features 14, 15, and 16, as it does under Feature 7. However, these fields do seem to have been built later than Feature 9, and some of the elements used to construct them may have been salvaged from it. This may have contributed to the deterioration of the east edge of Feature 9. About 40–50 percent of the surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation.

Boundary and interior subdividing alignments are a single element high and wide, and they were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 10–25 cm long. Small boulders occur rarely and are 25–40 cm long. Most elements were placed end-to-end, though some side-by-side placement occurs. Most elements were also placed on their broadest surfaces, but a few were set upright. Surface indications suggest that the feature interior is subdivided into multiple compartments. Parts of the field are dotted by large cobbles set into the gravel mulch, suggesting that a pattern of noncontiguous, evenly spaced elements prevails in those areas.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 12 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. This feature is mounded 2–5 cm higher than the adjacent terrace. The gravel-mulch layer is probably 5–15 cm thick over most of the feature. No differences in gravel or vegetative density were noted between on- and off-feature areas.

Artifacts found within project limits were collected for analysis; they are discussed in a later chapter. Other cultural materials noted on the surface of the feature were inventoried and left in place. The latter were dominated by chipped stone artifacts. Materials noted included gray rhyolite (44 core flakes, 12 angular debris, 1 core) and andesite (12 core flakes, 8 angular debris, 2 cores). Artifacts observed outside project limits included 1 Biscuit B bowl sherd, 3 Tewa Gray jar sherds, and 3 pieces of amethyst glass.

Feature 10

Feature 10 is an oval terrace-edge borrow pit measuring 7.2 by 6.2 m, with a maximum depth of 0.7 m (Fig. 12.5). It is within construction limits but was not examined in detail because excavation would have provided few data that were not available from surface examination. This borrow pit is near Feature 9 and was probably the source of some of the materials used to build that field. Sediments have built up in the bottom of the pit to an undetermined depth. The trail (LA 118549) runs along the west edge of Feature 10 and is separated from it by a low berm, which is quite distinct though it is only 10–20 cm high. It was not possible to determine whether the berm represents spoils from the borrow pit or material removed from the trail to clear it. While the former is more likely, it is also possible that the spoils were supplemented by materials removed from the trail.

Feature 11

Feature 11 is a large, nearly round terrace-edge borrow pit measuring 13.6 by 13.0 m, with a maximum depth of 1.6 m (Fig. 12.5). It is within construction limits, but it was not examined in detail because excavation would have provided few data that were not available from surface examination. This borrow pit is near Feature 9 and was probably the source of some of the materials used to build that field. Interestingly, a smaller borrow pit was excavated at the bottom of the larger pit, near its west edge. The smaller pit measures 3.4 by 2.2 m and is nearly surrounded by a spoils pile except on the north side (Fig. 12.6). The trail (LA 118549) runs along the west edge of the feature and appears to truncate it, since there is nothing to demarcate the east edge of the trail from the borrow pit in that area. While it is possible that the elaboration of the borrow pit was related to the presence of the trail, we have no way of deter-

Figure 12.6. Feature 11 at LA 105708, showing the smaller interior borrow pit and spoils pile in the center of the photo, and the trail (LA 118549) just outside the fence.

mining this for certain. However, this feature is similar to another borrow pit near the trail at LA 105707, and both may have had some significance beyond field construction and maintenance.

Feature 12

Feature 12 is an large, oval terrace-edge borrow pit measuring 9.1 by 7.1 m, with a maximum depth of 1.5 m (Fig. 12.5). It is within construction limits, but it was not examined in detail because excavation would have provided few data that were not available from surface examination. This borrow pit is near Feature 9 and was probably the source of some of the materials used to build that field. Because of its position at the edge of the terrace, this borrow pit is open to the west. A small erosional drainage heads in the bottom of the pit, and it is impossible to determine how much of its current depth is attributable to gullying. The only artifacts noted in association with this feature were two pieces of chipped stone.

Feature 13

Feature 13 is a large, irregularly shaped terrace-edge borrow pit measuring 19.5 by 12.1 m, with a maximum depth of 1.3 m (Fig. 12.5). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is near Feature 9 and an unmapped gravel-mulched plot and was probably the source of some of the materials used to build those fields. Sediments have built up to an undetermined depth in the bottom of the pit, and a small spoils pile occurs along its northwest edge. The irregular shape of this feature may be indicative of multiple episodes of use. The central section of the pit seems to represent the original excavation, while lobes on the north and south may be indicative of later reuse of the feature to obtain more materials for the construction of adjacent fields. No artifacts were noted in association with this feature.

Feature 14

Feature 14 is a large irregularly shaped gravel-mulched plot that measures a maximum of 43 by 39 m and covers roughly 1,700 sq m (Fig. 12.5). Since this field was mostly outside the detailed examination zone, the entire feature was not mapped. Only the westernmost 7 m were within the mapping zone, so the full extent of the feature was estimated by pacing. For the most part, only the area within the detailed examination zone is described. About 50 percent of the surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation.

Boundary and interior subdividing alignments are a single element high and wide, and they were built with locally obtained cobbles, most of which are 10–20 cm long. Elements were mostly placed end-to-end, though side-by-side placement is also common. All elements in the detailed examination zone were placed on their broadest surfaces; no uprights were noted.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 12 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. This feature is distinctly mounded, particularly along the west edge, where it is 5–10 cm higher than the terrace. The gravel-mulch layer is probably of equivalent depth. No differences in gravel or vegetative density were noted between on- and off-feature areas.

This field overlaps the east edge of Feature 15 and was probably built at a later time. Two adjacent terrace-interior borrow pits may have provided some of the materials used to construct this feature. Like Feature 7, this field probably represents part of a second tier, or later phase, of construction. No artifacts were noted on the portion of Feature 14 within the detailed mapping zone.

Feature 15

Feature 15 is a small irregularly shaped gravel-mulched plot that measures 14.0 by 11.4 m and covers roughly 114.2 sq m (Fig. 12.5). Since this field was in the detailed examination zone, it was completely mapped. About 60–70 percent of its surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation.

All alignments are a single element high and wide, and they were built with locally obtained cobbles, most of which are 10–25 cm long. All visible elements were placed end-to-end, and most were set on their broadest surfaces, though a few uprights were noted.

The mulch is mainly composed of unsorted gravels and pea gravels, though small cobbles up to 14 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. The layer of mulch is probably 8–12 cm thick. No differences in vegetative density were noted between on- and off-feature areas.

Sedimentation has concealed most boundary and internal subdividing alignments in this feature. Indeed, only two short segments of boundary alignments and no internal subdividing alignments were visible from the surface. Most of the feature edges are marked by a sudden decrease in surface gravel density. Where the mulch is visible, gravels cover 70–80 percent of the surface, while they cover only 10–40 percent of the surface in adjacent off-feature areas. There is also a barely perceptible mounding about 2–5 cm high at the feature's west edge. In contrast, Features 14 and 16 seem to cover the east edge of this small field and are distinctly mounded 5–10 cm above its surface. Feature 15 was probably built before Features 14 and 16, and most likely belongs in the first tier of fields along with Feature 9. The subsequent construction of adjacent fields may have contributed to the deterioration of Feature 15, and some building elements may have been removed for use in the later features. Indeed, a pile of cobbles between Features 9 and 15 could be evidence of this process (Fig. 12.7). However, it is also possible that it is a small rock pile shrine.

All cultural materials noted on the surface of this feature were inventoried. Gray rhyolite dominated the chipped stone (five core flakes, two angular debris, and one core). The only other chipped stone artifact noted was a red rhyolite angular debris. The only temporally diagnostic artifacts were two Biscuit A bowl sherds.

Feature 16

Feature 16 is a large irregularly shaped gravel-mulched plot that measures 34 by 24 m and cov-

Figure 12.7. Small rock pile between Features 9 and 15, LA 105708.

ers roughly 820 sq m (Fig. 12.5). Since this field was mostly outside the detailed examination zone, the entire feature was not mapped. Only the westernmost 5 m were within the mapping zone, so the full extent of the feature was estimated by pacing. About 50–60 percent of its surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation.

Boundary and interior subdividing alignments are a single element high and wide, and they were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 15–25 cm long. Small boulders are also common, and they are 25–35 cm long. Elements were mostly placed end-to-end, though they are occasionally interspersed by elements placed sideways. Most elements were also set on their broadest surfaces, though uprights are also fairly common. Surface indications suggest that the feature interior is subdivided into multiple compartments. However, cobbles are very common on the surface of this feature. Most occur in clusters with no evidence of arrangement in alignments, suggesting that larger elements were important in the mulching strategy applied to this field. This type of mulching makes most interior subdividing alignments difficult to discern; indeed, none were visible in the section of field within the mapping zone.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 16 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. This field is distinctly mounded 10–12 cm higher than the adjacent terrace. The gravel-mulch layer is probably of equivalent depth. Gravels cover 60–70 percent of the field surface where the mulch is visible. In contrast, gravels cover only 15–20 percent of the adjacent terrace surface. Vegetation is also visibly denser on the field than in nearby off-feature areas.

This field overlaps the east edge of Feature 15 and seems to have been built at a later time. A nearby terrace-interior borrow pit (Feature 17) may have provided some of the necessary materials. Like Features 7 and 14, this field probably represents part of a second tier, or later phase, of construction. All cultural materials noted on the surface of this feature were inventoried. Gray rhyolite dominated the chipped stone (ten core flakes, seven angular debris, one core, and one tested cobble). Other materials included andesite (three core flakes, two cores) and red rhyolite (one core flake). No temporally diagnostic materials were noted.

Feature 17

Feature 17 is a large, round terrace-interior borrow pit measuring 11.0 m in diameter, with a maximum depth of 0.9 m (Fig. 5.6 and 12.5). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is near Features 14, 15, and 16, and it was probably a source of some of the materials used to build one or more of those fields. Sediments have built up in the bottom of this pit to an undetermined depth. Associated artifacts included ten pieces of chipped stone.

Feature 18

Feature 18 is a large scatter of chipped stone and ceramic artifacts that bisects the farming features at LA 105708, dividing them into north and south sections (Fig. 12.1). Farming features bound the scatter on the south and along most of its north perimeter, are sparse to the east, and do not occur on the west. This feature is outside the detailed examination zone, but it was mapped because an understanding of its location and basic structure is crucial to the discussion of this site. The artifact scatter is irregular in shape, measures 156 by 70 m, and covers approximately 4,900 sq m. Since this feature bisects the fields at LA 105708, it may represent a boundary zone separating farming areas controlled by different corporate groups.

Although internal characteristics of this feature are not shown on the plan, its configuration suggests that it represents a residential zone. Between four and six clusters of burned and fire-cracked rock were noted and probably represent the remains of thermal features. The assemblage is dominated by chipped stone artifacts, and only a few sherds were noted. Artifact density is relatively high, and most chipped stone artifacts occur in clusters. A sample of around 55 percent of surface artifacts was recorded and is discussed later.

No evidence of any structures was noted, but it is likely that field shelters were erected in this zone and were probably fairly insubstantial, perhaps meant only to provide shade on hot summer days. Temporary shelters similar to the Hopi *kishoni*, or uncovered shade (Mindeleff 1891:217), could have been used without leaving surface indications. Ramadas could also have been built and would be similarly invisible on the modern ground surface as long as partial stone walls were not appended to them. Unfortunately, since this feature was completely outside project limits, excavation was not an option, so it was not possible to explore this area for the remains of shelters or other features.

Surface Information

Like several other farming sites examined during this study, LA 105708 is rather elongated and follows the edge of the terrace that forms the east boundary of the Ojo Caliente Valley. Its north and south borders are arbitrary and almost certainly do not represent aspects of the prehistoric land tenure system. However, the presence of an apparent residential area (Feature 18) that bisects the site suggests the existence of a boundary between farming areas controlled by different corporate groups. Unfortunately, whether those groups were from the same or different villages was impossible to determine.

When compared to most of the other farming sites examined, LA 105708 seems rather wide and contains numerous terrace-interior borrow pits ringed by gravel-mulched fields that display a definite mounding above the natural terrace surface. Gravel-mulched fields that follow the edge of the terrace are not as highly mounded and are in a worse state of preservation than those on the interior. Both types of fields have been subjected to the same range of erosional impacts, though those on the terrace edge are somewhat more susceptible to slope wash. Even so, the inside edges of those plots, which have almost certainly been subjected to the same erosive forces as the fields on the interior of the terrace, display greater evidence of deterioration.

Because of this, there seems to be two tiers of fields at this site. The original tier mostly follows the edge of the terrace and was probably built with materials from terrace-edge borrow pits.

Features 1, 2, 3, 9, and 15 represent this tier of fields within the detailed examination zone. A second tier seems to have been built at a later time and is situated toward the interior of the terrace, adjacent to terrace-interior borrow pits. This tier is represented by Features 7, 14, and 16 within the detailed examination zone. All three of these features appear to overlap fields of the first tier and are mounded above their surfaces. The highly deteriorated nature of some parts of the first tier fields suggests that materials were salvaged from them for building the later fields.

LA 105708 is one of the few sites where the trail (LA 118549) ascends to the top of the terrace, providing direct access to the farming features. Indeed, the trail cuts behind Feature 3, and a berm on its east side may overlap the edge of that field, though our excavations provided no evidence of this. The relationship between the trail and Feature 11, an elaborate double terrace-edge borrow pit, is also interesting to speculate upon. The large outer pit almost certainly represents the original borrow area, which was probably used to build Feature 9. The purpose of the smaller interior pit is more difficult to explain. While it may represent reuse of the borrow pit as a materials source, it is also possible that it had a less practical function associated with the trail. A ritual use is possible, though highly speculative. For now, the meaning behind this type of feature must remain a mystery.

Limited reconnaissance on top of a higher terrace east of LA 105708 showed that it also contains extensive farming features. Since that area is well outside the construction zone, those features were neither recorded nor assigned a site number. However, it is likely that they were previously noted during Bugé's (1984) study of the region. In general, they are similar to the features investigated during this study, though they usually do not appear to have suffered as much erosional impact. There is also no evidence of terrace-interior borrow pits in that area.

No definite shrines were found at this site. However, several rock piles were noted that may have served this function. A low rock pile was found on the east edge of the trail near the south end of Feature 3 (Fig. 12.3). A second small rock pile was found in the area between Features 9 and 15 (Fig. 12.5), though, as discussed earlier, it may be a stockpile of building materials. Again, Feature 11 may have served in a ritual capacity, but no modern cognate for this form has yet been documented.

A total of 101 chipped stone artifacts were collected from the sections of farming features that extended into the highway right-of-way (Table 12.1). Most came from Features 3 (44; 43.6 percent) and 9 (40; 36.9 percent). Others were collected from Features 11 (15; 14.9 percent) and 12 (2; 2.0 percent). Overall, this small assemblage is dominated by rhyolites (85.1 percent), and andesite (9.9 percent) is the only other material that can be considered common. The other materials that occur in this assemblage are represented by only one or two specimens apiece. Only reduction debris (angular debris, core flakes, and cores) was identified in this small assemblage, suggesting that raw-material quarrying and initial reduction were the most important chipped stone reduction-related activities conducted near the west edge of the terrace, where this assemblage was collected. This possibility is addressed in greater detail in a later chapter. Since these artifacts were collected from feature surfaces, they were produced either after the fields were built and while they were still in use, or after they were abandoned.

Table 12.1. Chipped stone artifacts collected from features within the highway right-of-way at LA 105708 (material type by morphology)

Feature No.	Material Type	Angular Debris	Core Flakes	Cores
3	Pedernal chert	-	1	-
	Gabbro	-	1	1
	Rhyolite	8	19	5
	Andesite	2	4	1
	Massive quartz	1	1	-
9	Rhyolite	5	29	3
	Andesite	-	3	-
11	Rhyolite	3	10	-
12	Rhyolite	1	1	-

A comparatively large number of sherds was also recovered from these farming features. This was especially true of Feature 9, which yielded 18 unpainted biscuit ware sherds, 1 Classic period nonmicaceous utility ware sherd, and 2 clusters of sherds thought to represent pot drops. The first probable pot drop contained 74 sherds from an unpainted biscuit ware vessel, and the second was composed of 39 sherds from a micaceous utility ware vessel. Feature 3 yielded a single Biscuit B sherd and 4 unpainted biscuit ware sherds, six Classic period nonmicaceous utility ware sherds were found in Feature 10, and Feature 11 contained 3 unpainted biscuit ware sherds and 1 micaceous utility ware sherd. Biscuit B is the only type with a comparatively restricted temporal range identified in this small assemblage, and it is interesting that all but one specimen of this type were recovered from the layer of gravel mulch in EU-B.

In addition to the artifacts collected within project limits, a sample of the surface assemblage in Feature 18 was also inventoried. As noted earlier, Feature 18 is a probable residential zone that contains most of the surface artifacts noted at LA 105708. About 55 percent of the artifacts visible in Feature 18 were recorded, and they serve as a sample of the overall assemblage from the large section of site that could not be surface collected. The recorded chipped stone assemblage was dominated by gray rhyolite (475 core flakes, 141 angular debris, 13 cores, and 3 tested cobbles). Andesite was also common (227 core flakes, 28 angular debris, 4 cores, and 1 biface). Other materials observed in Feature 18 included red rhyolite (17 core flakes, 2 angular debris), obsidian (2 core flakes, 2 angular debris, 1 biface, 5 projectile points), Pedernal chert (12 core flakes, 7 angular debris, 1 scraper, 1 drill), other cherts (3 core flakes), and massive quartz (1 core flake, 1 angular debris).

The distribution of artifacts in this inventory is very interesting. Together, gray rhyolite and andesite comprise nearly 95 percent of the debitage and all of the cores, yet they make up only about 11 percent of the formal tools. No formal tools were made from gray rhyolite, and only one was andesite. Materials used most frequently for tool manufacture were obsidian and Pedernal chert. These materials comprised only 2.5 percent of the debitage assemblage and none of the cores, yet nearly 89 percent of the formal tools. While gray rhyolite and andesite were most commonly reduced in this feature, they were only rarely turned into formal tools. Indeed, the paucity of both Pedernal chert and obsidian suggests that tools made from those materials were produced elsewhere and only used and discarded at this location.

Chipped stone artifacts dominate the Feature 18 assemblage. However, a few ground stone tools and ceramic artifacts were also recorded. The ground stone consists of fragments from a trough metate and a slab metate, both made from quartzite. Seven sherds were noted, including four from Biscuit A bowls, one from a Biscuit B jar, one from an unidentified glaze-on-red bowl, and one from a micaceous jar. The small ceramic assemblage is indicative of a Classic period date that is somewhat earlier than the date indicated by the pottery recovered from EU-B. The sizes of the projectile points suggest that they were all used on arrows. Three were corner-notched, and one was side-notched; a fifth specimen was represented by only a tip. As temporal indicators, projectile points are not as sensitive as pottery. Corner-notched points were used from the Early Developmental period until at least the seventeenth century. The side-notched form probably first appeared during the Late Developmental period and was used into the historic period. Thus, both types of points observed in Feature 18 were used during the Classic period, and neither disagrees with nor strongly supports the ceramic dates.

The residential area at this site appears to have been heavily used. Chipped stone artifacts tend to occur in clusters throughout this zone, though a light scatter covers the whole area. Several activities are represented, including core reduction, hunting, and vegetal processing. The remains of at least four thermal features were noted, and the presence of several more is likely. These features are probably indicative of food preparation by roasting or stone boiling. While no structures were found, our examination was not detailed enough to define temporary field shelters. However, coupled with the presence of thermal features and artifact concentrations, the existence of one or more temporary shelters that were used while cultivating nearby fields is quite likely.

Results of Excavation

Six 2 by 2 m excavation units were used to examine subsurface deposits and construction techniques in Features 3 and 9. These were the only gravel-mulched fields that extended into project limits at this site. They appear to represent series of individual plots constructed closely together or large fields that grew by accretion. The soil strata are discussed first, followed by descriptions of the excavation units.

Excavation was conducted in natural stratigraphic levels. Because of the paucity of materials recovered during excavation, only the fill from two 1 by 1 m grids within each excavation unit was screened through 1/4-inch mesh hardware cloth, and all artifacts recovered in this fashion were collected for analysis. Plans of rock alignments and other rocks that appeared to have been intentionally placed within each excavation unit were drawn before and after excavation. This enabled us to compare surface indications with the actual configurations of alignments and details of construction. It also allowed us to compare detailed studies of small sections of the fields with the more cursory observations made during site mapping. Variations between these views revealed that the features are more intricately built and subdivided than surface observations suggest.

Soil Strata

Three strata were encountered during excavation at LA 105708. Stratum 1 was uppermost and consisted of a layer of eolian sediments deposited on the surface of the fields since the time of abandonment and anchored in place by vegetation. This layer was a pale brown to brown silty sand of variable thickness, ranging up to 11 cm. In addition to these sediments, there was some mixing with the underlying gravel mulch, so this layer also contained small (pea to marble size) gravels and pebbles. Alignments as well as the gravel mulch were sometimes concealed beneath a mantle of this material.

The layer of gravel mulch that was applied to the terrace surface between cobble alignments was designated Stratum 2, and it underlay the thin mantle of eolian sediments (Stratum 1). Its thickness was variable, ranging from 2 to 12 cm in excavation units. This stratum contained unsorted small (pea to marble size) gravels, larger gravels, and small cobbles, but perhaps 30–40 percent of it was a brown silty sand. The latter probably represents eolian-deposited sediments (i.e., Stratum 1) and soil that infiltrated and clogged the mulch. It was impossible to determine whether these sediments were deposited when the field was in use or after it was abandoned, but deposition during both periods is likely.

Stratum 2 was apparently placed directly upon the original terrace surface. Though this surface was configured somewhat differently from trench to trench, it was always designated Stratum 3. Excavation usually halted when this layer was encountered, so detailed descriptions were not written. However, Stratum 3 is usually a brown or dark brown silty sand or loam that contained few gravels, especially compared to Stratum 2.

Feature 3

Three excavation units were used to examine Feature 3 (Fig. 12.3). EU-D was placed at the north end of the feature along its west edge to examine a north-south cobble alignment thought to represent the west boundary of the feature and two perpendicular interior subdividing alignments. EU-E was placed near the center of Feature 3 in an area without surface indications of alignments. This unit was on the west side of the trail (LA 118549), where it passed through Feature 3, and its placement had two intentions. First was to determine whether alignments actually occur in that area. Second was to determine whether the berm that lined the west side of the trail covered farming features. This was important for defining the age of the trail: if the berm covered farming features, then the trail was not constructed so as to avoid the features and therefore postdates them. Conversely, if no features were evident beneath the berm and the trail was built to avoid them, then the trail was probably contemporaneous with the farming sites through which it passes. EU-F was placed near the south end of Feature 3 to examine a north-south cobble alignment thought to be the west boundary of the feature and its intersection with a perpendicular interior subdividing alignment that appeared to be the north boundary of a rectilinear plot.

The area in which EU-D was placed was eroded and not well preserved. Stratum 1 was very thin in this unit, ranging from 0 to 3 cm thick. This may be due to its location near the break of terrace slope at the top of the existing roadcut, resulting in slope wash that removed part of the eolian stratum or impeded its deposition. Support for this is found in the observation that, while some cobbles comprising the west alignment were set upright, several were found lying on their sides in Stratum 2, suggesting that they had fallen over. Additionally, Figure 12.8 shows that several large cobbles were found immediately east of the alignment, and they may have been moved out of line by the same process. Stratum 2 was more variable in thickness, ranging from 3 to 11 cm, though it was most often 3–8 cm thick. A sample from the mulch yielded a high corn pollen concentration. Two chipped stone artifacts were also recovered, a piece of rhyolite angular debris from Stratum 1 and a rhyolite core flake from Stratum 2.

As shown in Figures 12.8 and 12.9, excavation revealed parts of the west boundary alignment and two perpendicular alignments. The larger sizes of cobbles in the north-south alignment and the southern east-west alignment suggests that they may comprise boundaries of a plot system or set of plots that were a subset of Feature 3. The northern east-west alignment may represent an internal plot division, since its cobbles are smaller than in the other alignments. Additionally, the larger cobbles were often set sideways, while smaller cobbles in the northern east-west alignment were most often set end-to-end. These differences indicate internal subdivisions within the field.

Although the cobble alignments revealed during excavation were at least partly visible before excavation, the variation in size of cobbles and construction of the alignments actually present was not apparent until they were uncovered. The long axis of plots revealed by excavations in EU-D runs east-west and suggests internal alignment spacing of about 1 m. No north-south plot alignments were revealed by excavation, so the

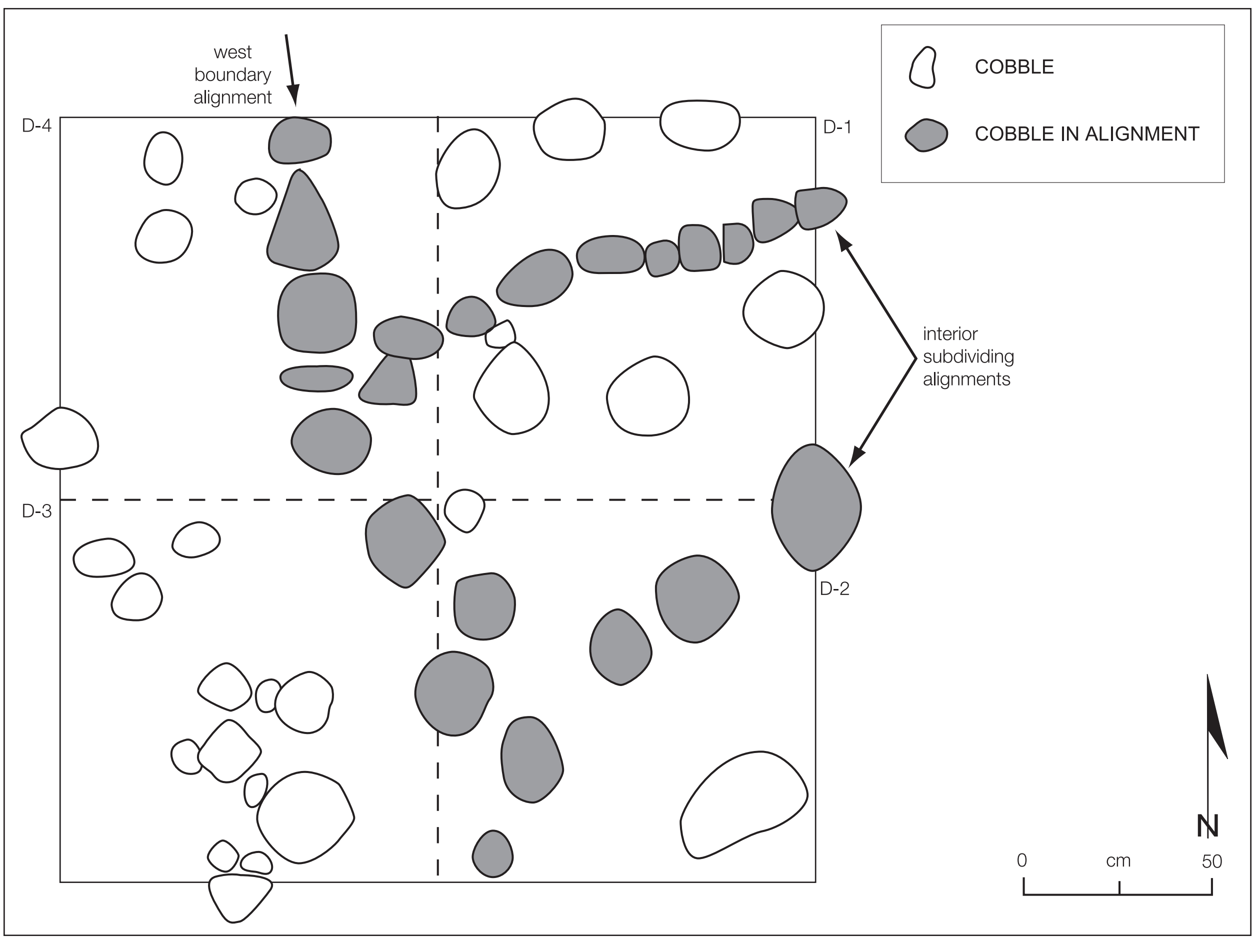


Figure 12.8. Postexcavation plan of EU-D in Feature 3 at LA 105708. Shaded rocks are in alignments.

Figure 12.9. EU-D in Feature 3, LA 105708, looking east.

actual size(s) of internal plots cannot be defined.

EU-E was excavated near the center of Feature 3 in an area without surface indications of alignments or other features. Stratum 1 was thicker in this unit than in EU-D, ranging from 2 to 8 cm, but it was 4–6 cm thick in most grids. This stratum was described by excavators as a sandy, silty loam containing some small and medium (pea to golf ball size) gravels, but in smaller amounts than Stratum 1 in EU-D. Similar variation was recorded in Stratum 2, which ranged from 0 to 11 cm thick but was 3 to 4 cm thick in most units. Excavators observed that gravels and small to medium cobbles were present, but the gravels did not form a discernible mulch layer, and the cobbles did not form alignments (Figs. 12.10 and 12.11). The thickness of Stratum 1 is probably the result of erosion from the trail berm and eolian deposition. Stratum 2 in EU-E was probably not the same as Stratum 2 in EU-D or EU-F, since there was no clear evidence of intentionally placed cobbles or gravel mulch. There is, therefore, no indication that this part of Feature 3 was the location of formal farming features. However, the fact that the few cobbles observed were found beneath Stratum 1 suggests that the trail was excavated into the prehistoric ground surface and the berm was placed on that ground surface, showing that it was probably a prehistoric feature. A sample from Stratum 2 yielded a high corn pollen concentration. A rhyolite core flake was recovered from the surface; an andesite core flake, two rhyolite core flakes, and a possible ground stone artifact came from Stratum 1; and three micaceous utility sherds and a rhyolite core flake were recovered from Stratum 2.

EU-F was excavated near the south end of Feature 3. Stratum 1 was 0–11 cm thick in this excavation unit, but it was quite variable and often thin, averaging 4–5 cm. It was thinnest in the western grids, probably due to erosion near the edge of the terrace. Stratum 2, the gravel-mulch layer, was generally thicker, ranging up 19 cm thick but averaging over 6 cm. Interestingly, while Stratum 1 was thinnest on the west side, Stratum 2 was thickest on the west side, ranging from 1 to 19 cm thick in Grids F-3 and F-4 (average 6.25–10.25 cm), compared to thicknesses of 0–9 cm in Grids F-1 and F-2 (average 4.25–5.5

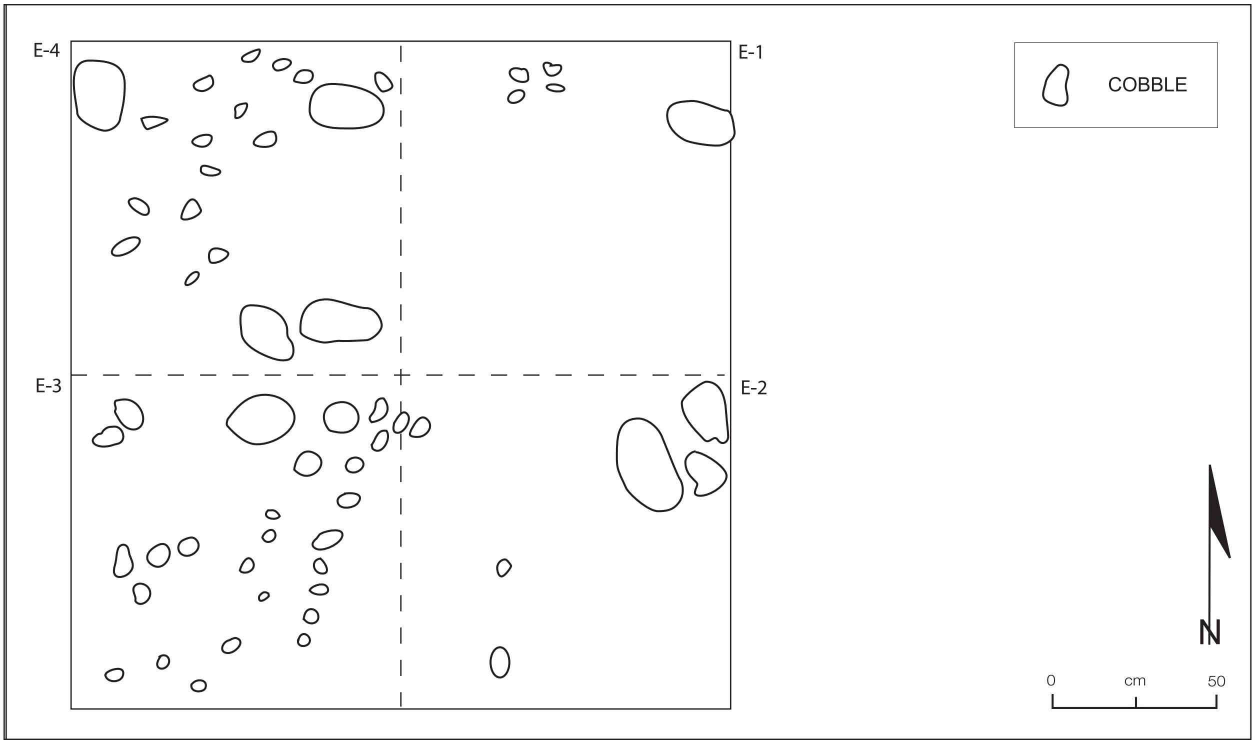


Figure 12.10. Postexcavation plan of EU-E in Feature 3, LA 105708, showing lack of alignments in the distribution of subsurface cobbles.

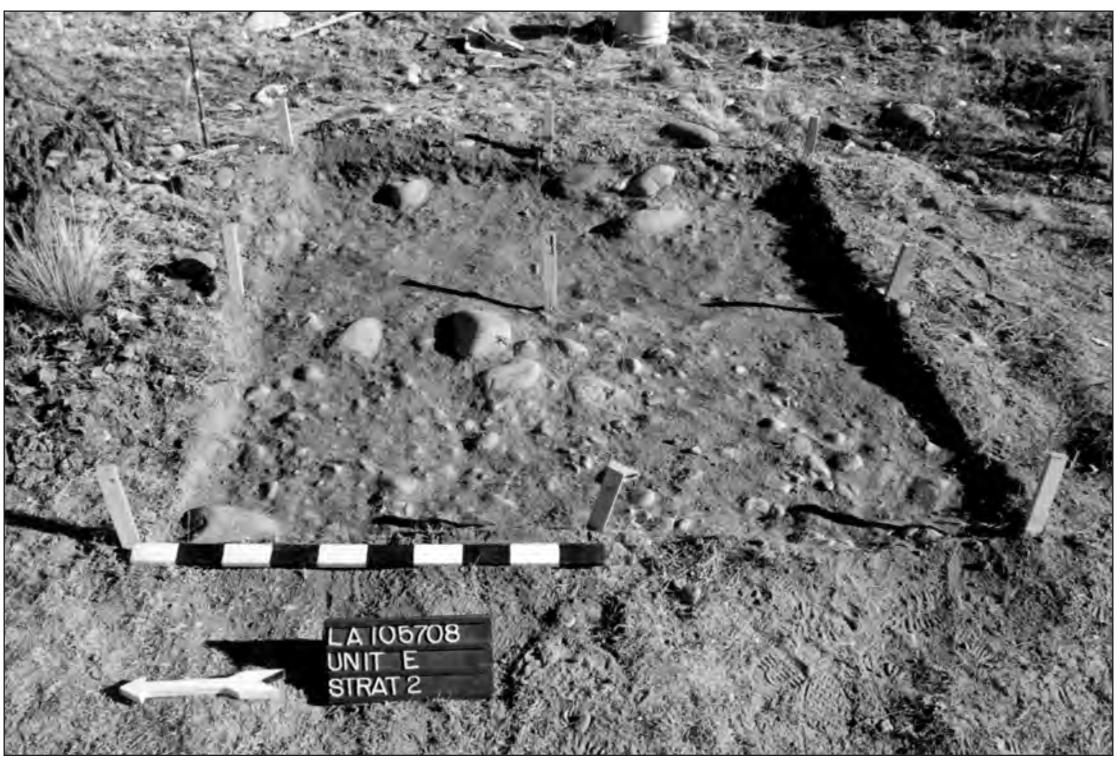


Figure 12.11. EU-E in Feature 3, LA 105708, looking east, showing the lack of alignments in the distribution of subsurface cobbles.

cm). This points to intentional spreading and leveling of the gravel-mulch layer on the shallow slope above the terrace edge. A sample from the mulch contained no pollen from domesticated plants. Two rhyolite core flakes and a Pedernal chert core flake were recovered from Stratum 2.

Figures 12.12 and 12.13 show that the west boundary alignment consisted of relatively large cobbles connected by slightly smaller cobbles. Most of the smaller cobbles appear to have been moved west out of alignment, probably because of erosion near the terrace edge, as we saw in EU-D. Running east-west and perpendicular to the boundary alignment was an alignment that apparently consisted of smaller cobbles. We could not determine the placement of the cobbles in the boundary alignment. However, cobbles in the east-west alignment appear to have been placed end-to-end, as we saw in the interior alignment at EU-D. This suggests that the east-west alignment was not a boundary, but probably an interior subdividing alignment. This notion is supported by the presence of Stratum 2, the gravel-mulch layer in Grids F-1 and F-4, which were north of the east-west alignment, as well as in Grids F-2 and F-3. The large, isolated cobbles may represent internal plot dividers, but we cannot be sure of this.

Like EU-D, excavations in EU-F revealed variation in cobble sizes and alignment construction within Feature 3. Also like EU-D, the long axis of plots within the field around EU-F runs east-west, but we cannot define spacing between alignments or sizes of plots. However, variation in thickness of Stratum 2 across EU-F provided data on placement of the gravel mulch within the field.

Feature 9

Three excavation units were used to examine Feature 9 (Fig. 12.5). EU-A was placed near the north end of the part of this very large feature that extends into project limits. It was used to examine a small cobble mound thought to be a farming plot or a historic grave near a long north-south cobble alignment considered to be the west boundary alignment. EU-B was placed in the central part of Feature 9 to examine a north-south cobble alignment that may have been the west boundary of the feature and its intersection with a short, perpendicular, east-west alignment. EU-C was placed near the southwest corner of Feature 9 to examine the same north-south alignment investigated in EU-B and thought to be the west boundary alignment.

The area in which EU-A was placed contained a concentration of cobbles of unknown function or derivation. Stratum 1 was described by excavators as more clayey than the silty, sandy soil encountered in most excavation units. It was relatively thick and ranged from 2 to 10 cm thick but was mostly 2–5 cm thick. It was thicker on the east side of the unit, averaging 5.5– 6.75 cm, and thinner on the west side, averaging 3.25–4.25 cm. This was probably the result of erosion near the feature boundary. Stratum 2 was also thicker in this unit, ranging from 3 to 13 cm and averaging 7–11.5 cm. Again, the stratum was thicker in the east half (average thickness of 9.75–11.5 cm) than in the west half (average thickness of 7.25–9 cm). However, variation between the east and west halves of Stratum 2 was not as great as in Stratum 1, suggesting that Stratum 2 was more evenly spread during construction and less affected by later erosion. A sample from the mulch contained no pollen from domesticated plants. Six chipped stone artifacts were recovered from this excavation unit. Stratum 1 yielded two rhyolite core flakes, and Stratum 2 contained three rhyolite core flakes and a piece of rhyolite angular debris.

Excavation in EU-A revealed that the small mound of cobbles, which was mostly in the east half of the excavation unit, was placed on top of Stratum 2, the gravel-mulch layer. It was within Stratum 1, and its cobbles were placed directly on top of the gravels in Stratum 2 (Figs. 12.14 and 12.15). Whether it was placed there during or after use of the field is not known, though there was no clear evidence of an extended period of time between use of the field and placement of the cobble pile. The pile, which was oval to subrectangular, measured 1.35 m north-south by 1.05 m east-west and appeared to consist of a “ring” of cobbles surrounding a smaller pile of cobbles. Whether it represents division of plot space after deposition of the gravel mulch or some other function is not known. When it was removed prior to excavation of Stratum 2, definition of cobble alignments within EU-A became very difficult.

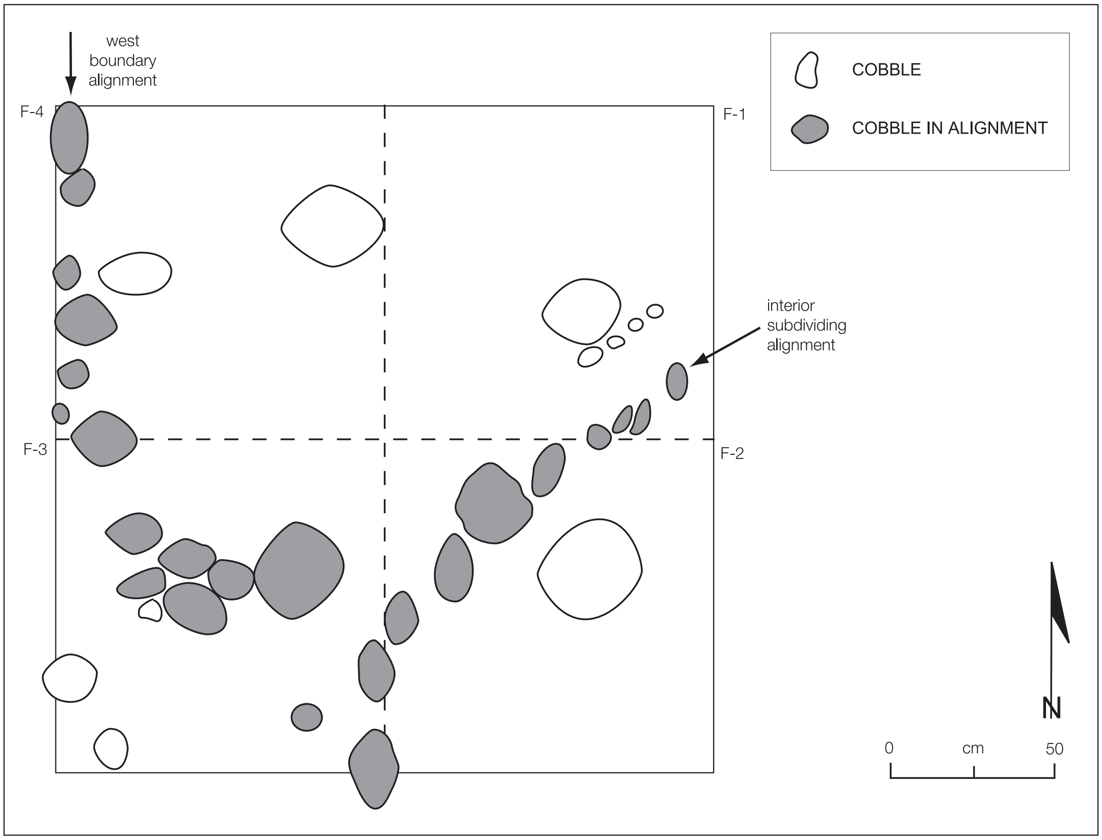


Figure 12.12. Postexcavation plan of EU-F in Feature 3, LA 105708. Shaded rocks are in alignments.

Figure 12.13. EU-F in Feature 3, LA 105708, looking east.

Figure 12.14. Cobbles piled on top of gravel mulch in EU-A, Feature 9, LA 105708.

Figure 12.15. Gravel-mulch surface under the pile of cobbles in EU-A, Feature 9, LA 105708.

Figures 12.16 and 12.17 show that two possible alignments were present. One ran north-south through the center of the excavation unit. The other ran northwest-southeast through Grid A-3 and intersected the first alignment near the south edge of the excavation unit. Since descriptions of other excavation units included some large gravels and small cobbles in the gravel mulch comprising Stratum 2, it is entirely possible that these alignments were actually small cobbles within that stratum rather than subdividing walls.

EU-B was used to investigate a possible boundary alignment. Stratum 1 was very thin, ranging from 0 to 4 cm thick but averaging 0.5–1.25 cm. In contrast, Stratum 2 was 0–11 cm thick, averaging 3.25–8.25 cm. Stratum 2 was thickest in Grids B-2 and B-3, the south half of the excavation unit. However, only in Grid B-2 was the stratum appreciably thicker than in other units (average of 8.25 cm, compared to 3.25–4.25 cm in other units). Whether this reflects intentional construction variation or some other factor is not clear. A sample from the mulch yielded a fairly high corn pollen concentration. Two ceramic artifacts were recovered from Stratum 1—a Biscuit B sherd and an unpainted biscuit ware sherd. Stratum 2 contained 5 Biscuit B sherds, 24 unpainted biscuit ware sherds, 2 rhyolite core flakes, 1 rhyolite angular debris, 1 rhyolite core, and 1 chert core flake. The high frequency of artifacts recovered from EU-B, including those grids that were not screened, contrasts distinctly with other excavation units at LA 105708, which yielded few artifacts. Clearly, most artifacts recovered from this unit were associated with the gravel-mulch layer, showing that they were likely deposited during the construction or use of the garden plot.

Excavation in EU-B revealed a single north-south cobble alignment running through the center of the excavation unit (Figs. 12.18 and 12.19). The alignment was not well defined, however, since several elements seemed to be missing, and many other cobbles of varying sizes were present in the fill. Another alignment may have been present, running perpendicular to the first alignment through the north half of the unit. In Figure 12.18, that possible alignment is seen as a series of cobbles set end-to-end through Grid B-4. It may have extended across Grid B-1, connecting to two cobbles exposed on the modern ground surface immediately east of the excavation unit. Whether other alignments were present is difficult to discern. However, if the east-west series of cobbles was an actual alignment, it suggests that the north-south alignment was not the west boundary in this area and that plots were present on both sides of the north-south alignment. Thus, excavations in EU-B suggest that Feature 9 is more extensive and complex than indicated by surface evidence.

EU-C was also used to investigate the potential boundary alignment. Stratum 1 in this unit was 2–10 cm thick and averaged 3–5 cm. In contrast, Stratum 2 was 0–12 cm thick but averaged 2.5–9.25 cm, showing that it was thicker than the eolian topsoil. In a situation not recorded in other units, excavators observed that Stratum 1 was separated from Stratum 2 by a thin (less than 1 cm thick) lens of small (pea to marble size) gravels. Since eolian processes would not have deposited these gravels, we can assume that they were not part of Stratum 1 and were intentionally placed on top of the gravel-mulch layer. The function of these small gravels is unclear. A sample from the mulch yielded a high corn pollen concentration. Two rhyolite core flakes were recovered from Stratum 2, one of which was found at the top of Stratum 3, the original terrace surface. The latter may have been left there before deposition of the gravel mulch, or it may have been included in the gravel mulch.

Excavation in EU-C revealed two parallel cobble alignments running north-south almost 1 m apart (Figs. 12.20 and 12.21). One alignment followed the east edge of the excavation unit, while the other ran just east of the unit's west edge. Adjacent to the west alignment was another series of cobbles. The excavators suggest that there may have been a double alignment of cobbles along that side of the excavation unit, although not enough of that series of cobbles was exposed to confirm this observation. Interestingly, observations during excavation of Stratum 2 also suggest that an alignment of small, upright cobbles and large gravels was present along the east side of the west alignment. This alignment lined the west side of the plot and appeared to separate the gravel-mulch layer (Stratum 2) from the larger cobble alignment.

Although no perpendicular east-west cobble

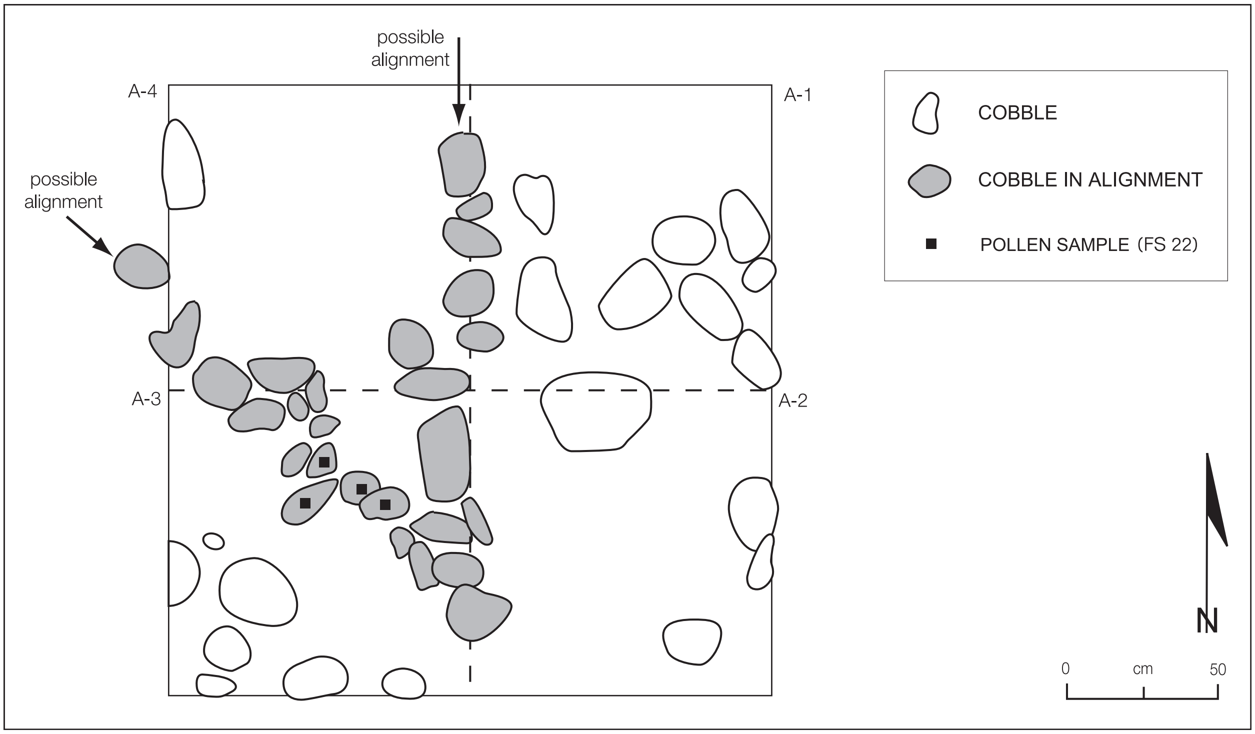


Figure 12.16. Postexcavation plan of EU-A in Feature 9, LA 105708. Shaded rocks are in alignments.

Figure 12.17. EU-A in Feature 9, LA 105708, looking east.

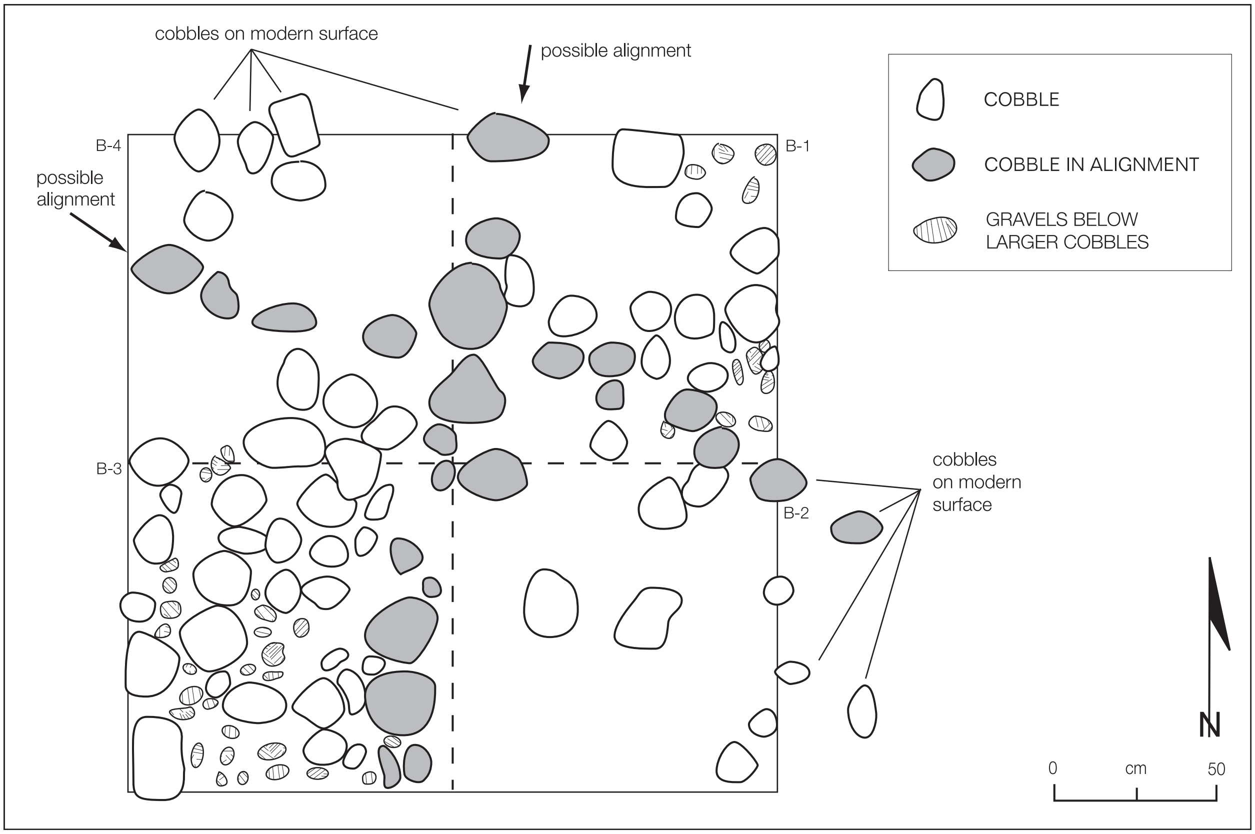


Figure 12.18. Postexcavation plan of EU-B in Feature 9, LA 105708. Shaded rocks represent possible alignments.

Figure 12.19. EU-B in Feature 9, LA 105708, looking south.

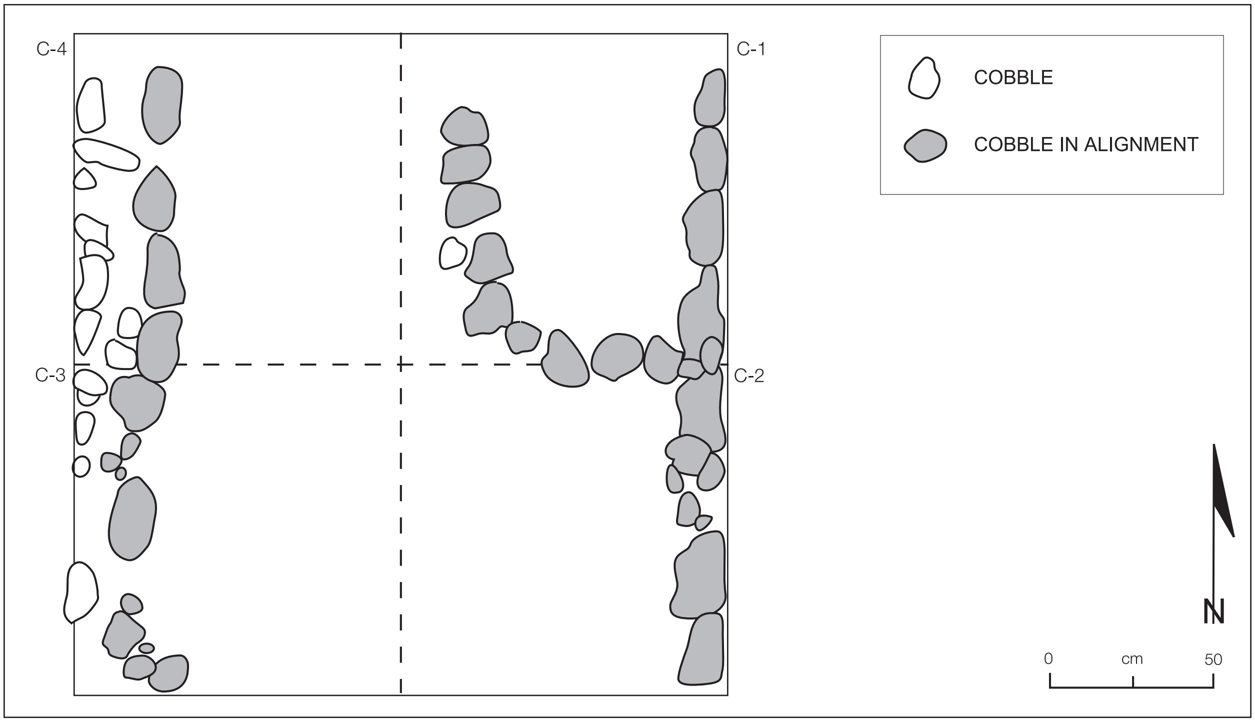


Figure 12.20. Postexcavation plan of EU-C in Feature 3, LA 105708. Shaded rocks are in alignments.

Figure 12.21. EU-C in Feature 9, LA 105708, looking east.

alignments were found in EU-C, Figure 12.20 shows that a short, curved alignment was recorded in Grid C-1 and connected to the east cobble alignment. While the east and west alignments were built by laying cobbles end-to-end, the short, curved alignment was less formal in construction, suggesting that subdivision of space within plots was sometimes more expedient than the division of plots represented by the two parallel alignments.

Summary of Findings

Though LA 105708 was a large site that contained numerous farming features, two gravel-mulched fields were the only features within project limits considered capable of providing more information than was available from surface examination alone. Feature 3 was on a small lower terrace below the main section of site. In this position, Feature 3 was badly eroded near the terrace edge and more heavily covered with eolian and colluvial sediments. This feature may also not have been contiguous, as surface indications suggested. No good evidence of farming was found in EU-E, which was placed near the center of the field as defined from the surface. Thus, surface indications suggesting that Feature 3 was contiguous across the front of this lower terrace may have been incorrect, and more than one small gravel-mulched plot could have been present in this area. However, excavation of EU-E did suggest that the trail (LA 118549) was a prehistoric feature.

Evidence of prehistoric farming was found in the other two excavation units used to investigate Feature 3. The west boundary alignment was defined in both cases, and interior space was subdivided into smaller plots with an east-west orientation. In neither case was a more intricate pattern revealed by excavation than was originally visible from the surface. Thus, excavation in this feature showed that some of our conclusions concerning its structure that were made on the basis of surface information alone were correct, while others were wrong.

Feature 9 was the other farming plot investigated at this site. Deterioration along the west edge of this feature affected our ability to fully interpret our findings. While it is possible that the west boundary alignment was as defined from surface indications in this area, there were hints that the feature may have extended farther west toward the edge of the terrace. This would mean that at least some sections of the west boundary alignment were actually interior subdividing alignments, but this was not clearly demonstrated. The pile of cobbles placed on top of a section of gravel-mulched field in EU-A was similarly difficult to interpret. Since there is evidence of sequential feature construction elsewhere on the site, these cobbles could represent a material stockpile placed on an abandoned plot in preparation for further construction. However, this rock pile was also similar to others defined by this study that seem to have served as small field shrines, so it could instead represent a later ritual feature.

Preservation was not especially good in the areas that were investigated but still provided enough information to show that plot interiors were highly subdivided and artificially mulched. Indeed, in one case, evidence of more than one layer of gravel mulch may have been found. Since corn pollen was the only evidence of domesticated plants recovered from these features, they may have been monocropped.

Artifacts were recovered from both strata encountered within excavation units. Materials from Stratum 1 postdate the construction and probably use of the farming features at this site. Artifacts found in Stratum 2 were present on the ground surface before the farming features were built, part of the materials used to mulch the plots, or they were deposited as the features were being built and used. Cultural materials that were deposited in the first two ways would predate construction of the farming features, while those deposited in the third way would provide a temporal context for the period in which the features were built and used. The occurrence of several Biscuit B sherds found in the mulch excavated in EU-B is important and points toward construction during the Late Classic period.

Chapter 13. LA 105709

James L. Moore

LA 105709 is a large farming site on land administered by the USDI Bureau of Land Management. It occupies an irregular F-shaped area and is bounded by the main terrace edge overlooking the Ojo Caliente Valley on the west and by arroyos formed by intermittent drainages on the north, south, and southeast (Fig. 13.1). The north drainage forms an arbitrary boundary with unexamined farming features to the north that are outside project limits and were not recorded. Using a drainage for the south and southeast boundary is more problematic. Between that drainage and Forest Road 556 is an area that has been heavily damaged by historic trash disposal and subsequent cleanup. There are some indications that prehistoric farming features occurred in that area, but they have been eradicated by modern activities. If so, the south and southeast boundaries arbitrarily separate the features included in LA 105709 from those in LA 118547 to the south.

LA 105709 measures 570 m north-south by 147 m east-west and covers about 42,200 sq m (4.22 ha). Only about 4.8 percent of the site extended into the right-of-way, comprising a narrow sliver along its southwest edge. In-field pottery analysis indicated that this site was used during the Classic period.

Vegetation is moderate on the site, and plant cover is generally similar between on- and off-feature areas. Grasses were the most common plants noted. They included grama, muhly, and Indian ricegrass. Other common plants include rabbitbrush, snakeweed, prickly pear, narrowleaf yucca, sage, and cholla. Small junipers occur at the terrace edge; though only a few have spread onto the surface of the fields, they are common in and around borrow pits.

Field Procedures

Detailed mapping was restricted to the section of site that extended into the U.S. 285 right-of-way and an adjacent 25 m wide zone, extended to 60 m in one location to allow a complete feature to be mapped. This area comprises a sample of about 28 percent of the site, and all cultural features within this zone were mapped and recorded in detail. Several features were partly or wholly within project limits, including two gravel-mulched fields (Features 1 and 4), a possible temporary structure and adjacent scatter of chipped stone artifacts (Feature 3), a hearth (Feature 8), and a collection of several farming features which may or may not represent a single entity (Feature 6). In addition, a small portion of a shrine (Feature 9) extends into the right-of-way. All cultural materials noted on the surface within the highway right-of-way were collected for analysis, as were artifacts encountered in excavation units. These materials are summarized later in this chapter. Artifacts noted elsewhere on the surface of features in the detailed mapping zone were inventoried by feature and are summarized in those discussions.

Features

Fourteen features were at least partly mapped and described (Fig. 13.1). Nine additional terrace-edge borrow pits are shown on the site plan, but since they were outside the detailed examination zone they were not described or assigned feature numbers. Field limits were often difficult to accurately define in the mapped area, though outside that zone, some fields are much better delineated. A combination of colluvial and eolian processes have caused soil to build up against alignments that face the terrace interior, obscuring those edges in many places. Eolian deposits also cover much of the surface of the fields, especially where they are anchored by vegetation. This made it difficult to discern many alignments and to define the full extent of others. Livestock grazing has also caused damage, displacing elements in cobble alignments and blurring feature borders. Along the terrace edge this seems to have exacerbated damage caused by erosion. Other

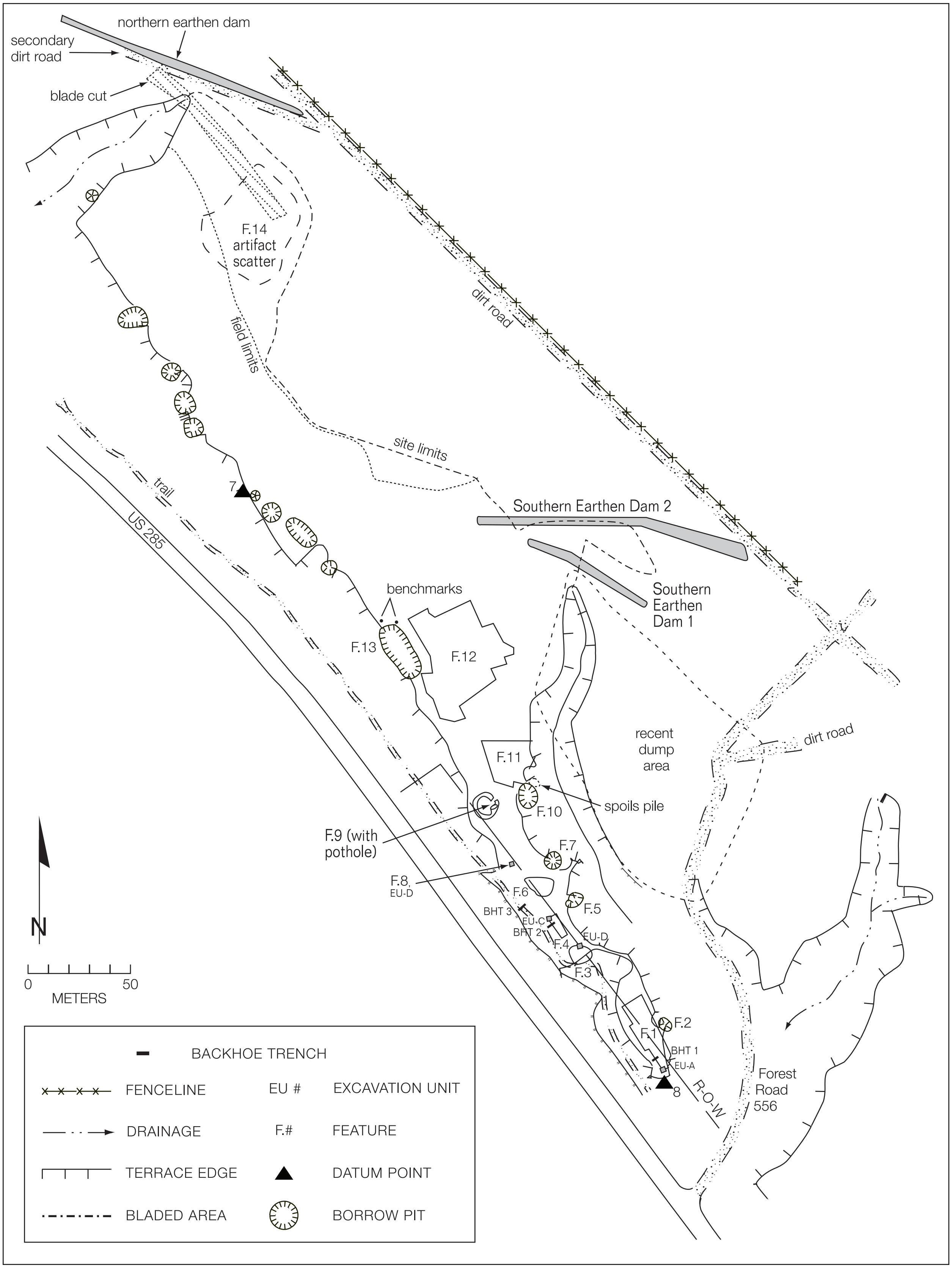


Figure 13.1. Plan of LA 105709.

surface disturbances include a trail (LA 118549), which runs along the west edge of the site next to U.S. 285 and enters site limits near Feature 3. Modern damage includes two earth dams built to control runoff through the south drainage. As mentioned earlier, much of the area between these dams and Forest Road 556 was damaged when it was used as a dump and subsequently cleaned up. A blade cut has damaged the north part of the site. The cut was probably made during construction of a third earth dam just outside the north site boundary.

Feature 1

Feature 1 is a medium-sized rectangular gravel-mulched plot that measures 40 by 14 m and covers about 444 sq m (Fig. 13.2). Since part of this feature extended into project limits and the rest was in the detailed mapping zone, it was completely mapped. One excavation unit and a backhoe trench were used to examine Feature 1. The southeast corner of this feature is at the edge of the terrace and has partly eroded down the terrace slope. Elements in boundary alignments have been displaced by livestock, so the outer edge of the feature was difficult to define in places. About 40–50 percent of the surface of this feature is obscured by eolian sediments that have infiltrated the gravel mulch and are anchored by vegetation.

Boundary and interior subdividing alignments are a single element high and wide, and they were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 10–25 cm long; the small boulders that occur are 25–30 cm long. Elements in boundary alignments were mostly set end-to-end on their broadest surfaces, though some side-by-side placement also occurs. Some upright elements occur, but they are much less common than those set on their broadest surfaces. Surface indications suggest that the interior of the feature is subdivided into multiple compartments, but since most of the interior subdividing alignments are obscured by eolian sediments, only a few compartments were identifiable from the surface. Many of these compartments appear to have been quite small, measuring less than 1 m per side.

The mulch is mostly composed of unsorted pea gravels and gravels, though small cobbles up to 15 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Since the alignments are only one element high, the layer of mulch is probably 7–10 cm thick. Feature 1 was distinctly mounded 5–10 cm higher than the adjacent terrace surface. No variation in surface gravel or vegetational densities were noted between on- and off-feature areas.

Feature 2

Feature 2 is an oval terrace-edge borrow pit measuring 6.8 by 4.9 m, with a maximum depth of 0.9 m (Fig. 13.2). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is near Feature 1 and was probably a source of some of the materials used to build that gravel-mulched field. Feature 2 is cut into a fairly steep slope and may have been enlarged a bit by erosion. No artifacts were found in association with this feature.

Feature 3

Feature 3 was the foundation of a possible temporary structure that measured 2.6 by 2.1 m (Fig. 13.3). Surface remains of this feature consisted of a rectangular alignment of cobbles (Fig. 13.4), with a chipping area to the southwest. This feature was within project limits and was completely excavated. The results of that excavation are discussed in detail in a later section of this chapter.

Feature 4

Feature 4 is a small rectangular gravel-mulched plot that measures 13 by 4 m and covers roughly 47 sq m (Fig. 13.3). Since most of this feature extended into project limits, and the rest was in the detailed mapping zone, it was completely mapped. One excavation unit was used to examine Feature 4. Many elements in boundary alignments have been displaced by erosion and livestock, and most interior subdividing alignments are covered by eolian sediments, so only the general outline of the feature was discernible on the surface. About 50–60 percent of the surface of this feature is obscured by eolian sediments that have

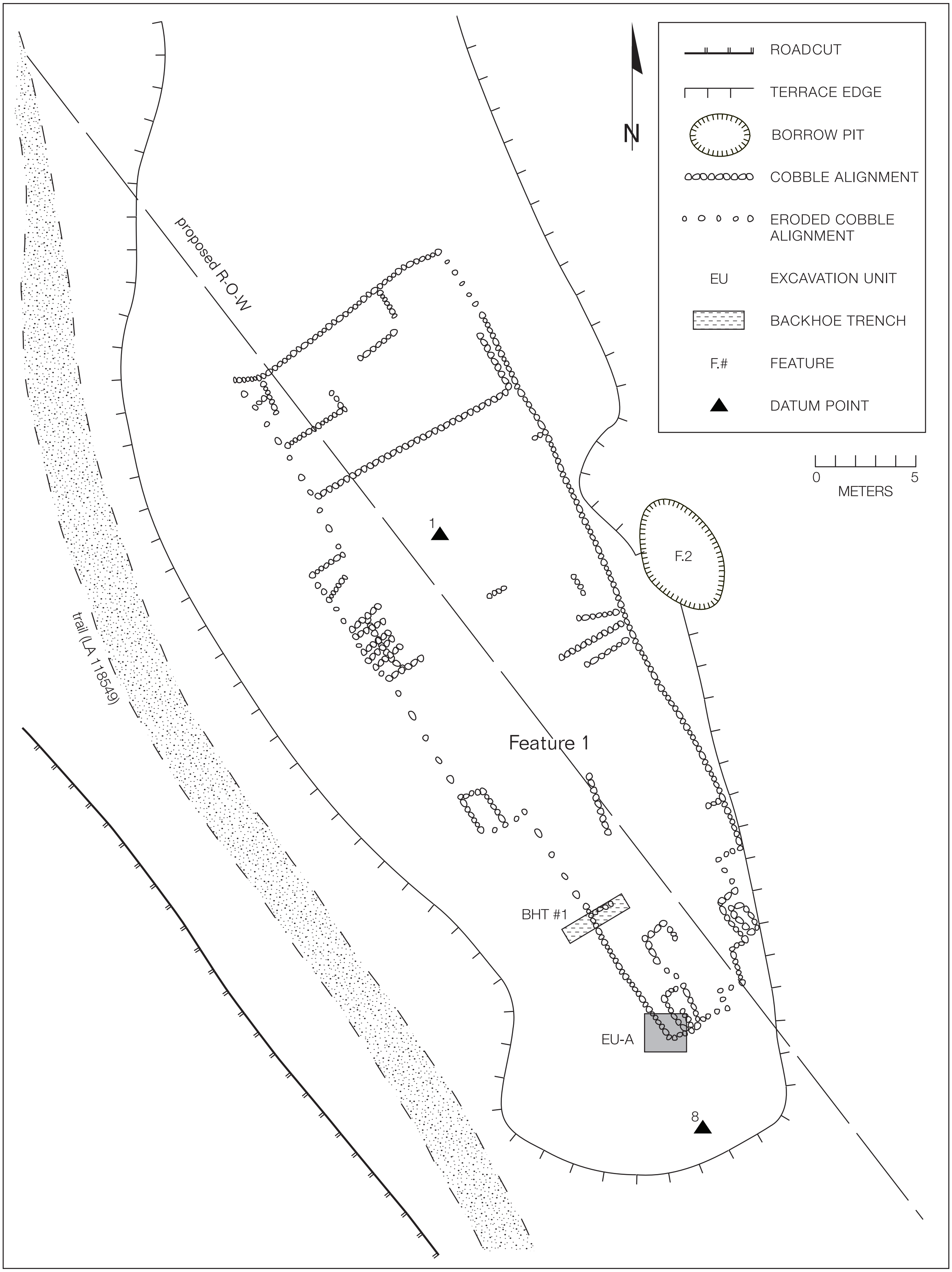


Figure 13.2. Features 1 and 2, LA 105709.

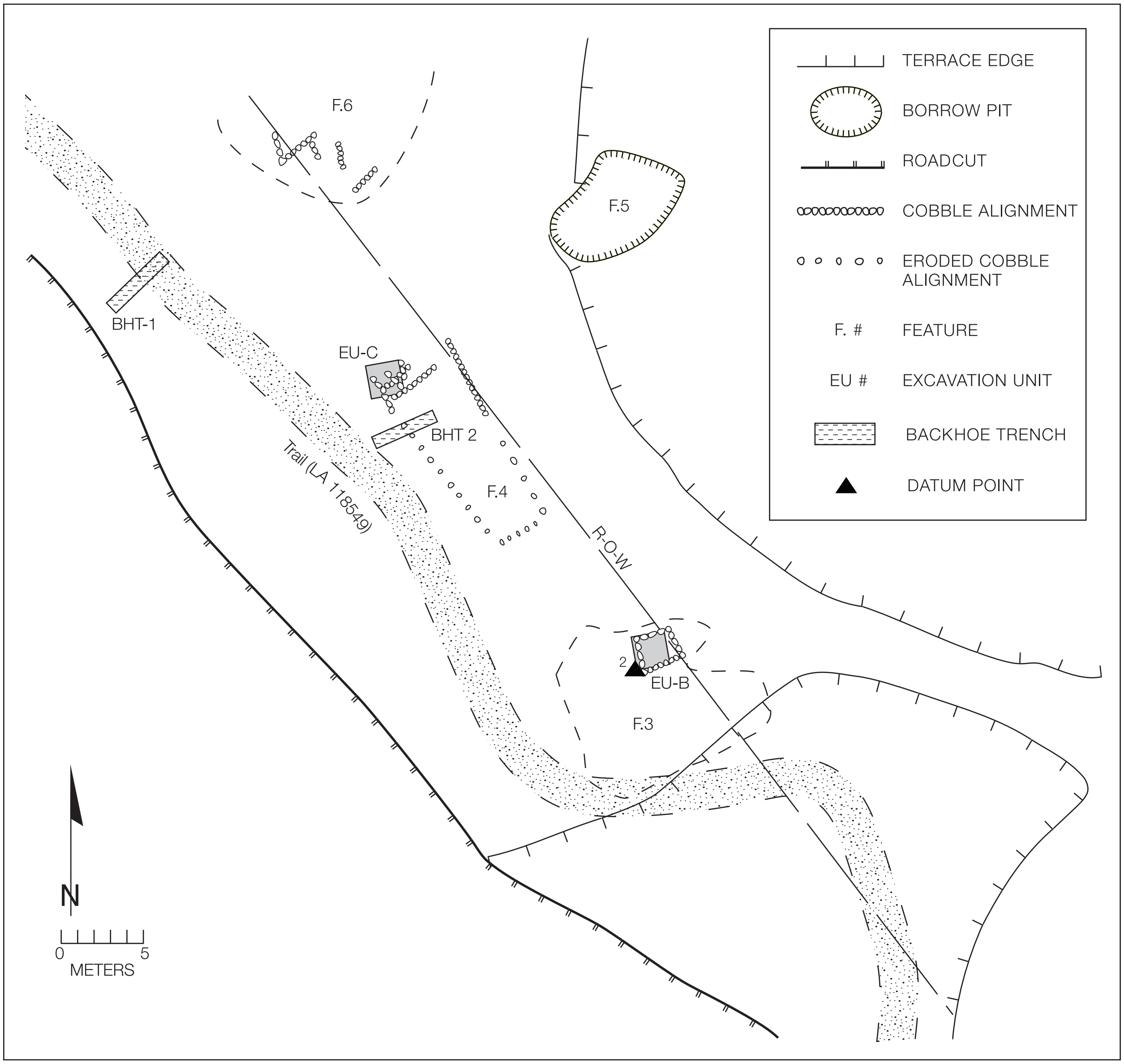


Figure 13.3. Features 3, 4, and 5, LA 105709.

Figure 13.4. Feature 3, a probable structure foundation at LA 105709, before excavation.

infiltrated the gravel mulch and are anchored by vegetation.

Boundary and interior subdividing alignments all appear to be a single element high and wide, and they were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 14–25 cm long; the small boulders that occur are 25–30 cm long. Building elements were mostly placed end-to-end on their broadest surfaces, though there was some sideways placement, and occasional elements were set upright. The northwest part of this feature appears to have been subdivided into multiple small cells. Since the rest of the feature was concealed beneath a mantle of eolian sediments, we can only suggest that this building style encompassed the entire field.

The mulch is mostly composed of unsorted pea gravels and gravels, though small cobbles up to 12 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Most of the gravel used to mulch this feature was less than 3 cm in diameter. Since the alignments are only one element high, the layer of mulch is probably 7–10 cm thick. Feature 1 was distinctly mounded 5–7 cm higher than the adjacent terrace surface. Grasses were more common, and snakeweed was much less common on the feature surface than on the adjacent terrace. Gravel densities were also distinctly higher on the feature than on the terrace surface.

Feature 5

Feature 5 is a large kidney-shaped terrace-edge borrow pit measuring 9 by 7 m, with a maximum depth of 0.2 m (Fig. 13.3). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is near Feature 4 and was probably the source of some of the materials used to build that gravel-mulched field. This pit was dug near the top of a steep slope, and erosion has partly blurred its downslope outline. In addition, sediments have partly filled it to an undetermined depth. No artifacts were found in association with this feature.

Feature 6

Several alignments and two rock piles were grouped together as Feature 6 (Fig. 13.5), but it was uncertain whether they represented a single coherent entity or several small unassociated farming features. Since this feature was in the detailed examination zone, it was completely mapped. Only about 10 percent of this feature extended into project limits, and it was not excavated because that part of the feature did not appear likely to yield any information. Much of this feature may have been covered by eolian sediments, though it is more likely that construction of this field was simply never completed, making it seem more obscured than it actually was.

Two factors suggest that this feature represents an uncompleted field. First, the surface of the feature is not visibly higher than the adjacent terrace surface, and there is no evidence of gravel mulch, even in areas that contain cobble alignments. While there was a fairly high concentration of surface gravels in the north part of the feature, that area is next to the terrace edge, and the gravels more likely represent the natural eroded terrace surface. Second, the two rock piles probably represent materials stockpiled in preparation for construction; the central rock pile (Fig. 13.5) contains six or more cobbles that are 10 to 25 cm long, while the northwest rock pile contains seven stones that are 12 to 25 cm long. Thus, it is possible that this feature was abandoned before it was completed or was scheduled for expansion when use of the site was discontinued.

Where alignments are visible, they are constructed of locally obtained cobbles that are mostly 12–25 cm long. Most elements were set end-to-end and on their broadest surfaces. No variation between on- and off-feature vegetative densities were noted.

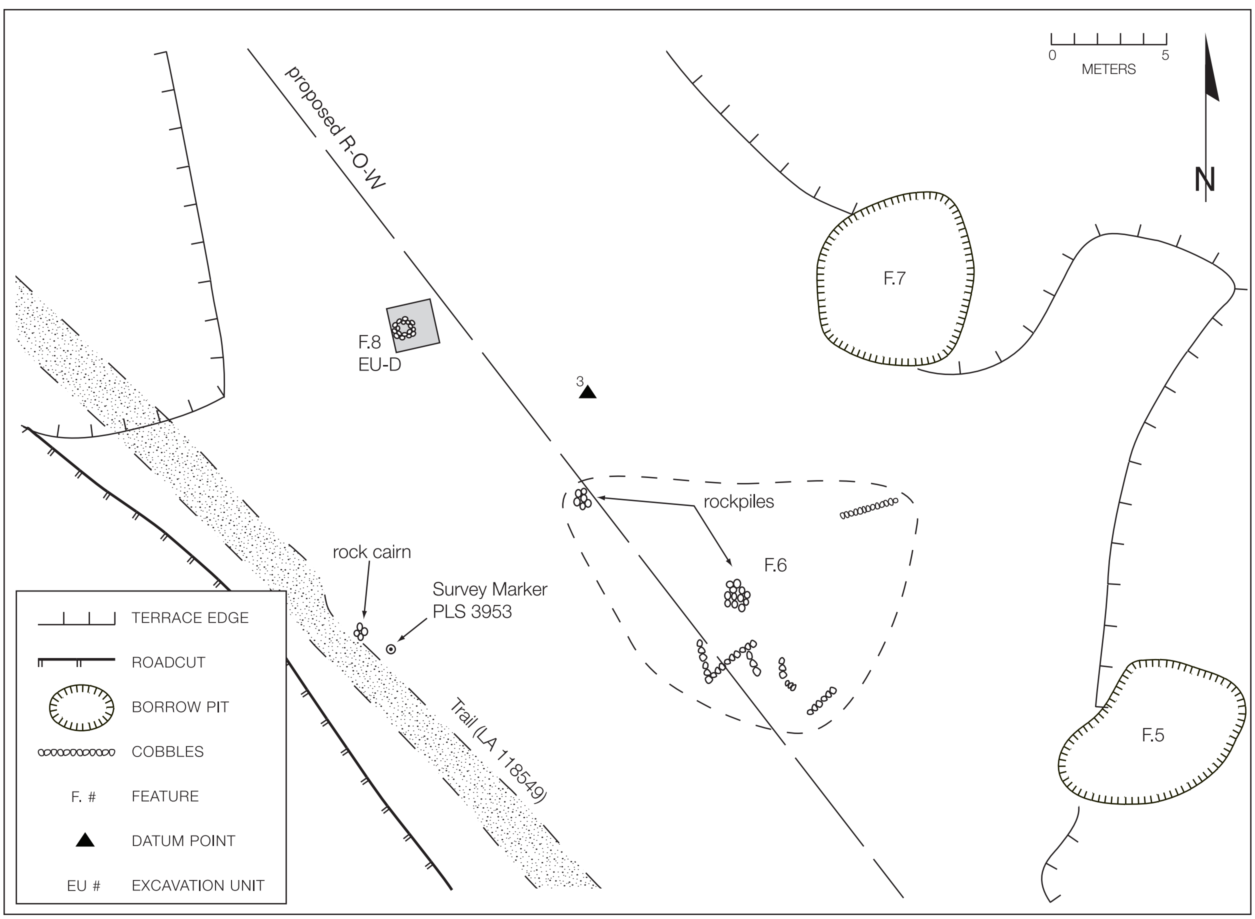


Figure 13.5. Features 6, 7, and 8, LA 105709.

Feature 7

Feature 7 is an oval terrace-edge borrow pit measuring 8.5 by 7 m, with a maximum depth of 0.4 m (Fig. 13.5). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is near Features 4 and 6, and it may be a source of some of the materials used to build those gravel-mulched fields. Feature 7 was dug near the top of a steep slope, and erosion has partly blurred its downslope outline. In addition, sediments have filled it to an undetermined depth. Though associated cultural materials were not inventoried, they included quartzite core flakes and angular debris and gray rhyolite core flakes.

Feature 8

Feature 8 was a small hearth that measured 0.78 by 0.55 m and was located northwest of Feature 6 (Fig. 13.5). Surface indications suggested that this hearth was at least partly cobble-lined, but several elements had become disarticulated (Fig. 13.6). Since this feature was within project limits, it was excavated and is more fully described later.

Feature 9

Feature 9 is a nearly round, ring-shaped shrine, similar to a type often referred to as a world-quarter shrine. The ring measures 14.4 by 13.9 m and is 0.20–0.30 m higher than the adjacent terrace surface (Figs. 13.7 and 13.8). This feature extended slightly into the right-of-way but was 90 percent outside project limits. Because of the sensitive nature of this feature, the section within the right-of-way was not excavated, and our examination was limited to surface documentation. The wall of the enclosure consisted of piled cobbles that had been infiltrated by eolian and colluvial sediments. The elements used to build the feature were obtained locally and consist of waterworn cobbles and small boulders 10–40 cm long. Some gravels were noted on the surface of the mound, suggesting that they might have been included with the cobbles during construction. A 1.4 m wide break in the enclosing mound on the east side probably represents an intentional opening (Fig. 13.9). Most cobbles in the mound were placed with their long axes running parallel with the mound. However, along the south edge of the opening, several cobbles were set with

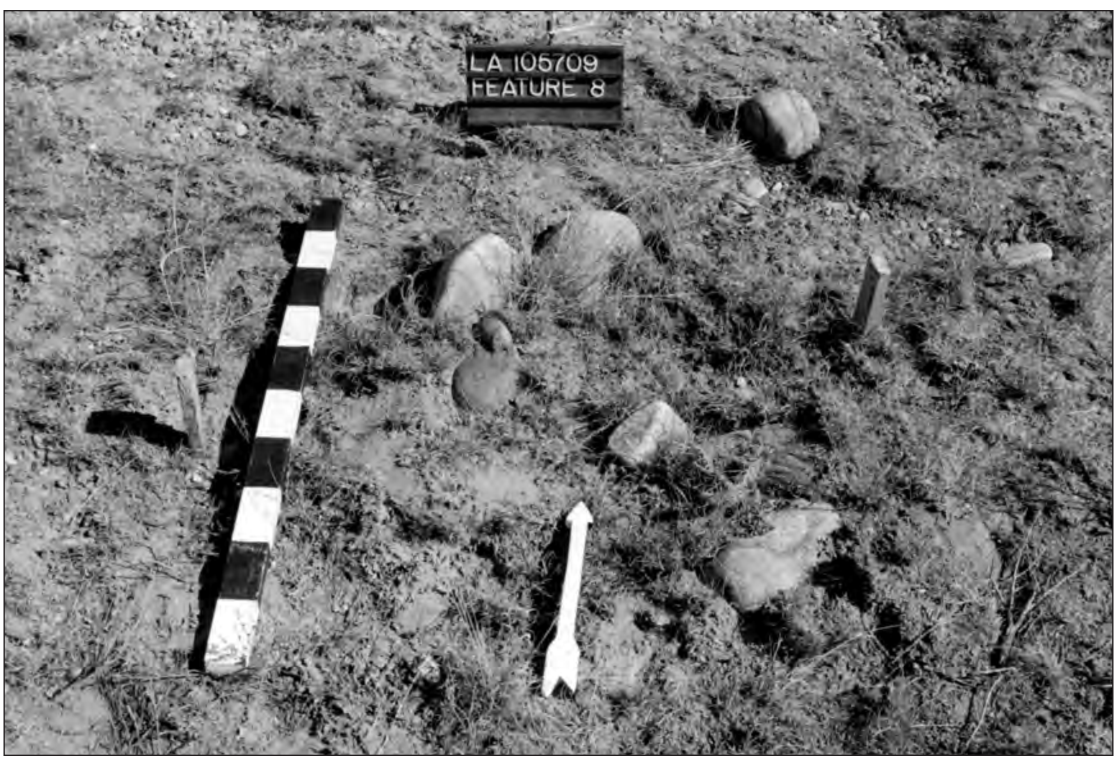


Figure 13.6. Feature 8, a hearth at LA 105709, before excavation.

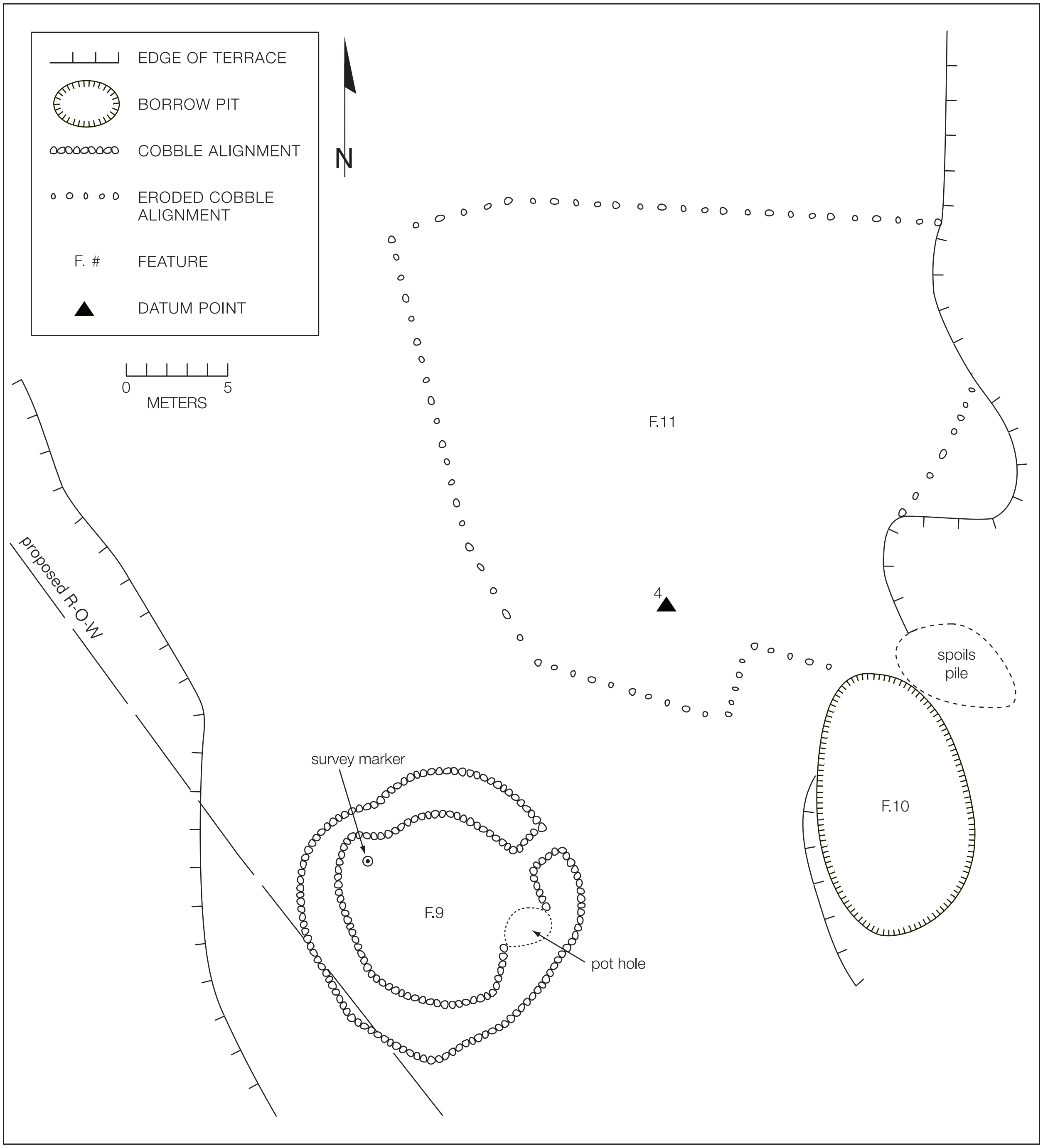


Figure 13.7. Features 9, 10, and 11, LA 105709.

Figure 13.8. Feature 9, a cobble ring shrine at LA 105709.

Figure 13.9. Opening in the enclosing mound of Feature 9, a cobble ring shrine at LA 105709.

their long axes running perpendicular to the mound and were apparently used to line the entrance.

There is some deterioration along the west side of the mound and in its northwest quadrant, which is probably due to erosion and, perhaps, livestock. Cobbles appear to be more scattered in those areas, and the mound is not as high as it is elsewhere in the feature. In addition to this damage, there is a probable pot hole in the southeast quadrant of the shrine measuring 1.9 m northeast-southwest by 1.5 m northwest-southeast. The pothole is 10–15 cm deep and was probably abandoned because no cultural materials were present.

The width of the mound is variable, measuring 2.9 m on the north, 2.9 m on the east, 1.8 m on the south, and 2.3 m on the west. The variation in width is most likely the result of a partial collapse of the enclosure due to erosion and, perhaps, grazing livestock. Thus, the wall of the shrine was probably higher originally. Artifacts inventoried inside the shrine included three pieces of gray rhyolite debitage, two andesite core flakes, an obsidian core flake, and eight fragments of clear glass. Outside the shrine, we found a Biscuit B bowl sherd, a Biscuit A bowl sherd, an indeterminate biscuit ware sherd, three gray rhyolite cores, and a metal condiment lid.

Feature 10

Feature 10 is a large oval terrace-edge borrow pit measuring 10.5 by 9.5 m, with a maximum depth of 0.75 m (Fig. 13.7). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is near Feature 11 and may be a source of some of the materials used to build that gravel-mulched field. It is near the top of a steep slope, and erosion has partly blurred its downslope outline. In addition, sediments have filled the pit to an undetermined depth. A spoils pile or material stockpile is adjacent to the northeast edge of the borrow pit (Fig. 13.7); it measures 7 m east-west by 5 m north-south and probably contains rejected materials. No associated artifacts were noted.

Feature 11

Feature 11 is a fairly large gravel-mulched plot that measures 27 by 25 m and covers about 484 sq m (Fig. 13.7). Since this field was mostly in the detailed mapping zone, it was completely mapped. The northeast and southeast edges of this feature are at the edge of the terrace top and have partly eroded downslope. Only the north boundary alignment was readily discernible; elements in other alignments were displaced by erosion or livestock, or had been mostly covered by eolian sediments. Thus, the edges of this feature were difficult to define.

Visible boundary and interior subdividing alignments are a single element high and wide and were built with locally obtained cobbles and small boulders. Cobbles predominate in all visible alignments, and most are 10–25 cm long. Elements were mostly placed end-to-end and on their broadest surfaces. Since the interior of this field is so heavily covered by sediments, we were unable to determine how or if it is subdivided. Other than a few alignments, the best evidence for the existence of this feature was a heavier concentration of gravels than tended to occur naturally on the terrace surface. Vegetational density is not visibly different from adjacent ungrazed areas that do not contain farming features.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 12 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Since the alignments are one element high, the mulch is probably 10–15 cm thick.

Feature 12

Feature 12 is a large irregularly shaped gravel-mulched plot that measures 59 by 51 m and covers 1,890 sq m (Fig. 13.10). Since this feature was mostly within the detailed examination zone it was completely mapped. There has been a considerable amount of eolian sedimentation on this field, augmented by erosion and displacement of elements in alignments by livestock. Thus, the edges of this feature are very indistinct in places. About 50–60 percent of the surface of this feature is obscured by eolian sediments that have infiltrated the gravel mulch and are anchored by vegetation.

Boundary and interior subdividing alignments are a single element high and wide and

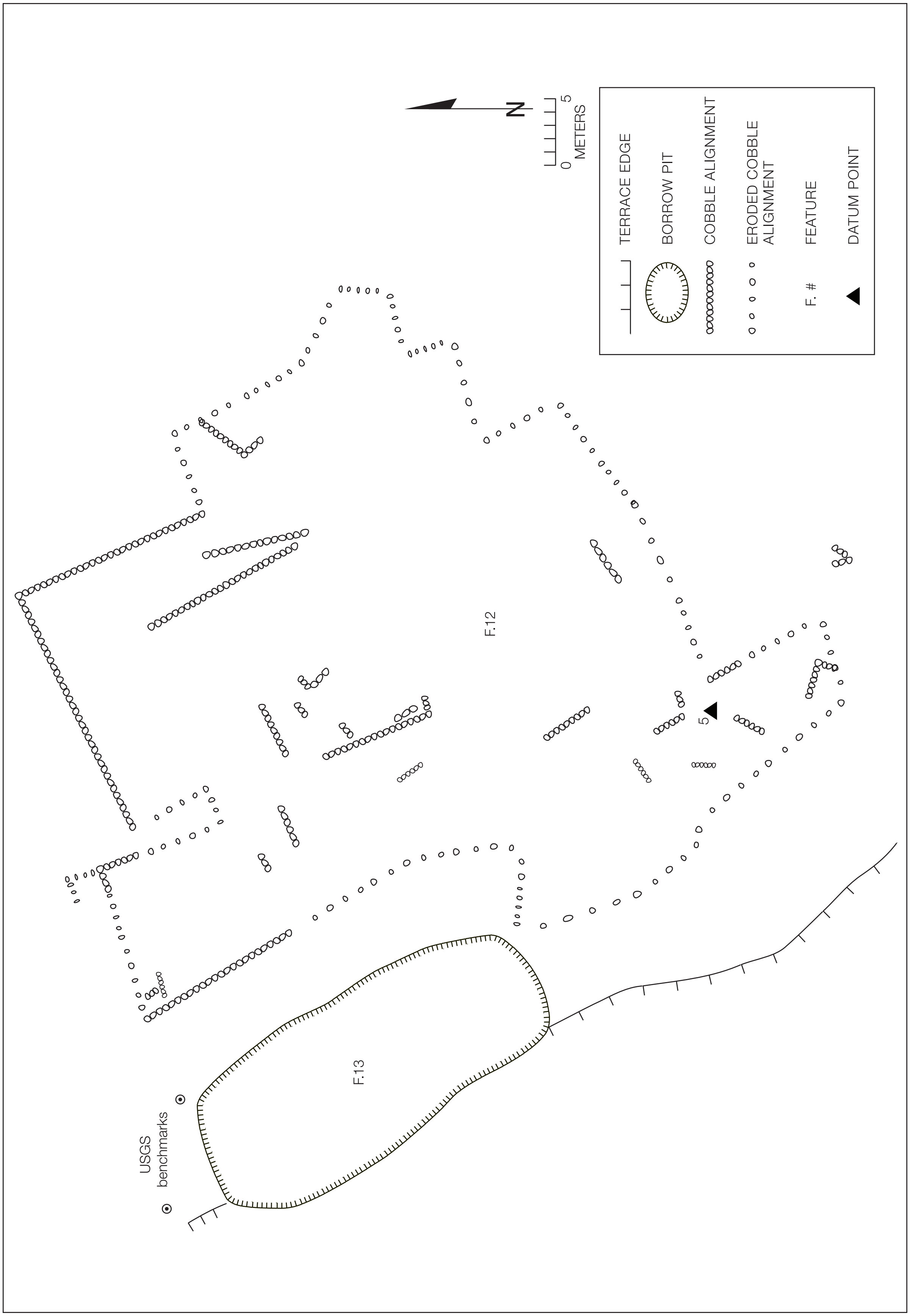


Figure 13.10. Features 12 and 13, LA 105709.

were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 10–25 cm long. A few small boulders were also used and are 25–40 cm long. Elements were mostly placed end-to-end, though some side-by-side placement also occurs. Most elements were set on their broadest surfaces, but a few were set upright. The edges of this feature were mostly defined by major changes in surface gravel densities. However, enough alignment segments were visible that we could fairly accurately define the shape and extent of the field. A V-shaped wall on the south side of Feature 12 could be the remains of an eroded grid, but it could also be a marker of some sort, since it points at the shrine (Feature 9), which is 30–40 m away.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 10 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Since the alignments are one element high, the mulch is probably 8–12 cm thick. This field is mounded 10–15 cm above the terrace surface; no real differences in vegetative density were noted between on- and off-feature areas.

Feature 13

Feature 13 is a large oval terrace-edge borrow pit measuring 17 by 11 m, with a maximum depth of 0.86 m (Fig. 13.10). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is near Feature 12 and may be a source of some of the materials used to build that gravel-mulched field. It was dug near the top of a steep slope, and erosion has partly blurred its downslope outline. In addition, sediments have filled the pit to an undetermined depth.

Feature 14

Feature 14 is a large scatter of chipped stone artifacts and pottery that is directly adjacent to the farming features on the terrace interior at the north end of the site (Fig. 13.1). This scatter measures 50 by 50 m and covers approximately 2,162 sq m. Although no evidence of thermal or structural features was seen, Feature 14 probably served as a temporary living area for farmers attending fields. Artifacts from this feature were included in the general site inventory and so cannot be examined separately. However, we did note that most of the pottery observed at LA 105709 occurred in this feature. Part of Feature 14 was damaged by a blade cut at the north end of the site, which probably occurred during construction of an earth dam.

Surface Information

Another elongated series of farming features follows the edge of the terrace that borders the east edge of the Ojo Caliente Valley. LA 105709 is nearly contiguous with LA 118547 on the south, and had it not been for disturbances caused by the use and cleanup of a historic dump (Fig. 13.1), there may have been no real break between the two collections of farming features. The north boundary seemed a bit more secure, and the features associated with this site extend nearly as far north as Hilltop Pueblo (LA 66288). At that point there seems to be a break in the distribution of fields. However, because reconnaissance was limited in that area, this is uncertain. No evidence of multiple construction episodes was noted in the part of LA 105709 that was examined in detail, and no terrace-interior borrow pits were seen. While all of the features at this site were probably not built at the same time, there was no good evidence for the sequential construction seen at several other sites.

An apparent residential area at the north end of the site consists of a scatter of chipped stone and ceramic artifacts, but no thermal or structural features were noted. Since this feature is toward the interior of the terrace, eolian and colluvial sediments have probably covered any evidence of the latter. Occupation of this area by farmers was probably very sporadic and short term, especially considering the proximity of LA 105709 to both Hilltop Pueblo and Nute.

Two features that set LA 105709 apart from the other farming sites investigated during this study are a possible field structure and a formal shrine. As is discussed in the next section of this chapter, we remain uncertain about the actual nature and date of Feature 3, the possible field structure. There is no doubt about Feature 9, which is a Pueblo shrine that seems to have a fairly close relationship with the trail (LA 118549) that ascends to the top of the terrace near the south end of Feature 1 and descends just before Feature 9 is reached. The trail probably came to the terrace top to provide access to the shrine, and any access to the farming features was of secondary importance.

Numerous artifacts were collected from the portion of LA 105709 that extends into the highway right-of-way. Two methods were used to collect these materials. Artifacts in the chipping area southwest of Feature 3 were collected in 1 by 1 m grids in a 74 sq m area. Artifacts outside this area were collected by point provenience. The chipped stone artifacts in these assemblages are inventoried in Table 13.1. When combined, the assemblages contain 2,196 artifacts, about 70 percent in the grid assemblage and 30 percent in the point-provenienced assemblage. While rhyolite dominates both assemblages, it is more common in the grid collection assemblage (72.6 percent) than in the point-provenienced assemblage (61.0 percent). Andesite is the second most abundant material in both assemblages, but it is more abundant in the point-provenienced assemblage (35.1 percent) than in the grid-collection assemblage (20.3 percent). Massive quartz is more common in the grid-collection assemblage (4.5 percent) than in the point-provenience assemblage (1.2 percent). Cherts comprise slightly more than 1 percent of each assemblage, quartzite makes up slightly less than 1 percent of each, and other materials are rare in both.

Both assemblages are mostly composed of core-reduction debris (angular debris, core flakes, and cores), though other artifact types also occur. The point-provenienced assemblage contains one biface flake, one possible ground stone flake, and three bifaces. Identification of the ground stone flake is questionable, and it may instead be a core flake struck from a flat surface on a heavily waterworn cobble. Two biface flakes were the only other type of artifact identified in the grid collected assemblage. All three biface flakes are andesite, while two of the bifaces are obsidian, and only one is andesite. The andesite biface is complete, generalized in form, and fairly small (3.5 cm long). A second specimen is a small unidentified fragment of an obsidian biface of unknown form. The third specimen is a medial fragment of a medium-sized Polvadera obsidian projectile point.

In addition to chipped stone artifacts, some pottery was recovered from the surface of LA 105709. A Biscuit B sherd and a micaceous utility ware sherd were found in the grid-collected area, and three Biscuit A sherds, four Biscuit B sherds, and one micaceous utility ware sherd were collected by point provenience. The large propor-

Table 13.1. Chipped stone artifacts collected from grids or by point proveniencing within the highway right-of-way at LA 105709 (material type by morphology)

Collection Area	Material Type	Angular Debris	Core Flakes	Biface Flakes	Ground Stone Flakes	Cores	Bifaces
Grid collection	Chert	6	9	-	-	-	-
	Pedernal chert	1	2	-	-	-	-
	Obsidian	2	-	-	-	-	-
	Rhyolite	386	717	-	-	12	-
	Andesite	99	209	2	-	1	-
	Welded tuff	2	2	-	-	-	-
	Quartzite	2	12	-	-	2	-
	Massive quartz	43	26	-	-	-	-
Point provenience	Chert	3	2	-	-	1	-
	Pedernal chert	-	2	-	-	-	-
	Obsidian	-	-	-	-	-	2
	Rhyolite	116	265	-	1	21	-
	Andesite	64	162	1	-	4	1
	Welded tuff	1	1	-	-	-	-
	Quartzite	1	5	-	-	-	-
	Massive quartz	2	6	-	-	-	-

tion of core-reduction debris in both assemblages suggests that raw-material quarrying and initial reduction were important activities in the section of LA 105709 within the highway right-of-way. However, the occurrence of a few biface flakes and formal tools suggests that other chipped stone–related activities also occurred. These possibilities are addressed in greater detail in a later chapter. Since the artifacts in the grid-collection assemblage and most of those in the point-provenienced assemblage did not come from the surface of farming features, it is difficult to determine their relationship to the gravel-mulched fields.

Surface artifacts were inventoried on the main part of the site outside the highway right-of-way using transects spaced 2–3 m apart, and no attempt was made to record them by more specific provenience. Some observations concerning the distribution of cultural materials were made, however. Chipped stone artifacts were most common in the living area (Feature 14), on field surfaces, and at the terrace edge. The array of material types included gray rhyolite (276 core flakes, 41 angular debris, 18 cores, 1 tested cobble), andesite (151 core flakes, 28 angular debris, 3 cores), chert (27 core flakes, 1 angular debris), Pedernal chert (7 core flakes), red rhyolite (6 core flakes, 1 angular debris), quartzite (4 core flakes, 1 angular debris, 1 core), Polvadera obsidian (1 flake, 2 angular debris), and massive quartz (1 core flake). Formal chipped stone tools included a Pedernal chert side-notched arrow point, a Polvadera obsidian medium-sized corner-notched dart point, a Polvadera obsidian arrow point tip, and an obsidian biface fragment. As noted earlier, most of the sherds occurred in the living area (Feature 14). They included Biscuit A (64 bowl sherds), Biscuit B (36 bowl sherds, 2 jar sherds), unidentified biscuit ware (16 sherds), micaceous ware (1 jar, 2 unidentified), and unidentified jar sherds (5).

A large array of historic artifacts was also noted on the surface of the farming features. Glass fragments were the most common artifact type. Several colors were represented, including brown (46), clear (1), green (20), light green (33), and purple (36). Several cans and can fragments were also noted, including 6 aluminum beverage cans and 3 aluminum pull tabs, a rectangular pin hinge can lid, a rectangular key strip meat can, an aluminum pull-type top, the top of a sardine can with a rollback key strip, a quart paint can, a rectangular condiment can top, and a round bayonet-opened can. Other historic artifacts included a large dry cell battery, two bundles of bailing wire, a wooden broom or mop handle, and two fragments of desiccated leather.

Even though the historic dump area had been cleaned up, it still contained quite an array of artifacts dating to the 1960s. No attempt at inventorying all artifacts was attempted; instead, basic artifact categories were recorded. These materials include quite a bit of household trash such as condiment bottles, baby food bottles, coffee cans, beverage bottles, food cans, toothbrushes, tennis shoes, hair curlers, aerosol cans, car seat springs, and broken toys. House furnishings included ceramic toilet fragments, washtubs, bedsprings, garden hose, a barrel hoop, a section of stove pipe, a fragment of an enameled cast iron stove, a mop bail, and Euroamerican pottery. Construction materials included shingles, electric wire, decorative tin screening, milled lumber, fragments of concrete with chicken wire, and firebrick.

Results of Excavation

Four excavation units were used to examine subsurface deposits and construction techniques in Features 1, 3, 4, and 8 at LA 105709. Features 1 and 4 were the only well-preserved and definable farming plots that extended into project limits, Feature 3 was a possible structure, and Feature 8 was a probable historic hearth. Considering the variability in types of features investigated at this site, soil strata are detailed in excavation unit descriptions.

Excavation was conducted in natural strata. Because of the paucity of materials recovered during excavation, only the fill from two 1 m by 1 m grids within each excavation unit in farming plots was screened through 1/4-inch mesh hardware cloth to collect artifacts, though cultural materials noted in the other grids were also collected. Plans of rock alignments in farming features and other rocks that appeared to have been intentionally placed within each excavation unit were drawn before and after excavation. This enabled us to compare surface indications with the actual configurations of alignments and internal construction details. It also allowed us to compare detailed views of small sections of features with the more cursory examinations possible during site mapping. All construction elements were similarly mapped for surface and subsurface exposures in other features.

Feature 1

EU-A was placed at the southwest corner of Feature 1 to examine the intersection of two boundary alignments and the internal structure of this gravel-mulched plot (Fig. 13.2). In order to expose an interior subdividing alignment that was visible on the surface, excavation continued a bit to the east, outside the excavation unit proper. Stratum 1, a layer of eolian and colluvially deposited sediments, occurred on top of and outside the feature. On top of Feature 1, Stratum 1 was a 1–4 cm thick layer of brown sandy loam containing about 40 percent pea gravels. The mean thickness of this unit was 2 cm, and it was 1–4 cm thick. Stratum 1 had the same composition outside the feature as within. It was 1–15 cm thick, with an average of 5.7 cm. In this area, Stratum 1 covered a very cobbly soil that represented the original terrace surface. Colluvial movement seemed to have removed the top of the gravel-mulch layer from the feature, depositing it in a narrow downslope band, which was augmented by eolian sediments. Similar processes led to the development of Stratum 1 on the feature. Gravels from the top of the mulch became mixed with eolian sediments. Three rhyolite artifacts were recovered from Stratum 1—a core flake and two angular debris.

Stratum 2 was a very gravelly brown sandy loam. It was 6–11 cm thick and had a mean thickness of 8.3 cm. The upper 3–4 cm contained mostly pea- to medium-sized gravels (2–3 cm long). The lower 3–4 cm was also very gravelly, but the gravels were smaller. No distinct break was discernible between these layers, and it was impossible to determine whether two separate layers of mulch were present, or a layer of mulch above a naturally gravelly surface. Considering the structure of the adjacent terrace surface, however, it is likely that two layers of mulch were present. A sample taken from the mulch yielded a moderate concentration of corn pollen. No artifacts were recovered from this stratum.

Surface indications suggested that EU-A was placed over the southwest corner of Feature 1 at the intersection of two boundary alignments. A single interior subdividing alignment also seemed to be present (Fig. 13.11). However, excavation revealed a more complex situation. Three interior subdividing alignments occurred within EU-A, all running parallel to the west boundary alignment (Fig. 13.12). Figure 13.13 shows EU-A with Stratum 1 removed. The surface of the gravel-mulched field was clearly distinct from the adjacent terrace, and some cobbles in interior subdividing alignments were visible, but the alignments themselves were indistinct. With the mulch removed, the interior subdividing alignments were much clearer (Fig. 13.14).

Elements in alignments were predominantly set end-to-end and on their broadest surfaces, though some sideways placement was visible after excavation, and a few of the stones that were set sideways were also placed upright. There are several intriguing aspects to the configuration of the exposed section of Feature 1. First, the interior subdivision of this field is much more complex than is immediately apparent from the surface, though there are some hints of this complexity. Surface observations suggested that some parts of Feature 1 were intricately subdivided (Fig. 13.2). Results of excavation in EU-A indicate that the level of subdivision is even higher than was suggested by the surface appearance of areas that were not heavily covered by sediments. Though the interior subdividing alignments exposed in EU-A ran parallel to the west boundary alignment, they appeared to have been truncated by a perpendicular alignment about 1 m north of the excavation unit. Thus, rather than creating long linear rows, the interior subdividing alignments seemed to create a series of rectangular cells that were 20–30 cm wide and about 2 m long. Looking at the structure of Feature 1 from the surface, cells with this shape and directionality seem to dominate the south part of the feature, but they do not appear to make up the entire field. This suggests that Feature 1 may not have been built in one construction episode, but over time, and new extensions often took a different form.

Another question raised by excavation in EU-A was whether all of the mulch was applied at

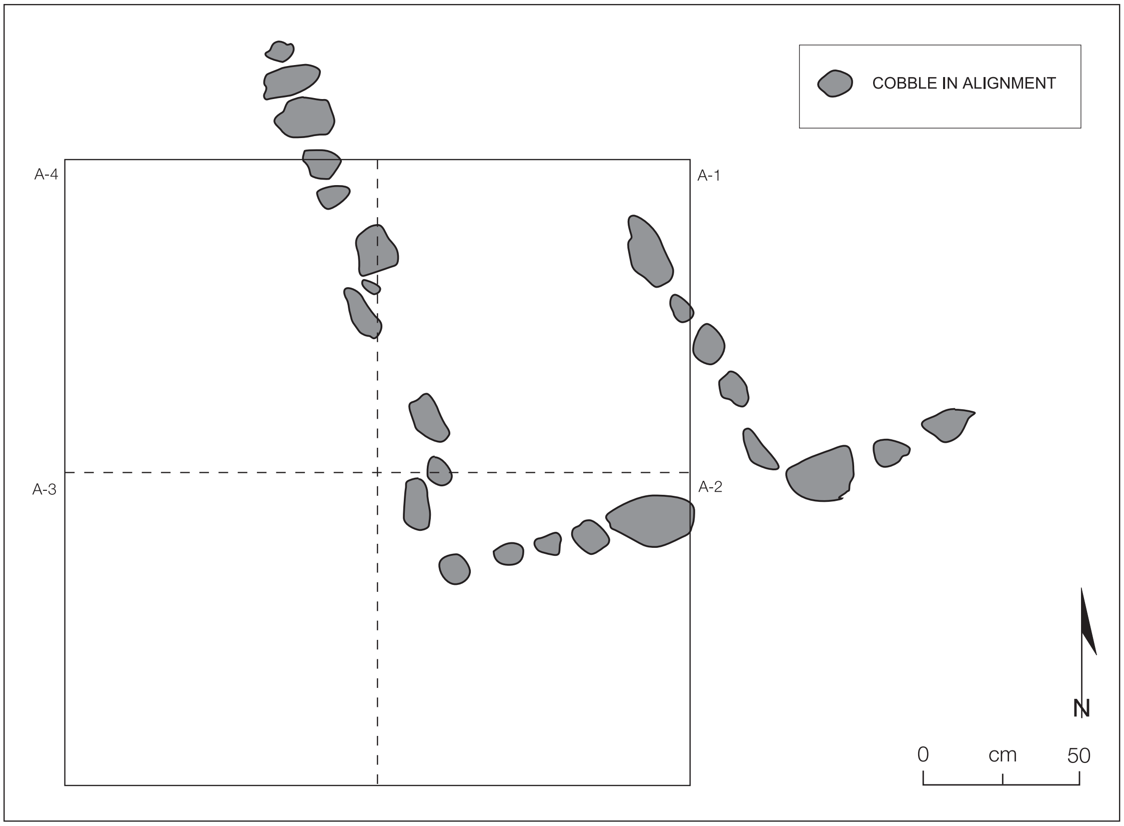


Figure 13.11. Pre-excavation plan of EU-A in Feature 1, LA 105709. Shaded rocks are in alignments.

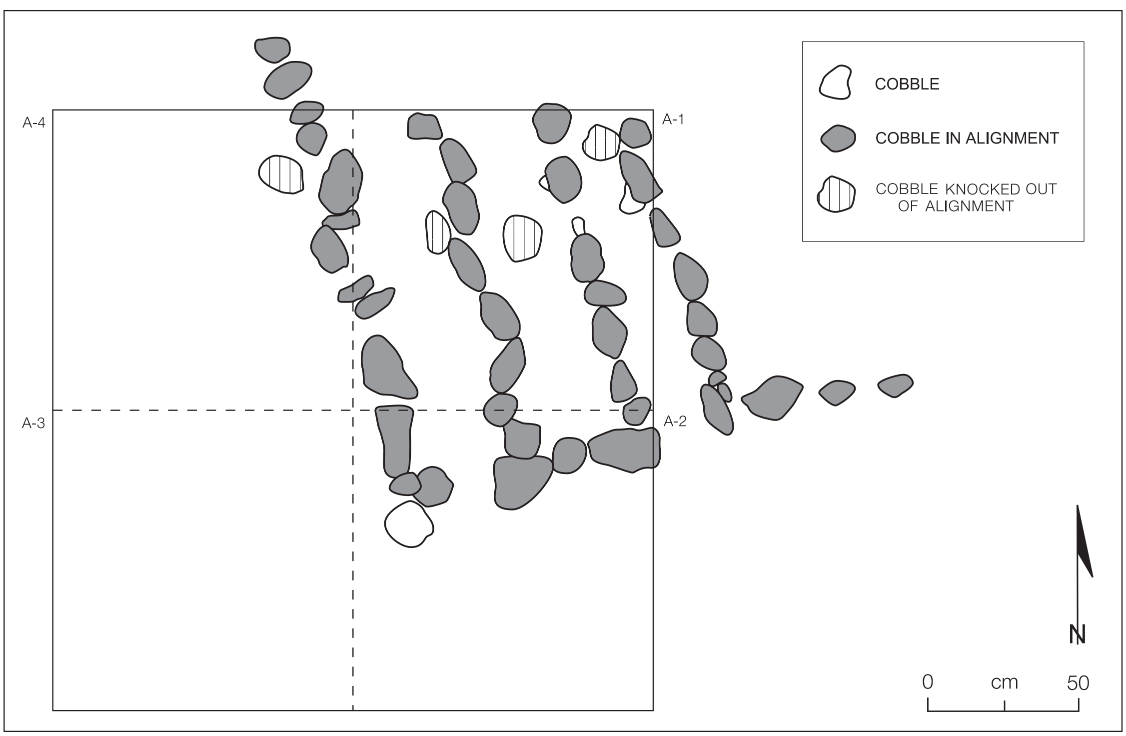


Figure 13.12. Postexcavation plan of EU-A in Feature 1, LA 105709. Shaded rocks are in alignments.

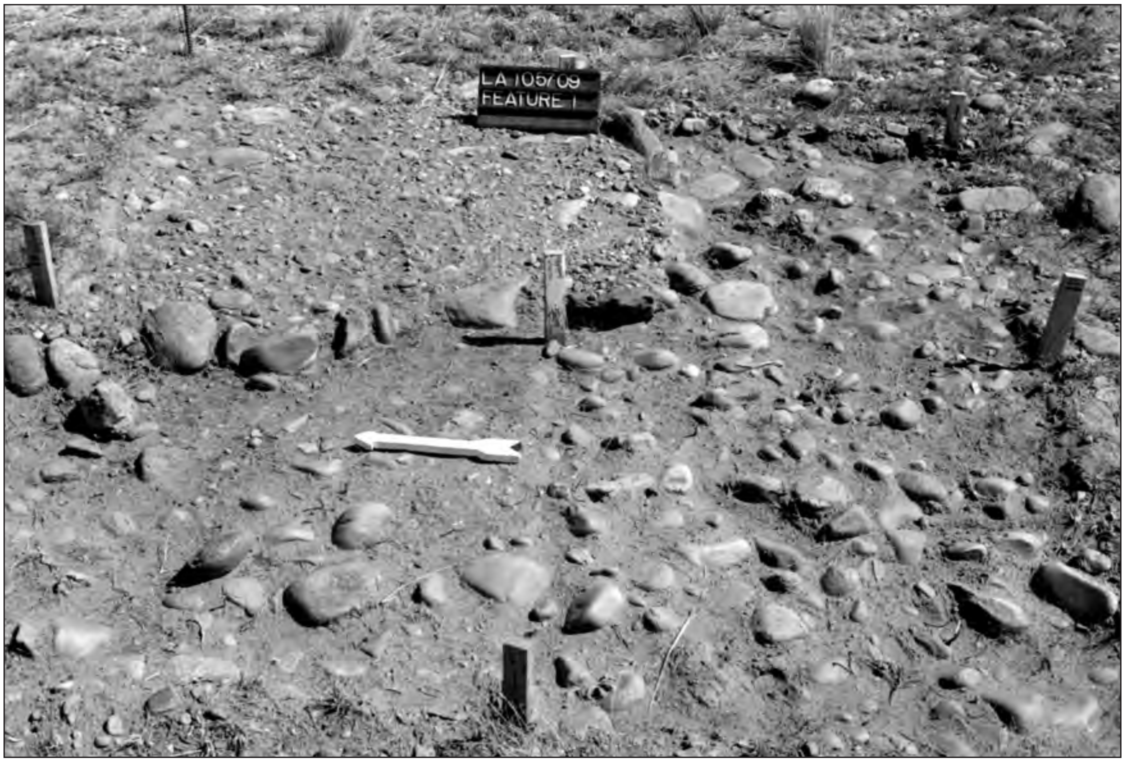


Figure 13.13. EU-A in Feature 1, LA 105709, after removal of Stratum 1.

Figure 13.14. A portion of EU-A in Feature 1, LA 105709, after removal of the gravel mulch.

once or multiple applications occurred. As seen in the description of Stratum 2 above, two layers of gravel mulch seemed visible in this soil unit, though they were not distinct enough for separate excavation. Added to this was the relative invisibility of most interior subdividing alignments after Stratum 1 was removed. Why bother with intricate subdivisions if they become virtually invisible once the field is mulched? Thus, at least two mulch applications appear to be in evidence in EU-A, and the later application mostly obscured the interior subdividing alignments.

Feature 1 was also investigated using a short (4 m long) backhoe trench to help determine the relationship between the gravel-mulched field and the terrace upon which it sits. Figure 13.15 shows a profile of the south wall of Backhoe Trench 1. Strata 1 and 2 were not separated from Stratum 3, the original terrace surface, because of general similarities in structure. Stratum 3 covers the terrace top in this area and contains numerous cobbles and gravels in a yellowish brown sandy clay loam matrix, and it was 20–25 cm thick. Stratum 4 occurred under this surface layer and was a light yellowish brown sandy clay loam containing much caliche and numerous gravels. This layer was 12–30 cm thick. Stratum 5, the deepest soil layer encountered, consisted of a light brown clay. This profile shows why most borrow pits were relatively shallow and predominantly occurred at terrace edges. The gravelly layer used as a source of materials for gravel mulching is relatively thin, only about 30–40 cm thick in this area. Stratum 3 is probably thicker near the terrace edge, since that area also contains materials that have been eroded off the top of the terrace. Since Feature 1 occurred on an eroded terrace finger, Stratum 3 is probably a bit thicker elsewhere, but in most cases it is probably no more than a 1 m thick layer of gravels and cobbles covering the terrace surface.

Feature 3

Feature 3 initially appeared to be an isolated gravel-mulched plot or small structure (Fig. 13.4). Since it occurred within project limits, it was investigated during the excavation of EU-B. A heavy concentration of chipped stone artifacts surrounded Feature 3 and extended toward the south and southwest. This and the shape of the feature suggested that it might be a prehistoric fieldhouse. EU-B was expanded toward the west to allow complete examination of the interior of the feature (Fig. 13.16). Fill in this feature consisted of a tan sandy loam that was 2–14 cm thick, with an average thickness of 5.8 cm. Removal of this soil exposed a rectangular arrangement of cobbles measuring 2.0 m east-west by 1.8 m north-south (Fig. 13.16). A stained area toward the center of the feature was at first thought to be the remains of a hearth, but further examination showed that it was a naturally burned root that was not associated with the feature. The interior surface of the feature was moderately packed dirt, and no formal improvements had been

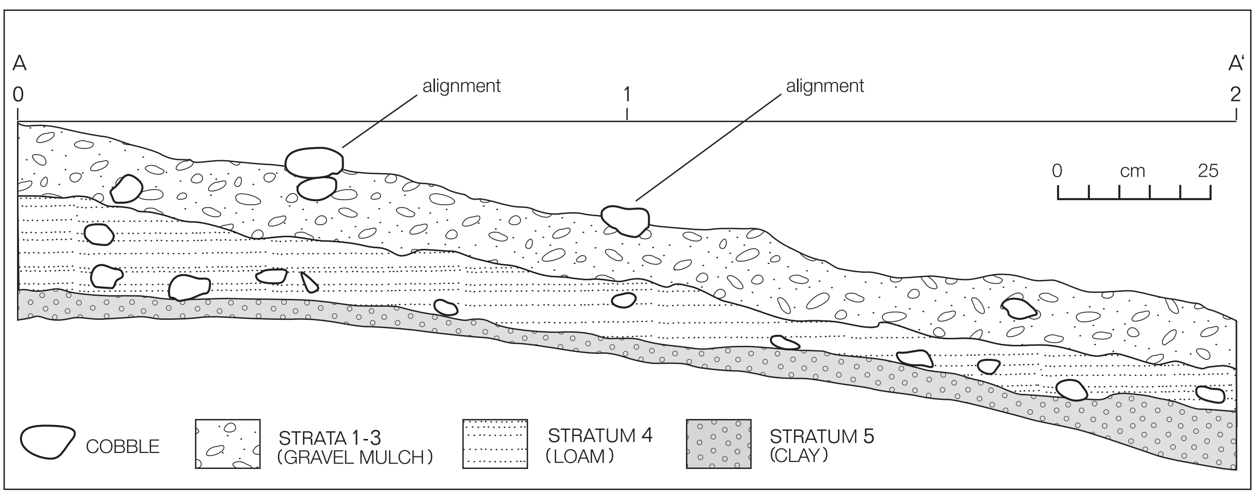


Figure 13.15. Profile of Backhoe Trench 1 in Feature 1, LA 105709.

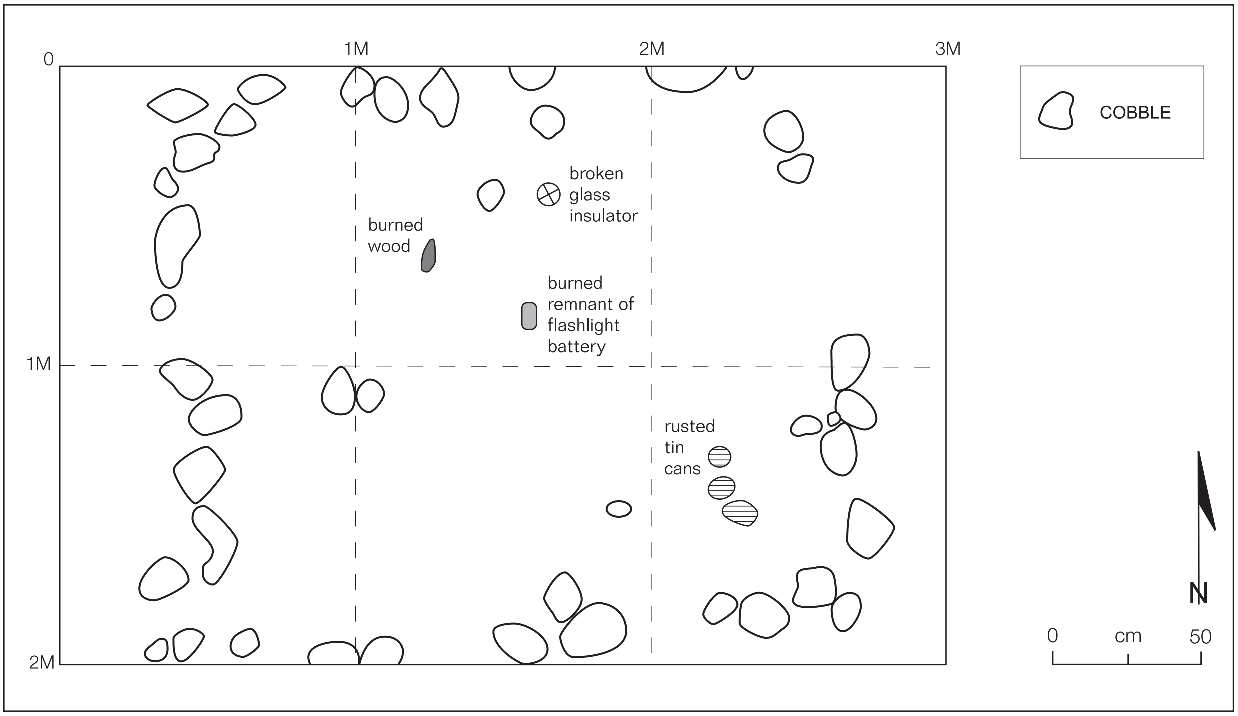


Figure 13.16. Postexcavation plan of Feature 3, LA 105709.

made. While a rhyolite core and core flake were found inside Feature 3, most cultural materials recovered were of historic age, including 18 glass fragments, 2 nails, 3 fragments of metal cans, a battery core, and a bullet. Considering the array of materials found inside the cobble alignments, Feature 3 appears to represent a temporary historic structure of some sort, possibly a tent base or similar informal shelter. Thus, it was not related to the farming features at the site.

Feature 4

EU-C was placed in the northwest section of Feature 4 to examine the internal structure of this field and search for interior subdividing alignments that surface indications suggested would exist. Stratum 1 was a moderately thick layer of pale brown sandy loam containing some pea gravels. It was 2–8 cm thick, with a mean thickness of 6.5 cm. No cultural materials were recovered from this layer of soil. Stratum 2 was a matrix of pea gravels and small to large gravels that had been infiltrated by a pale brown sandy loam. Numerous cobbles up to 15 cm long were floating in this matrix and did not represent construction elements. The gravel mulch was 3–16 cm thick, with a mean thickness of 9 cm. A sample taken from the mulch yielded a high corn pollen concentration. Artifacts recovered from the layer of mulch included a rhyolite core, a piece of rhyolite angular debris, and 26 Biscuit B sherds. Excavation ended at the top of Stratum 3, a very dark grayish brown clay loam containing numerous cobbles.

The sherds recovered from EU-C were found in a unique subfeature. The top of a small boulder was evident in the northwest corner of Grid C-2 before excavation began (Figs. 13.17 and 13.18). Since the boulder did not seem to be part of an interior subdividing alignment, it was removed as part of Stratum 2 fill. The sherds were under the boulder, and when reconstructed proved to be three ceramic tools made from fragments of the same Biscuit B bowl (see Chapter 19). All three tools showed evidence of heavy use as digging implements and were sitting on the original terrace surface with the boulder intentionally placed on top of them. These tools were deposited when the gravel-mulched field was being built and probably were not cached for future use since they were at the bottom of the

Figure 13.17. Boulder (center of photo) in EU-C before excavation of Feature 4, LA 105709. (Signboard has incorrect feature designation.)

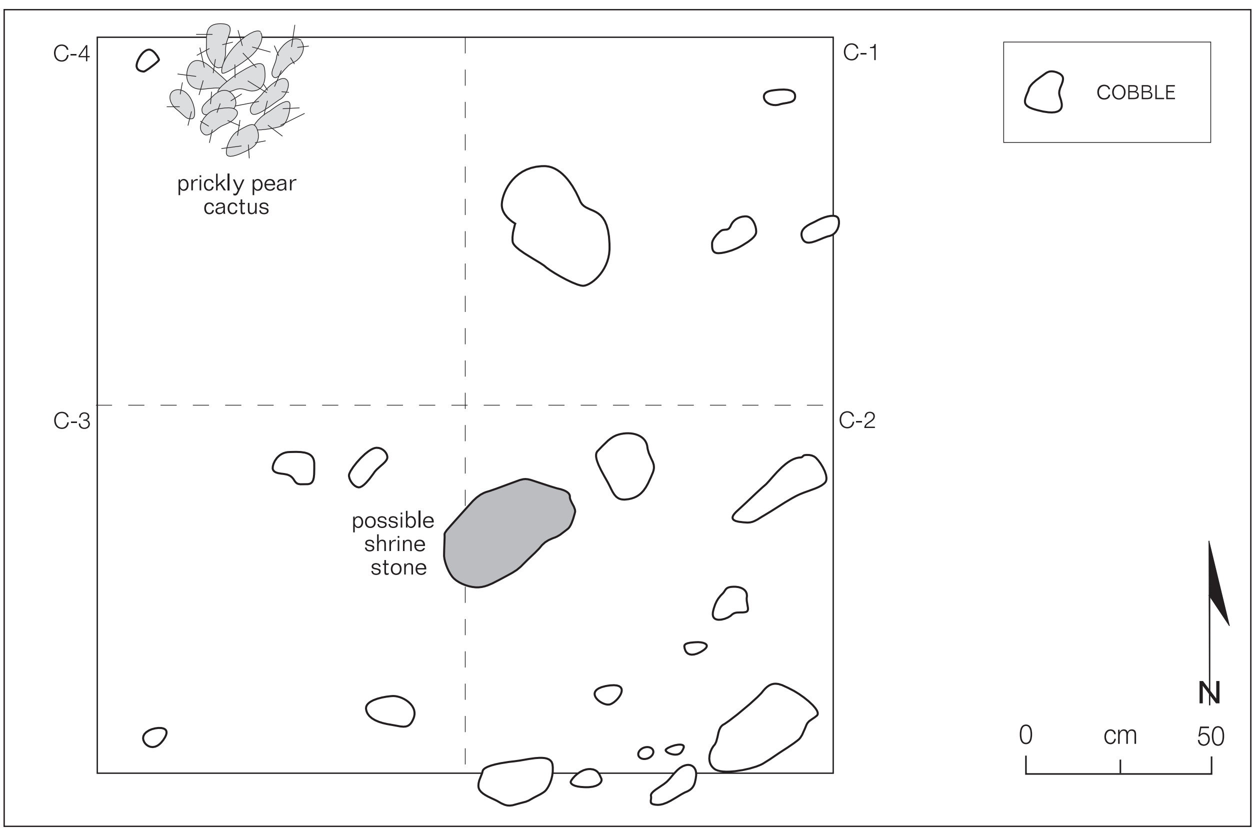


Figure 13.18. Pre-excavation plan of EU-C in Feature 4, LA 105709. The possible shrine stone is shaded.

mulch and under a small boulder, a location that could hardly have been expected to leave them intact and reusable. Thus, some other sort of behavior is represented. This subfeature was probably a small shrine constructed as part of the field.

Removal of the mulch also exposed most of a cell bounded by three interior subdividing alignments in the area excavated and a fourth that was visible on the surface just east of EU-C (Figs. 13.19 and 13.20). Parts of other cells were also undoubtedly exposed, but no consistent interior subdividing alignments were found other than in the southeast part of the excavation unit. The exposed cell measured 1.5 m east-west by 1 m north-south and was bounded by elements that were mostly set end-to-end on their broadest surfaces, though sideways placement was also fairly common, and several elements were set upright (Fig. 13.20). The rest of Feature 4 was probably similarly subdivided, but eolian sediments obscured most interior subdividing alignments.

Feature 4 was also investigated using a short (3.5 m long) backhoe trench to determine the relationship between the gravel-mulched field and the terrace upon which it sits. Figure 13.21 shows a profile of the south wall of Backhoe Trench 2. Stratum 2 (gravel mulch) sat directly on top of Stratum 3, the original terrace surface. Stratum 3 was a yellow brown sandy clay loam containing numerous gravels and cobbles, and it was 20–25 cm thick. Under this was Stratum 4, a light yellowish brown sandy clay loam containing much caliche and numerous gravels and cobbles. This configuration is very similar to what we saw in Backhoe Trench 1 and shows that the soil strata mined for building materials were fairly thin. In this area they appear to be at least 30 cm thick and were probably thicker, since the bottom of Stratum 4 was not reached in the backhoe trench.

Feature 8

EU-D was used to investigate Feature 8, a probable hearth. Though a 2 by 2 m grid was placed over this area, only the feature was excavated. The presence of a hearth was marked on the surface by a semicircle of upright cobbles comprised of at least four elements (Fig. 13.6). Excavation revealed only two more elements adjacent to those visible on the surface (Fig. 13.22). Several other cobbles were scattered across the surface near the remains of this feature and probably represent displaced elements. Thus, this feature has suffered considerable damage from surface traffic, most likely grazing livestock.

The remaining section of this hearth measured 1.25 by 0.88 m and was excavated about 10 cm into Stratum 3. Hearth fill was a 4–9 cm thick layer of pinkish gray sandy loam containing charcoal fragments and gravel (Fig. 13.23). We were uncertain whether Feature 8 was associated with the prehistoric or historic component, since it contained no artifacts.

Summary of Findings

LA 105709 was one of the first sites investigated by this study, and field methods were still being perfected. Even so, our examination of LA 105709 provided data that are mostly consistent with those obtained from other farming sites in the area. In particular, we were able to examine the internal construction of two gravel-mulched fields, which were quite comparable to those seen at other sites. LA 105709 was one of two sites where backhoe trenches were excavated to examine the structure of farming features in relation to the terrace they were built upon. The terrace surface in this area was covered by two strata containing numerous gravels and cobbles, which provided a source of building materials near the terrace edge. Interestingly, these strata seem to be relatively thin, perhaps only 1 m thick or less.

Excavation in Features 1 and 4 showed that those fields were built in a much more intricate manner than was suggested by surface indications. Interior subdividing alignments in Feature 1 created fairly narrow cells that may represent the locations of individual crop rows. A larger cell structure appears to have been used in Feature 4 and probably could have accommodated two or three short crop rows. Analysis of pollen samples from these features showed that corn was grown in each. The lack of pollen from other domesticates may be an indication of monocropping, but this is by no means certain.

Initially it appeared that Feature 3, set within a fairly dense scatter of chipped stone and fairly

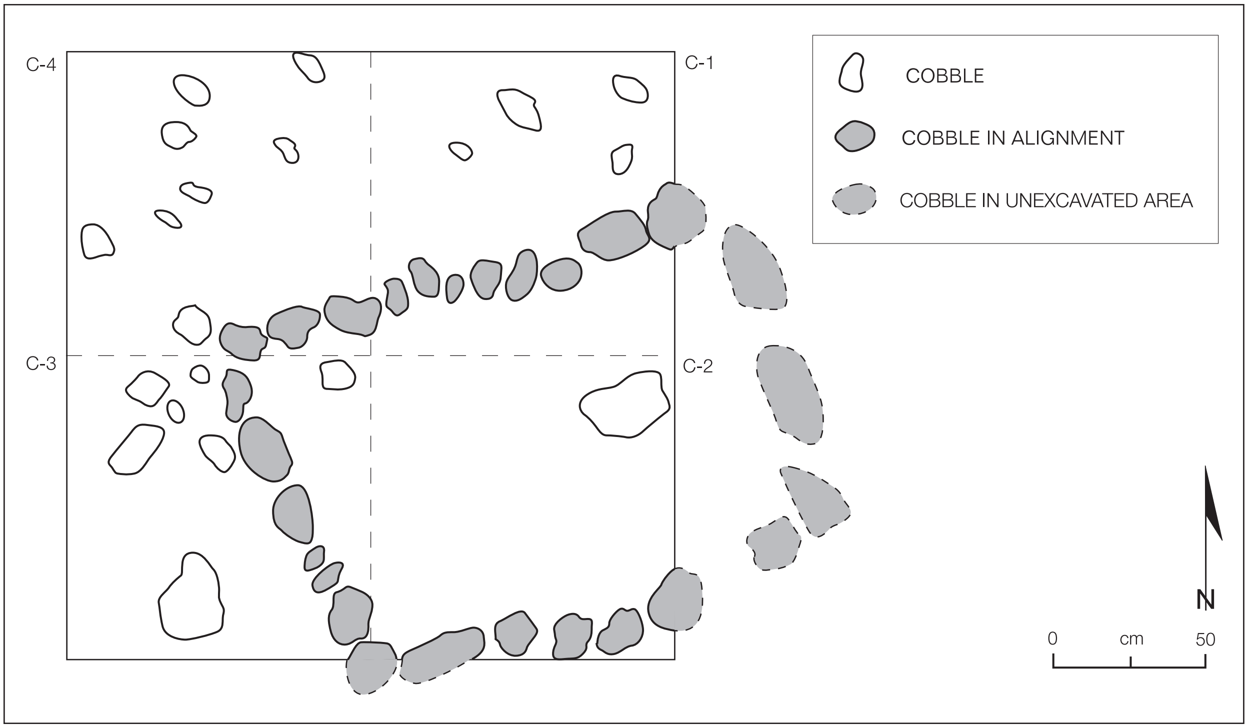


Figure 13.19. Postexcavation plan of EU-C in Feature 4, LA 105709. Shaded cobbles are in alignments.

Figure 13.20. Postexcavation view of exposed cell in EU-C, Feature 4, LA 105709.

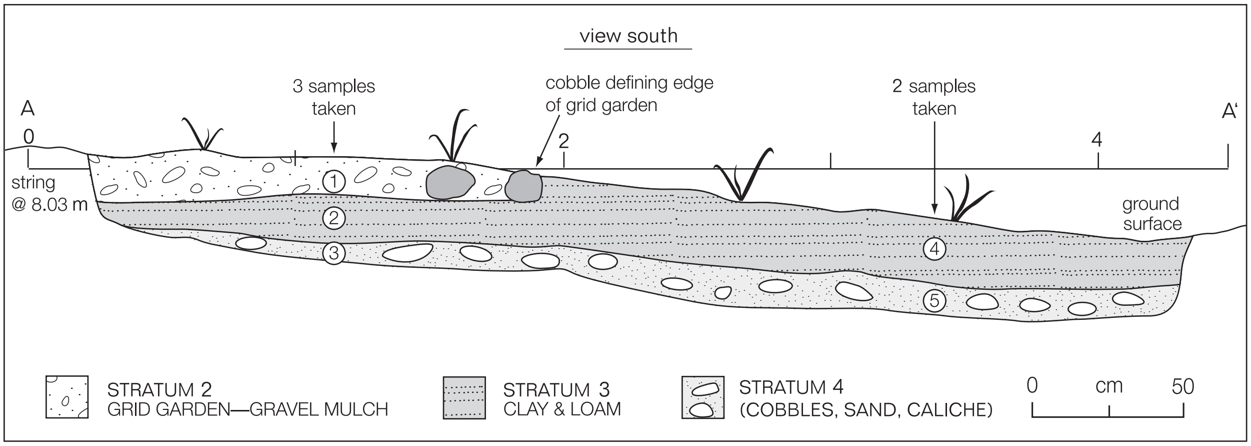


Figure 13.21. Profile of Backhoe Trench 2 in Feature 4, LA 105709.

Figure 13.22. Feature 8, a hearth at LA 105709.

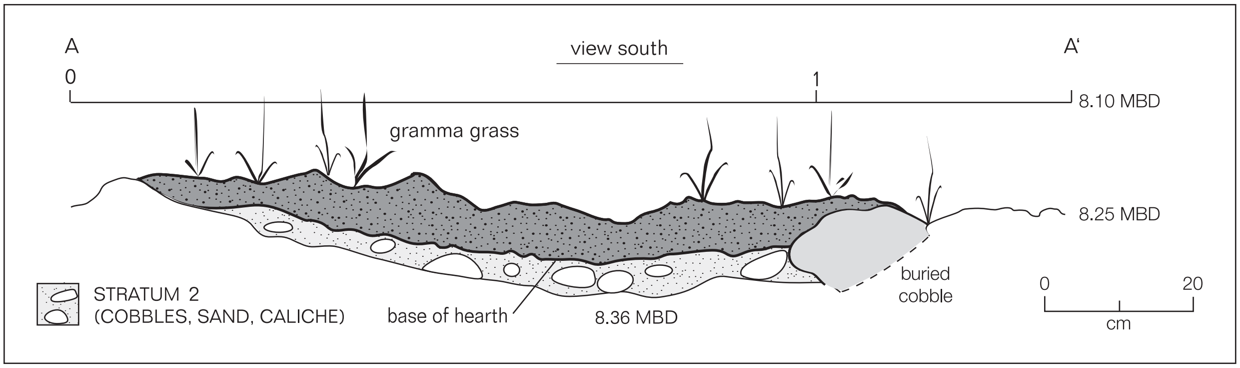


Figure 13.23. Profile of Feature 8, LA 105709.

near an extramural hearth (Feature 8), might represent a living area associated with use of the fields. The presence of a potential field structure was particularly intriguing, since no features of this type were noted at other sites investigated during this study. Unfortunately, the presence of numerous historic artifacts within Feature 3 indicated a historic date for that possible structure and cast doubt on a prehistoric date for Feature 8 as well. While the scatter of chipped stone artifacts might represent a living area similar to those seen at other sites, the density of artifacts and their location on a slope are more suggestive of a single chipping episode that may or may not have been related to the use of this site for farming.

While it is unclear whether the large shrine (Feature 9) was built as part of this farming complex, the probable small shrine in Feature 4 undoubtedly was related to agricultural pursuits. The simplicity of this shrine and its rather innocuous nature argue that similar features may be fairly common in these fields, but they are impossible to identify without excavation and the fortuitous presence of offerings. Several other farming features examined during the course of this project also contained small boulders in rather anomalous situations. While these boulders might represent other simple agricultural shrines in fields, without excavation this remains uncertain.

No direct evidence of sequential construction was found in the features examined in detail at LA 105709. However, variability in construction methods and the possible presence of at least two layers of mulch in Feature 1 may be indicative of continual feature growth and modification throughout their use-life. The presence of three ceramic tools made from sections of a Biscuit B bowl under a boulder that was intentionally placed in a field at the time of construction suggests that at least Feature 4 was built fairly late in the Classic period. Though Biscuit A sherds seem to predominate elsewhere on the surface of LA 105709, Biscuit B sherds comprise at least a third of the decorated pottery assemblage. Thus, most or all of these features were probably built after Biscuit B was first produced, and the entire site probably dates to the Late Classic period.

Chapter 14. LA 105710: The Gavilan Morada Meeting Room, the Candido García Store, and the Archuleta Corrals

Jeffrey L. Boyer

LA 105710 is a large multicomponent site on the east side of U.S. 285 in the community of Gavilan, on land administered by the Bureau of Land Management (see Fig. 1.1). It was first recorded by Marshall (1995). As discussed in Chapter 6, the site's prehistoric component consists of two small hearths and artifacts associated with Hilltop Pueblo that were redeposited in colluvial strata at the base of the terrace. Its historic component is comprised of the meeting house of the Gavilan morada, the Candido García store, and the locations of corrals, pens, and a shed used in the early 1900s by the Archuleta family (Fig. 14.1). The site measures 260 m north-south by 50 m east-west and covers approximately 1.8 ha.

Marshall (1995) recorded four features at the site: the morada building, the concrete foundation of a house, an abandoned road north of the morada, and a concrete foundation thought to be the base of a cattleguard at the junction of the abandoned road and the highway. Wiseman returned to LA 105710 during the testing phase of this project (Wiseman and Ware 1996). He observed the morada building and the abandoned road, made no mention of the possible cattleguard, and identified the "house foundation" as the remains of a small store operated by Candido and Manuel García in the early 1930s. He also noted a concentration of wolfberry bushes that corresponded, according to local residents, to the location of corrals used by the Archuleta family in the early 1900s. Both Marshall and Wiseman noted that the morada building is outside the existing right-of-way; in fact, the right-of-way boundary runs along the west wall of the structure. Wiseman focused his testing activities on the area within the right-of-way immediately west of the morada building, limiting his examination to three series of auger tests and a surface artifact inventory.

Because the morada building was outside project limits and could be avoided during planned construction activities, in the data recovery plan Wiseman recommended no archaeological investigations of this structure (Wiseman and Ware 1996). Wiseman also assumed that the García store had been almost completely dismantled and that no archaeological investigations were warranted there. He did recommend ethnohistoric investigations of the morada and the García store. However, during data recovery we determined that more remained of the García store than had previously been thought. Consequently, data recovery investigations of the historic component of LA 105710 focused on excavation of the García store and recording the other site features.

Field Procedures

LA 105710 was mapped with optical and laser transits. Figure 14.1, the site plan, shows the historic site features and excavation areas. During the testing phase, a primary datum was established at the north end of the site near an unnumbered highway right-of-way stake. That datum, originally designated 0/0, was redesignated 500N/500E during data recovery and was used to establish a grid system across LA 105710, oriented to true north.

Although the data recovery plan only called for ethnohistoric investigation of the García store, excavations were conducted there to ensure that the structure truly had no archaeological potential. Excavations at the store began with two 1 by 1 m test units on each side of the long north-south wall foundation. The test units revealed the depth of the foundation and the presence of a floor, indicating that the structure had been built into the hillslope. The interior of the structure was excavated by dividing it into quadrants along lines within the site grid. Each quadrant was excavated to the structure floor by strata defined in the first 1 by 1 m unit within the structure. Vertical control was maintained relative to the elevation of the primary datum. All fill was screened, and all recovered artifacts were collect-

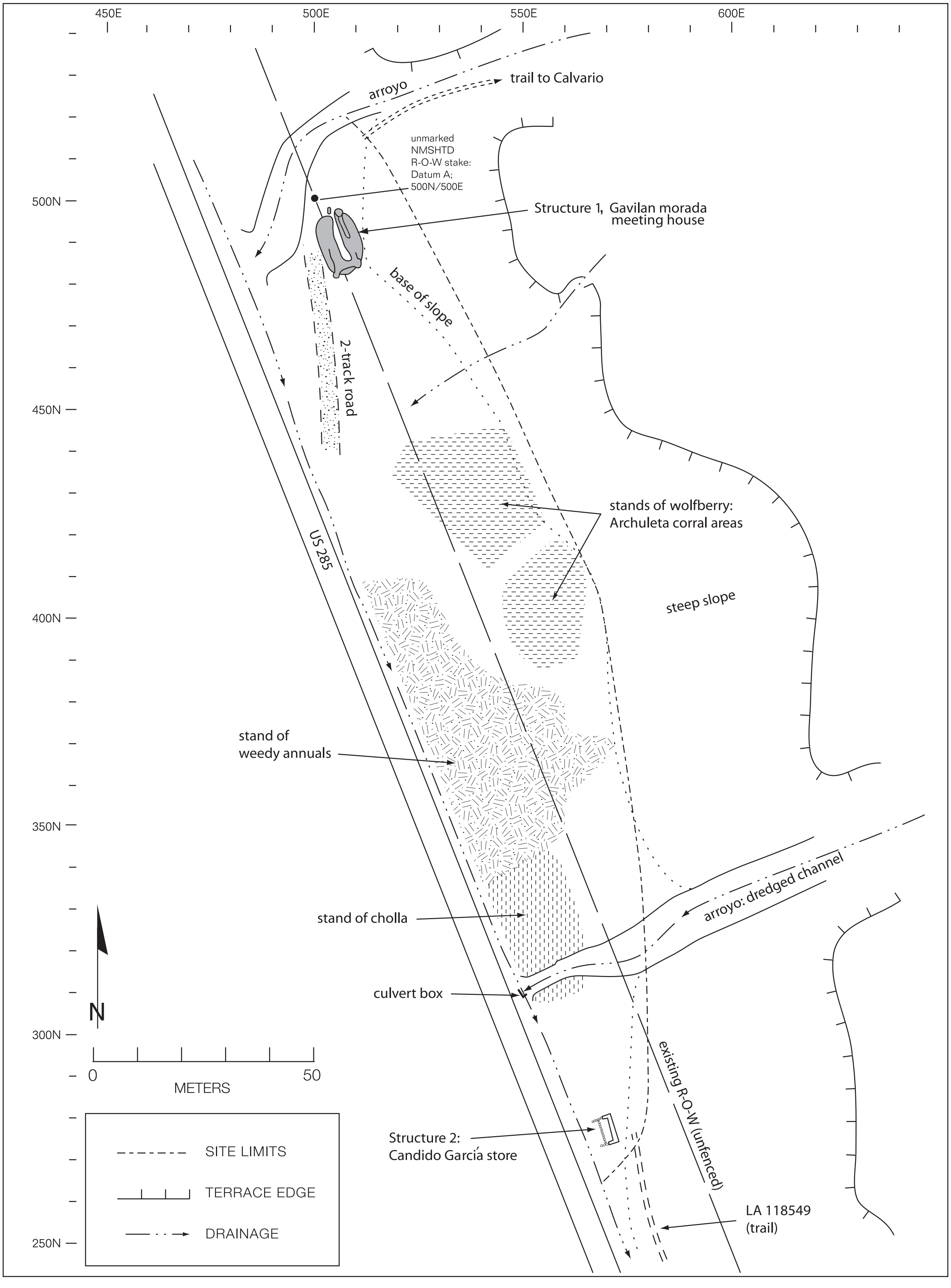


Figure 14.1. Plan of the historic component at LA 105710.

ed. Artifacts on the floor were point-provenienced, photographed, and drawn in place before collection. Portions of the floor were then removed to search for subfloor features. None were found. A series of 1 by 1 m units was excavated around the perimeter of the structure. These units were excavated in 10 cm levels to a surface presumed to represent the historic ground surface.

The morada building was mapped, photographed, and described. No material samples were collected. The corral locations were mapped, but no detailed examinations were conducted.

Results of Investigations

Structure 1: The Gavilan Morada Meeting House

Structure 1 was a single building within a complex of structures and features comprising the Gavilan morada (see Chapter 25 for descriptions of this building and the other structures and features provided by informants). It was a small, approximately rectangular structure constructed of adobe bricks. The building now consists of an elongated C-shaped mound of melted adobe, opening to the northwest (Figs. 14.2–14.5). The mound is 14.2 m long by 9.8 m wide and about 0.5 m tall.

The building measured about 12.2 by 5.5 m (exterior measurements). It was not possible to determine the original wall heights. Based on a standing segment of the east wall, bricks in the structure's walls were laid side-by-side, and the walls were a single brick thick—about 0.5 (Figs. 14.4 and 14.6). The structure's interior space would have measured about 11.2 by 4.5 m (50.4 sq m).

The only door into Structure 1 was in the north wall, seen as the opening in the C-shaped mound (Fig. 14.2). A concrete doorstep, immediately north of the structure (Fig. 14.2), is seen in Figure 14.4 in front of the meter board. There was apparently a *fogón* (corner fireplace) in the northwest corner. Fragments of burned adobe and ceramic flue pipe were present on the mound in that area. No evidence of other interior features or of divisions of internal space was discernible. Fragments of flat glass may reflect the presence of windows, but their locations could not be defined based on surface evidence.

Remnants of adobe plaster were present on the interior surface of the standing wall segment. The exterior of the structure had been finished with cement plaster. Conical buttresses constructed of large cobbles held with adobe mortar and covered with cement plaster were at the northeast, southeast, and southwest corners of the building (Fig. 14.2). Figure 14.5 shows the three buttresses in a view from the south; Figure 14.7 shows a close-up of the southwest buttress.

The three 1 by 1 m test units and two backhoe trenches excavated at LA 105710 were intended to enable the archaeologists to examine the terrace base area because of subsurface artifacts recovered during testing (Chapter 6). They also enabled us to search for historic features within project limits near the morada, but none were found.

The Archuleta Corrals

Although the modern plant community across most of LA 105710 was comprised of grama and other grasses, four distinct areas with very different plant communities were observed. Two of these were stands of wolfberry bushes (*Lycium* sp.) at the base of the gravel terrace in the central portion of the site (Fig. 14.1). One stand was irregularly pentagonal with relatively straight sides that ranged from about 10 to 33 m long. The stand was a maximum of about 40 m long from its southeast-northwest corners by 27.5 m wide from its northeast corner to the center of the southeast side. It encompassed an area of about 536 sq m (0.5 ha).

The second wolfberry stand was an irregularly shaped area immediately southeast of the first. Two sides of this stand were relatively straight. The north side, which ran parallel to the south side of the first stand, was about 17 m long. The southeast side was about 18 m long. Four other sides were less straight or regular. The stand was a maximum of about 30.5 m long by 19.5 m wide and encompassed an area of about 490 sq m (0.5 ha).

In addition to the wolfberry stands, a large, irregularly shaped area characterized by weedy annuals, primarily bassia (*Bassia hyssopifolia*) or

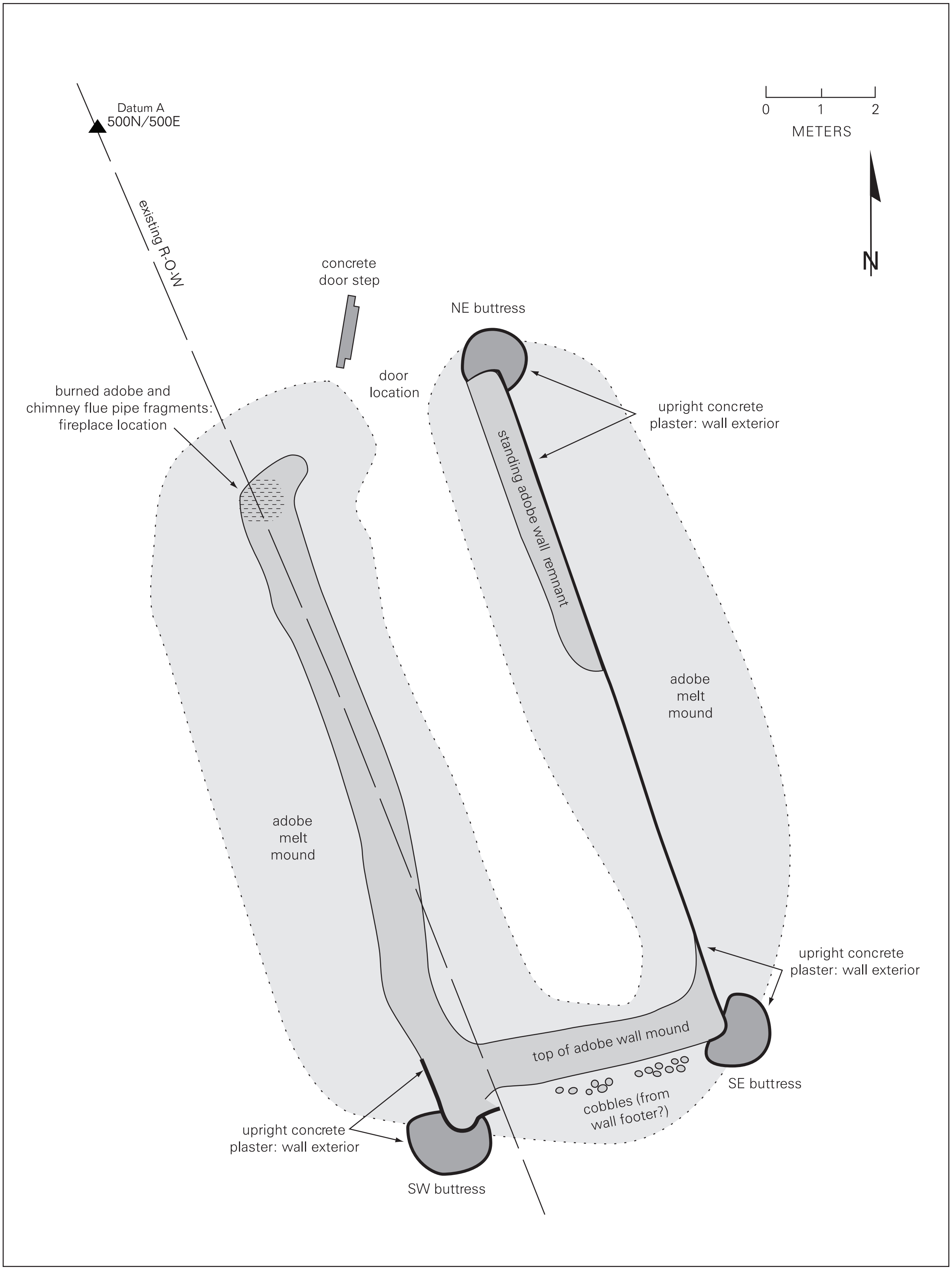


Figure 14.2. Plan of Structure 1, the Gavilan morada meeting house, LA 105710.

Figure 14.3. Structure 1, LA 105710, looking east.

Figure 14.4. Looking southeast through the door in the front of Structure 1, LA 105710.

Figure 14.5. Looking northwest toward the rear of Structure 1, LA 105710.

Figure 14.6. Standing portion of the east wall of Structure 1, LA 105710.

Figure 14.7. Buttress at the southwest corner of Structure 1, LA 105710.

kochia (*Kochia scoparia*), was present southeast of the wolfberry stands, between them and the highway (Fig. 14.1). Immediately south of this area was a roughly rectangular area with a dense growth of cholla cactus (*Opuntia* sp.) (Fig. 14.1). This area was cut by the dredged channel of an arroyo.

The wolfberry stands were identified by Wiseman (Wiseman and Ware 1996) as the location of corrals used by the Archuleta family. One of Goodman's informants (see Chapter 25) identified the central portion of LA 105710 as the location of corrals for cattle and sheep, pens for chickens and pigs, a large wood pile, and a wagon and tack shed, all used by the family of Antonio and Faustina Archuleta. Beyond recording their presence, no other archaeological investigations of these areas were conducted during data recovery. The corrals, pens, and shed are discussed in detail in Chapter 25.

Structure 2: The Candido García Store

Structure 2, at the south end of LA 105710 (Fig. 14.1), was the remains of a small building identified by informants as a store (*tiendita*) owned by Candido García (Wiseman and Ware 1996; see Chapter 25). The store was a small, one-room structure measuring 5.9 m north-south by 3.3 m east-west (exterior measurements) (Fig. 14.8). Remains of the east wall and portions of the north and south walls consisted of a foundation of poured concrete containing medium to large gravels and small cobbles. Poured between forms

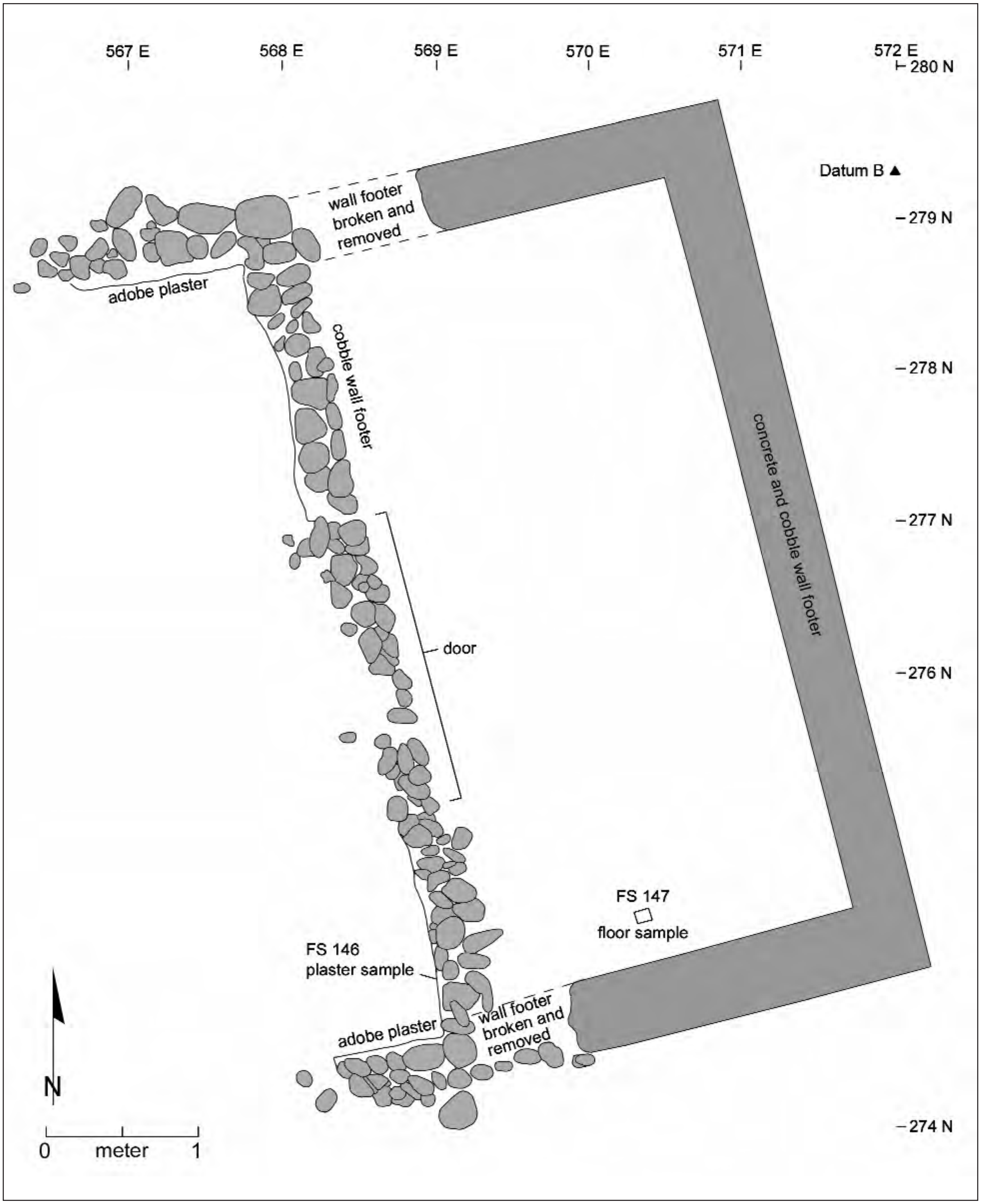


Figure 14.8. Postexcavation plan of Structure 2, the García store, LA 105710.

of milled lumber upon a footer of large cobbles that were probably set in a shallow trench (Fig. 14.9), the foundation was 40 cm thick and 40–45 cm tall, and extended below and just above the historic ground surface. The western ends of the north and south wall foundations and the west wall foundation consisted of footers of large cobbles (Figs. 14.8 and 14.10). The north and south walls extended past the west wall (Figs. 14.8 and 14.10), suggesting that the building had a portal on its west side.

The walls of Structure 2 were apparently constructed of adobe bricks, based on the presence of brick fragments in the structure fill. The thickness of the wall foundation and footers indicates that the bricks were probably set side-by-side and that the walls were one brick thick. Interior wall surfaces and the exterior surface of the west wall had been covered with adobe plaster and a single layer of whitewash plaster. Figure 14.11 shows the plaster in the southeast corner of the portal area, and Figure 14.12 is a detail of the plaster in the same corner. That only single layers of plaster and whitewash were present shows that the structure had a short life. The floor was apparently packed earth.

A probable door location was identified in the approximate center of the west wall (Fig. 14.8), indicated by a single layer of cobbles in the footer that contrasted with multiple layers of cobbles in adjacent northern and southern segments of the west wall (Figs. 14.13 and 14.14). Concentrations of window glass fragments found on the floor inside the south wall and in sediment outside the south wall may have pointed to a window in that wall.

The fill of Structure 2 consisted of three strata. Stratum 1 was reddish-brown melted adobe with brick fragments, probably representing wall plaster and brick material. It was 4–8 cm thick and was present over the structure's packed-earth floor. The adobe material was probably deposited on the floor during dismantling of the structure. Stratum 2 was a 10–30 cm thick layer of light reddish brown, compacted, sandy loam, probably representing natural colluvial and eolian sediments. A thin charcoal lens was recorded within Stratum 2 on the north side of the structure, but there was no indication that it was related to structural burning; indeed, there was no other evidence of structural burning, such as burned plaster, floor, or roof materials. The upper surface of Stratum 2 was undulating, indicating that it had been disturbed by natural erosion. Above Stratum 2 was Stratum 3, which was light brown, loose, sandy loam, also probably representing natural colluvial and eolian sediments. Stratum 3 was 7–17 cm thick; thicker portions were found over more disturbed portions of Stratum 2. The upper surface of Stratum 3 was the modern ground surface, and the combined strata filled Structure 2. Only a thin layer of Stratum 3 covered parts of the wall foundation and footers.

Stratigraphy within Structure 2 showed that, at the time the structure was dismantled, adobe from wall plaster, mortar, and brick fragments was deposited on the structure floor. There was no evidence of structural remodeling prior to dismantling. Evidence of the superstructure was limited to adobe materials in Stratum 1, tar paper fragments on the floor, and window glass fragments on the floor and outside the south wall. This shows that essentially all structural materials were removed from the site when the building was dismantled. Following dismantling, Structure 2 filled with natural colluvial and eolian sediments.

Artifacts recovered from Structure 2 are discussed in Chapter 21. Ethnohistoric information about Structure 2 is presented in Chapter 25. In Chapter 26, the results of archaeological and ethnohistorical investigations of Structure 2 are discussed with regard to research issues defined in the data recovery plan (Wiseman and Ware 1996:63–64).

Figure 14.9. East wall of Structure 2, LA 105710, showing poured foundation on top of cobble footer.

Figure 14.10. Structure 2, LA 105710, looking south.

Figure 14.11. Southeast corner of the portal area along the exterior of the west wall of Structure 2, LA 105710, showing adobe and whitewash plaster.

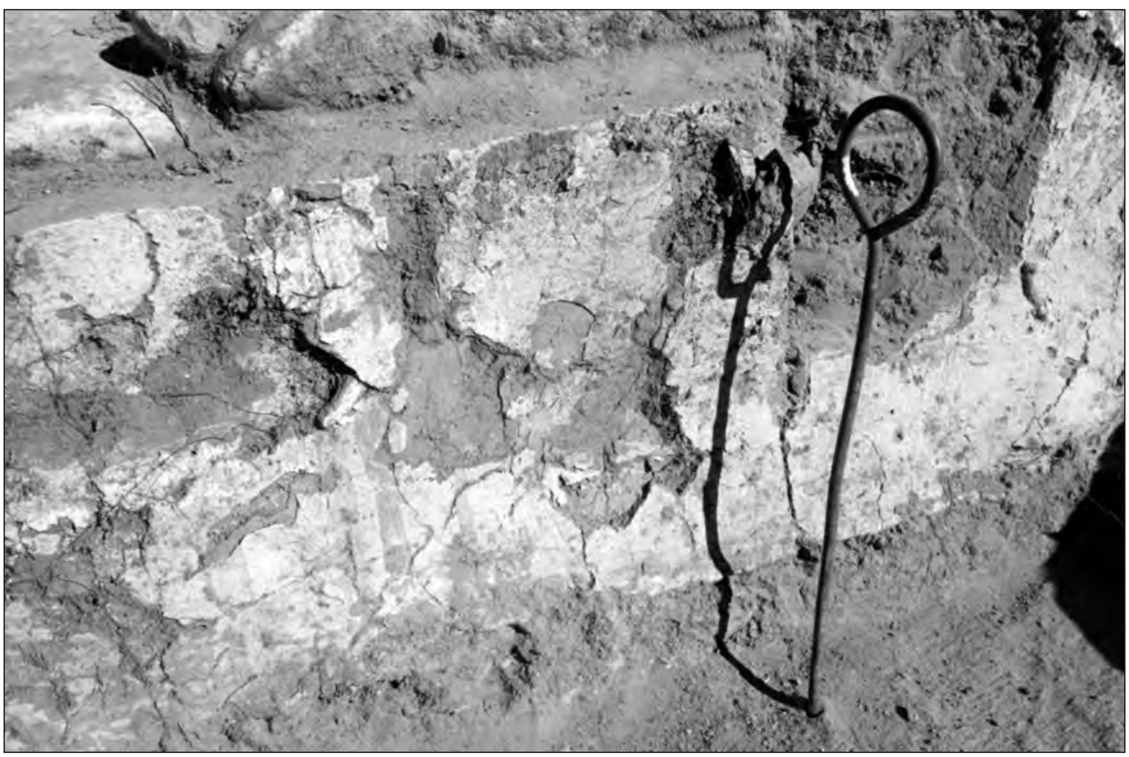


Figure 14.12. Southeast corner of the portal area along the exterior of the west wall of Structure 2, LA 105710, showing detail of adobe and whitewash plaster.

Figure 14.13. Structure 2, LA 105710, after excavation. Meter board is in the probable door location.

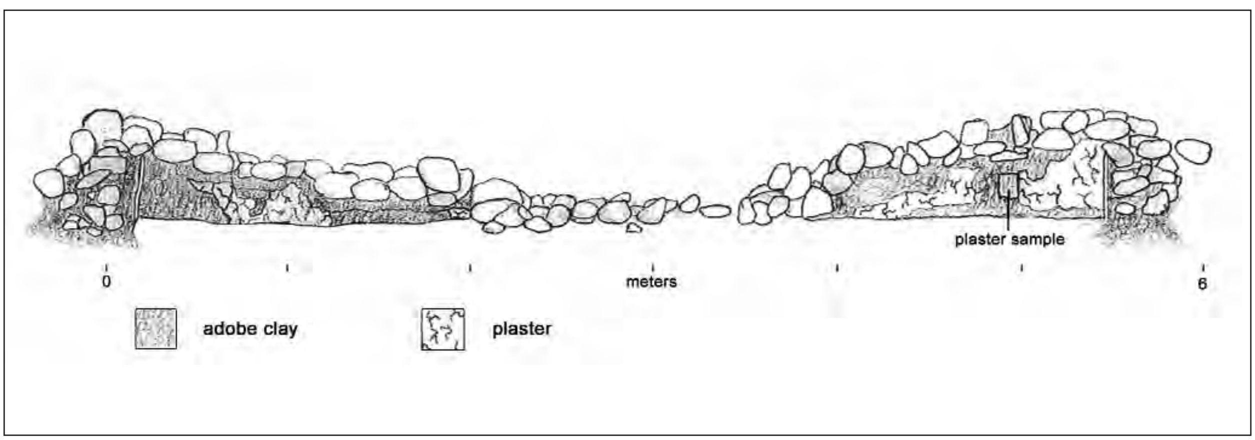


Figure 14.14. Elevation of doorway, Structure 2, LA 105710.

Chapter 15. LA 105713

James L. Moore

LA 105713 is a large farming site on land administered by the USDI Bureau of Land Management. The site is roughly rectangular in shape, with a small finger extending to the northeast and its edges cut by several small drainages. The west site boundary is formed by the edge of the main terrace that overlooks the Ojo Caliente Valley, and it is bounded on the north and south by intermittent drainages. The east boundary is formed by the edge of farming features and the base of a higher terrace. LA 105713 measures 195 m east-west by 190 m north-south, and covers about 37,050 sq m (3.71 ha). Only about .4 percent of the site extends into the U.S. 285 right-of-way, comprising a narrow sliver along the west edge of the site. In-field pottery analysis indicated that LA 105713 was used during the Classic period.

Vegetation is moderate on the site and shows evidence of heavy grazing. Heavy stands of prickly pear and quite a bit of cholla occur. Grasses are the most common plants, including grama and muhly. Other common plants are prickly pear, cholla, rabbitbrush, and snakeweed. Small junipers occur at the terrace edge, and a few have spread onto field surfaces. Junipers are also common on the slope that forms the east boundary of the site, and a few piñons were also seen in that area.

Field Procedures

Detailed mapping was restricted to the section of site that extends into the U.S. 285 right-of-way and an adjacent 25+ m wide zone. This area comprises a sample of about 13 percent of the site, and all cultural features within this zone were mapped and recorded in detail. Three borrow pits (Features 1, 7, and 8) are the only features that extend into project limits. Since excavation of these features would have provided few data that were not available from surface examination, no subsurface studies were conducted, and data recovery focused on the surface description and photographing of features in the mapped area. All cultural materials noted on the surface within the highway right-of-way were collected for analysis and are summarized later in this chapter. Artifacts noted elsewhere on the surface in the detailed mapping zone were inventoried, but they were not separated by feature.

Features

Thirteen features were at least partly mapped and described (Fig. 15.1). The locations of six additional terrace-edge borrow pits are shown on the site plan, but since they were outside the detailed examination zone they were not described or assigned feature numbers. Most feature perimeters are fairly well defined, but some field boundaries are partly obscured, especially those near the terrace edge. A combination of colluvial and eolian processes have caused soil to build up against alignments that face the interior of the terrace, obscuring those boundaries in many places. Eolian deposits also cover much of the surface of the fields, especially where they are anchored by vegetation. This made it difficult to discern many alignments and to define the full extent of others. Livestock grazing has likewise caused damage, displacing elements in cobble alignments and blurring feature edges. Along the terrace edge this seems to have exacerbated damage caused by erosion. Other surface disturbances include a trail (LA 118549) that runs along the west edge of the site next to U.S. 285.

Feature 1

Feature 1 is a large, oval terrace-edge borrow pit measuring 11.0 by 6.1 m, with a maximum depth of 0.75 m (Figs. 15.2a and 15.2b). Only about 15 percent of Feature 1 was within project limits, and it was completely mapped. This borrow pit is next to Features 3 and 4, and it was probably a source of some of the materials used to build one or both of those gravel-mulched fields. Some spoils materials, mostly cobbles, were piled in the

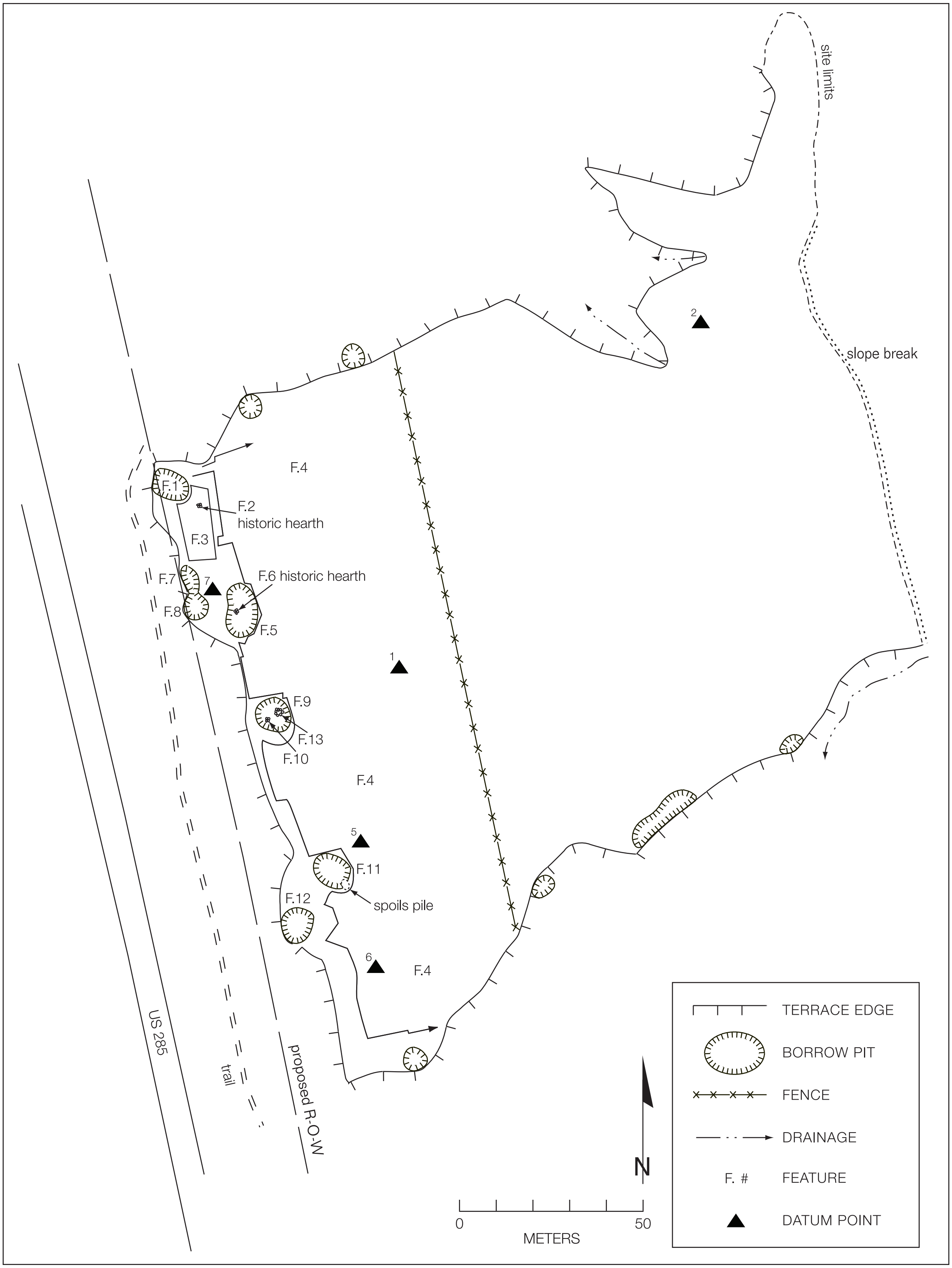


Figure 15.1. Plan of LA 105713.

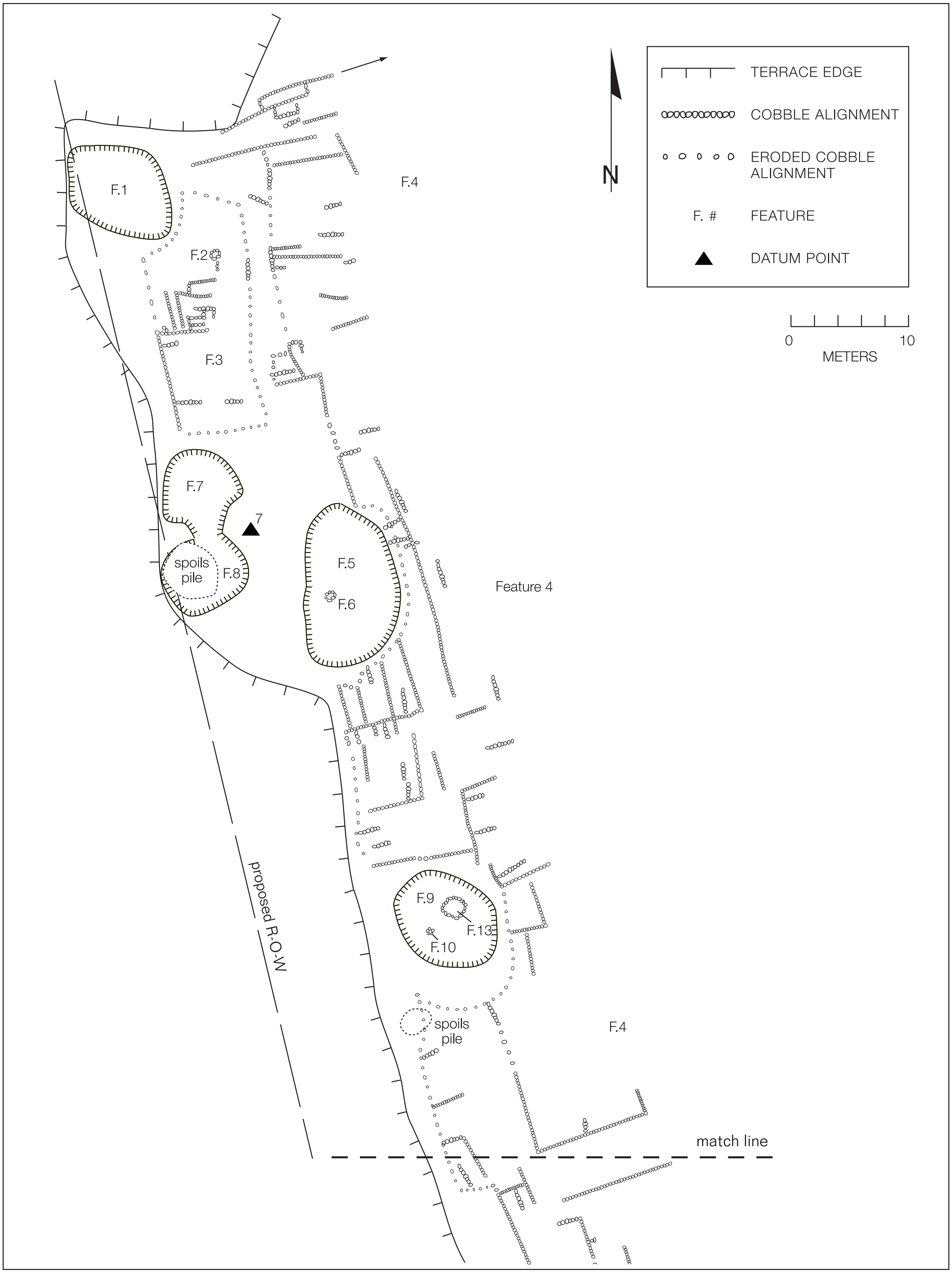


Figure 15.2. Features 1 through 13, LA 105713.

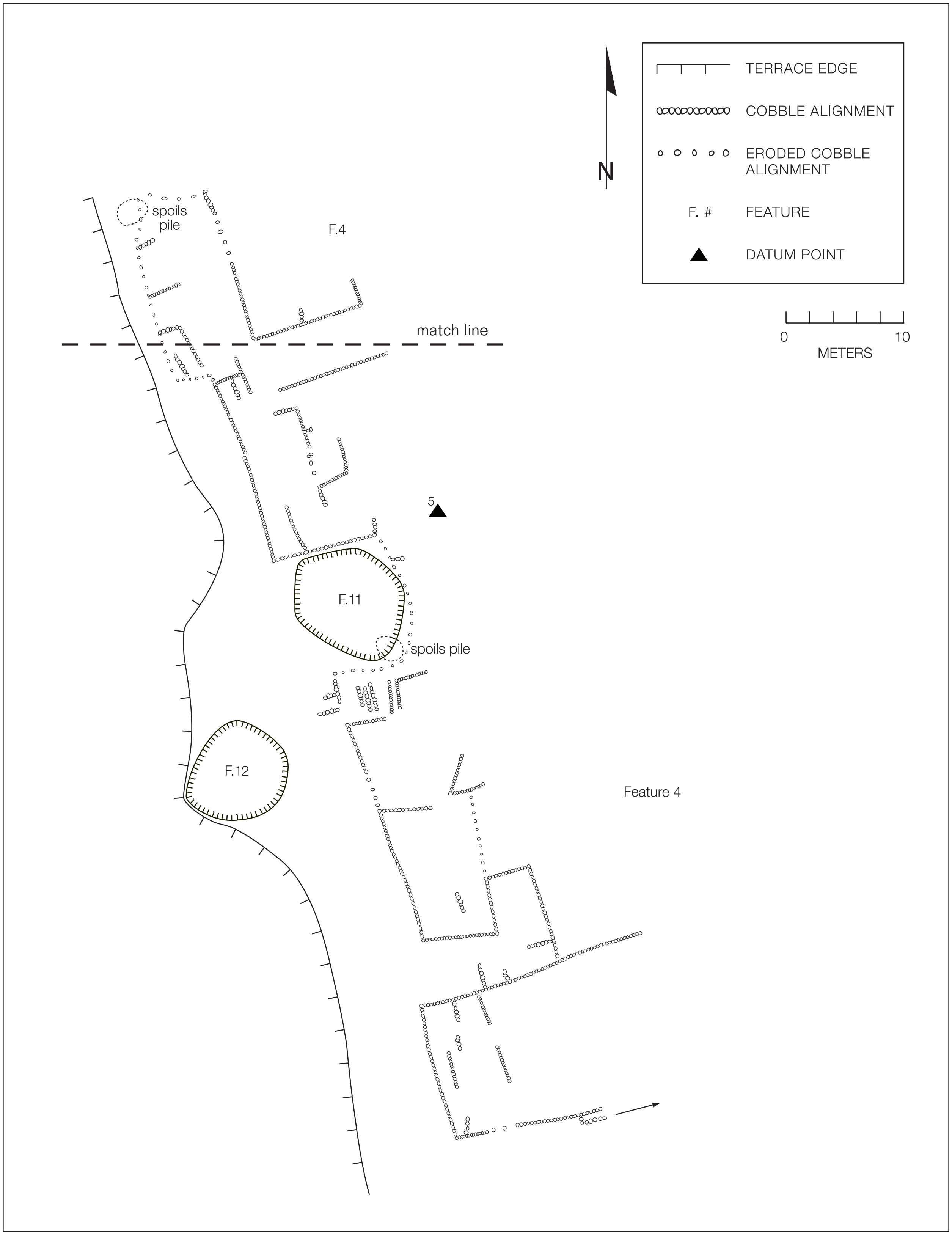


Figure 15.2 (continued).

northeast quadrant of this feature. In addition, some recent historic trash was noted, including glass and aluminum cans.

Feature 2

Feature 2 is a cobble-bordered hearth that measures 0.90 by 0.75 m, with a maximum depth of 0.12 m (Fig. 15.2 and 15.3). It sits on top of Feature 3, a gravel-mulched plot. Though outside construction limits, it was in the detailed examination zone and was mapped. This feature is comprised of 15 cobbles arranged in an oval, with charcoal and burned wood inside the cobble ring. From the condition of the latter, Feature 2 is of recent historic derivation. No other cultural materials were found in association with the hearth.

Feature 3

Feature 3 is a small gravel-mulched plot that measures 21.0 by 9.5 m and covers 187 sq m (Fig. 15.2). Since this field was in the detailed examination zone, it was completely mapped. Much of its surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation.

Boundary and interior subdividing alignments are a single element high and wide, and they were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 10–25 cm long. The few small boulders that occur are 25–40 cm long. Most elements in alignments were placed end-to-end, though some were set sideways. Most elements were also placed on their broadest surfaces, though a few were set upright. Surface indications suggested that the interior of the feature was highly subdivided, though interior alignments were obscured by eolian sediments across much of this plot.

The mulch is mostly composed of pea gravels and gravels, though small cobbles up to 10–15 cm long are also common, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Since the alignments are a single element high, the mulch is probably 5–10 cm thick. This feature did not appear to be mounded above the adjacent terrace surface, and no real differences in vegetative or

Figure 15.3. Feature 2, a historic hearth, at LA 105713.

gravel densities were noted between on- and off-feature areas.

Feature 4

Feature 4 is a long, irregularly shaped gravel-mulched field that measures 166.5 by 90 m and covers roughly 15,000 sq m (Fig. 15.2). Since this field was mostly outside the detailed examination zone, the entire feature was not mapped. Only the west 20 percent of the feature fell within the mapping zone, so its full extent was measured by pacing. Perhaps 30–40 percent of the field surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation.

Boundary and interior subdividing alignments are a single element high and wide, and they were built with locally obtained cobbles and small boulders. Cobbles predominate in all alignments, and most are 10–25 cm long. Small boulders also occur, particularly in boundary alignments, and they are 25–40 cm long. Building elements were mostly placed end-to-end, though some sideways placement was noted. Most elements were also placed on their broadest surfaces, though upright cobbles were fairly common. From the number and placement of alignments traceable on the surface, Feature 4 appears to have been highly subdivided. The variation in patterning of these subdivisions from one end of the feature to the other suggests that it was not all built at one time. Rather, a series of building episodes is probably represented that began with several separate plots, which eventually grew together.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 6+ cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Since the alignments are a single element high, the mulch is probably 5–10 cm thick. No mounding above the terrace was seen, but a difference in gravel densities was noted between on- and off-feature areas, and the field surface was covered by a heavy carpet of gravels. The adjacent terrace surface contains much less gravel and considerably fewer cobbles. No similar variation in vegetative density was noted between these areas.

Feature 5

Feature 5 is a large terrace-edge borrow pit measuring 15.0 by 10.5 m, with a maximum depth of 0.64 m (Fig. 15.2). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is near Features 3 and 4 and was probably a source of some of the materials used to construct one or both of those gravel-mulched fields. Sediments have built up to an undetermined depth in the bottom of this pit. The only temporally diagnostic artifact noted in association with this feature was an unidentifiable Tewa polychrome series sherd.

Feature 6

Feature 6 is a cobble-bordered hearth that measures 0.90 by 0.80 m, with a maximum depth of 0.19 m (Fig. 15.2). It is situated near the middle of Feature 5, a prehistoric borrow pit. Though outside construction limits, it was within the detailed examination zone and was mapped. This feature is comprised of nine cobbles arranged in an oval. Two beverage cans with aluminum tops and a screw-top juice bottle are in close association with this hearth. The location, condition, and configuration of this feature in conjunction with the associated historic artifacts suggest it is of recent historic derivation.

Feature 7

Feature 7 is a fairly large round terrace-edge borrow pit measuring 8.3 by 8.2 m, with a maximum depth of 0.70 m (Fig. 15.2). Feature 7 extended partly into project limits and was otherwise within the detailed examination zone, so it was mapped. This borrow pit is next to Features 3 and 4 and was probably a source of some of the materials used to build one or both of those gravel-mulched fields. Sediments have built up in the bottom of this pit to an undetermined depth. The south end of Feature 7 opens into a second borrow pit (Feature 8), as discussed in the next section. No associated artifacts were noted.

Feature 8

Feature 8 is a round to oval terrace-edge borrow pit measuring 8.4 by 7.5 m, with a maximum depth of 0.62 m (Fig. 15.2). Feature 8 extended partly into project limits and was otherwise within the detailed examination zone, so it was mapped. This borrow pit is next to Features 3 and 4, and it was probably a source of some of the materials used to build those gravel-mulched fields. The central and northwest quadrants of this pit contain spoils consisting of cobbles and small boulders (Figs. 15.2 and 15.4), probably derived from the excavation of Feature 7, which adjoins Feature 8 on the north. Thus, Feature 8 was probably used before Feature 7. No associated artifacts were noted.

Feature 9

Feature 9 is an oval terrace-edge borrow pit measuring 11.8 by 11.0 m, with a maximum depth of 0.90 m (Fig. 15.2). Feature 9 was within the detailed examination zone, and it was mapped. This borrow pit is next to Feature 4 and was probably a source of some of the materials used to build that gravel-mulched field. Sediments have built up in the bottom of this pit to an undetermined depth. No associated artifacts were noted, but this feature contained two hearths (Features 10 and 13), both of probable historic date.

Feature 10

Feature 10 is a cobble-bordered hearth that measures 0.40 by 0.36 m, with a maximum depth of 0.05 m (Fig. 15.2). This is one of two hearths in the bottom of Feature 9, and it is in the west-central part of that borrow pit. Though outside construction limits, it was within the detailed examination zone and was mapped. This feature is comprised of 10 cobbles arranged in an oval, and small chunks of charcoal occur within (Fig. 15.5). The location, configuration, and contents of this hearth suggest that it is of recent historic derivation.

Feature 11

Feature 11 is a large, nearly round terrace-edge borrow pit measuring 11.0 by 10.7 m, with a maximum depth of 0.71 m (Fig. 15.2). Though outside

Figure 15.4. Feature 8, LA 105713, showing the cobble and boulder spoils in the bottom of the borrow pit.

Figure 15.5. Feature 10, LA 105713, a historic hearth in the bottom of a borrow pit (Feature 9).

construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Feature 4 and was probably a source of some of the materials used to build that gravel-mulched field. A spoils pile containing large cobbles and small boulders is on the southeast edge of this feature and represents materials that were discarded during quarrying. This borrow pit was probably used near the end of the use-life of the adjacent section of Feature 4, since the spoils would have served as building materials if that field had been further expanded.

Feature 12

Feature 12 is a large, oval terrace-edge borrow pit measuring 10.4 by 8.0 m, with a maximum depth of 0.65 m (Fig. 15.2). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Feature 4 and was probably a source of some of the materials used to build that gravel-mulched field. Erosion along the west edge of this pit may have enlarged it a bit, and colluvial fill has built up in its bottom to an undetermined depth. No associated artifacts were noted.

Feature 13

Feature 13 is a cobble-bordered hearth that measures 2.3 by 1.8 m (Fig. 15.2). This is the second of two hearths in the bottom of Feature 9, and it is in the northeast quadrant of that borrow pit. Though outside construction limits, it was within the detailed examination zone and was mapped. This feature is comprised of eight large cobbles or small boulders arranged in an oval, with small chunks of charcoal within. A cholla is growing out of the middle of this feature, and either that or later human activity has scattered the cobble border. The location, configuration, and contents of this hearth suggest that it is of recent historic derivation.

Surface Information

While the preceding discussion describes the basic configuration of LA 105713, other observations were made during examination of this site that are not as easily pigeonholed. LA 105713 essentially occupies the entire top of a terrace remnant, which is bounded by the Ojo Caliente

Valley on the west and intermittent drainages on the north and south. Figure 15.6, a view of the terrace remnant from the slope to the west, shows that junipers occur around the rim of the farming features, though few have as yet managed to invade the terrace top. This photo was taken from near the top of a higher terrace, the base of which forms the east boundary of LA 105713. Cursory examination of the higher terrace showed that it also contains extensive farming features, similar to those at LA 105713.

Most other farming features observed in the unrecorded part of the site are similar to those described above. Between two and four possible terrace-interior borrow pits were noted; however, all of these features are situated near the terrace edge and are probably more properly considered a variant of that type. Features 5 and 11 are good examples of this type of borrow pit. They are positioned near the terrace edge but do not overlap the break in slope, as is common for terrace-edge borrow pits. There were undoubtedly no rules about borrow pit placement; as long as suitable materials were easily available, it did not matter whether the location overlapped the terrace edge or not. The only features outside the detailed examination zone that did not duplicate recorded types was a series of two or three contour terrace walls in the far northeast quadrant of the site, at the base of the slope that forms the east boundary.

The surface of the site shows quite a bit of historic activity, though most of the later use appears to have been transient. Several fairly recent campfire rings were noted and described as features, and a lot of historic trash is scattered across the site. Several hundred historic artifacts were inventoried, but they were not counted since they are unrelated to the prehistoric use. Historic artifact types include bottle glass (green, purple, brown, clear, aqua), aluminum beverage cans, steel food cans, stove parts, enameled cooking and table ware, milled wood, cartridge cases, and miscellaneous metal fragments. The presence of several cartridge cases and metal artifacts with bullet holes through them suggest that much of the trash was used for target practice.

No prehistoric artifacts occurred within the part of LA 105713 that extends into the right-of-way. Thus, an inventory of surface materials that

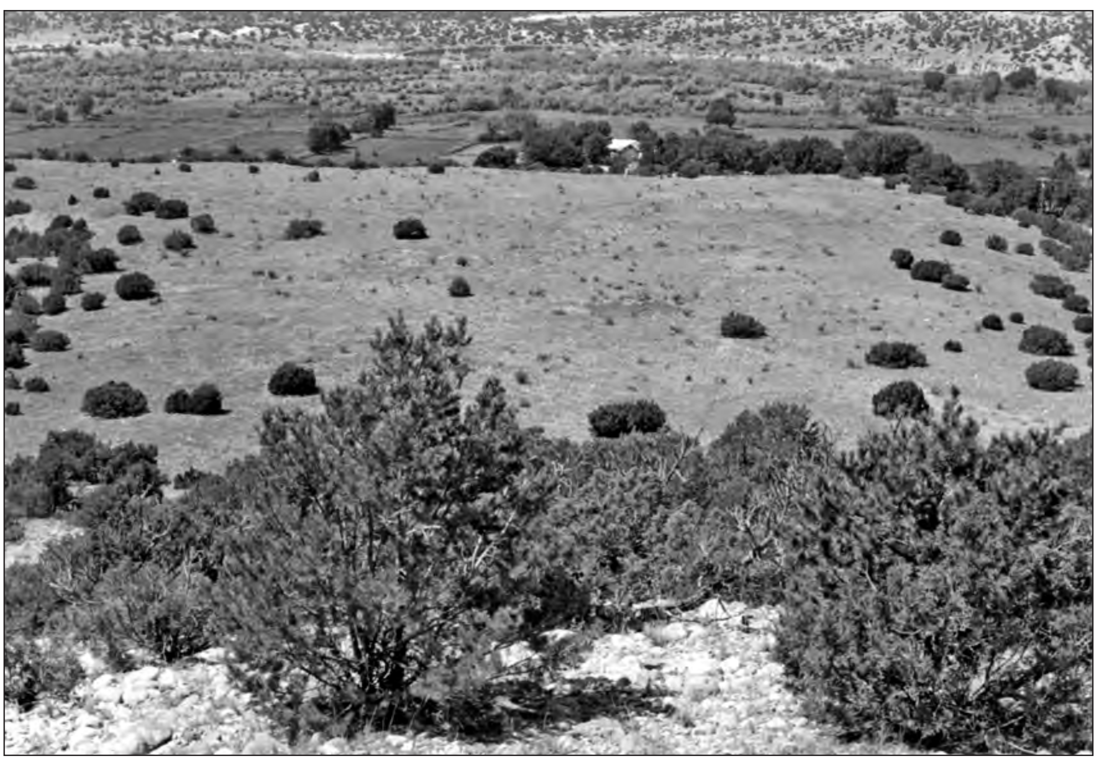


Figure 15.6. LA 105713 from the slope above the site.

was conducted for the remainder of the site provides the only assemblage information. No attempt was made to inventory features individually. Chipped stone artifacts dominated this assemblage, and the most common material type was gray rhyolite. Interestingly, there was no clear evidence of quarrying activities along the edge of the terrace. Most artifacts were found away from the edge and on the surfaces of farming features. Gray rhyolite artifacts included 275 core flakes, 60 angular debris, 41 cores, an axe or hoe, and a chopper. Other materials were far less common and included andesite (10 core flakes, 1 angular debris, 2 cores), red rhyolite (6 core flakes, 5 angular debris, 1 core), quartzite (2 core flakes, 1 angular debris, 1 core), massive quartz (1 core flake, 4 angular debris), and Pedernal chert (1 core flake).

Pottery was less common than chipped stone, but quite a few sherds were seen. Biscuit B, the most common type noted, included 25 bowl sherds, 6 jar sherds, and 1 sherd from an indeterminate type of vessel. Biscuit A sherds, the next most common, included 17 bowl sherds and a sherd from a possible bowl. A single Potsuwi'i Micaceous jar sherd was found, as were 6 sherds of indeterminate type and vessel form. A single possible Tewa polychrome series bowl sherd was also found, as discussed in the Feature 5 description. This historic ware was widely traded to the Spanish population and occurs on Spanish sites dating into the early twentieth century, which is consistent with some of the other types of historic trash noted on the surface of this site.

Chapter 16. LA 118547

James L. Moore

LA 118547 is a large farming site on land administered by the USDI Bureau of Land Management (Fig. 16.1). It occupies a irregular L-shaped area and is bounded by the main terrace edge overlooking the Ojo Caliente Valley on the west, an arroyo formed by an intermittent drainage on the south, and Forest Road 556 on the north. The east boundary is the edge of the farming features, while the south drainage forms an arbitrary boundary with LA 118548 to the south, and Forest Road 556 separates this site from LA 105709 to the north. These arbitrary boundaries were used to maintain the original numbering system and restrict LA 118547 to a manageable size. It is unlikely that they replicate the prehistoric land tenure system.

LA 118547 measures 530 m north-south by 112 m east-west and covers about 49,500 sq m (4.95 ha). It may once have extended slightly further south, but that area is within the current U.S. 285 right-of-way and has been removed. Only 4.6 percent of LA 118547 extends into the right-of-way, comprising a narrow sliver along the west edge of the site. In-field pottery analysis indicated that LA 118547 was used during the Classic period.

Vegetation is moderate on the site, and the plant cover is generally similar between on- and off-feature areas. Grasses, the most common plants noted, include grama, muhly, and Indian ricegrass. Other common plants are rabbitbrush, snakeweed, prickly pear, narrowleaf yucca, sage, and cholla. Small junipers occur at the terrace edge; while only a few have spread onto the surface of the fields, they are common in and around borrow pits.

Field Procedures

Detailed mapping was restricted to the section of site that extends into the U.S. 285 right-of-way and an adjacent 25–30 m wide zone. This area comprises a sample of about 26 percent of the site, and all cultural features within this zone were mapped and recorded in detail. Several features were partly or wholly within construction limits, including two gravel-mulched fields (Features 15 and 23) and 13 terrace-edge borrow pits (Features 1 through 13). Data recovery efforts concentrated on surface description of features in the mapped area and sample excavation of fields within project limits. The latter focused on Feature 15, which was sampled with 12 excavation units and two mechanically excavated trenches. Because most of the part of Feature 23 that extended into project limits was removed during an earlier construction phase and the remaining section was damaged at the same time, no excavation was conducted in that feature.

Since detailed excavation of borrow pits would have provided few data that were not available from surface examination, subsurface investigations were limited to the mechanical trenching of two terrace-edge borrow pits (Features 1 and 2) to examine their structure and obtain samples. Profiles of the trenches were drawn, and two types of samples were taken. Gravel samples were obtained for comparison with gravel mulch from nearby fields to determine whether differences could be discerned that might be attributable to size-sorting. Samples of sediments from the bottoms of the trenched borrow pits were taken for pollen analysis to determine whether they might have been used as planting areas.

All visible surface artifacts within project limits were collected and point provenienced. Parallel transects were walked across the rest of the site, and all visible artifacts outside project limits were recorded and left in place. Artifacts outside project limits were usually not inventoried by feature, but in some cases artifacts from a specific feature were recorded separately and are included in the feature description.

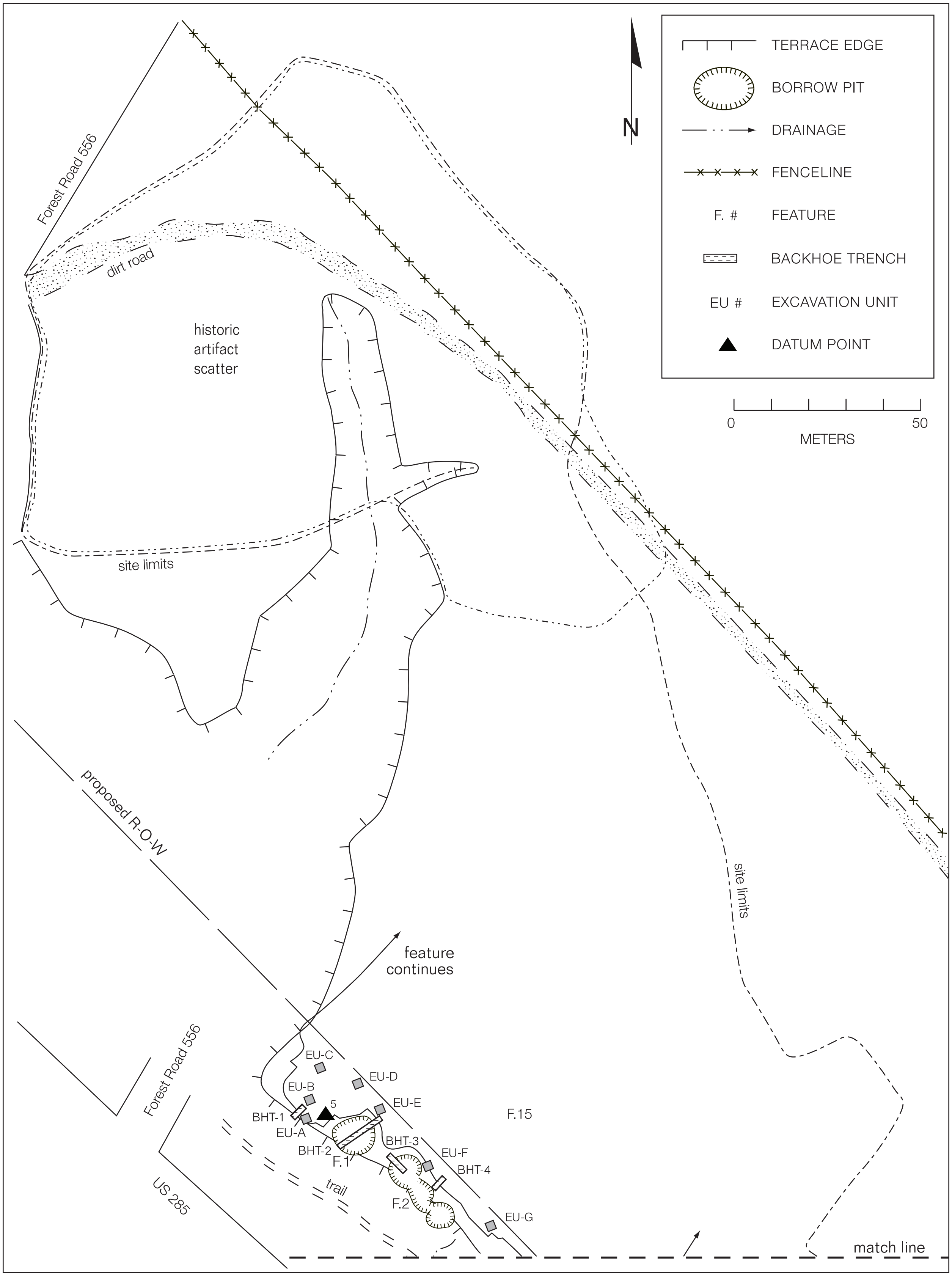


Figure 16.1. Plan of LA 118547.

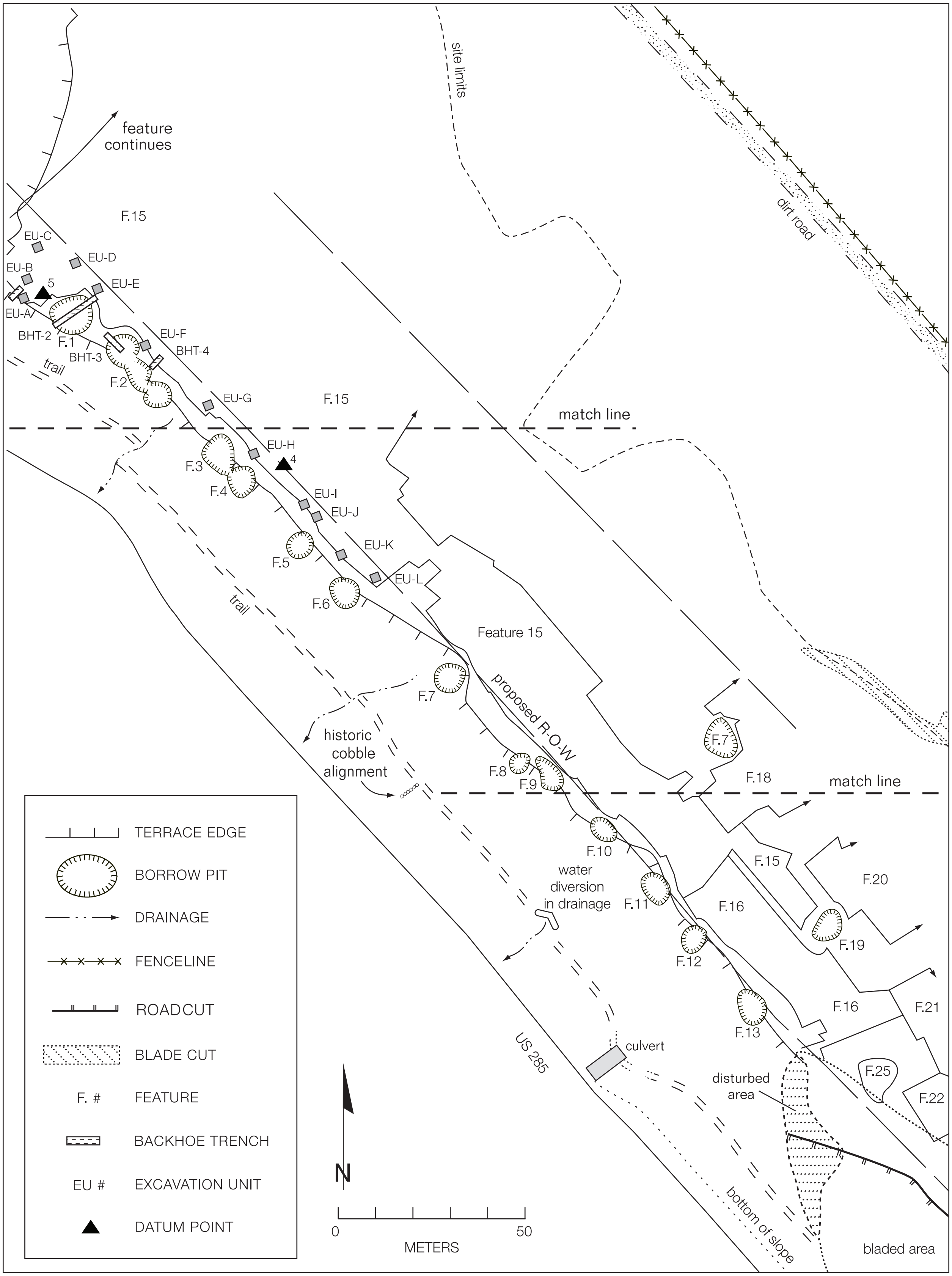


Figure 16.1 (continued).

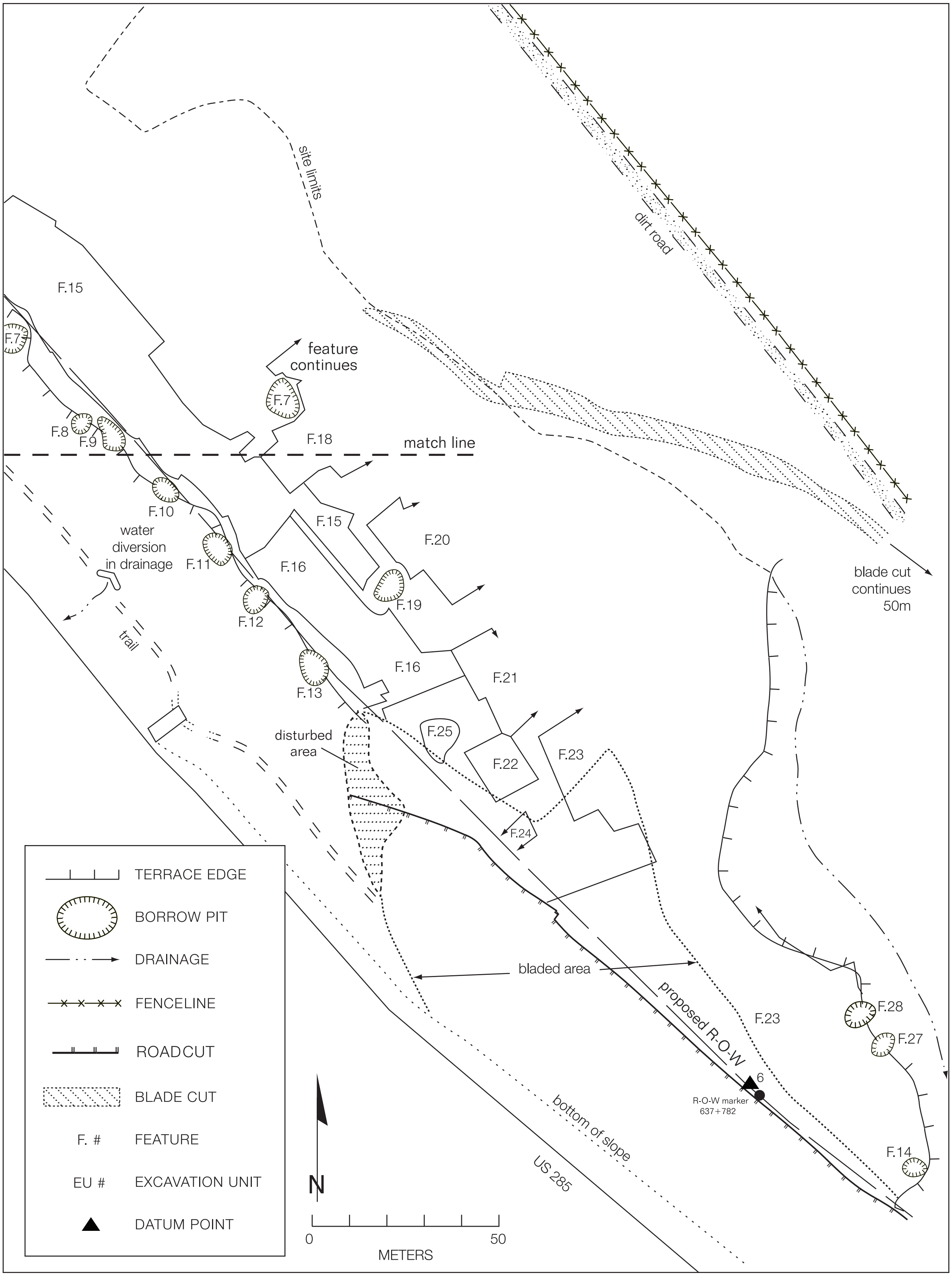


Figure 16.1 (continued).

Features

Twenty-eight features were at least partly mapped in detail and described (Fig. 16.1). With a few exceptions, feature limits were fairly well defined. Those exceptions include Features 15, 16, 23, 24, and 25. Parts of the boundaries of Features 15 and 16 appear to have been obscured by the later construction of Features 18, 20, and 21, which in places cover sections of their boundaries. It is also possible that cobbles were salvaged from alignments in Features 15 and 16 for reuse in the later fields. Features 23, 24, and 25 were damaged during recent road construction, and their west boundaries can no longer be defined.

A combination of colluvial and eolian processes have caused soil to build up against alignments that face the terrace interior, obscuring boundaries in many places. Eolian deposits also cover much of the surface of the fields, especially where they are anchored by vegetation. This made it difficult to discern many alignments and to define the full extent of others. Livestock grazing has also caused damage, displacing elements in cobble alignments and blurring the feature edges. Along the terrace edge this seems to have exacerbated damage caused by erosion. Other surface disturbances include a trail (LA 118549) that runs along the west edge of the site next to U.S. 285 but does not cross into LA 118547. An unimproved dirt road crosses the north part of the site, providing access to the terrace top from U.S. 285. That area has also been used as a modern trash dump. The southeast section of the site has been disturbed by a blade cut associated with construction of a modern earth dam that is outside site limits.

Feature 1

Feature 1 is a large, oval terrace-edge borrow pit measuring 14.0 by 10.1 m, with a maximum depth of 1.1 m (Fig. 16.2). It is completely within project limits, and a mechanically excavated trench, discussed later in the chapter, was used to investigate it. This borrow pit is next to Feature 15 and was probably a source of some of the materials used to build that gravel-mulched field. No associated artifacts were noted.

Feature 2

Feature 2 is a large, three-lobed terrace-edge borrow pit measuring 23.5 by 9.2 m, with a maximum depth of 1.1 m (Fig. 16.2). It is completely within project limits, and a mechanically excavated trench, discussed later in the chapter, was used to investigate it. This borrow pit is next to Feature 15 and was probably a source of some of the materials used to build that gravel-mulched field. The three distinct lobes visible in this feature suggest that it represents a reused borrow location or three adjacent borrow pits that grew together as materials were removed for use. Artifacts noted in association with this feature included a gray rhyolite core and three core flakes. Eolian and colluvial sediments have filled the bottom of this pit to an undetermined depth.

Feature 3

Feature 3 is a large, oval terrace-edge borrow pit measuring 10.4 by 9.5 m, with a maximum depth of 1.7 m (Fig. 16.2). It is completely within project limits and was mapped but not excavated. This borrow pit is next to Feature 15 and was probably a source of some of the materials used to build that gravel-mulched field. It also connects with another borrow pit (Feature 4). These pits represent a reused borrow location or two adjacent borrow pits that grew together as materials were removed for use in a nearby field. Sediments have built up in the bottom of the pit to an undetermined depth. No associated artifacts were noted.

Feature 4

Feature 4 is a nearly round terrace-edge borrow pit measuring 8.0 by 7.7 m, with a maximum depth of 1.5 m (Fig. 16.2). It is completely within project limits and was mapped but not excavated. This borrow pit is next to Feature 15 and was probably a source of some of the materials used to build that gravel-mulched field. As noted above, it connects with Feature 3. Together they represent a reused borrow location or two adjacent borrow pits that grew together as they were used. Sediments have built up in the bottom of this pit to an undetermined depth. No associated artifacts were noted.

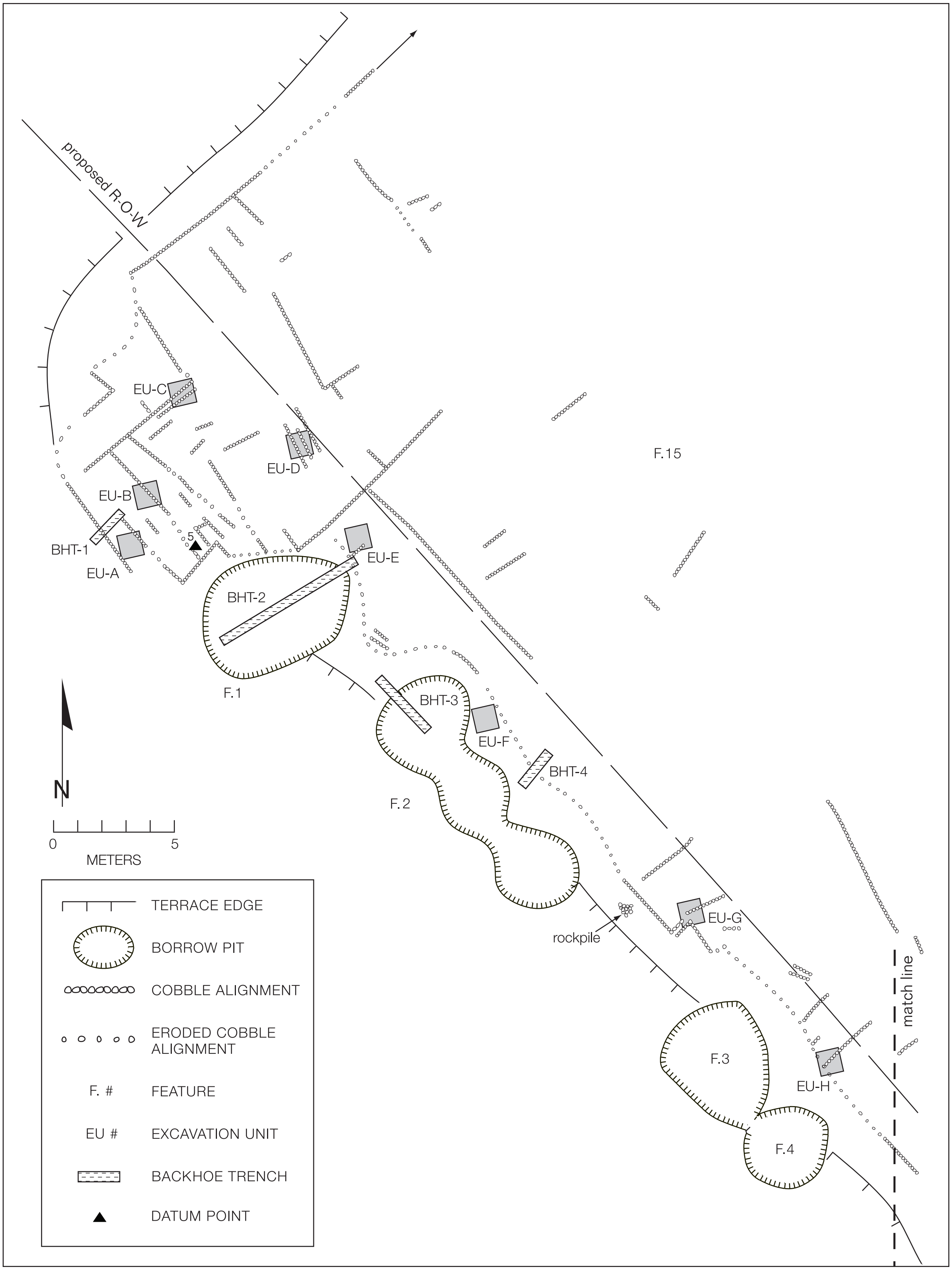


Figure 16.2. Features 1–12 and 15–19, LA 118547.

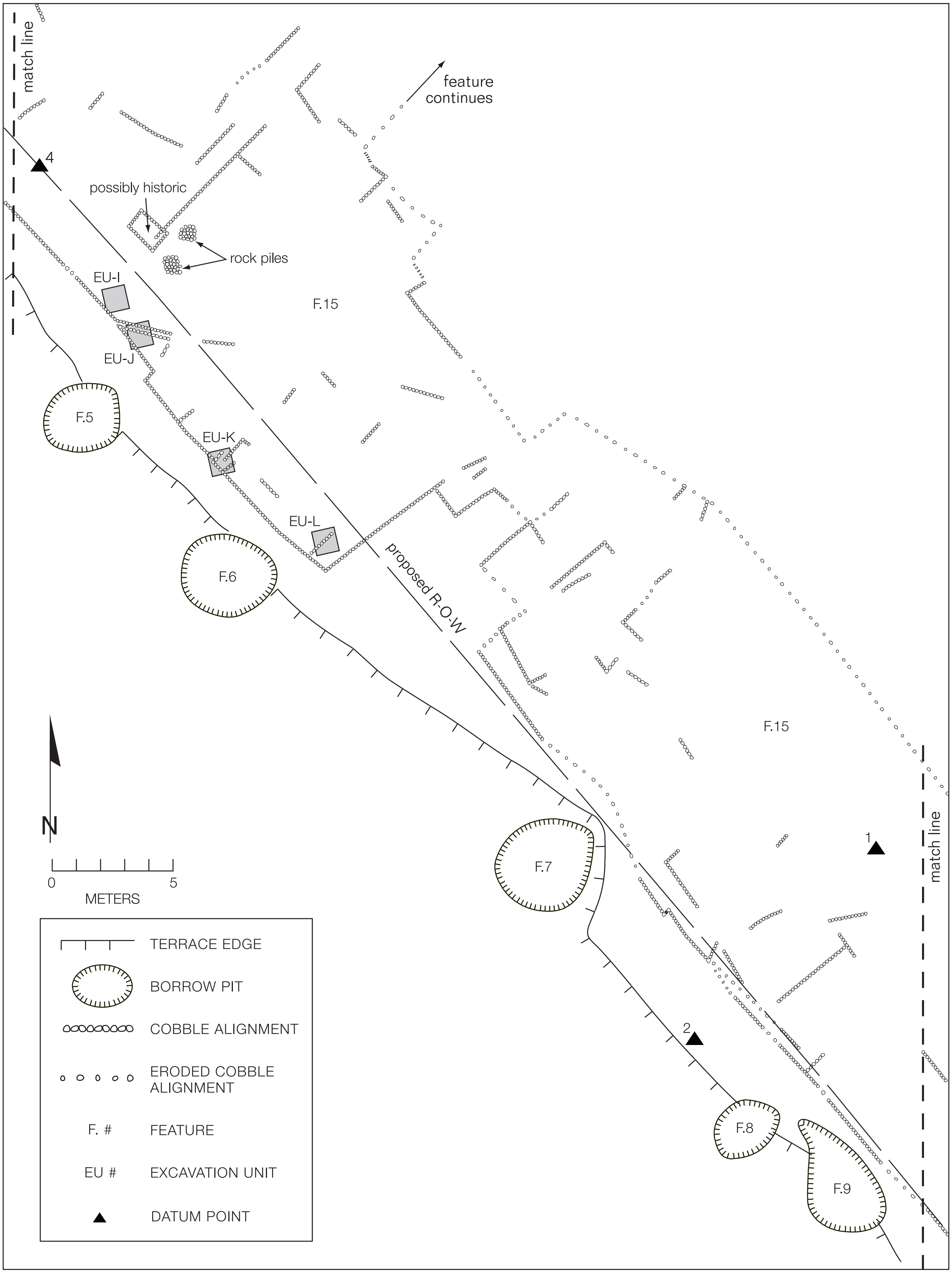


Figure 16.2 (continued).

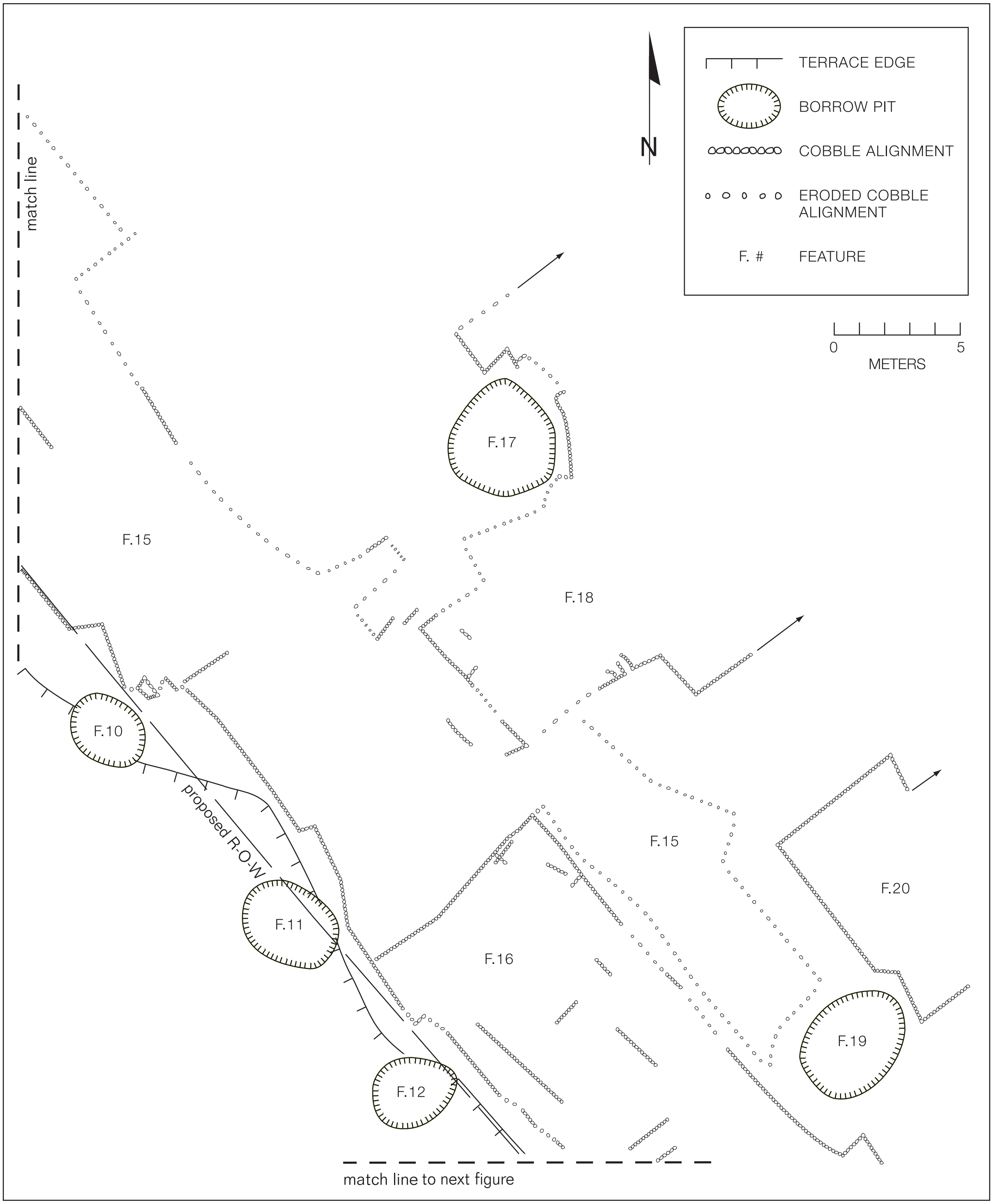


Figure 16.2 (continued).

Feature 5

Feature 5 is an oval terrace-edge borrow pit measuring 7.6 by 6.9 m, with a maximum depth of 1.6 m (Fig. 16.2). It is completely within project limits and was mapped but was not excavated. This borrow pit is next to Feature 15 and was probably a source of some of the materials used to build that gravel-mulched field. Sediments have built up in the bottom of this pit to an undetermined depth. The only artifacts noted in this feature were recent historic materials that date to a much later use of the area.

Feature 6

Feature 6 is a large, round terrace-edge borrow pit measuring 8.3 by 7.8 m, with a maximum depth of 1.6 m (Fig. 16.2). It is completely within project limits and was mapped but not excavated. This borrow pit is next to Feature 15 and was probably a source of some of the materials used to build that gravel-mulched field. Sediments have built up in the bottom of Feature 6 to an undetermined depth. Associated artifacts included two rhyolite core flakes and an andesite core.

Feature 7

Feature 7 is a large, round terrace-edge borrow pit measuring 9.1 by 8.3 m, with a maximum depth of 1.6 m (Fig. 16.2). It is completely within project limits and was mapped but not excavated. This borrow pit is next to Feature 15 and was probably a source of some of the materials used to build that gravel-mulched field. Sediments have built up in the bottom of Feature 7 to an undetermined depth. The only associated artifact was an andesite core flake.

Feature 8

Feature 8 is an oval terrace-edge borrow pit measuring 6.5 by 5.0 m, with a maximum depth of 0.7 m (Fig. 16.2). It is completely within project limits and was mapped but not excavated. This borrow pit is next to Feature 15 and was probably a source of some of the materials used to build that gravel-mulched field. Sediments have built up in the bottom of Feature 8 to an undetermined depth. No associated artifacts were noted.

Feature 9

Feature 9 is a large, teardrop-shaped terrace-edge borrow pit measuring 12.0 by 6.5 m, with a maximum depth of 0.9 m (Figs. 16.2 and 16.3). It is completely within project limits and was mapped but not excavated. This borrow pit is next to Feature 15 and was probably a source of some of the materials used to build that gravel-mulched field. Sediments have built up in the bottom of Feature 9 to an undetermined depth. No associated artifacts were noted.

Feature 10

Feature 10 is an oval terrace-edge borrow pit measuring 7.1 by 5.9 m, with a maximum depth of 1.1 m (Fig. 16.2). It is completely within project limits and was mapped but not excavated. This borrow pit is next to Feature 15 and was probably a source of some of the materials used to build that gravel-mulched field. Because of its position at the edge of the terrace, Feature 10 is open to the west. A small drainage heads in the bottom of the pit, and it is impossible to determine how much of its depth is attributable to gullying. No associated artifacts were noted.

Feature 11

Feature 11 is a large, oval terrace-edge borrow pit measuring 8.8 by 6.9 m, with a maximum depth of 0.7 m (Fig. 16.2). About 80 percent of this feature is within project limits, and it was mapped but not excavated. This borrow pit is next to Features 15 and 16, and it was probably a source of some of the materials used to build one or both of those gravel-mulched fields. Sediments have built up in the bottom of Feature 11 to an undetermined depth. The only artifact noted in association with this feature was a piece of andesite angular debris.

Feature 12

Feature 12 is an oval terrace-edge borrow pit measuring 7.5 by 5.9 m, with a maximum depth of 1.1 m (Fig. 16.2 and 16.4). About 90 percent of this feature is within project limits, and it was mapped but not excavated. This borrow pit is next to Features 15 and 16, and it was probably a

Figure 16.3. Feature 9, a terrace-edge borrow pit, LA 118547.

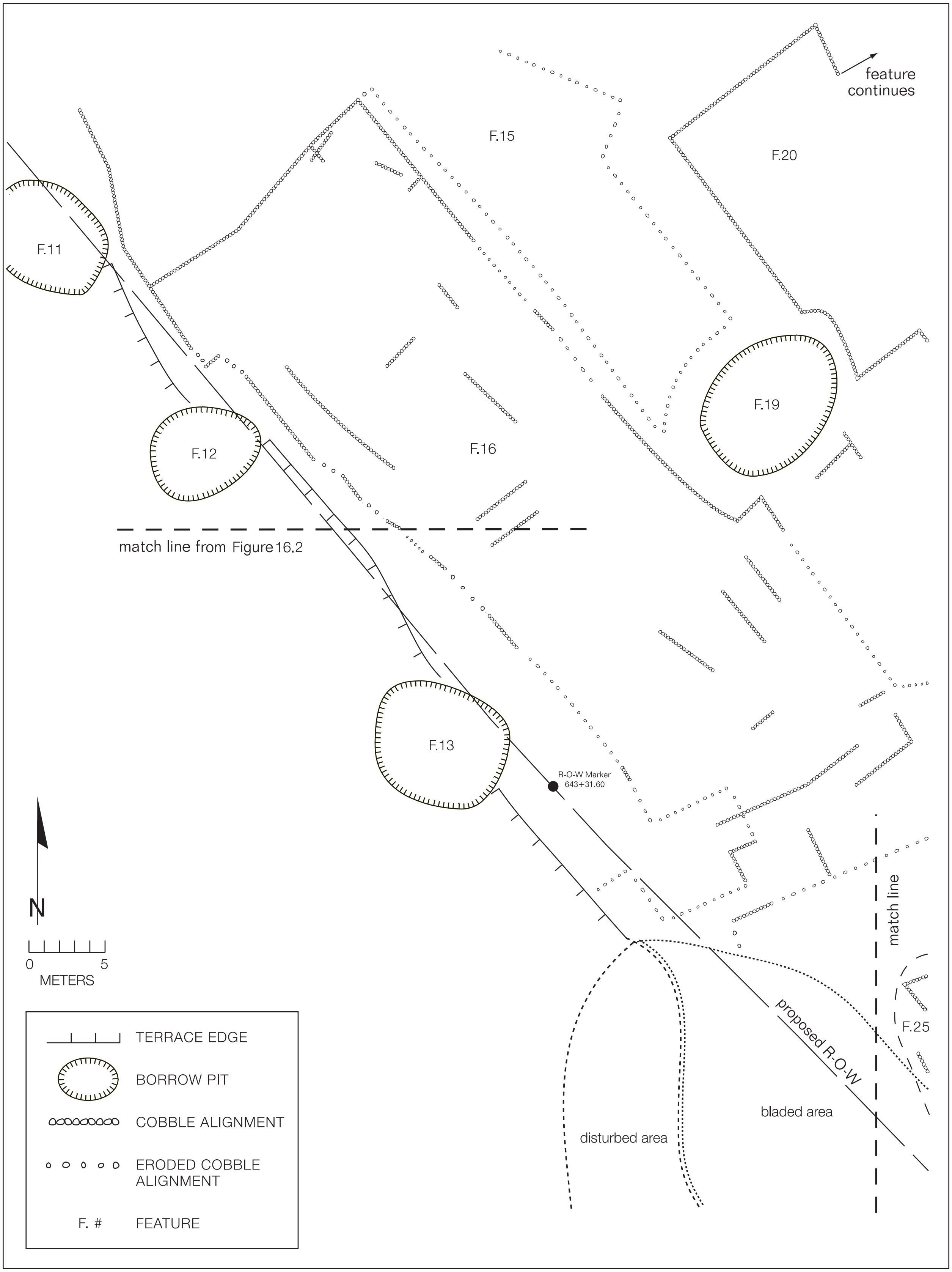


Figure 16.4. Features 12, 13, 16, 19, 20–22, and 24–26, LA 118547.

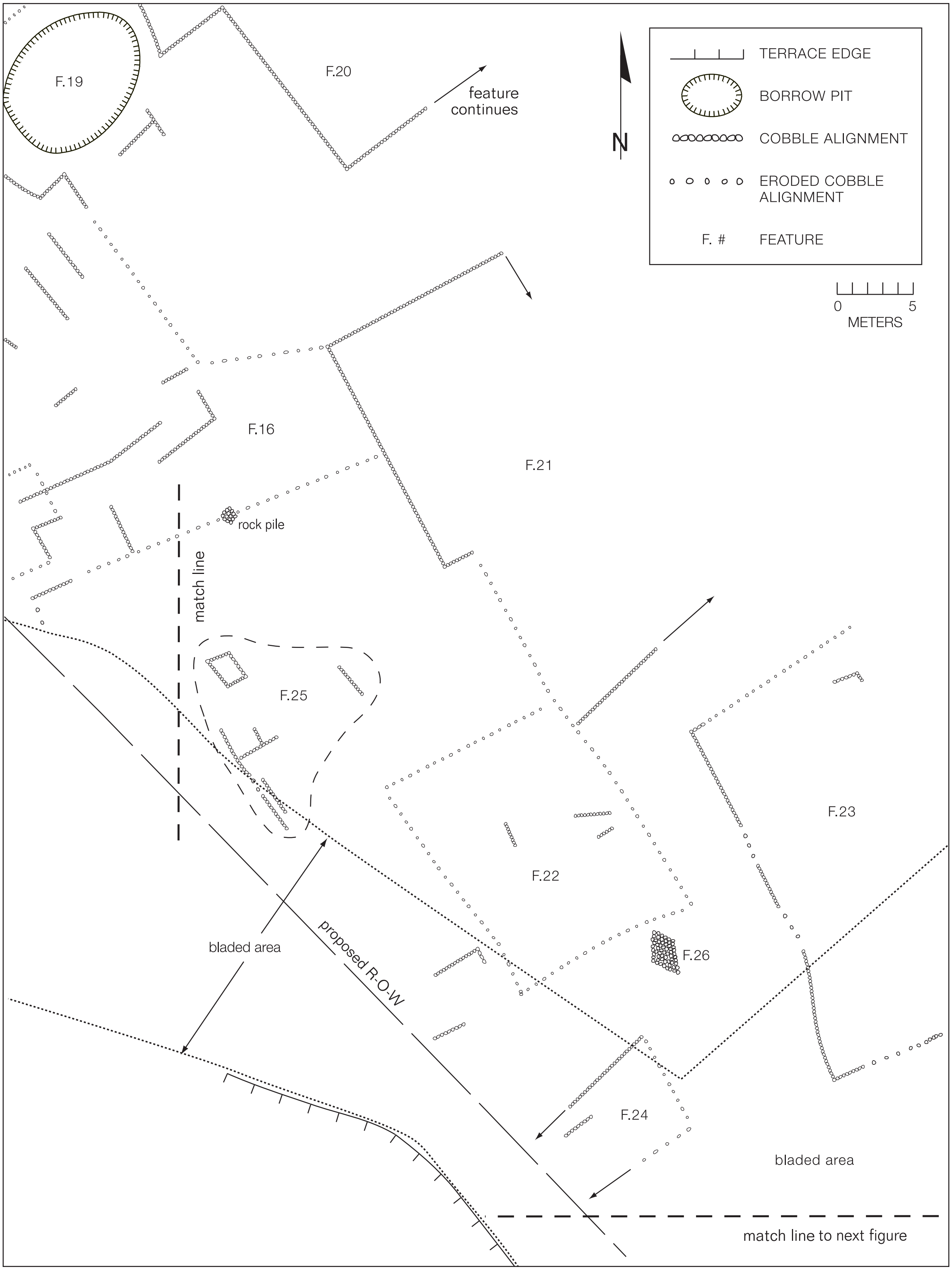


Figure 16.4 (continued).

source of some of the materials used to build one or both of those gravel-mulched fields. Sediments have built up in the bottom of Feature 12 to an undetermined depth. No associated artifacts were noted.

Feature 13

Feature 13 is a large, oval terrace-edge borrow pit measuring 9.6 by 8.3 m, with a maximum depth of 1.4 m (Fig. 16.4). About 90 percent of this feature is within project limits, and it was mapped but not excavated. This borrow pit is next to Feature 16 and was probably a source of some of the materials used to build that gravel-mulched field. Sediments have built up in the bottom of Feature 13 to an undetermined depth. Associated artifacts included two andesite core flakes, a gray rhyolite core, and a modern steel can.

Feature 14

Feature 14 is a small, oval terrace-edge borrow pit measuring 6.6 by 5.5 m, with a maximum depth of 1.5 m (Fig. 16.5). Though entirely outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Feature 23 and was probably a source of some of the materials used to build that gravel-mulched field. Because of its position at the edge of the terrace, Feature 14 is open to the south, and it is impossible to determine how much of its depth is attributable to erosion. The only artifacts noted in association were two gray rhyolite core flakes.

Feature 15

Feature 15 is a very large, irregularly shaped gravel-mulched field that measures 215 m north-south by at least 44 m east-west (Fig. 16.2). The east boundary of the field extended beyond the mapping zone for much of the north half of Feature 15. This field covers at least 6,039 sq m within the detailed examination zone. The unmapped portion of the feature is at least half as large and possibly nearly as large as the mapped section. About 40–50 percent of the surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation. Since Feature 15 extends into project limits, 12 excavation units were used to examine it. They are described later in the chapter.

Boundary and interior subdividing alignments are a single element high and wide. They were built with locally obtained cobbles and small boulders (Fig. 16.6). Cobbles predominate in all alignments, and most are 10–25 cm long. Small boulders are also common and range up to 35 cm long. Most elements were set end-to-end, but some side-by-side placement also occurs. Most elements were also set on their broadest surfaces, but uprights are common in some areas. Surface indications suggest that the feature interior is highly subdivided. Parts of the field are dotted by large cobbles and small boulders set into the gravel mulch, which may indicate that a pattern of noncontiguous, evenly spaced elements prevails in those areas.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 10 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. This field is slightly mounded in places, particularly along its west edge, where it is 5–8 cm higher than the adjacent terrace surface. The gravel-mulch layer is probably 5–15 cm thick over most of the feature. Gravels are much denser on the surface of the field than they are in adjacent off-feature areas. Where visible on the feature, gravels cover 70–90 percent of the surface. Away from the feature they cover only 10–30 percent. The only area in which this does not hold true is along the terrace edge, where erosion has removed sediments and exposed gravels in densities similar to those seen on the surface of Feature 15. Similarly, grasses were taller and denser on Feature 15 than in adjacent off-feature areas. Interestingly, most of the areas that contain dense growths of grasses are those in which eolian sediments are thicker. The grass clumps are almost certainly helping this process along by trapping and stabilizing more eolian sediments than might otherwise be retained on the surface of the feature.

The west boundary alignment is fairly continuous along the terrace edge but has been nearly eradicated in a few places by slope wash. Livestock grazing has exacerbated this process. It was not possible to determine whether the length of this boundary alignment signified that the entire feature was built and used at one time, or

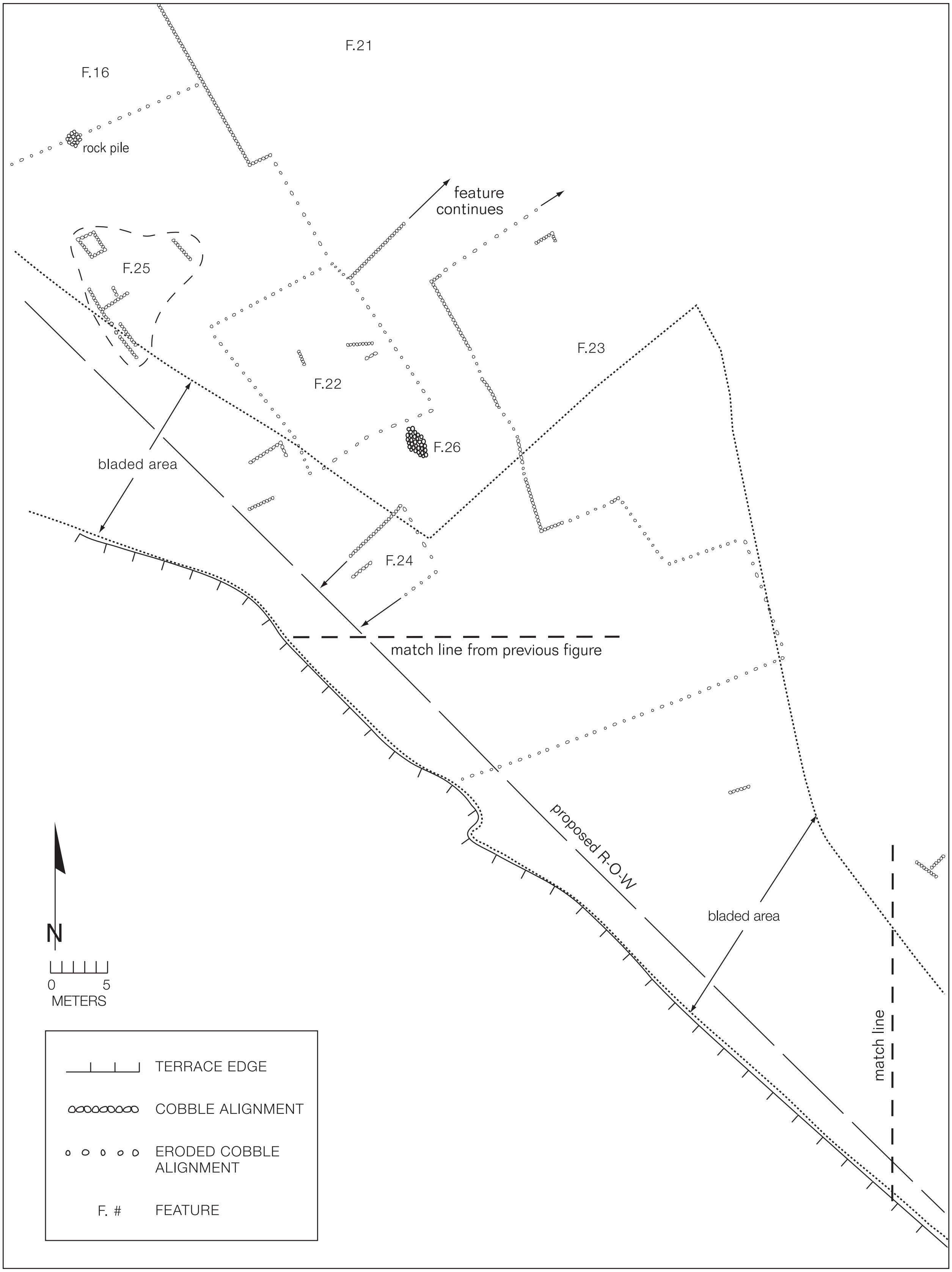


Figure 16.5. Features 14, 23, 27, and 28, LA 118547.

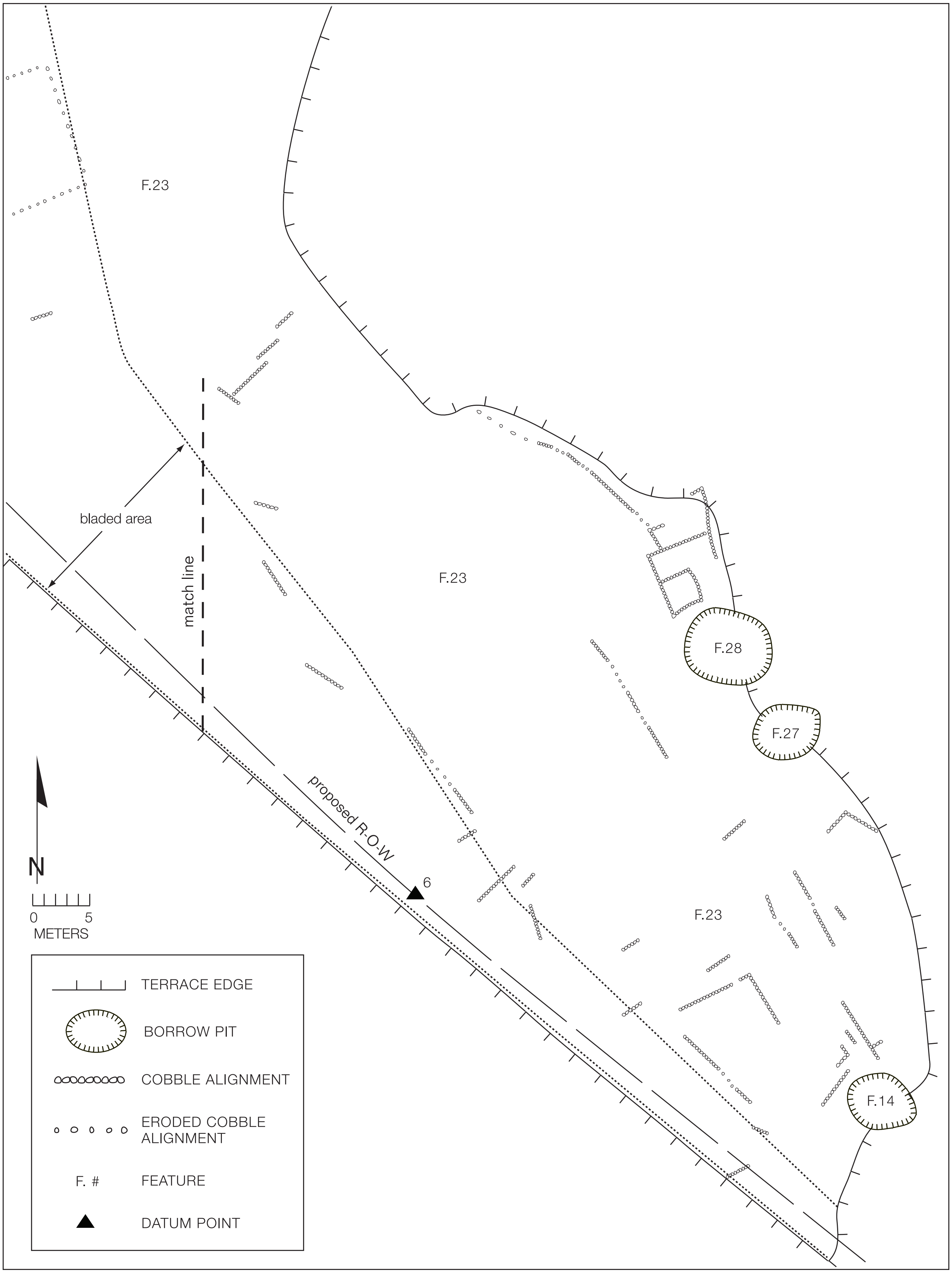


Figure 16.5 (continued).

Figure 16.6. Cobble alignments in Feature 15, LA 118547.

whether it grew through time by accretion. It is more likely that accretional growth eradicated any boundaries that might have existed between individual farming plots.

The east boundary of this field is fairly indistinct, especially near Features 18, 20, and 21. These fields appear to have been built later than Feature 15, and it is possible that some materials were salvaged from the earlier field to build the later plots. This would have contributed to the deterioration of adjacent parts of Feature 15 and could account for its current condition. Conversely, eolian and colluvial deposition could also have obscured alignments toward the interior of the terrace, though it is unlikely that this would have occurred to the degree observed.

Finally, Feature 16 forms part of the south boundary of Feature 15 and seems to have been built later. A cobble alignment separates the features, and the surface of Feature 16 is 5–8 cm higher than Feature 15. Since the east boundary alignment of Feature 15 extends beyond the north edge of Feature 16 (on the east side of that feature), and the west and south boundaries of Feature 15 are fairly indistinct in that area, Feature 16 probably covers much of the south end of Feature 15. The mounding of Feature 16 above Feature 15 adds credence to this and indicates that Feature 16 represents a later construction phase.

In a few areas, cobbles were moved around to form new configurations. Most of these alterations seem to have occurred during the historic occupation of the region, since they are on the surface of the mulch and have not been buried by eolian deposition to any appreciable depth. An example of this type of alteration may represent a historic tent base (Fig. 16.7).

Feature 16

Feature 16 is a large, irregularly shaped gravel-mulched field that measures 62 by 31 m and covers 1,078 sq m (Fig. 16.4). Since this field was entirely in the detailed examination zone, it was mapped. About 40–50 percent of the surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation.

Boundary and interior subdividing alignments are a single element high and wide. They were built with locally obtained cobbles and small boulders. Cobbles predominate in all align-

Figure 16.7. A historic reconfiguration of cobbles on the surface of Feature 15, LA 118547.

ments, and most are 15–25 cm long. Small boulders are also common and are up to 30–40 cm long. Elements were mostly placed end-to-end but are occasionally interspersed by rocks set sideways. Most elements were set on their broadest surfaces, but uprights also occur. Surface indications suggest that the feature interior is highly subdivided. In some parts of the field, especially near Feature 13, large cobbles and small boulders are set into the gravel mulch and form evenly spaced, noncontiguous alignments.

The mulch is mostly composed of unsorted gravels and pea gravels, though small cobbles up to 8 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. The north boundary alignment also forms part of the south edge of Feature 15. As discussed earlier, Feature 16 covers part of the south end of Feature 15 and represents a later phase of construction, as indicated by the mounding of this field above the surface of Feature 15.

Since boundary and interior subdividing alignments are a single element high, the gravel-mulch layer is probably 5–12 cm thick over most of the feature. Gravels are much denser on the surface of the field than in adjacent off-feature areas. Where visible on the feature, gravels cover 70–90 percent of the surface. Away from the feature they cover only 10–30 percent of the surface. The only area in which this does not hold true is along the terrace edge, where erosion has removed sediments and exposed gravels in densities similar to those on the surface of Feature 16. Similarly, grasses were taller and denser on the field than in adjacent off-feature areas. Most areas that contain dense grasses are also those in which eolian sediments are thickest. The grass clumps are probably helping this process along by trapping and stabilizing more eolian sediments than would otherwise be retained on the surface of the feature.

The southeast part of this field grades into the natural terrace-edge surface, which also contains dense gravels and cobbles that have been exposed by erosion. The field becomes rather indistinct in this area, and it was damaged by earth-moving activities associated with construction along U.S. 285. Thus, it is impossible to determine whether Feature 16 ends where shown in Figure 16.4 or at one time extended further south along the terrace edge. However, a lack of visible cobble alignments in that area suggests that the former is more likely.

Feature 17

Feature 17 is a large, oval terrace-interior borrow pit measuring 13.2 by 11.6 m, with a maximum depth of 0.6 m (Fig. 16.2). Though outside construction limits, it was in the detailed examination zone and was mapped. Sediments have built up in the bottom of this pit to an undetermined depth. As can be seen from Figure 16.2, Feature 17 is closely edged on two sides by Feature 18 and probably served as a source of some of the materials used to construct that field, which was subsequently built partly around it. Associated artifacts included five rhyolite core flakes, one andesite core flake, a Biscuit B sherd, and an aluminum can.

Feature 18

Feature 18 is a medium-sized, irregularly shaped gravel-mulched field that measures a maximum of 34 by 25 m and covers roughly 540 sq m (Fig. 16.2). Since this field was partly outside the detailed examination zone, the entire feature was not mapped. Only the western 80 percent was in the mapping zone, so the full extent of the feature was estimated by pacing. About 40–50 percent of the surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation.

Boundary and interior subdividing alignments are a single element high and wide. They were built with locally obtained cobbles and a few small boulders. Cobbles predominate in all alignments, and most are 10–20 cm long. The few small boulders average 30–35 cm long. Elements were mostly placed end-to-end except in the south and southeast boundary alignments, where many cobbles were set sideways. Most elements were set on their broadest surfaces, but uprights also occur, especially in the south and southeast boundary alignments. The presence of several short segments of interior subdividing alignments suggests that the feature is highly subdivided.

The mulch is mostly composed of gravels and pea gravels, though small cobbles up to 8 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. This feature is distinctly mounded above both Feature 15 and the adjacent unaltered terrace surface. Where the two fields abut, the surface of Feature 18 is about 5 cm higher than Feature 15 and tends to contain larger gravels. However, in some places the boundary between these fields is indistinct, and they could not be accurately separated by surface assessment alone. The blurring was probably caused by displacement of elements by grazing livestock. The demarcation between Feature 18 and the adjacent unaltered terrace surface is quite distinct. Not only is Feature 18 mounded 10–15 cm above the terrace, the gravel cover is also much denser on the field than in off-field areas. Where the mulch surface is visible on Feature 18, gravels cover 60–90 percent, in contrast with a 20–30 percent coverage on the nearby terrace surface.

Feature 19

Feature 19 is a large, oval terrace-interior borrow pit measuring 12.5 by 10.5 m, with a maximum depth of 0.4 m (Fig. 16.4). Though outside construction limits, it was in the detailed examination zone and was mapped. Sediments have built up in the bottom of this pit to an undetermined depth. As can be seen from Figure 16.4, this feature sits between Features 16 and 20, both gravel-mulched fields. Since part of the west boundary alignment of Feature 20 is curved to accommodate the borrow pit, Feature 19 was probably already in place when Feature 20 was built. If this is correct, Feature 19 probably provided some of the materials used to build Feature 16. However, if Feature 20 grew by accretion, it is also possible that Feature 19 was a source of materials for that field as well. Unfortunately, even with more detailed examination it may be impossible to demonstrate which of these interpretations is more likely. The only associated artifact was a steel beverage can, which is undoubtedly a later intrusion.

Feature 20

Feature 20 is a large, irregularly shaped gravel-mulched field that measures a maximum of 47 by 31 m and covers roughly 1,270 sq m (Fig. 16.4).

Since this field was partly outside the detailed examination zone, the entire feature was not mapped. Only the west 25 percent was in the mapping zone, so the full extent of the feature was estimated by pacing. About 70 percent of the surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation. Two adjacent terrace-interior borrow pits (Feature 19 and an undocumented feature) may have provided materials for the construction of this field.

Boundary and interior subdividing alignments are a single element high and wide. They were built with locally obtained cobbles and a few small boulders. Cobbles predominate in all alignments, and most are 10–25 cm long. The few small boulders that were used average 30–35 cm long. Elements were dominantly set end-to-end, but sideways placement was also common, especially along the west edge of the field. Most elements were set on their broadest surfaces, but uprights also occur. The lack of visible interior alignments may indicate that there are few internal subdivisions, but this is unlikely considering the large amount of field surface that is obscured by sediments.

The mulch is mostly composed of gravels and pea gravels, though small cobbles up to 8 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. This feature is distinctly mounded on all but the east edge, which was removed during construction of a low earth berm used for erosion control. Where the boundary alignments are intact, the surface of this field is 5–12 cm higher than the adjacent terrace (Fig. 16.8). A visible difference in surface gravel concentrations makes the break between these edges and the unaltered terrace surface quite distinct. Where the mulch is visible on the field, gravels cover 60–70 percent of the surface. On the adjacent unaltered terrace surface, gravel concentrations are only 10–30 percent.

This field also contrasts sharply with an adjacent extension of Feature 15 (Fig. 16.2). The southern extension of that field has a very gravelly surface that was easily distinguished from the unaltered terrace, but cobbles are lacking in that area, and no boundary alignments were defined. While that extension may represent a

Figure 16.8. A boundary alignment in Feature 20, LA 118547, showing how the field surface is mounded above the adjacent terrace surface.

part of the terrace that was simply mulched with gravel but left unbounded by cobbles, this is unlikely. Instead, most of the cobbles used to build that part of Feature 15 were probably salvaged for reuse in another field, such as Feature 20.

Feature 21

Feature 21 is a medium-sized, irregularly shaped gravel-mulched field that measures a maximum of 26 by 13 m and covers roughly 300 sq m (Fig. 16.4). Since this field was partly outside the detailed examination zone, the entire feature was not mapped. Only the west 60–70 percent was in the mapping zone, so the full extent of the feature was estimated by pacing. About 60 percent of the surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation. This field may be associated with a nearby unrecorded terrace-interior borrow pit that was outside the mapping zone.

Boundary and interior subdividing alignments are a single element high and wide. They were built with locally obtained cobbles and a few small boulders. Cobbles predominate in all alignments, and most are 10–25 cm long. The few small boulders noted were 30–40 cm long. Elements were dominantly set end-to-end, but some sideways placement also occurs. Most elements were set on their broadest surfaces, but uprights are common. The presence of several short segments of interior subdividing alignments suggests that the feature interior is highly subdivided. In addition, part of the feature contains small boulders set into the gravel mulch to form evenly spaced, noncontiguous alignments.

The mulch is mostly composed of gravels and pea gravels, though small cobbles up to 8 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Though the edges of this field are fairly distinct, they are only mounded about 2–3 cm higher than the adjacent terrace surface. However, the field interior seems to be mounded as much as 20 cm higher than the adjacent terrace, suggesting that sediments have built up along the edge of the boundary alignments, obscuring the actual degree to which this field is raised above the terrace surface.

It is difficult to place this field within the construction sequence at LA 118547, but there are indications that it may have been built later than some adjacent plots. The southwest corner of Feature 21 abuts the northeast corner of Feature 22, and it is uncertain whether they represent contemporary use. However, since boundary alignments in Feature 21 are in generally better condition, that field may have been built later than Feature 22. Similarly, Feature 21 may overlap part of Feature 16, which also has badly preserved boundary alignments in that area. As suggested before, this may be an indication of material salvaging for reuse in new fields. If so, Feature 21 was built later than both of those other fields. Cultural materials were not inventoried separately for this feature, but a Biscuit A bowl sherd was noted on the surface during mapping.

Feature 22

Feature 22 is a small, rectangular gravel-mulched field that measures 15.2 by 12.8 m and covers 195 sq m (Fig. 16.4). Since this field was within the detailed examination zone it was mapped. About 60–70 percent of the surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation. The boundaries of this feature are fairly indistinct. This is probably partly due to the salvaging of cobbles for reuse elsewhere (perhaps in Feature 21). However, the west edge of the field was probably removed during construction along U.S. 285.

Boundary and interior subdividing alignments are a single element high and wide. They were built with locally obtained cobbles and a few small boulders. Cobbles predominate, and most are 15–25 cm long. No information on element placement was available because of the deteriorated nature of this feature. Similarly, it was not possible to determine whether the interior of the field was subdivided.

The mulch is mostly composed of gravels and pea gravels, though small cobbles up to 10 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. This feature may have been built early in the use of this location and was superseded by other fields away from the terrace edge when it was no longer suitable for use. While cultural materials were not inventoried separately for this feature, numerous chipped stone artifacts were noted, including 40+ gray rhyolite core flakes and 12+ andesite core flakes.

Feature 23

Feature 23 is a large, irregularly shaped gravel-mulched field that measures 113 by 48 m and covers roughly 1,900 sq m (Fig. 16.5). Since this field was partly outside the detailed examination zone, the entire feature was not mapped. Perhaps two-thirds of the field was in the mapping zone, so its full extent was estimated by pacing. The east boundary is a deep tributary drainage, and a series of gravel-mulched plots that line the northwest rim of that drainage may represent a continuation of this field. Though this was uncertain, Feature 23 is probably larger than initially defined. About 50–60 percent of the field surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation.

Boundary and interior subdividing alignments appear to have been a single element high and wide. They were built with locally obtained cobbles and a few small boulders. Cobbles predominate, and most are 10–25 cm long. The few small boulders noted were 30–40 cm long. Elements were dominantly set end-to-end, but some sideways placement also occurs. Most elements were set on their broadest surfaces, but upright placement also occurs, especially when elements were set sideways. The presence of several short segments of interior subdividing alignments suggests that the feature was highly subdivided.

The mulch is mostly composed of gravels and pea gravels, though small cobbles up to 8 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. While little evidence of mounding was visible, the field appears to be 2–5 cm higher than the terrace surface. Where the natural terrace surface is visible next to the field, there are distinct differences in surface gravel concentrations. Gravels cover 60–80 percent of the field surface, while the unaltered terrace surface only has a 20–30 percent gravel cover.

This field comprises the south quarter of the site, and it was impossible to determine whether it represents a single coherent farming complex or developed through time by accretion. The west half of Feature 23 was damaged during the reconstruction of U.S. 285. The east half exhibits little better preservation. A few segments of boundary alignments are visible along the east edge, where erosion seems to have displaced most elements. Only the presence of occasional interior subdividing alignments and a generally heavy cover of gravel on the surface allowed us to define this feature. There seemed to be at least three terrace-edge borrow pits associated with the construction of this field, including Features 14, 27, and 28.

Feature 24

Feature 24 is a small, possibly rectangular gravel-mulched field that measures at least 10.0 by 6.4 m and covers a minimum of 64 sq m (Fig. 16.4). Since this field was in the detailed examination zone, it was mapped. Unfortunately, the west edge of the field was removed during reconstruction of U.S. 285, so its east-west dimensions are uncertain. Much of the surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation. The remaining boundaries of this feature are fairly indistinct, perhaps because of salvaging of cobbles for reuse elsewhere.

Boundary and interior subdividing alignments appear to have been a single element high and wide. They were built with locally obtained cobbles and a few small boulders. Cobbles predominate in all alignments, and most are 10–25 cm long. The few small boulders noted were 25–35 cm long. No information on element placement was available because of the deteriorated nature of this feature. Similarly, it was not possible to determine whether the interior of the field was subdivided.

The mulch is mostly composed of gravels and pea gravels, though small cobbles up to 5 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. The surface of this feature is mounded about 5 cm above the adjacent terrace. Cultural materials were separately inventoried for this feature; they included two gray rhyolite core flakes and two andesite core flakes.

Feature 25

Feature 25 is a small, irregularly shaped gravel-mulched field that measures at least 8 by 7 m and covers a minimum of 40 sq m (Fig. 16.4). Since this field was in the detailed examination zone, it was mapped. Unfortunately, the west edge of the field was removed during reconstruction of U.S. 285, so its east-west dimensions are uncertain. Much of the surface is obscured by sediments that have infiltrated the mulch and are anchored by vegetation. The remaining boundaries are fairly indistinct, perhaps because of salvaging of cobbles for reuse elsewhere.

Boundary and interior subdividing alignments seem to be a single element high and wide. They were built with locally obtained cobbles. Cobbles were used to construct alignments, and most are 10–25 cm long. No information on element placement was available because of the deteriorated nature of this feature. The presence of several short segments of interior subdividing alignments suggests that the feature was highly subdivided. However, because of disturbance and erosional deposition in this area, we are uncertain whether the alignments used to define Feature 25 represent a single coherent field or several small individual features.

The mulch is mostly composed of gravels and pea gravels, though small cobbles up to 5 cm long also occur, and their frequency on the surface suggests that only larger rocks were sorted out for use as building elements. Cultural materials were separately inventoried for this feature and included six gray rhyolite core flakes and two obsidian core flakes.

Feature 26

Feature 26 consists of a roughly rectangular concentration of cobbles that measures 3.2 by 2.6 m and stands 0.2 m above the terrace surface (Fig. 16.4). Approximately 36 cobbles and small boulders are included in the feature, and they are 15–30 cm long (Fig. 16.9). Feature 26 abuts the south edge of a prehistoric field (Feature 22), and the materials used in its construction may have been scavenged from that feature. Conversely, a shallow depression just east of the cobble concentration may have been the source of these materi-

Figure 16.9. Feature 26, LA 118547.

als, since that area is now devoid of cobbles.

The function of Feature 26 is problematic. In some ways it resembles several possible historic graves found at LA 118548 directly south of this site (Levine 1997). However, this could not be determined for certain from surface indications alone. Whatever its function, it appears to postdate the use of this area for farming and is most likely of historic origin. Since it is outside project limits, no further investigations were conducted.

Feature 27

Feature 27 is a small, oval terrace-edge borrow pit measuring 7.8 by 4.3 m, with a maximum depth of 1.4 m (Fig. 16.5). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Feature 23 and was probably a source of some of the materials used to build that gravel-mulched field. Because of its location at the terrace edge, this pit is open to the east, and it is uncertain how much of its depth is attributable to erosion. The only associated artifacts noted were recent historic materials that postdate use of this site for farming.

Feature 28

Feature 28 is a large, oval terrace-edge borrow pit measuring 11.4 by 7.6 m, with a maximum depth of 1.8 m (Fig. 16.5). Though outside construction limits, it was in the detailed examination zone and was mapped. This borrow pit is next to Feature 23 and was probably a source of some of the materials used to build that gravel-mulched field. Because of its location at the terrace edge, this pit is open to the east, and it is uncertain how much of its depth is attributable to erosion. The only associated artifacts noted were recent historic materials that postdate use of this site for farming.

Surface Information

The farming features at this site occur as a narrow band along the west edge of a terrace that forms the east edge of the Ojo Caliente Valley, extending from a deep drainage on the north to a similarly incised drainage on the south. As mentioned earlier, these north and south boundaries are artificial. Rather than ending where large tributary drainages cut through the terrace, the farming features tend to follow the edges of those drainages around their heads and back to the main terrace edge. Thus, LA 118547 is part of a continuous band of farming features that extends from at least LA 118548 on the south to LA 105709 on the north. There, near Hilltop Pueblo, the band of farming features ends at a large arroyo. We were unable to determine how far south the prehistoric fields extend, but survey by Bugé (1984) suggests that they continue at least as far as Ponsipa'akeri, several kilometers to the south.

The configuration of features at LA 118547 is quite striking. The north three-quarters of the site is fairly intact, though it has sustained some damage from erosion and livestock grazing. Two bands of features are visible throughout this zone, one along the terrace edge and a second adjacent to the first but situated away from the edge. The terrace-edge band appears to have been built first. Rather than representing a single planned construction event, the configuration of these features suggests that they represent accretional growth through time. Feature 16, in particular, is illustrative of this process. While this field was included in the terrace-edge band, it was built after Feature 15 and partly overlaps it. Feature 15 probably represents several originally separate farming plots that now appear to be continuous.

Most, if not all, of the terrace-edge borrow pits seem to be related to construction of the terrace-edge band of features. In contrast, the terrace-interior borrow pits are all adjacent to fields built in the second (interior) band and were probably used as material sources during construction of those features. The interior band of fields includes Features 18, 20, 22, and 23, as well as several unmapped fields outside the mapping zone. All of the recorded fields in the interior band are qualitatively distinct from those in the terrace-edge band—their boundary alignments are better preserved and more visible, and their surfaces are clearly mounded above those of the terrace-edge band. In some instances, fields in the interior band seem to overlap those in the terrace-edge band. Boundary alignments in the interior band may be better preserved than those in the terrace-edge band because of the salvaging of construction materials from the earlier (terrace-edge) fields for use in the newer (interior) fields.

If this interpretation is correct, LA 118547 provides evidence of a rather lengthy use of this location for farming. As early fields became less suitable for use, they appear to have been abandoned and replaced. If unused land adjacent to the terrace edge was still available, new fields were built there. Once that area was completely occupied, either by abandoned fields or features that were still being used, construction began on a new band of fields. Since gravels and cobbles are heavy, new pits on the terrace interior that were closer to the building area were used to provide at least some of the needed materials for the interior band of fields.

A considerable number of artifacts were collected or recorded at this site. They indicate both prehistoric and historic uses. Table 16.1 inventories the chipped stone artifacts collected from the surface. Most artifacts were recovered from the zone between the west edge of Feature 15 and the terrace slope, though a few also came from the feature surface. Except for cherts and obsidians, which together comprise only 1.2 percent of the assemblage, materials were immediately available in the gravel deposits that cloak the edge of the terrace. This assemblage is dominated by rhyolites, which comprise just over 75 percent of the collection. Andesite is a distant second at 19.3 percent. Except for quartzite, which makes up 3 percent of the assemblage, other materials are rare and comprise less than 1 percent of the total apiece. Two formal tools were recovered, both Pueblo corner-notched arrow points. Otherwise, only reduction debris (core flakes, angular debris, and cores) was recovered, suggesting that raw-material quarrying and initial reduction were important activities. This possibility is addressed in greater detail in a later chapter. Since most chipped stone artifacts were recovered from the terrace edge in nonfeature areas, we could not determine whether material acquisition occurred before the fields were built, while they were in use, or after they were abandoned. However, it is possible (if not likely) that materials were quarried from the gravel deposits exposed in this area at all those times. In addition to the chipped stone artifacts, three Biscuit B sherds were also collected from the surface.

Numerous prehistoric artifacts were also recorded by walking transects across the part of the site that lay outside the highway right-of-way. The chipped stone assemblage recorded in this way was dominated by gray rhyolite (117 core flakes, 39 angular debris, 20 cores, 2 tested cobbles). Other materials noted were red rhyolite (6 core flakes, 5 angular debris, 1 core), andesite (69 core flakes, 15 angular debris, 4 cores), obsidian (1 core flake), Pedernal chert (3 core flakes), and other cherts (3 core flakes, 1 angular debris). Ceramic artifacts recorded on the surface included 4 Biscuit A bowl sherds, 12 Biscuit B sherds (7 bowl, 4 jar, 1 indeterminate), and one bowl sherd from an unidentified type of pottery.

Historic artifacts were also common on the surface and may represent several different periods of use or trash discard. However, most of these materials date to the last half of the twentieth century and represent numerous trash disposal episodes. Such materials are particularly

Table 16.1. Chipped stone artifacts collected from within the highway at LA 118547 (material type by artifact morphology)

Material Type	Angular Debris	Core Flakes	Cores	Bifaces
Chert	1	-	-	-
Pedernal chert	1	1	-	1
Obsidian	-	1	-	1
Igneous undifferentiated	1	1	-	-
Rhyolite	142	237	19	-
Andesite	42	58	2	-
Welded tuff	-	-	1	-
Quartzite	3	13	-	-
Massive quartz	1	2	-	-

common around the head of the drainage that forms part of the north boundary of the site, but they were not inventoried. The only materials that suggest use of this area before the late 1800s are three olive jar sherds that fit together and suggest use during the Spanish Colonial or Mexican Territorial periods. These sherds were collected from the highway right-of-way, as was a two-hole shell button. Since the manufacture of shell buttons did not begin commercially in the United States until about 1855, it is unlikely that these artifacts were contemporary. Other temporally diagnostic historic artifacts at LA 118547 were recorded in the section of site that extends outside the right-of-way and are indicative of use during the late American Territorial and Statehood periods, ca. 1880 to the present. They included 2 pieces of amethyst glass, 4 fragments of a glass bottle with a 1908 date, 3 hole-in-top cans, 3 fragments of brown glass, 16 pieces of clear glass, 9 aluminum beverage cans, 1 steel beverage can with aluminum top, 1 plastic bottle, and part of an automobile headlight.

Results of Excavation

Twelve excavation units and four mechanically excavated trenches were used to examine subsurface deposits and construction techniques in Feature 15, a large gravel-mulched field at LA 118547. This was the only such feature that extended into project limits at the site. It represents a series of individual plots constructed so closely together that they could not be separated by surface examination alone, or a large field that grew through time by accretion. Mechanically excavated trenches were used to examine subsurface deposits in Features 1 and 2, both terrace-edge borrow pits. The soil strata encountered during excavation are discussed first, followed by descriptions of excavation units and mechanically excavated trenches. Variations in soil strata are detailed in excavation unit descriptions. Excavation was conducted in natural units except in mechanically excavated trenches.

Three basic soil layers were defined in fields during hand excavation. Stratum 1 was uppermost and consisted of a layer of eolian sediments deposited on field surfaces and anchored in place by vegetation. This layer was a pale brown silty sand of variable thickness ranging from virtually nothing up to an average thickness across excavation units of 3.8 cm. In addition to sediments, there was some mixing with the underlying gravel mulch, so about 30 percent of this layer consisted of pea gravels and gravels. Alignments and the gravel-mulch surface were often concealed beneath a thin mantle of this material.

The layer of gravel mulch applied to the terrace surface between cobble alignments was designated Stratum 2, and it underlay Stratum 1. Stratum 2 was variable in thickness, ranging in thickness across excavation units between 7.3 and 12.1 cm. This layer contained mostly unsorted pea gravels, gravels, and small cobbles, but perhaps 30–40 percent was a brown silty sand. The latter probably represents eolian sediments that infiltrated and clogged the mulch. It was impossible to determine whether these sediments were deposited when the field was in use or after it was abandoned, but deposition during both periods is likely.

Stratum 2 was placed directly upon the original terrace surface. Though the terrace surface was configured somewhat differently from trench to trench, it was always designated Stratum 3. Excavation usually halted when this surface was encountered, so detailed descriptions were not generated. However, Stratum 3 usually consisted of a brown silty sand that contained fewer gravels than Stratum 2.

Feature 1

Backhoe Trench 2 was dug through the center of Feature 1 to allow us to examine the structure of that terrace-edge borrow pit, determine how much soil had washed in since it was used, and see if it penetrated through a gravel stratum. It was also used to collect samples of gravel for comparison with materials recovered from the mulch layer in Feature 15, and pollen to help determine if it was used to grow crops.

A 13.2 m long section of terrace sediments was exposed in this trench, and a 3 m long segment of trench near the edge of the feature was profiled (Fig. 16.10). Three strata were defined. The uppermost layer contained a mixture of eolian and colluvially deposited sediments, mostly brown sand and small gravels. This stratum was 15–20 cm thick and occurred only in the

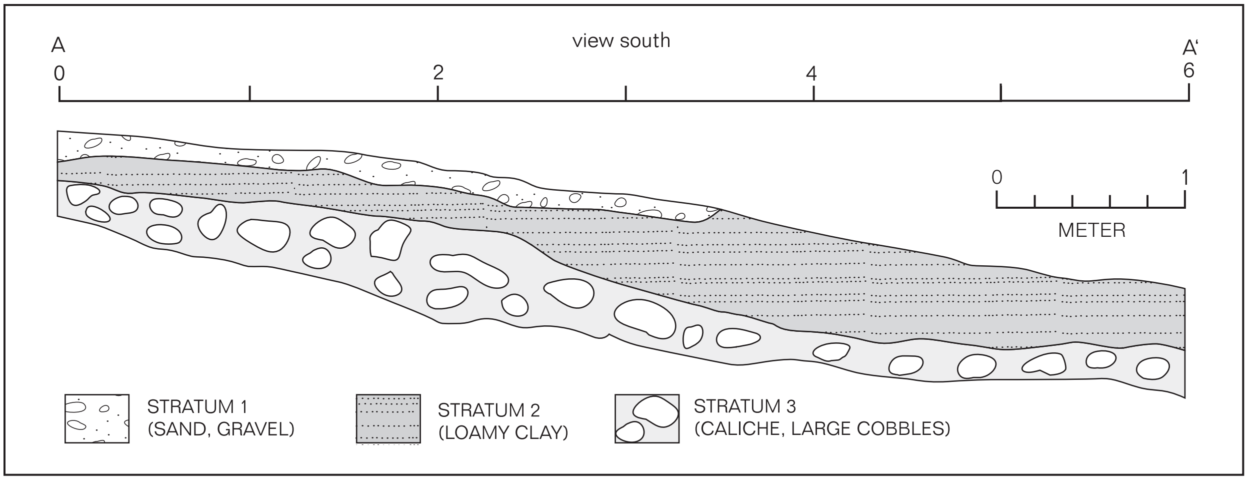


Figure 16.10. Profile of a section of the south wall of Backhoe Trench 2, Feature 1, LA 118547.

east part of the profile. Underlying it was a 10–28 cm thick layer of brown loamy clay. The lowermost layer encountered in this trench was a very pale brown sand containing numerous gravels and large cobbles. Caliche deposits were very common in this stratum. A sample taken from the fill in this feature yielded a moderate concentration of corn pollen.

The borrow pit was a fairly wide, comparatively shallow excavation into a gravel- and cobble-bearing layer. In cross section, the pit was saucer-shaped, and much deeper in the center than at the edges. The two uppermost strata represent sediments deposited since the feature was used. Thus, 18–26 cm of sediments have built up since that time. Exposure of a stratum containing numerous gravels and cobbles in the bottom of the trench indicates that the borrow pit did not completely penetrate the layer of gravels into which it was excavated.

Feature 2

Backhoe Trench 3 was used to examine the north end of Feature 2, a large borrow pit showing evidence of multiple episodes of use. Like Backhoe Trench 2, it was excavated to allow us to examine the structure of the borrow pit, determine how much soil has washed in since it was used, and see if it penetrated through a gravel stratum. It was also used to collect samples of gravel for comparison with materials recovered from the mulch in Feature 15.

A 6.2 m long section of terrace sediments was exposed in this trench, and a 4 m long segment of trench near the north edge of the feature was profiled (Fig. 16.11). Three strata were defined. The uppermost stratum at the north edge of the trench was a 27 cm thick layer of brown sandy soil containing numerous gravels and cobbles. This unit represented the original surface layer in this part of the terrace (Stratum 3). It was absent in most of the borrow pit, and in its place was a 37–46 cm thick layer of very pale brown loamy clay deposited by eolian and colluvial processes. The lowermost stratum exposed throughout this trench was a layer of brown sand containing numerous gravels and cobbles. Caliche deposits were very common in this stratum.

This borrow pit was a fairly wide, comparatively shallow excavation into a gravel- and cobble-bearing layer. In cross section the pit was bowl-shaped and seems to have been excavated to similar depths at its center and along the north edge. A layer of loamy clay represents materials deposited in the feature since it was used. Thus, 37–46 cm of sediments have built up since that time. The exposure of a stratum containing numerous gravels and cobbles in the bottom of the trench indicates that the borrow pit did not completely penetrate the layer of gravels into which it was excavated.

Feature 15

Part of the west edge of the north half of Feature 15 extended into project limits, and twelve excavation units were used to examine that part of the

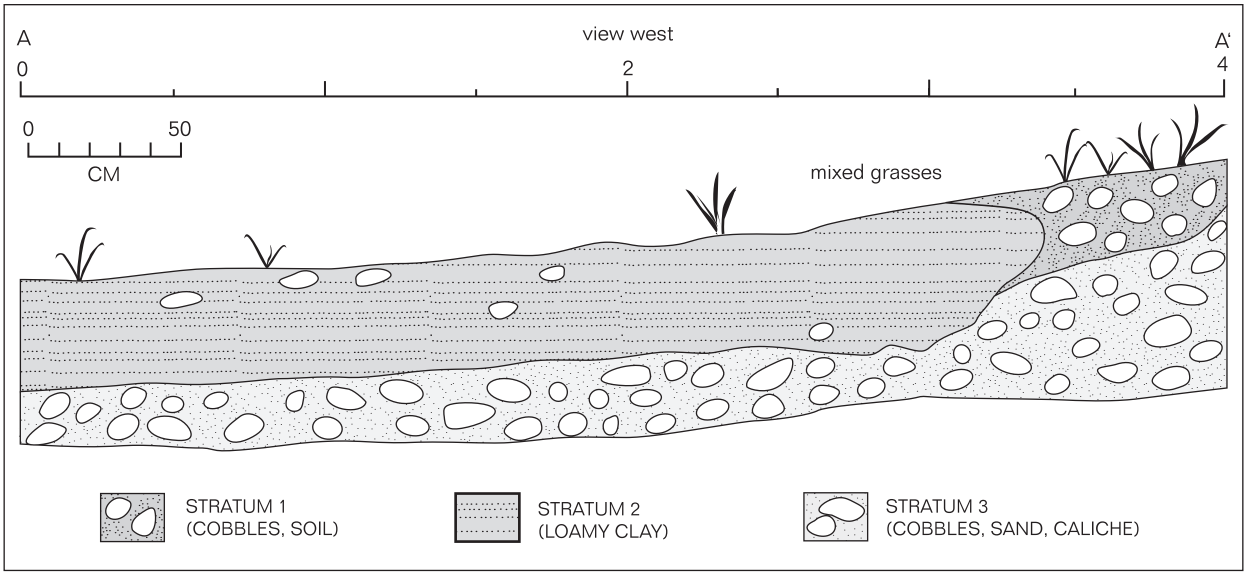


Figure 16.11. Profile of a section of the west wall of Backhoe Trench 3, Feature 2, LA 118547.

feature. Four units (EU-A through EU-D) were in the far northwest part of the field, while the eight remaining units were just inside the edge of the right-of-way, which contained a long, linear section of Feature 15 (Figs. 16.2, 16.4, and 16.5).

EU-A was placed along the west edge of Feature 15 near the northwest corner of the field. It was used to examine the west boundary alignment and a parallel interior subdividing alignment defined during site mapping. Close inspection of the surface in this area before excavation suggested that another parallel alignment might exist between the two that were initially defined. A possible perpendicular alignment joining the boundary and nearest parallel interior alignments was also noted.

Stratum 1 was virtually nonexistent in this unit. Because of its location at a break in slope on the edge of the field, eolian materials that were unable to infiltrate the mulch were probably removed by slope wash. Similarly, much of the layer of mulch may have been washed away, since Stratum 2 was fairly shallow in this area, ranging between 3 and 6 cm thick. A sample from the mulch contained a moderate concentration of corn pollen. Two artifacts were recovered from this excavation unit—a small fragment of bone in Stratum 1, and a piece of rhyolite angular debris in Stratum 2.

As shown in Figures 16.12 and 16.13, excavation exposed part of the west boundary alignment and several connected interior subdividing alignments. All exposed alignments were built in the same fashion. Most cobbles were placed end-to-end on their broadest surfaces, though a few were set sideways and mixed into alignments otherwise dominated by end-to-end placement. Similarly, a few elements were set upright, but this was uncommon. All alignments were a single element high and wide.

This area was more highly subdivided than suggested by the configuration initially visible on the surface. As noted earlier, only two parallel alignments were seen in this area during site mapping. Surface examination before excavation suggested the presence of another parallel alignment and a perpendicular joining it to the west boundary alignment. Excavation revealed that the intervening parallel interior alignment was indeed present, and that the perpendicular alignment joined all three together. Thus, parts of at least three small cells were encountered in this EU (Fig. 16.12). The two southernmost cells were about 1 m wide; their lengths were undetermined, but their long axes trended northwest-southeast, and they were over 1.8 m long.

EU-B was near the northwest corner of Feature 15, a short distance northeast of EU-A. It was used to examine an interior subdividing alignment seen during site mapping. Close inspection of the surface before excavation suggested that a parallel alignment might exist to the

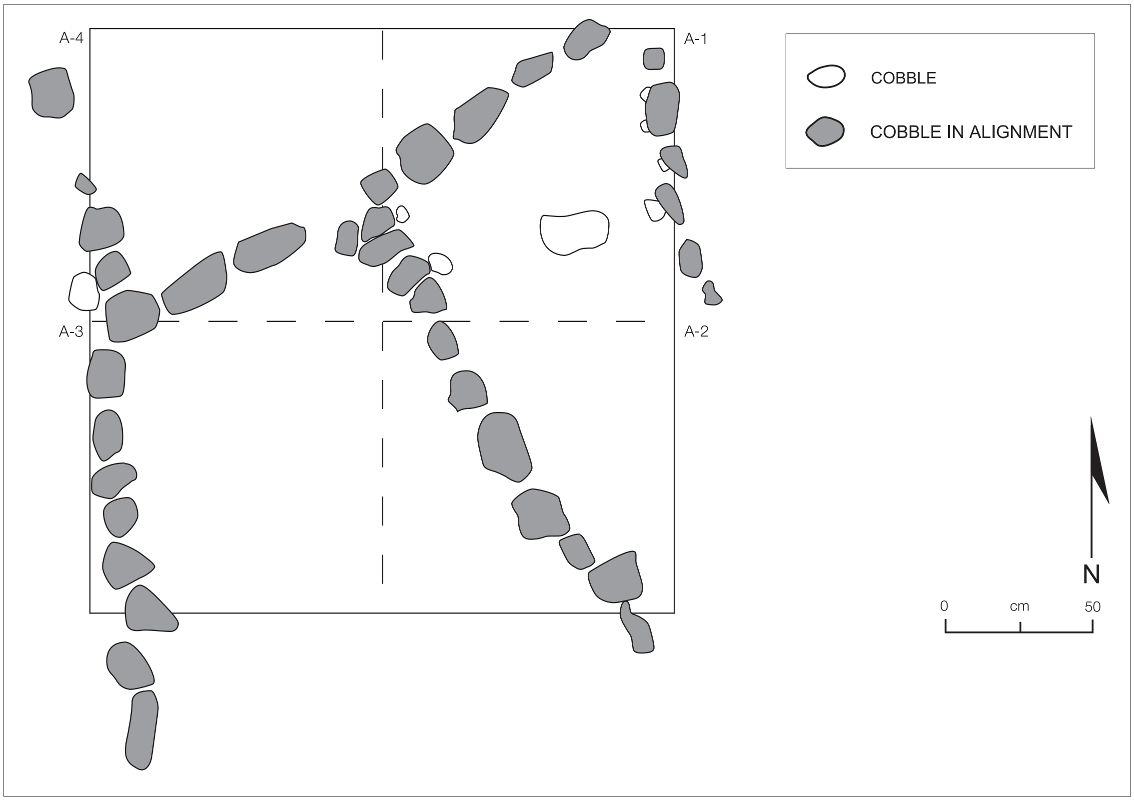


Figure 16.12. Postexcavation plan of EU-A in Feature 15, LA 118547. Shaded rocks are in alignments.

Figure 16.13. Postexcavation view of EU-A in Feature 15, LA 118547.

west, and a perpendicular alignment might crosscut both.

Stratum 1 was an average of 0.5 cm thick in this unit. It yielded six rhyolite core flakes, one piece of rhyolite angular debris, and a blue-banded and fluted rim sherd from a Euroamerican bowl or saucer. The gravel mulch (Stratum 2) was also relatively thin and averaged only 7.3 cm thick. The underlying terrace surface (Stratum 3) was hard packed in places and appeared to contain numerous small gravels. A sample taken from the mulch contained a moderate concentration of cotton pollen and a moderate to high concentration of corn pollen. Five chipped stone artifacts were also recovered from this layer, including two rhyolite core flakes, two rhyolite angular debris, and one rhyolite unidirectional core.

As shown in Figures 16.14 and 16.15, excavation exposed two parallel northwest-southeast trending interior subdividing alignments. Both alignments were built in the same fashion—most cobbles were set end-to-end and on their broadest surfaces, though a few were placed sideways and mixed into alignments otherwise dominated by end-to-end placement. Similarly, a few elements were set upright, but this was uncommon. Both alignments were a single element high and wide.

This area was somewhat more highly subdivided than suggested by the configuration initially visible on the surface. As noted earlier, only one interior subdividing alignment was seen in this area during site mapping. Examination of the surface prior to excavation suggested the presence of another parallel alignment and a possible perpendicular alignment that might join the two. Excavation revealed that the parallel interior subdividing alignment was indeed present, but no perpendicular alignment was found. The western alignment was broken at the north end of the segment exposed in Grid B-3. This break was probably not purposeful, and it reflects postabandonment damage. Parts of at least three small cells were encountered in this unit (Fig. 16.14). While these cells appear to be long and narrow, it was not possible to measure their lengths, and only one width could be obtained. In that instance, the section of exposed cell averaged 0.74 m wide.

EU-C was near the northwest corner of Feature 15, a short distance northeast of EU-B. It was used to examine two parallel interior subdividing alignments noted during site mapping. Close examination of the surface before excavation suggested that a third parallel alignment might exist to the north of these alignments and that the southern alignment might actually consist of evenly spaced, noncontiguous large cobbles.

Stratum 1 had an average thickness of 0.5 cm where it occurred in this unit and yielded 2 rhyolite core flakes, 1 andesite core flake, and 1 quartzite core flake. The gravel mulch (Stratum 2) averaged 10.4 cm thick and contained 49 chipped stone artifacts representing three material types including rhyolite (30 core flakes, 11 angular debris, 1 tested cobble, 2 cores), chert (1 angular debris), and andesite (1 core flake). The soil was more compact toward the bottom of Stratum 2, gravel inclusions became smaller, and most of the chipped stone artifacts were recovered from this zone. The deepest few centimeters of fill excavated as Stratum 2 probably represented the top of the original terrace surface (Stratum 3), and the artifacts found at that level reflect use before the field was constructed. Thus, the gravel mulch was probably only 7–8 cm thick in this unit. A sample taken from the mulch contained a high concentration of corn pollen.

As shown in Figures 16.16 and 16.17, excavation exposed two parallel northeast-southwest trending interior subdividing alignments. Both alignments were built in the same fashion. Most cobbles were set end-to-end and on their broadest surfaces, though a few elements were placed sideways and mixed into alignments otherwise dominated by end-to-end placement. No uprights were noted in this area, and both alignments were a single element high and wide.

This area was pretty much as defined during site mapping—only two parallel alignments were exposed by excavation. The third possible parallel alignment to the north turned out to be nothing more than a few large cobbles floating in the mulch. Parts of three small plots were encountered in this unit (Fig. 16.15). While these plots seemed to be long and narrow, measurement of their lengths was not possible, and only one width could be obtained. In that instance, the section of plot exposed averaged 0.54 m wide.

EU-D was near the northwest corner of Feature 15, a short distance southeast of EU-B and EU-C. It was placed there to examine three

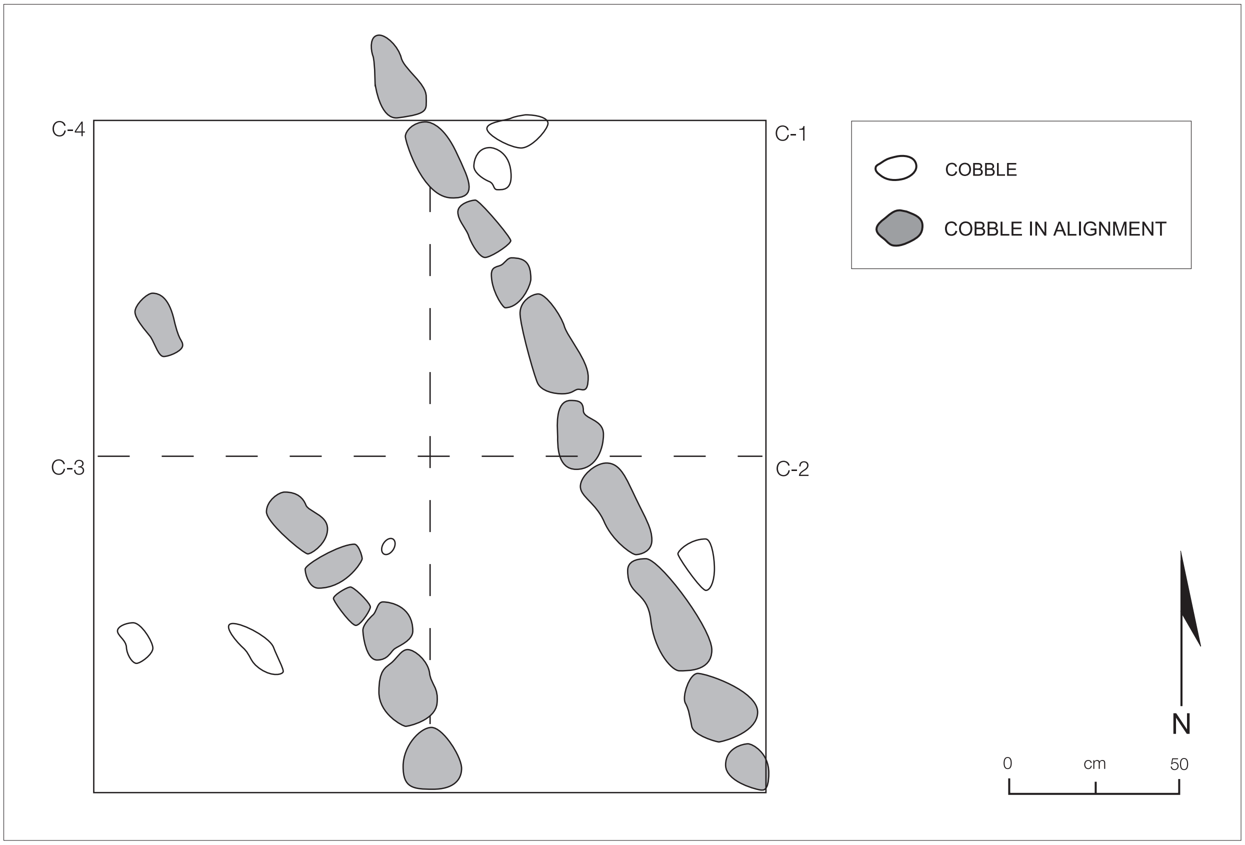


Figure 16.14. Postexcavation plan of EU-B in Feature 15, LA 118547. Shaded rocks are in alignments.

Figure 16.15. Postexcavation view of EU-B in Feature 15, LA 118547.

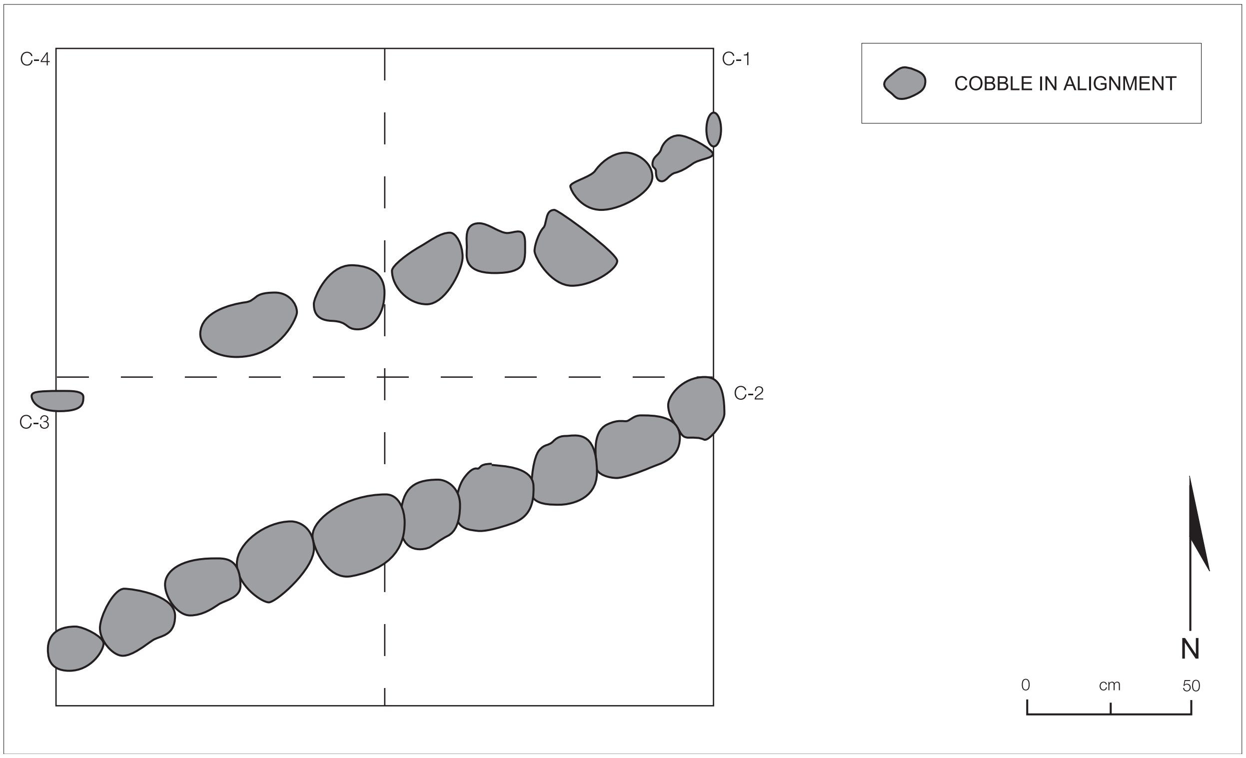


Figure 16.16. Postexcavation plan of EU-C in Feature 15, LA 118547. Shaded rocks are in alignments.

Figure 16.17. Postexcavation view of EU-C in Feature 15, LA 118547.

parallel interior subdividing alignments noted during site mapping. Close examination of the surface before excavation suggested that another parallel alignment might exist to the west. The center alignment of the three defined during site mapping appeared to have a break in it. There was a possibility that two large cobbles east of these alignments may have been part of a fifth alignment, but this could not be determined from surface examination alone.

Stratum 1 averaged 1.4 cm thick where it occurred and yielded three rhyolite core flakes and a Biscuit A sherd. The gravel mulch (Stratum 2) averaged 10.6 cm thick. The lower 3–4 cm of Stratum 2 contained very fine pea gravels (almost coarse sand) mixed with coarse pea gravels, which sat directly atop the original terrace surface and may have been a base course. Cultural materials were somewhat more common in Stratum 2 and included four rhyolite core flakes, two rhyolite angular debris, one rhyolite core, and two andesite angular debris. A sample taken from the mulch contained a fairly low concentration of corn pollen.

As shown in Figures 16.18 and 16.19, excavation exposed five parallel northwest-southeast trending interior subdividing alignments. All alignments were built in the same fashion—most cobbles were set end-to-end and on their broadest surfaces, though a few elements were placed sideways and mixed into alignments otherwise dominated by end-to-end placement. Similarly, a few elements were set upright, but this was uncommon. All alignments were a single element high and wide.

This area was somewhat more highly subdivided than suggested by the configuration of building elements seen on the surface. As noted earlier, three interior subdividing alignments were visible in this area during site mapping. Examination of the surface before excavation suggested the presence of two other parallel alignments. Excavation revealed that these alignments were indeed present. The break noted in the center of the three alignments defined during site mapping was not real and resulted from eolian sediments that had covered the cobbles in that area. Parts of at least four plots were encountered in this unit (Fig. 16.18). These plots are long and narrow, and it was not possible to measure their lengths. They ranged between 0.20 and 0.66 m wide, with an average width of 0.37 m.

EU-E was near the north end of Feature 15, a short distance south of EU-D. It was placed there to examine an area that contained no evidence of interior subdividing alignments during site mapping. Close examination of the surface indicated that several large cobbles were visible and suggested that this area contained a series of evenly spaced, noncontiguous elements. However, since several cobbles were aligned, it was also possible that they represented interior subdividing alignments in which most elements were covered by eolian sediments.

Stratum 1 averaged 1.4 cm thick where it occurred and contained a rhyolite core flake. However thin this stratum was, it tended to cover up to 70 percent of the gravel-mulch surface. The gravel mulch (Stratum 2) was quite distinct with the eolian sediments removed (Fig. 16.20), and it averaged 10.2 cm thick. The lower 2–4 cm of Stratum 2 was a silty sand containing few to abundant pea gravels. Under this layer in Grid E-2 was a slightly reddish sandy clay. The layer of silty sand and gravel may represent a separate base course, or it could be the original terrace surface. If the latter is true, then the mulch was only 6–8 cm thick. Cultural materials in the gravel mulch included a Biscuit B sherd and seven rhyolite core flakes, all of which were found near the top of the stratum, suggesting that they were deposited during or after use of the field. A sample taken from the mulch contained a low concentration of cotton pollen and a moderate concentration of corn pollen.

As shown in Figures 16.21 and 16.22, excavation exposed a series of irregularly spaced large cobbles and small boulders. Two of the smaller cobbles in Grid E-2 were floating in the gravel mulch and probably represent part of that stratum rather than elements used in construction. Bottom depths were measured for construction elements that were completely exposed by excavation, and most were 1–2 cm higher than the defined base of the gravel mulch. This suggests that the lower 2–4 cm of fill represented the original terrace surface rather than a preparatory course. The spacing of elements near the center of the unit suggests that there may have been some attempt to maintain an even distance. Similarly, there may have been some placement in noncontiguous alignments. However, spacing and place-

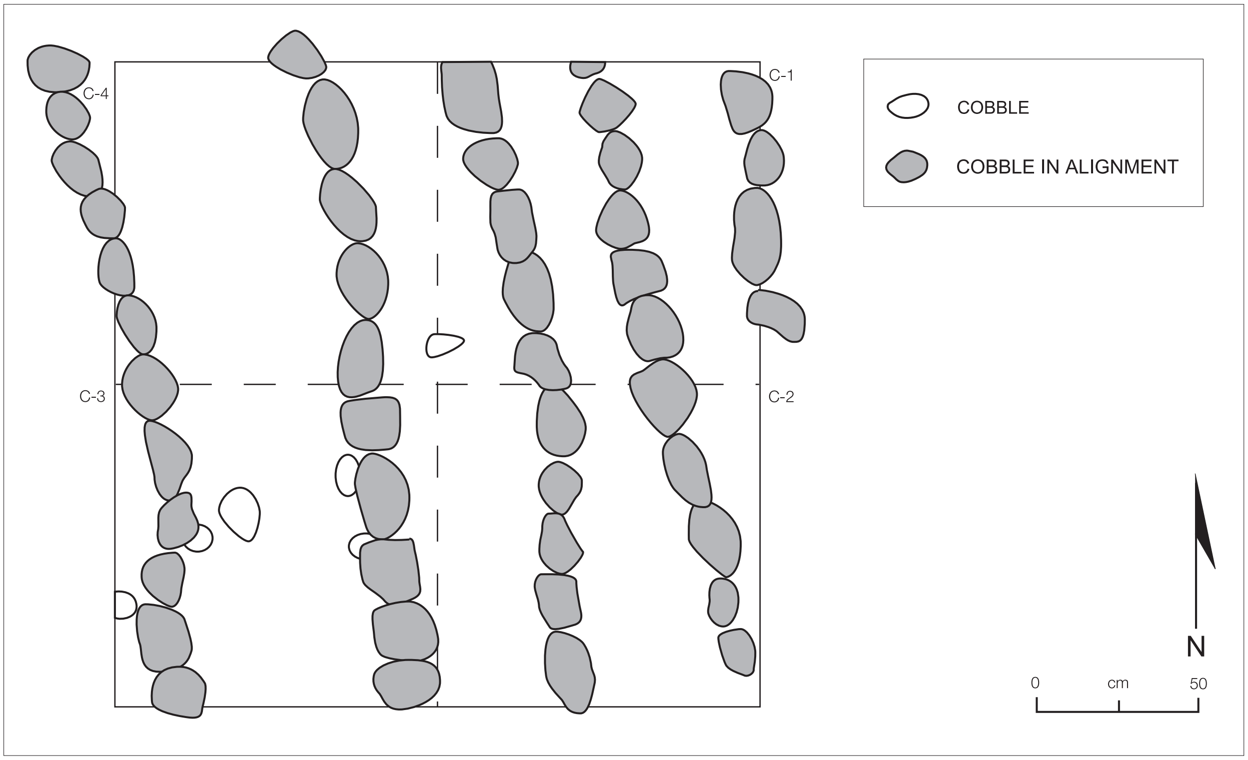


Figure 16.18. Postexcavation plan of EU-D in Feature 15, LA 118547. Shaded rocks are in alignments.

Figure 16.19. Postexcavation view of EU-D in Feature 15, LA 118547.

Figure 16.20. Surface of mulch in EU-E, Feature 15, LA 118547.

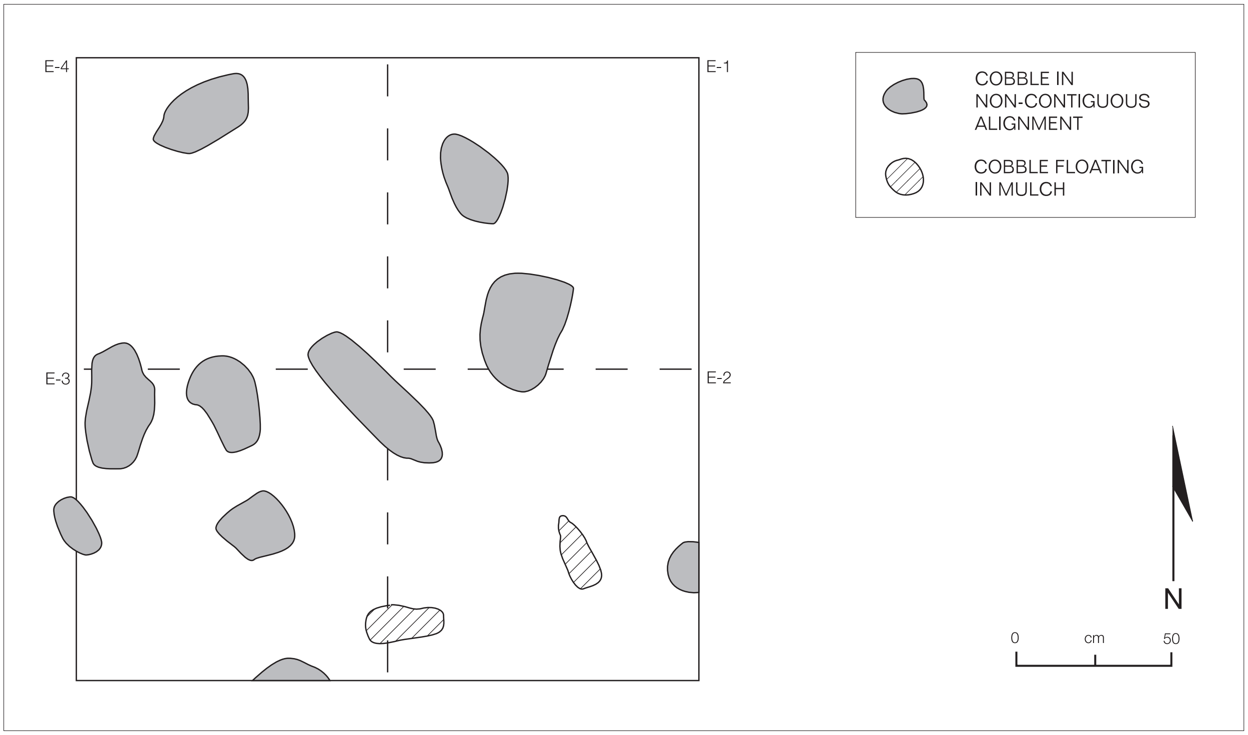


Figure 16.21. Postexcavation plan of EU-E in Feature 15, LA 118547. Shaded rocks are in alignments.

Figure 16.22. Postexcavation view of EU-E in Feature 15, LA 118547.

ment are not as standardized as they were at other sites, LA 105703 in particular. All elements exposed in this EU were set on their broadest surface.

EU-F was near the north end of Feature 15, 17 m south of EU-E. Like EU-E, it was used to investigate an area that contained no surface evidence of interior subdividing alignments during site mapping. Close examination of the surface indicated that several large cobbles were visible and suggested that this area contained a series of evenly spaced, noncontiguous elements. However, since several cobbles were aligned it was also possible that they represented interior subdividing alignments in which most elements were covered by eolian sediments.

Stratum 1 had an average thickness of 2.3 cm and covered nearly the entire surface of the gravel-mulch layer. The gravel mulch (Stratum 2) averaged 12.1 cm thick. The bottom of the mulch was difficult to define in places, and excavation ended when the amount of gravel dropped. Thus, part of the upper terrace surface (Stratum 3) may also have been removed with these materials. Interestingly, small fragments of charcoal were found throughout Stratum 2, and patches of oxidized soil were noted in Grid F-2. The charcoal and oxidized soil may be indications of a surface fire, possibly a natural burn. Cultural materials were uncommon in this unit. Only two rhyolite artifacts—a core flake and piece of angular debris—were recovered from the gravel mulch. A sample taken from the mulch contained a moderate concentration of corn pollen.

As shown in Figure 16.23, excavation exposed a series of irregularly spaced large cobbles. Bottom depths were measured for construction elements that were completely exposed by excavation, and most were 3–5 cm higher than the base of Stratum 2. This suggests that the lower 3–5 cm of fill represented the original terrace surface rather than part of the gravel mulch. The spacing of elements near the center of the unit suggests that there may have been some attempt to maintain an even distance. Similarly, there may have been some placement in noncontiguous alignments. However, spacing and placement are not as standardized as they were at other sites. All exposed elements were set on their broadest surface.

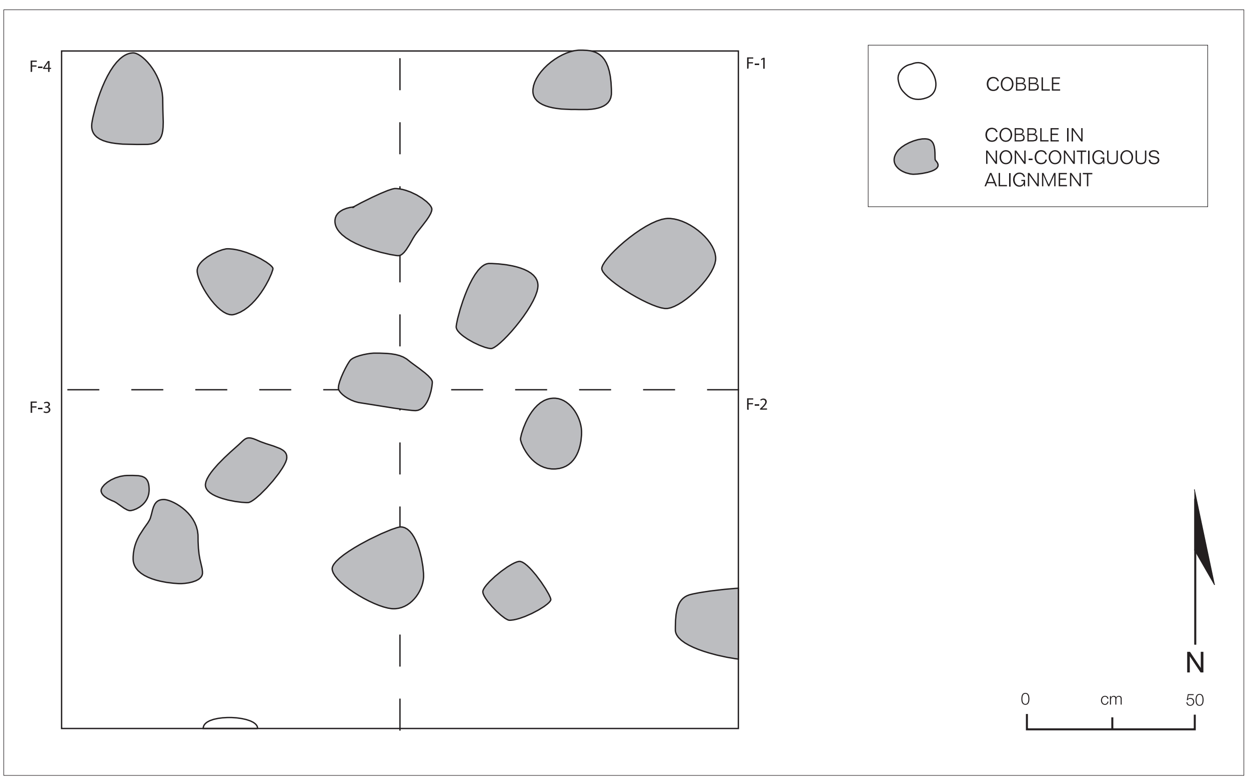


Figure 16.23. Postexcavation plan of EU-F in Feature 15, LA 118547. Shaded rocks are in alignments.

EU-G was excavated in the north-central part of Feature 15, 40 m south of EU-F. It was placed there to examine a corner in the boundary alignment and an interior subdividing alignment that were noted during site mapping. Close examination of the surface before excavation suggested that alignments in this area were either fragmented or covered by a mantle of eolian sediments. The corner was ill-defined, and the interior subdividing alignment was questionable.

Stratum 1 was an average of 3.1 cm thick in this unit. A rhyolite core was found on the surface, and eight rhyolite artifacts—four core flakes and four angular debris—were found in Stratum 1. These materials were either deposited while the field was in use or after it was abandoned. Nearly the entire mulched surface was concealed beneath the mantle of eolian sediments. The gravel mulch (Stratum 2) averaged 8.4 cm thick, but the lower few centimeters contained a high percentage of small pea gravels and probably represented the original terrace surface. Thus, the gravel-mulch layer may have been 1–2 cm thinner than it appeared. Cultural materials recovered from the gravel mulch included six Biscuit A sherds—five of which fit together—and a piece of rhyolite angular debris. A sample taken from the mulch contained no pollen from domesticated plants.

As shown in Figure 16.24, three alignments were exposed in this unit—two that met at a perpendicular to form a corner of the west boundary alignment in Grid G-3, and an interior subdividing alignment that ran across the south edge of Grids G-1 and G-4. All three alignments were built in the same fashion. Most elements were set end-to-end on their broadest surfaces, though a few were placed sideways and mixed into alignments otherwise dominated by end-to-end placement. Similarly, a few elements were set upright. All alignments were a single element high and wide.

Excavation showed that this area was somewhat more complicated than first thought. A corner in the west boundary alignment and a section of an interior subdividing alignment were exposed. In addition, a series of large cobbles on the south side of the interior subdividing alignment seemed to represent an area that was treated similarly to those found in EU-E and EU-F. These cobbles were fairly evenly spaced but formed no definite alignments. This pattern was not replicated on the north side of the interior subdividing alignment, suggesting that it formed a boundary between areas in which different construction techniques were used. The interior subdividing alignment probably intersected the west boundary alignment just outside the excavation unit. Parts of two plots were exposed, but no length or width measurements could be obtained.

EU-H was in the north-central part of Feature 15, 15 m south of EU-G. It was placed there to examine a section of the west boundary alignment and an intersecting interior subdividing alignment noted during site mapping. Close examination of the surface before excavation suggested that the boundary alignment might be missing from this area or was covered by a mantle of eolian sediments. The interior subdividing alignment appeared to be real, though it was broken in places, and a second possible interior subdividing alignment was noted south of the first.

Stratum 1 had an average thickness of 1.5 cm in this unit and concealed nearly the entire surface of the gravel mulch. The gravel mulch (Stratum 2) averaged 9.1 cm thick and contained five artifacts: two rhyolite core flakes, a core, one igneous undifferentiated core flake, and a piece of andesite angular debris. All of the artifacts came from the upper 3–4 cm of mulch and were probably deposited during or after use of the field. A sample taken from the mulch contained a high corn pollen concentration.

As Figures 16.25 and 16.26 show, only one definite alignment was exposed in this unit. A short section of a second very questionable interior subdividing alignment was south of the definite segment. Most elements were set end-to-end and on their broadest surfaces, though a few were placed sideways and mixed into the alignment. No uprights were noted, and the alignment was mostly a single element high and wide, though in places two cobbles appear to have been set abreast.

Excavation showed that this area was more badly damaged than surface indications suggested. Except for a few cobbles, most of the west boundary alignment was displaced, probably by slope wash. Parts of two plots were exposed, but no length or width measurements were possible.

EU-I was in the north-central part of Feature

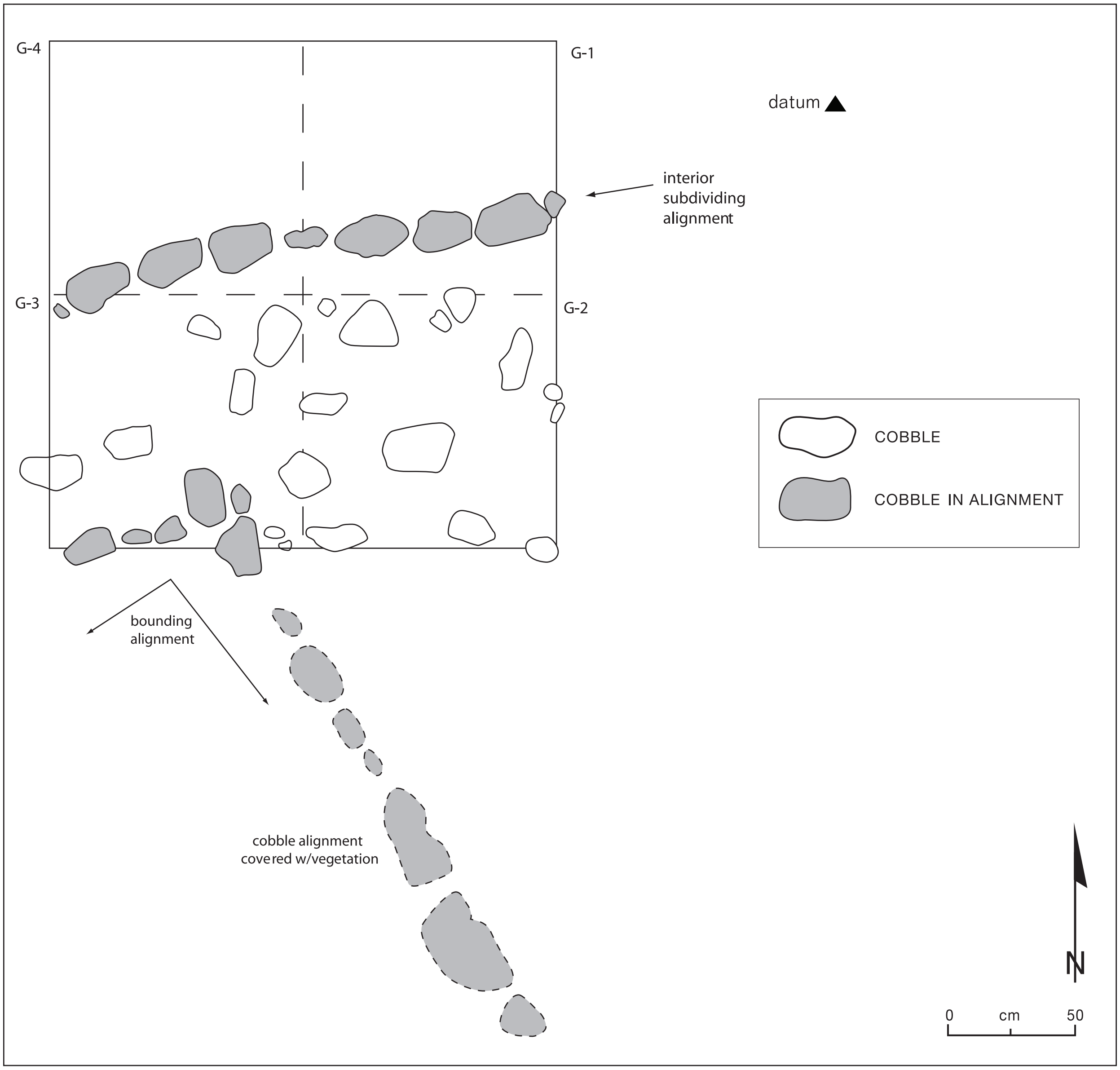


Figure 16.24. Postexcavation plan of EU-G in Feature 15, LA 118547. Shaded rocks are in alignments.

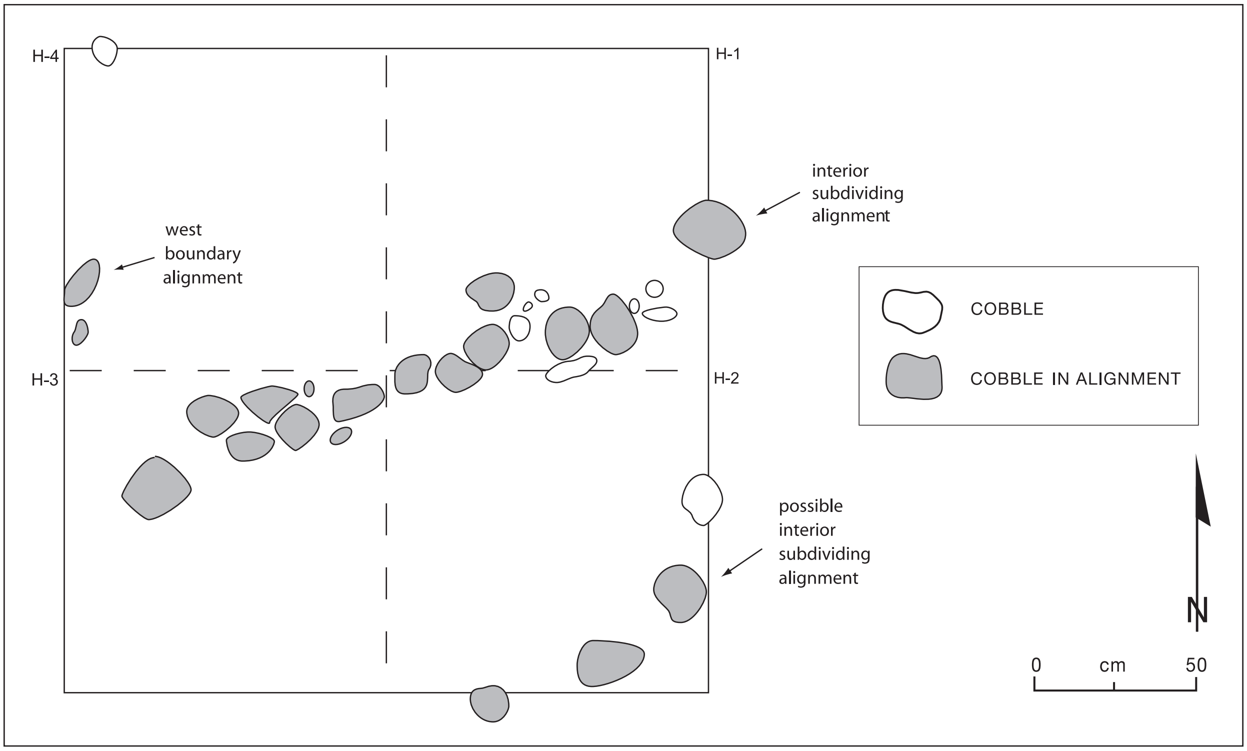


Figure 16.25. Postexcavation plan of EU-H in Feature 15, LA 118547. Shaded rocks are in alignments.

Figure 16.26. Postexcavation view of EU-H in Feature 15, LA 118547.

15, 17 m south of EU-H. It was placed there to examine a section of the west boundary alignment and an adjacent area that seemed to contain no evidence of interior subdividing alignments. Close examination of the surface before excavation suggested the presence of at least one interior subdividing alignment running perpendicular to the boundary alignment. South of that were several large cobbles that were relatively evenly spaced but not contiguous. The west boundary alignment extended through this unit from the northwest corner to the center of the south edge, and the zone outside the field was not excavated.

Stratum 1 had an average thickness of 1.9 cm and concealed nearly the entire surface of the mulch. An andesite core flake was recovered from this layer. The gravel mulch (Stratum 2) was comparatively thin and averaged only 7.6 cm thick. A rhyolite core flake was the only artifact recovered from this layer. A sample taken from the mulch contained both corn and cotton pollen.

As Figures 16.27 and 16.28 illustrate, two alignments were exposed in this unit. Most cobbles were placed end-to-end and on their broadest surfaces, though a few elements were set sideways. Upright placement occurred but was uncommon. All alignments were a single element high and wide. The only exceptions were a few cobbles that were displaced by erosion and resembled a double-coursed alignment.

Excavation showed that the section of field investigated in this unit was more complex than originally thought. The west boundary alignment was relatively intact in this area, though a few elements were displaced. A short segment of interior subdividing alignment was visible in Grid I-1 and probably intersected the boundary alignment at a perpendicular angle, though a break was encountered at the projected intersection. Again, erosion was probably the culprit. South of the interior alignment were several large cobbles set in a regular, relatively evenly spaced pattern. No such patterning was encountered north of the interior subdividing alignment. Thus, the two plots exposed in this unit were configured differently. No length or width measurements were possible.

EU-J was in the north-central part of Feature 15, just south of EU-I. It was placed across a section of the west boundary alignment and three interior subdividing alignments that were noted during site mapping, and it was used to provide a better look at this section of the field, supplementing data gathered from EU-I. Close examination of the surface before excavation suggested that the unit actually contained only two interior subdividing alignments set at an acute angle to the west boundary alignment. What had originally seemed to be the third interior subdividing alignment appeared, upon closer inspection, to be a series of large cobbles that were relatively evenly spaced but not contiguous.

Stratum 1 was moderately thick in this unit, averaging 2.3 cm, and it concealed nearly the entire surface of the mulch. Six chipped stone artifacts were recovered from this soil layer, including two rhyolite core flakes, two pieces of rhyolite angular debris, and two andesite core flakes. Once Stratum 1 was removed, the surface of the mulch and three alignments were clearly visible (Fig. 16.29). The gravel mulch (Stratum 2) averaged only 8.4 cm thick, and it ended near the base of the cobble alignments. A thin layer of sand containing numerous pea gravels occurred at the base of the mulch and probably represented the original terrace surface. Underlying that layer was a clayey sand that contained some cobbles. A rhyolite core flake was the only artifact found in the gravel mulch. All of the artifacts recovered from this excavation unit came from near the surface, suggesting that all were deposited during or after use of the field.

As Figures 16.30 and 16.31 illustrate, three alignments were exposed in this unit. Most cobbles were set end-to-end in all three alignments, though a few elements were placed sideways. Similarly, most cobbles were set on their broadest surfaces, though a few uprights were also noted. The latter were most common in the northernmost interior alignment. All alignments were a single element high and wide.

This was a rather complex section of field. The west boundary alignment was contiguous with the segment exposed in EU-I about 2 m to the north. There was no evidence that the regularly spaced cobbles found in the south section of EU-I continued into EU-J, suggesting that there was an interior subdividing alignment between these areas. Parts of three plots were exposed, and partial measurements were possible for two. The interior alignments created a narrow planting area that averaged about 0.2 m wide. The

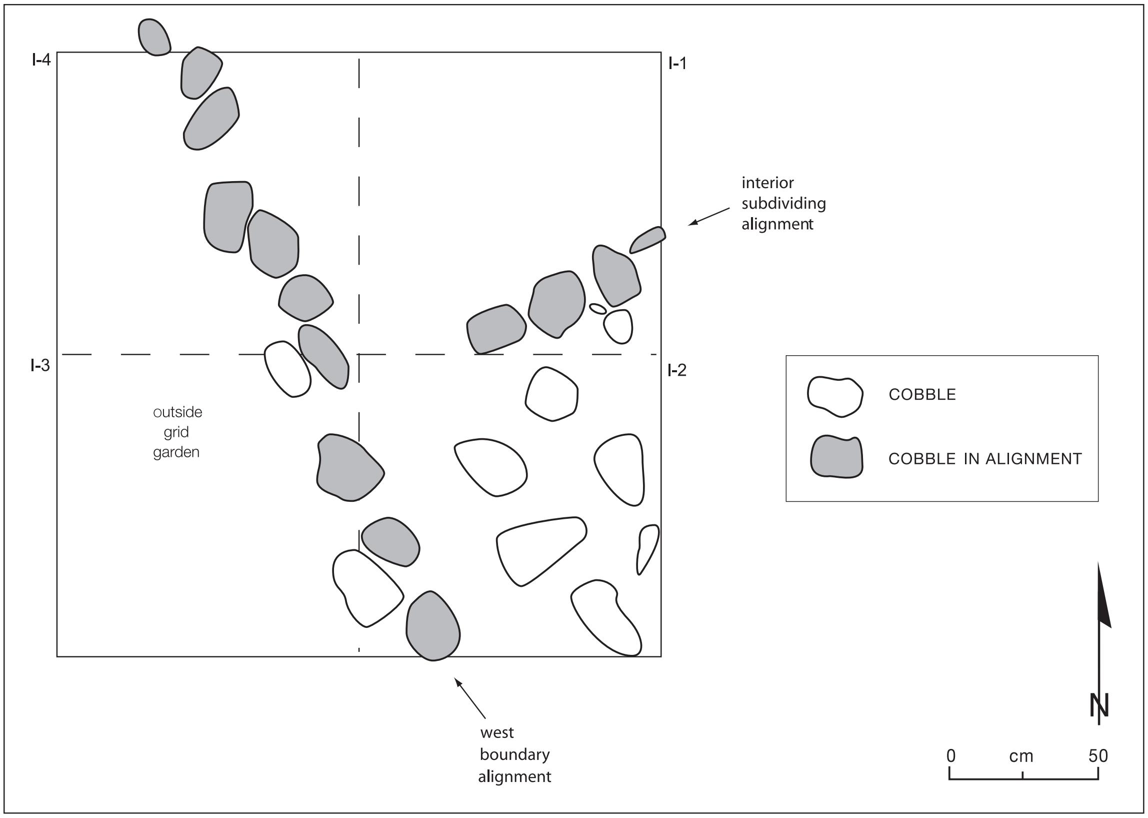


Figure 16.27. Postexcavation plan of EU-I in Feature 15, LA 118547. Shaded rocks are in alignments.

Figure 16.28. Postexcavation view of EU-I in Feature 15, LA 118547.

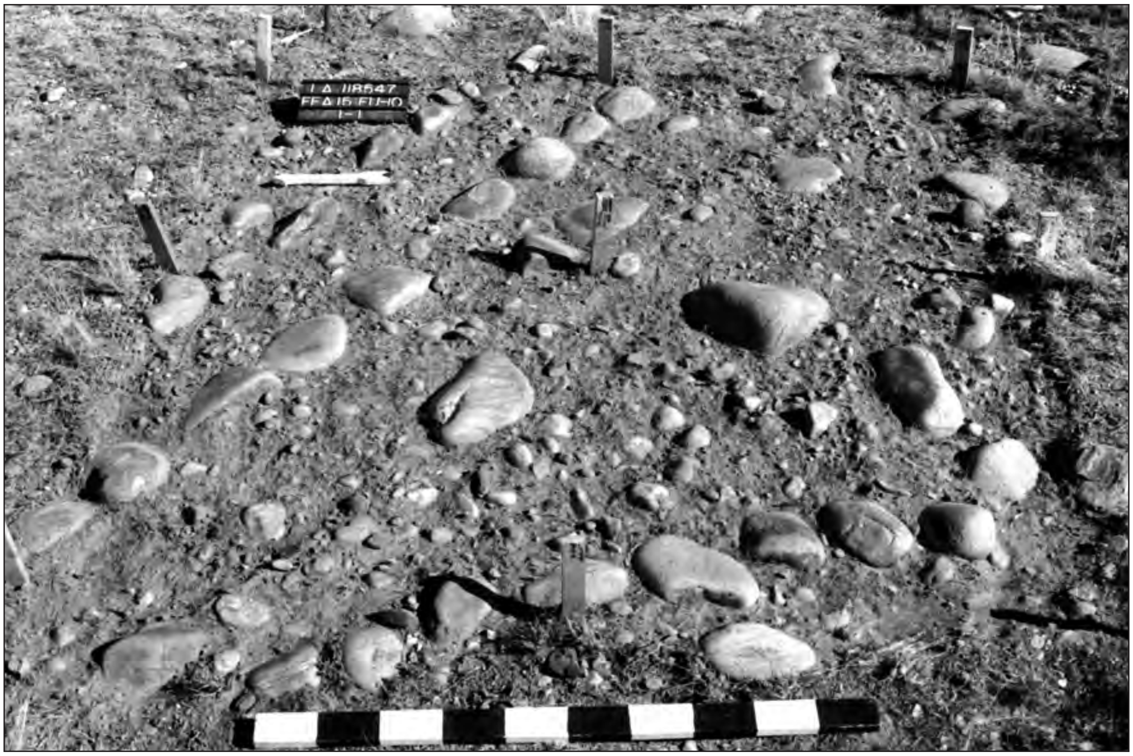


Figure 16.29. EU-J in Feature 15, LA 118547, after the mantle of sediments was removed, showing the surface of the mulch and three cobble alignments.

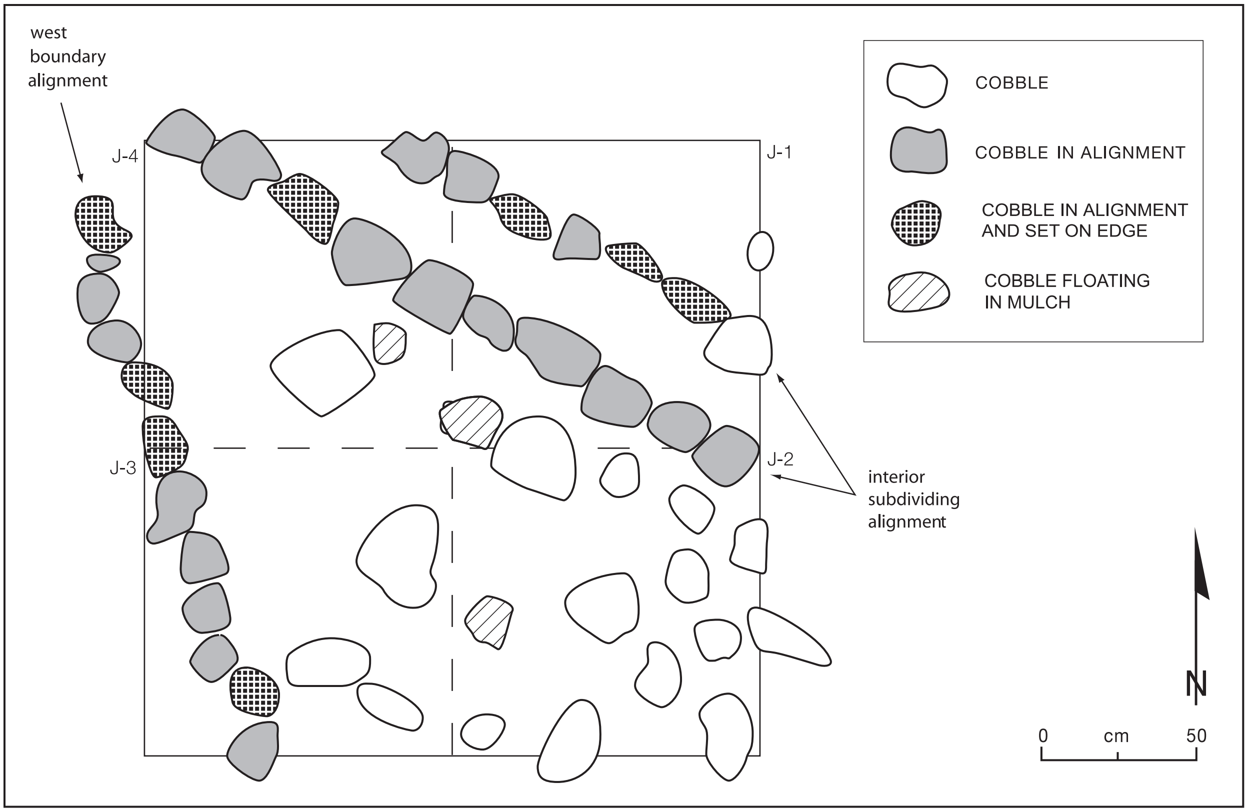


Figure 16.30. Postexcavation plan of EU-J in Feature 15, LA 118547. Shaded rocks are in alignment.

Figure 16.31. Postexcavation view of EU-J in Feature 15, LA 118547.

planting space between the southern interior subdividing alignment and the west boundary alignment varied between 0.6 and 1.6 m wide, and it is almost certain that this plot was larger outside the excavation unit. A series of irregularly spaced cobbles occurred through most of this space. Three of the cobbles in this area seemed to be floating in the gravel mulch, but the remainder rest on the original terrace surface. These elements probably functioned similarly to those that were regularly spaced in other areas.

EU-K was in the central part of Feature 15, 11 m south of EU-J. It was placed across a section of the west boundary alignment and three interior subdividing alignments that were noted during site mapping. Closer examination of the surface before excavation suggested that only the north alignment was real; the others consisted of noncontiguous collections of cobbles. Since part of this unit extended outside the west boundary of the field, only the section within feature boundaries was excavated.

Stratum 1 was an average of 3.8 cm thick in this unit and concealed nearly the entire surface of the mulch. Twelve chipped stone artifacts were recovered from this layer, including five rhyolite core flakes, six pieces of rhyolite angular debris, and one piece of andesite angular debris. The gravel mulch (Stratum 2) averaged 9.8 cm thick and ended on top of a hard, compact, almost clayey soil containing some caliche. Grid K-2 contained about 20 large cobbles floating in the gravel mulch 6–10 cm above the base of the level. Several similar cobbles were also found in the north half of the excavation unit. Stratum 2 contained only one artifact, a Biscuit A sherd. A sample taken from the mulch contained a moderate concentration of corn pollen.

As Figures 16.32 and 16.33 show, two to three alignments were exposed in this excavation unit. Most cobbles were set end-to-end, though a few were placed sideways. Similarly, most cobbles were set on their broadest surfaces, though a few uprights were noted. All alignments were a single element high and wide. Figure 16.32 shows that several large cobbles that were not part of alignments were floating in or on top of the gravel mulch. They may represent a modification of this part of the feature from a simple gravel-mulched area to one containing a series of unevenly spaced, noncontiguous cobbles exposed on the surface. Some of these elements were initially mistaken for sections of interior alignments during mapping, so this part of the feature is not as intricately subdivided as the site plan suggests.

This was a rather complex section of field. The west boundary alignment jogs outward at a point intersected by an interior subdividing alignment. The configuration of these alignments suggests that two separate plots are represented and that they were built at different times. Had construction been concurrent, the boundary alignment would probably be straight, with the interior alignment added after the boundary was complete. Thus, the interior alignment exposed in this area probably served as a boundary alignment until the field was modified. The numerous cobbles floating in gravel mulch add to the complexity of this area and probably indicate another phase of modification, mostly to the zone south of the interior subdividing alignment. Though parts of two plots were exposed, no measurements were possible.

EU-L was in the central part of Feature 15, 8 m south of EU-H. It was placed there to examine a section of interior subdividing alignment near a corner of the west boundary alignment. Examination of the surface suggested the presence of at least one interior subdividing alignment and a large number of irregularly spaced, noncontiguous cobbles.

Stratum 1 was an average of 1.2 cm thick in this unit and concealed much of the mulch surface, especially where it was anchored by grass. The gravel mulch (Stratum 2) averaged 9.4 cm thick and yielded a single chert core flake. A sample taken from the mulch contained a moderate concentration of corn pollen.

As Figures 16.34 and 16.35 show, excavation exposed no alignments in this unit. Instead, numerous irregularly spaced and noncontiguous cobbles were found, many of which rested on the original terrace surface. Perhaps a third of the exposed cobbles were floating in the gravel mulch and represent late additions to the plot or elements in the mulch. This is one of the few areas shown to be less complicated than indicated by the surface configuration of cobbles. Part of a single plot was exposed in this excavation unit, and no measurements of it were possible.

Backhoe Trench 1 was placed near the north-

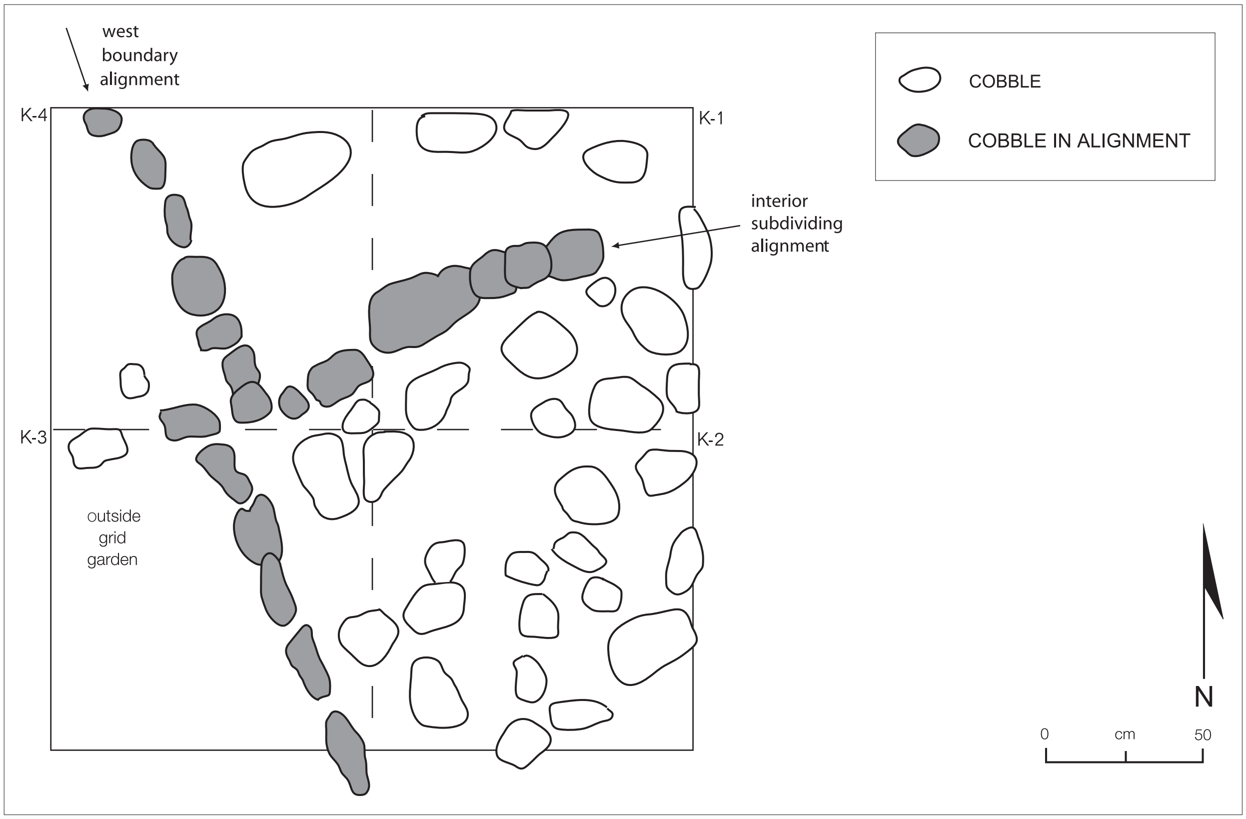


Figure 16.32. Postexcavation plan of EU-K in Feature 15, LA 118547.

Figure 16.33. Postexcavation view of EU-K in Feature 15, LA 118547.

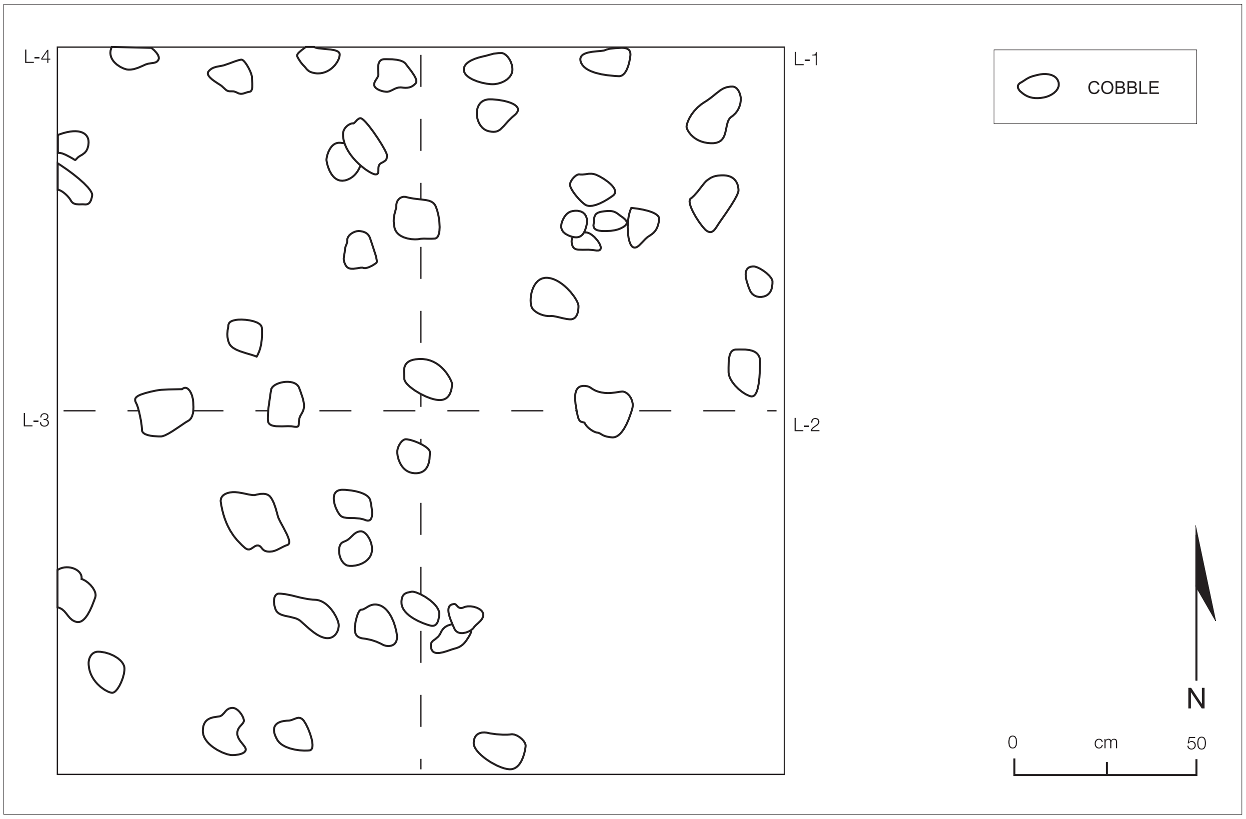


Figure 16.34. Postexcavation plan of EU-L in Feature 15, LA 118547.

Figure 16.35. Postexcavation view of EU-L in Feature 15, LA 118547.

east corner of Feature 15 to examine the structure of natural terrace fill and how the artificially constructed field articulated and compared with it (Fig. 16.2). A 3.4 m long section of the upper terrace sediments was exposed in this trench (Fig. 16.36). The gravel mulch was about 10 cm thick in this area and was distinguishable from the natural terrace fill it partly covered. The uppermost layer of terrace fill (Stratum 3) was a semicompact brown clayey loam containing numerous gravels and cobbles. The lowermost terrace fill layer exposed in the trench (Stratum 4) was a light yellowish brown clayey soil containing numerous gravels and cobbles and a great deal of caliche. A sample taken from the mulch contained a high concentration of corn pollen.

Backhoe Trench 4 was placed in the north-central part of Feature 15 to examine the structure of terrace fill and how the artificially constructed field articulated and compared with it (Fig. 16.2). A 3.2 m long section of upper terrace sediments was exposed in this trench (Fig. 16.37). The gravel mulch was about 12 cm thick in this area and was distinguishable from the layer of terrace fill that it partly covered. However, these strata graded together because the west boundary alignment of Feature 15 was eroded and sediments had washed downslope. The uppermost terrace fill stratum (Stratum 3) was a compact brown clayey loam containing numerous gravels and cobbles. Pea gravels were more common in this layer than they were in the adjacent gravel mulch, and some caliche deposits were noted. The lowermost terrace fill stratum exposed (Stratum 4) was a light yellowish brown clayey soil containing numerous gravels and cobbles and a great deal of caliche.

Summary of Findings

Examination of the surface expression of features at LA 118547 combined with information gathered during excavation provide several insights into the structure and use of this farming site. Surface observations suggested that these fields were built over time rather than in one construction episode. Two tiers of fields were defined, one near the edge of the terrace and a second behind it toward the terrace interior. The terrace-edge tier was built first and was affected by construction of the second tier. Boundary (and possibly interior) alignments are often obscured or absent in the terrace-edge tier, especially in areas adjacent to the terrace-interior tier of fields. This may be due to material scavenging and reuse in which some of the elements used to build alignments for the terrace-edge tier were reused in the terrace-interior tier. Most terrace-edge borrow pits also appear to be associated with the terrace-edge tier of fields, though some were probably used or reused during later construction episodes.

The terrace-interior tier of fields is better preserved than those at the terrace edge and often overlaps them, exhibiting a distinct mounding

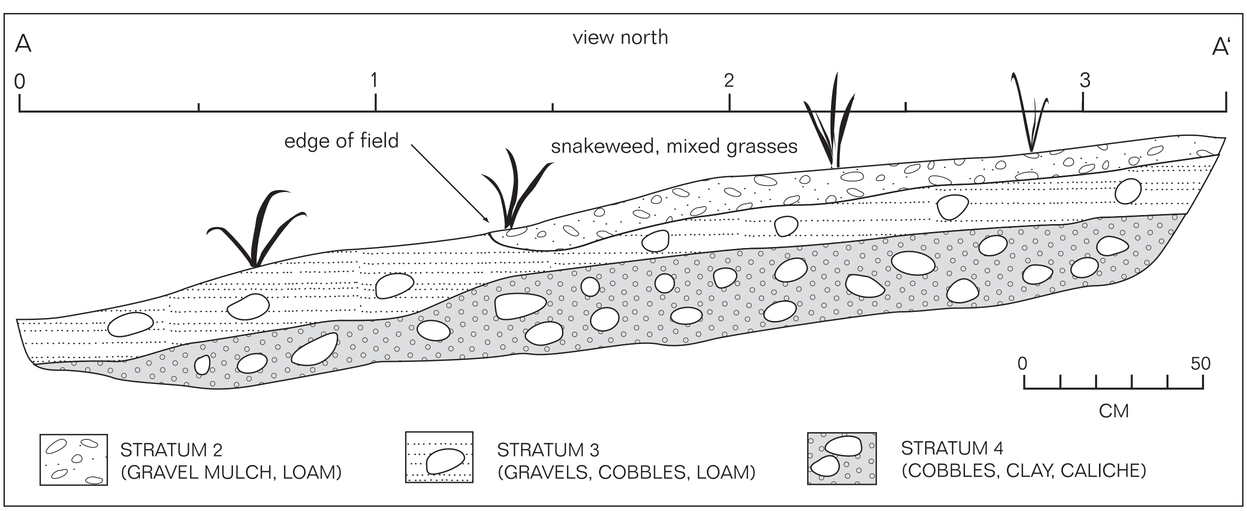


Figure 16.36. Profile of the north wall of Backhoe Trench 1 in Feature 15, LA 118547.

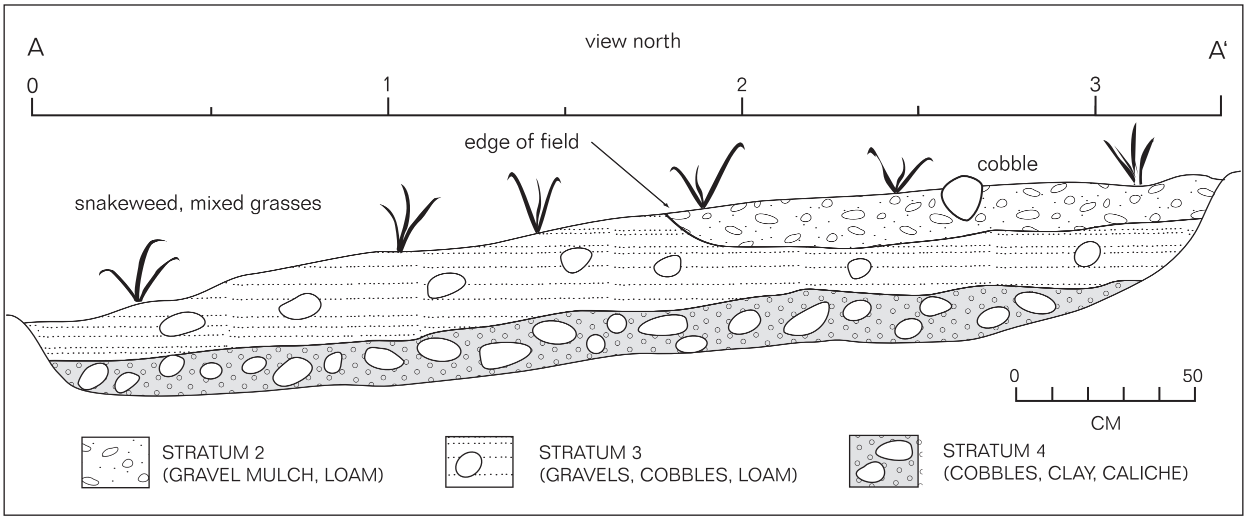


Figure 16.37. Profile of the north wall of Backhoe Trench 4 in Feature 15, LA 118547.

above the earlier field surfaces. The close association of terrace-interior borrow pits with this tier of fields suggests that they were used to obtain materials for constructing the terrace-interior fields. An interesting and potentially significant difference between the two tiers of fields is in their continuity. Fields are continuous along the terrace edge, exhibiting few breaks that are observable from the surface. Fields are more discrete in the interior tier and are not distributed continuously across the site. Indeed, breaks between these plots are quite visible and usually consist of exposures of the original terrace surface.

Some of excavation units provided data that shed light on construction of the terrace-edge fields. EU-G exposed a corner in the west boundary alignment (Fig. 16.24). The lack of any corresponding interior subdividing alignment in articulation with the corner suggests that it probably does not represent an area of accretional growth. In this case the field edge was being stepped back in reaction to variation in elevation at the edge of the terrace. In contrast, however, is EU-J (Fig. 16.30). In this instance, a jog in the west boundary alignment is matched with an interior subdividing alignment, suggesting that this represents an area of accretional growth. One of the plots in this area was added to an existing section of field, and the west boundary alignment simply did not match from one plot to the next, resulting in the jog. While only one such example was found by excavation, circumstantial evidence also suggests that the terrace-edge fields grew accretionally. Eventually, at least some were apparently abandoned and replaced by fields on the terrace interior.

Excavation showed that field structure was usually more complex than surface observations indicated. Some areas were highly subdivided into long, narrow, parallel plots, especially at the north end of Feature 15. Other plots seemed to be wider in proportion to their lengths, but without complete excavation of these areas exact measurement was impossible. Several areas contained collections of noncontiguous and irregularly spaced cobbles and small boulders. Generally, most of these elements rested on the original terrace surface, suggesting that they were purposely placed. Adjacent plots were configured differently in at least one case (EU-I; Fig. 16.27), where one plot contained numerous irregularly spaced cobbles and the other had none. Large cobbles were sometimes found to be floating in the gravel mulch, and could be indicative of intentional placement after fields were built, suggesting feature remodeling to create a new configuration.

One of the most important observations made, however, is that the surface configuration of farming features is usually indicative of feature structure, but cannot always be trusted. Alignments exposed by excavation were not always visible from the surface. In some cases, alignments defined from surface observations did not really exist. Thus, while surface mapping of farming features like these can provide a large amount of data, only excavation can yield more specific and accurate information on feature structure.

Artifacts were recovered from both strata encountered in excavation units. Materials found in Stratum 1 postdate the construction and possibly use of farming features at this site. This is especially true of the Euroamerican sherd recovered from Stratum 1 in EU-B. Artifacts from Stratum 2 either came from the materials used to build the features, were present on the surface when fields were built and therefore predate their construction, or were deposited as the features were being used or built. Evidence from EU-C and EU-D suggest that quarrying activities definitely occurred in places along the terrace edge before farming features were built, and the chipped stone artifacts recovered from the lowermost few centimeters in those units represent those earlier reduction activities. Some artifacts found in Stratum 2 may have come from the surface of the borrow pits from which mulch was obtained. However, it is more likely that most of the artifacts recovered from Stratum 2 (with the exception of those already discussed) were deposited when the fields were in use and reached their subsurface location through natural processes. Since a few sherds of both Biscuit A and B were recovered from the layer of mulch, these features were most likely built and used during the Classic period, and possibly during the later part of the Classic period.

Chapter 17. LA 118549

James L. Moore

LA 118549 is a long linear feature defined as a prehistoric trail, which was initially recorded by Levine (1997) after field studies began. Through the years, the trail has been broken into numerous segments by erosion and construction activities. Most segments noted are within the U.S. 285 right-of-way and traverse the west slope of the terrace that borders the east edge of the Ojo Caliente Valley (Fig. 17.1). In places the trail leaves the right-of-way, but perhaps 95 percent was within project limits. The main exceptions are where the trail ascends to the terrace top or the terrace is cut by large secondary drainages. In the former case the trail sometimes meanders out of project limits for short distances but tends to hug the terrace edge within the right-of-way. In the latter cases it usually curves up tributary valleys, often extending a short distance out of project limits and descending to the valley floor where it can no longer be traced. LA 118549 is visible for a distance of at least 9.2 km, including most of the length of this project. It continues south out of the study area past the Classic period village of Ponsipa'akeri. We found no evidence that the trail continues north beyond project limits.

Field Procedures

A sample of segments adjacent to the farming sites recorded during this project and within project limits was examined and described. Each of these segments was mapped along with features on the adjacent farming sites. Segments were then examined by pedestrian survey, their physical characteristics were recorded and described, and associated artifacts were collected. Subsurface investigations were limited to two mechanically excavated trenches along a segment of the trail south of LA 105710. Profiles of both trenches were drawn, but materials removed during excavation were not screened.

Segments

Trail segments were identified adjacent to seven of the nine farming sites. The southernmost segment was next to LA 118547, and the northernmost was adjacent to LA 105713. Unfortunately, modern disturbances at LA 105703 and LA 105704 have eradicated the trail in those areas, and it is no longer visible on the ground or in aerial photographs. Segments are described from south to north along the right-of-way. Aerial photographs of the project area taken in 1972 were furnished by the NMDOT, and unscaled sections of these photographs are used to illustrate the route of LA 118549 along recorded segments.

The trail was visible far to the south of the project area, but that section was not examined on the ground or described. However, LA 118549 was traced as far south as Arroyo del Pueblo, which is directly south of the ancestral Tewa village of Ponsipa'akeri. In our project area, this part of the trail is divided into discrete segments by deeply incised drainages and remains visible on the west terrace slope at the east edge of the Ojo Caliente Valley but disappears where it descends into drainages. Segments adjacent to LA 105705, LA 105706, LA 105707, and LA 105708 are on State Trust land administered by the State of New Mexico Land Office. Segments adjacent to LA 105709, LA 105713, and LA 118547 are on land administered by the USDI Bureau of Land Management.

Segment adjacent to LA 118547

The segment of LA 118549 adjacent to LA 118547 ran along the west slope of the terrace that forms the east edge of the Ojo Caliente Valley. This segment was bordered on the north and south by deeply incised drainages that have dissected the terrace edge. Though the southernmost section of this segment had been removed by construction when data recovery began, part of its route can be reconstructed using aerial photographs. As

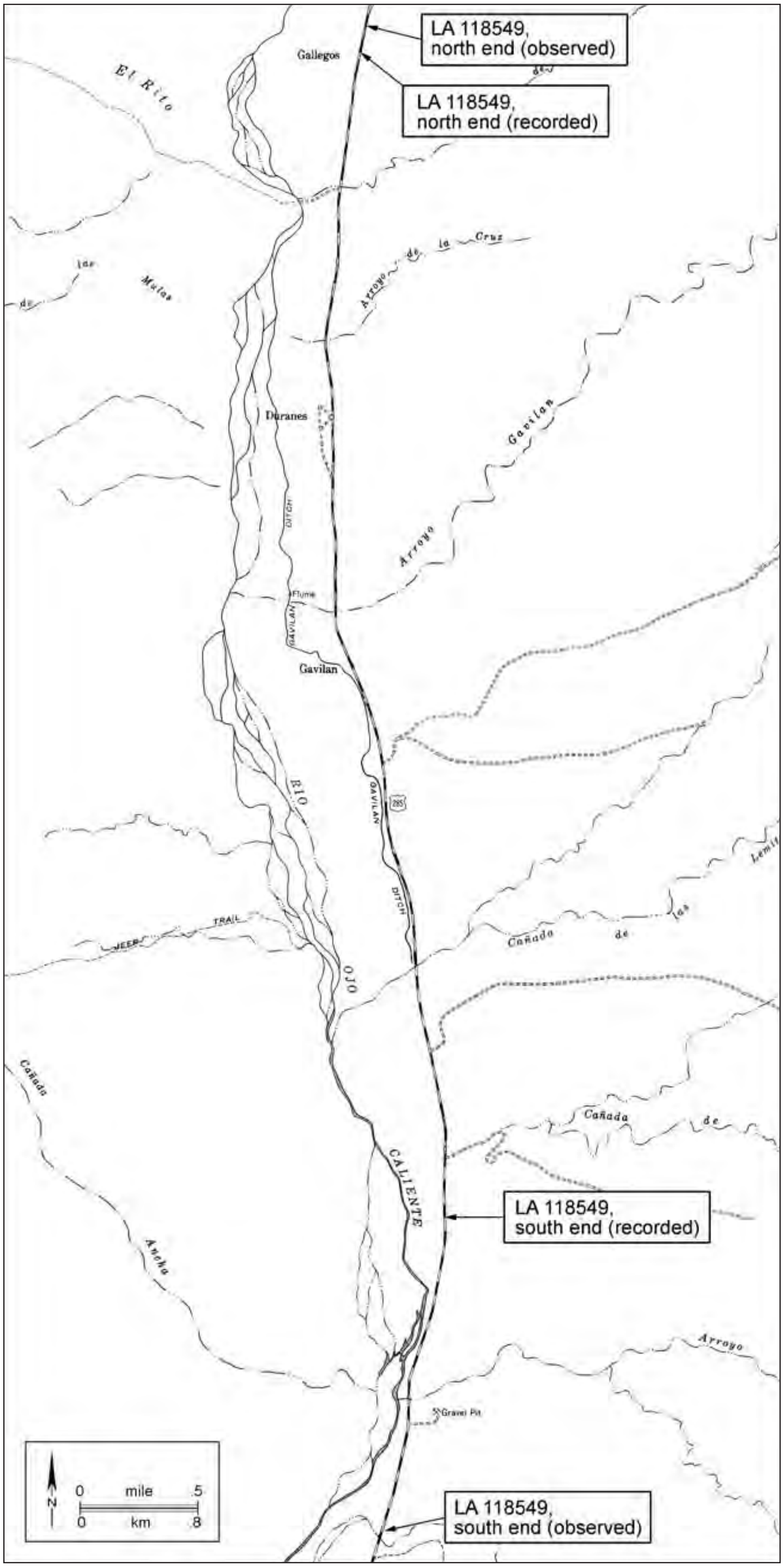


Figure 17.1. LA 118549, with observed and recorded end points.

Figure 17.2 shows, the trail first appeared next to LA 118547 about halfway up the terrace slope, originating in an eroded cutbank. A section of trail is also visible at the south end of the photo, running along the edge of LA 118548—another farming site just outside project limits. The trail swung east when it reached the deeply incised drainage that separates LA 118548 and LA 118549, crossing the valley bottom and curving back to the west before again ascending the terrace slope. This method of crossing drainages was used repeatedly along the trail.

The south 140 m of this segment was removed by construction before data recovery began. We could begin tracing the trail just west of a point parallel with Feature 22 on LA 118547 (see Fig. 16.1). At that point, the trail was about halfway up the terrace slope and, as Figure 17.2 shows, it had maintained that elevation from the time it leveled off after ascending the slope. Where it began, the trail was 1.2 m wide and was incised 15–20 cm deep by erosion. Two parallel shallow gullies cut through the trail 6–10 m north of that point, and a section was missing. Beyond the missing section the trail was no longer incised into the slope and formed a narrow shelf about 1.1 m wide, which soon widened to 1.4 m. Whether the trail attained this configuration through use or active modification of the slope is uncertain. However, since cobbles and boulders were obviously cleared from the trail (Fig. 17.3), both processes were probably factors in creating its current form.

A section of trail was modified to drain into a modern culvert about halfway along this segment (Fig. 16.1). Close examination of this area showed that the trail actually continued unbroken above the culvert, but that section was indistinct and was not visible on aerial photographs. This short section was 1.2 m wide and incised only about 5 cm into the terrace slope. At the south end of the area modified by the culvert, the trail split, and a segment ascended the terrace slope and emerged on top at Feature 11, a terrace-edge borrow pit (Fig. 16.1).

Thirty meters north of the culvert the trail was cut by a drainage that destroyed a 15–18 m long section (Fig. 16.1). An unmortared cobble wall about 1.5 m high and of probable historic age spanned part of this gap, creating a barrier to further erosion (Fig. 17.4). It also created a level area in the drainage, and the trail was redirected slightly to the east around the wall. At this point the trail was a bit below the midpoint of the slope. While the wall may simply have been built to halt downcutting and protect the main road in the bottom of the valley, the detour of the trail around it suggests that use of LA 118549 as a traffic corridor may have continued into the historic period.

Beyond the detour the trail widened to 1.5 m and again had a shelflike cross section and was mostly clear of cobbles (Fig. 17.5). However, colluvial movement resulted in the deposition of some debris on the trail, especially on the east edge, so it may have originally been even wider through this area. About 45 m north of the retaining wall, a cobble alignment 0.45 m wide and 10 m long crossed the trail at a perpendicular (Fig. 17.6). This alignment was two elements wide and was probably not associated with prehistoric use of the trail. We made this assumption because the alignment of cobbles lines up fairly well with a fence on the west side of U.S. 285, so it may represent a property boundary marker.

A drainage cut through the trail 27 m north of the cobble alignment, eradicating a 6–8 m long section (Fig. 16.1). Beyond this drainage the trail retained the same cross section but widened to 1.7 m. About 90 m north of this drainage the trail was cut by another gully, beyond which it was offset toward the terrace top (Fig. 16.1). The gully destroyed any evidence of a connection between these sections. The upper section was 1.4–1.5 m wide and had a low berm that was 10–20 cm high on the downslope side and disappeared after 15 m. This section was nearly two-thirds of the way up the slope, which was the closest the main trail came to the terrace top along this segment. As usual, the surface of this section of trail was nearly devoid of cobbles.

As the trail reached the northwest corner of the terrace finger occupied by LA 118547, it curved eastward around the slope, beginning its descent to the valley floor (Fig. 17.7). The segment ended at Forest Road 556. As was the case at the south end, the missing section of trail curved up the valley for a short distance then crossed the drainage before curving west around the terrace edge on the other side of the valley and heading back upslope to form the segment that ran parallel to LA 105709.

Figure 17.2. Aerial photograph showing the south part of LA 118549, adjacent to LA 118547.

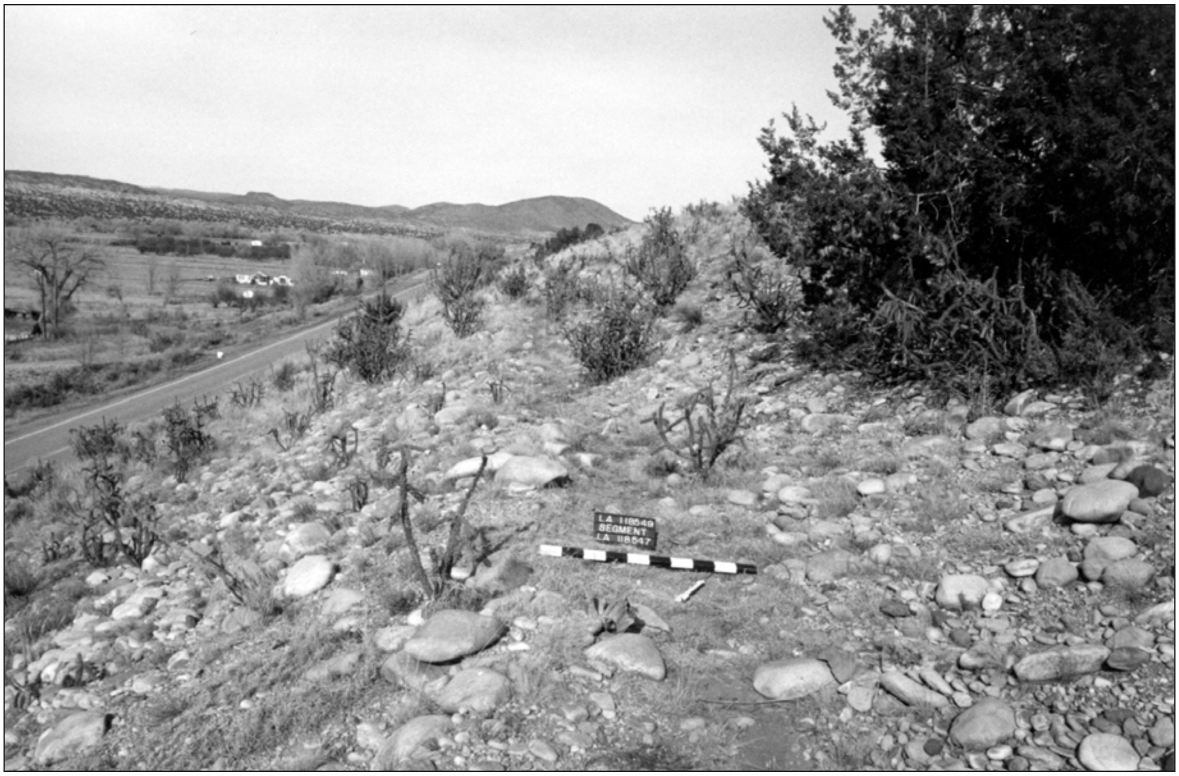


Figure 17.3. The segment of LA 118549 adjacent to LA 118547, illustrating the shelflike cross section of the trail and how it has been cleared of rocks.

Figure 17.4. Probable historic retaining wall built with unmortared cobbles to partly block a drainage cutting through the trail, LA 118547.

Figure 17.5. The north part of the segment of LA 118549 adjacent to LA 118547, showing its shelflike cross section and how it has been cleared of rocks.

Figure 17.6. Cobble alignment crossing the trail along the segment adjacent to LA 118547.

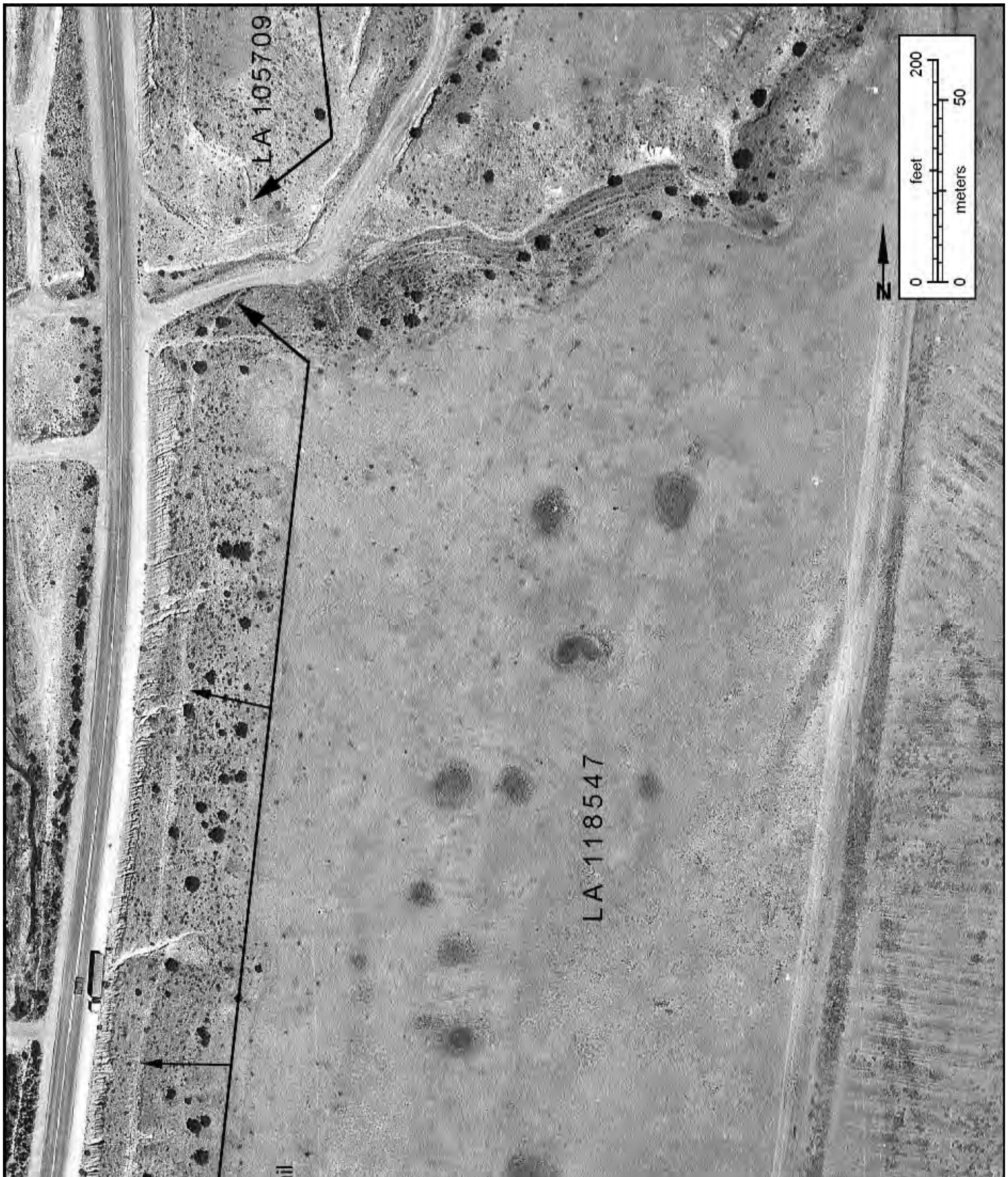


Figure 17.7. Aerial photograph showing the north part of the segment of LA 118549 adjacent to LA 118547.

Ten chipped stone artifacts were collected from this section of trail (Table 17.1). Rhyolite was the most abundant material, comprising 80 percent of this small assemblage. All three materials recovered from this segment are locally available in gravel deposits, and the types of artifacts recovered suggest that they were created by raw-material quarrying.

Segment adjacent to LA 105709

As noted above, the segment of LA 118549 adjacent to LA 105709 was essentially contiguous with the segment that paralleled LA 118547, with a short break in the bottom of the valley that separated those sites. While the section of trail that ascended the terrace slope at the south end of the terrace finger occupied by LA 105709 is clearly visible on the aerial photograph (Figs. 17.7 and 17.8), it was more difficult to define on the ground because it had been used and essentially eradicated by ATV traffic and now forms a distinct gully.

After ascending about four-fifths of the way up the terrace slope, the trail leveled off about 2.5 m below the terrace top and ran north-northwest along the west terrace slope. Through this area the trail formed a shallow swale that was about 1.75 m wide, including a distinct berm on the downslope side. The berm was 0.25–0.30 m high and seemed to be comprised mostly of cobbles and gravels removed from the swale and piled along the outer edge of the trail. The bottom of the swale was mostly devoid of cobbles except for those that had washed in from above. In some places the trail widened to about 2 m, and the berm was similarly higher at 0.30–0.40 m.

The trail almost immediately began to wind upward, paralleling the terrace edge and ascending to the terrace top near Feature 3 at LA 105709 (Fig. 13.1). Through this area the trail remained about 2 m wide, and the berm was 0.30–0.40 m high (Fig. 17.8). The trail remained on top of the terrace and closely paralleled its west edge until it reached a point about 30 m south of a large shrine, Feature 9, at LA 105709 (see Fig. 13.1). At this point the trail began descending from the terrace top and continued to be paralleled on its downslope side by a berm (Figs. 17.9 and 17.10). Erosion has deepened the trail by 15–20 cm through this area. By the time the trail was below Feature 9 it had descended about a third of the way down the slope. The berm disappeared at about that point, and the cross section of the trail became shelflike rather than a shallow swale. The trail continued to descend until it was two-thirds of the way down the terrace slope, where it leveled off.

Small gullies occasionally cut through the trail in this section, eradicating short stretches. The trail was also not as wide through this section as it was on top of the terrace, narrowing to 1.5 m. Colluvial wash had deposited sediments, gravels, and cobbles on much of this section of trail, nearly obscuring it in places. As the trail passed the north edge of Feature 12 at LA 105709 (Fig. 13.1) it began another gentle descent, ending near the foundations of the García store at LA 105710 (Fig. 17.8). From this point to the north edge of Hilltop Pueblo (LA 66288), the trail may

Table 17.1. Chipped stone artifacts collected from within the highway right-of-way at segments of LA 118549 (material type by artifact morphology)

Segment Is Next To	Material Type	Angular Debris	Core Flakes	Cores
LA 105707	Chert	-	1	-
	Pedernal chert	-	-	1
	Rhyolite	11	19	4
LA 105708	Rhyolite	3	5	2
LA 105709	Rhyolite	5	5	1
LA 105713	Rhyolite	4	6	5
	Andesite	-	1	-
LA 118547	Rhyolite	3	4	1
	Andesite	1	-	-
	Quartzite	-	-	1

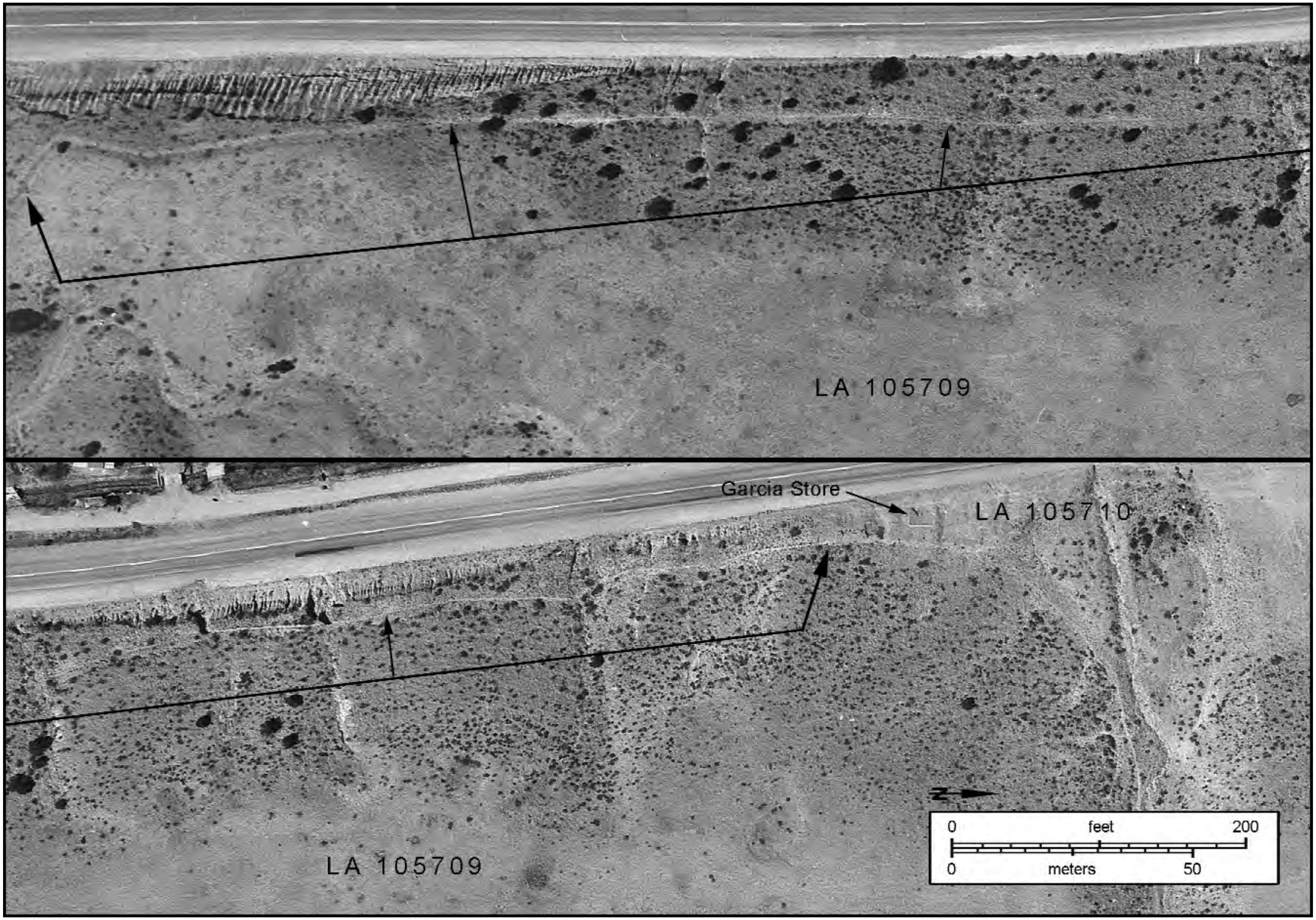


Figure 17.8. Aerial photograph showing the segment of LA 118549 adjacent to LA 105709.

Figure 17.9. South end of segment of LA 118549 adjacent to LA 105709, showing how it followed the contours up to the top of the terrace. Note the distinct berm on the downslope side and the swalelike cross section.

Figure 17.10. Segment of LA 118549 adjacent to LA 105709, showing the descent of the trail from the terrace top and the berm along its downslope side.

have followed the base of the terrace slope, but any evidence of its route through that area has been eradicated by a variety of later historic activities. Another possibility is that the ancestral Tewa villages of Nute and Hilltop Pueblo represented a terminus for this section of trail, and it simply disappeared into an activity zone that surrounded those large residential sites. In any event, there is a large gap in the trail between the segment adjacent to LA 105709 and the next segment adjacent to LA 105708 on the north side of the Arroyo de Gavilan.

Eleven chipped stone artifacts were collected from this section of trail (Table 17.1). All are rhyolite, which is locally available in gravel deposits, and the types of artifacts recovered suggest that they resulted from raw-material quarrying.

Segment adjacent to LA 105708

This segment of trail began at the edge of a deep drainage at the south end of LA 105708. The drainage separates LA 105708 and a series of unrecorded farming features on a terrace finger to the south of that site. These features were not recorded because they were well outside project limits and would not be affected by construction activities. As Figure 17.11 shows, the trail continued south past the terrace finger that contains the unrecorded features and originated at the north edge of the valley formed by Arroyo de Gavilan.

Much of the section of trail that originally ascended the terrace slope at the south edge of LA 105708 had washed away, and the remaining ascending section was deeply eroded (Fig. 17.12). This section of trail ran about 75 m north across a shelf that was 5 m below the top of the terrace, crossing behind (east of) Feature 3 at LA 105708 (see Fig. 12.1). The trail was about 2 m wide through this area, and a berm that was 0.2 m high and 1 m wide ran along its west edge. This part of the trail, a shallow swale in cross section, was mostly devoid of rocks but had been heavily disturbed by rodent activity.

The trail began sloping upward at the north end of Feature 3 (Fig. 12.1). The berm ended at that point, and the trail cross section became shelflike. Materials that were removed or dislodged from this section were deposited directly adjacent to the downslope side of the trail but did not form a berm. This section continued for about 15 m until the trail began to ascend the slope to the terrace top. It was only 1.2–1.3 m wide through this area, and as the ascent began, the berm again appeared and was quite distinct by the time the trail reached the top of the terrace next to Feature 11 at LA 105708, an elaborate double terrace-edge borrow pit (Fig. 12.1). The berm was 0.25–0.30 m high and 1 m wide in this section.

The trail crossed the terrace top west of Feature 11 and almost immediately began to descend again. The berm disappeared at this point, and the trail resumed a shelflike appearance. Soon after the descent began, a 10–15 m long section was removed by a gully that headed in Feature 12 on LA 105708, a terrace-edge borrow pit. The trail was cut 0.2–0.3 m deep from this point until it leveled off near the base of the slope (Fig. 17.13). It remained near the base of the slope for the next 80–100 m. This section of trail continued to have a shelflike cross section, was 1.5 m wide, and was cut by numerous small gullies. The trail then ascended to perhaps a quarter of the way up the slope until it neared the end of the terrace finger occupied by LA 105708, where it ascended until it was one-third of the way up the slope, then curved east around the end of the terrace and disappeared at the drainage that separates LA 105708 from LA 105705 (Fig. 17.14). As the curve around the northwest edge of the terrace finger began, a possible side trail split from the main trail, heading southeast toward the terrace top. While this side trail may have been used prehistorically, it could also be a historic game trail. The side trail seems to continue downslope to the valley bottom, potentially eliminating it as a prehistoric feature and confirming it as a path used by game or livestock (Fig. 17.11).

Ten chipped stone artifacts were collected from this section of trail (Table 17.1). All are rhyolite, which is locally available in gravel deposits, and the types of artifacts recovered suggest that they result from raw-material quarrying.

Segment adjacent to LA 105705

This segment of trail curved up the southwest corner of the terrace finger occupied by LA 105705 (Fig. 17.15). The trail was incised up to 40 cm deep in that area and had become the head of a gully. The incising ended about two-thirds of

Figure 17.11. Aerial photograph showing the segment of LA 118549 adjacent to the south part of LA 105708.

Figure 17.12. Ascending section of trail at the south end of LA 105708, showing erosional damage.

Figure 17.13. Segment of trail adjacent to LA 105708, showing its descent from the terrace top.

Figure 17.14. Aerial photograph showing the segment of LA 118549 adjacent to the north part of LA 105708 and LA 105705.

Figure 17.15. Trail ascending the terrace slope at the south end of LA 105705, showing how it has become incised into the slope.

the way up the slope, and from that point to just below the terrace top the trail had a shelflike cross section, was fairly indistinct, and was 1.0–1.1 m wide.

Another change in the configuration of the trail began about 2.5 m below the top of the terrace slope. At that point a distinct berm appeared on the downslope side of the trail. The berm was 0.2–0.3 m high and 1.0–1.2 m wide, and the trail adjacent to it formed a swale that was 1.3–1.5 m wide. The berm achieved its maximum height as the trail reached the top of the terrace slope, where it was 0.4–0.5 m high and the trail swale was about the same depth.

As the trail crossed the right-of-way fence it widened to 2 m and became shallower, decreasing to a depth of 0.10–0.15 m (see Fig. 9.1). The berm was only 0.15–0.20 m high through that area. As the trail swung back under the fence into the right-of-way, it almost immediately began to descend the slope (Fig. 9.1). The berm continued for about the first 20 m downslope, then disappeared, and the trail again assumed a shelflike cross section except for short areas that were eroded away. Through this area the trail was 1.3–1.5 m wide.

At the north end of the terrace finger, the trail descended toward the valley floor, curving gently eastward up a small valley, where it was truncated by an unimproved road and small drainage (Fig. 17.14). It disappeared at this point and was no longer visible on the ground. A small side trail might have led up to the north end of LA 105705, diverging from the main trail just north of the modern water tank at LA 105705, slanting southeast upslope toward the water tank and ending in a disturbed zone just below it (Fig. 17.14). The side trail was only about 1 m wide. A possible fork in the side trail is visible in Figure 17.14. An upper section heads toward the water tank and probably represents a modern feature. A lower section seems to have proceeded in a southerly direction to the terrace top. Unlike the possible side trail noted in the segment adjacent to LA 105708, there was no evidence that this side trail continued beyond the main trail into the valley bottom. No artifacts were collected from this segment.

Segment adjacent to LA 105706

There was a discontinuity between this segment and the segment adjacent to LA 105705 caused by erosion through the two drainages that separate those sites (Fig. 17.16). As noted above, the trail curved east around the northwest corner of the terrace finger occupied by LA 105705, descending into a narrow valley. At that point it disappeared and did not definitely reappear until it ascended the southwest corner of the terrace finger occupied by LA 105706. However, the trail may have run through a shallow notch that was visible near the end of an eroded terrace finger that separated the two drainages between LA 105705 and LA 105706. Unfortunately, extensive erosion in that area made it impossible to confirm this on the ground.

Where it again became visible, the trail curved gently west out of the northernmost of the two drainages that separate LA 105705 from LA 105706 and ascended the terrace slope (Fig. 17.17). This section of trail was about 1.5 m wide. It ascended the terrace slope at a moderate angle and was incised 2–5 cm deep by erosion. This section of trail had a shelflike cross section and was moderately clear of rocks and cobbles, though some debris had eroded down onto it. The highest point reached by this section was about three-quarters of the way up the terrace slope, and through that area the trail was 1.4–1.5 m wide and 2–3 cm deep. No berming was noted, so the slight depression probably resulted from use.

At the north end of the terrace finger the trail again began to descend the slope. This section was mostly concealed beneath cobbles moved downslope by colluvial wash and was fairly indistinct, so no measurement of width could be obtained. When the trail again became visible at ground level and was clear of debris, it was only one-third of the way up the slope. It retained its shelflike cross section and was 1.2–1.3 m wide. The trail continued to descend the slope fairly rapidly and was slightly incised (ca. 3–5 cm deep) up to the point where it was truncated by a drainage and disappeared. No artifacts were collected from this segment.

Segment adjacent to LA 105707

There was a short break between this segment and the segment adjacent to LA 105706 that resulted from truncation of the end of the terrace finger occupied by LA 105707 by the U.S. 285 roadcut. Thus, this segment of trail began near the top of the terrace slope at the edge of the roadcut (Fig. 17.18) and originally ascended the terrace slope from the south (see Fig. 11.1). The section of trail that crossed the terrace top formed a shallow swale about 0.10–0.12 m deep and 2 m wide at the edge of the roadcut and paralleled the right-of-way fence (Fig. 17.16). The downslope edge was bermed, but most of the berm was removed by the roadcut. Where most intact, the berm was about 0.2 m high and 1.5+ m wide.

After passing Feature 1 on LA 105707 (Fig. 11.1), the trail began to descend the terrace slope at a moderately steep angle. This section was only about 1 m wide and was incised 0.10–0.15 m deep by erosion. There was no evidence of a berm through this area. While the section of trail on top of the terrace was mostly clear of rock, this section was fairly choked by debris, a consequence of colluvial movement.

Runoff down the descending section of trail turned it into a gully. The trail leveled off about halfway down the slope, and at that point the gully cut through the outer edge of the trail, forming an incised channel. Beyond that point the trail followed the same contour for some distance, had a shelflike cross section, and was 1.5 m wide. Though this part of the trail was fairly clear of debris, several small gullies cut through it and erased short sections. About 30 m beyond the point where it leveled off the trail narrowed to 0.75–1.0 m wide. From that point on it was choked with colluvial debris that covered the uphill (east) edge and probably caused the narrowing. While the trail was visible at ground level through this area, it was not quite as distinct as elsewhere. This section remained fairly level and at the approximate midpoint of the terrace slope.

The final section of this segment began when the trail reached the end of the terrace finger and began to descend the slope at a moderate angle. This section was cut by several gullies and was mostly covered by colluvial debris, reducing its visibility considerably. The trail passed under the

Figure 17.16. Aerial photograph of the segments of LA 118549 adjacent to LA 105706 and LA 105707.

Figure 17.17. Trail ascending the terrace slope at the south end of LA 105706.

Figure 17.18. The beginning of the segment of LA 118549 adjacent to LA 105707 at the edge of the roadcut.

right-of-way fence at the north end of the terrace finger (Fig. 11.1) and disappeared about 15 m beyond the fence. Though the trail probably crossed the valley formed by Arroyo de la Cruz, that section was removed by erosion in the valley bottom. On the north side of Arroyo de la Cruz, the trail once again became visible, ascending the terrace slope from the east and winding up toward the top (Fig. 17.19).

Thirty-six chipped stone artifacts were collected from this section of trail (Table 17.1). Rhyolite was the most abundant material, comprising about 95 percent of this small assemblage. Rhyolite and various cherts are locally available in gravel deposits. Pedernal chert is not naturally available in this section of the Ojo Caliente Valley and was probably imported from the Chama Valley to the west. The types of artifacts recovered suggest that, with the exception of the Pedernal chert core, they resulted from raw-material quarrying.

Segment adjacent to LA 105713

Though the trail segment between the Arroyo de la Cruz just north of LA 105707 and LA 105713 was not examined in detail on the ground, it was more or less continuous between those sites (Fig. 17.19). The segment of trail adjacent to LA 105713 was the northernmost part of LA 118549 that was examined in detail. This segment was confined to the west edge of the terrace finger occupied by LA 105713, with discontinuities at both the north and south ends, where deeply incised drainages had eradicated the trail. It began with a section that curved gently upward along the southwest corner of the terrace finger, ascending from the bottom of a drainage to the southeast (Fig. 17.20). This section of trail was severely eroded, so measurements were not possible.

About a third of the way up the slope, the trail leveled off and ran along the west face of the terrace. In this area the trail was about 1.5 m wide and had a shelflike cross section (Fig. 17.21). Soon it again began to gently ascend the terrace slope. This section of trail was mostly clear of debris, but some cobbles and gravels had washed down onto it. As the trail reached the halfway point on the slope, a 5–7 m long segment was covered with colluvial debris. Beyond this point the trail returned to its original configuration (Fig. 17.22) but was only 1.0–1.2 m wide because the east edge was covered by colluvial debris. At the north end of this short section, the trail became difficult to define because it was cut by a gully and mostly covered by colluvial debris.

Short sections of trail remained visible through this area. They were about 1.5 m wide with a shelflike cross section. Other sections were covered by debris or had been erased by gullies (Fig. 17.23). As the trail approached the north end of the terrace, it began ascending the slope more rapidly. Though the ascending section was mostly covered with colluvial debris, it retained its shelflike cross section and remained about 1.5 m wide.

The trail climbed to a point about 2.5 m below the terrace top at the north end of the terrace finger, then leveled off and curved around the northwest corner of the terrace into the next small valley. The level section of trail had a shelflike cross section, and there was no evidence of a berm. From this point the trail descended fairly rapidly toward the northeast for about 20 m. This section was incised 10–15 cm deep by erosion and disappeared into an area covered by colluvial debris. The trail could be followed a short distance north of LA 105713 by sporadic and badly preserved short segments, but it disappeared before LA 105704 was reached. The terminus is probably at Posi'ouinge or further north at Howiri, but modern activities associated with road construction and development of the village of Ojo Caliente have eradicated signs of LA 118549 beyond the northern endpoint shown in Fig. 17.1.

Sixteen chipped stone artifacts were collected from this section of trail (Table 17.1). Rhyolite was the most abundant material, comprising about 94 percent of this small assemblage. Both materials recovered from this segment are locally available in gravel deposits, and the types of artifacts recovered suggest that they resulted from raw-material quarrying.

Summary of Findings

Where it occurred on the terrace slope the trail tended to have a shelflike cross section and was mostly 1.0–1.5 m wide. Where the trail ascended to the terrace top in the recorded segments, the

Figure 17.19. Aerial photograph showing segments of LA 118549 between Arroyo de la Cruz and LA 105713.

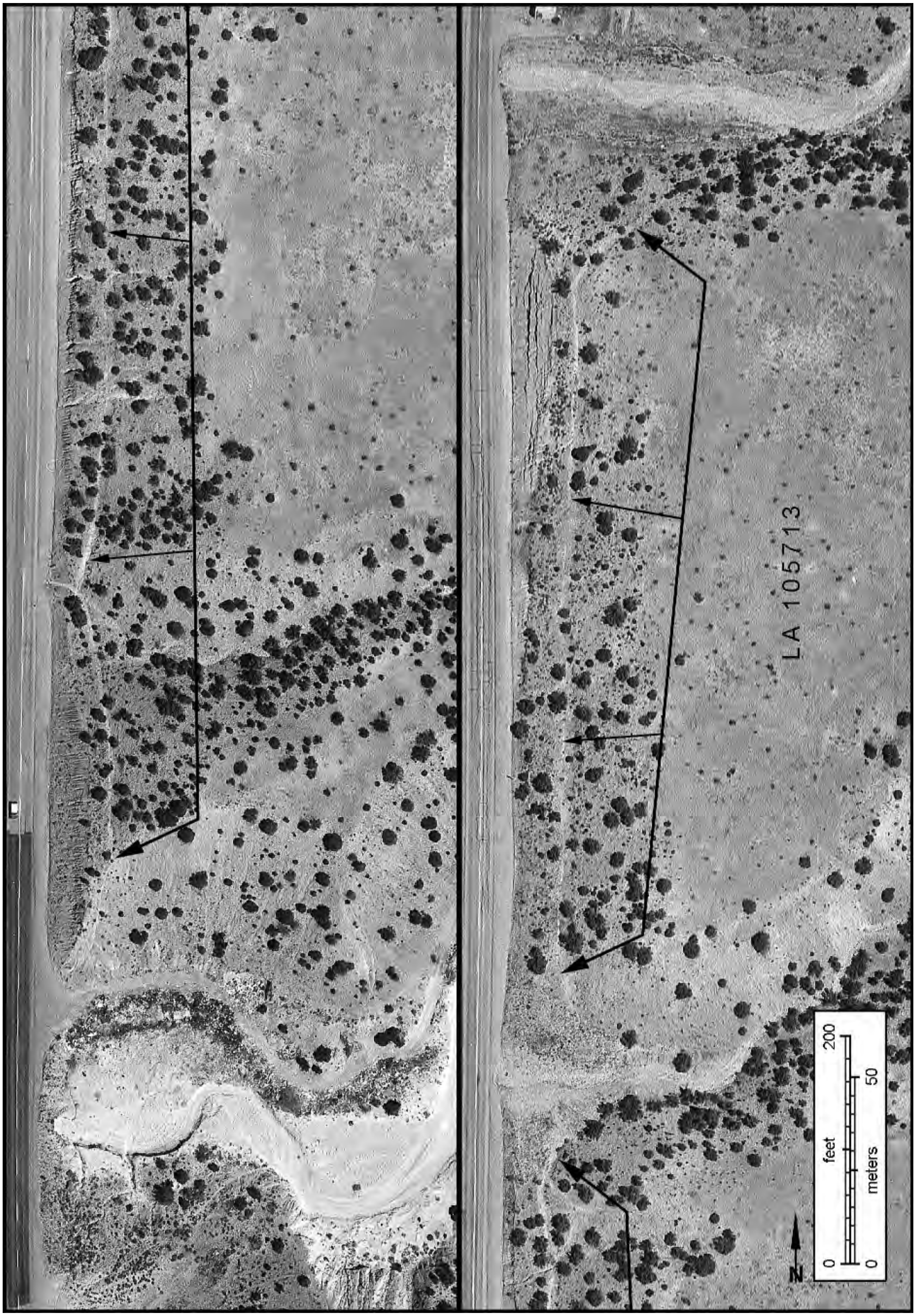


Figure 17.20. Aerial photograph showing the segment of LA 118549 adjacent to LA 105713.

Figure 17.21. Southern section of trail adjacent to LA 105713, showing its shelflike cross section and how it was mostly cleared of rocks.

Figure 17.22. Section of trail adjacent to LA 105713, showing its shelflike cross section and how it has been cleared of rocks.

Figure 17.23. A section of trail adjacent to LA 105713 that can be traced but is mostly covered by colluvial debris.

downslope side was usually bermed, and the surface of the trail was lower than the adjacent terrace, forming a shallow swale. These sections of trail were usually about 2.0 m wide, somewhat wider than those that ran along the slope. The longest and most elaborately bermed terrace top segment noted was near a shrine (Feature 9 at LA 105709).

The trail was cut into segments by numerous erosional channels that drain the terrace and form narrow valleys between fingers along its west edge. Smaller channels cut through trail segments in many places, but enough of the feature remained intact that it could be easily traced. Sections of trail were occasionally transformed into gullies. The trail tends to meander across the west ends of terrace fingers, occasionally ascending to the terrace top and seemingly always descending to the floors of small intervening valleys. There it disappears, only to reappear on the other side of the valley, where it ascends the terrace slope.

Most of our examination of this site was limited to mapping and describing sample segments. However, two mechanically excavated trenches were placed across the trail near LA 105709 and LA 105710. Backhoe Trench 1 was excavated across the section of trail that traverses the terrace top near Feature 6 on LA 105709 (Fig. 13.1). In cross section, this section of trail appears as a shallow swale with a maximum depth of 15 cm and a width of 1.65 m (Fig. 17.24). Two strata were encountered in this trench, an upper layer of yellowish brown colluvium containing some cobbles and gravels, and a lower layer containing numerous cobbles and gravels. Backhoe Trench 2 was excavated across a section of LA 118549 south of the foundations of the García store at LA 105710, just before the trail disappeared into the disturbed zone at that site (Fig. 13.1). In this cross section (Fig. 17.25), the trail had a maximum depth of 7 cm and a width of 1.2 m. Two soil strata were encountered in this trench and were essentially identical to those exposed in Backhoe Trench 1. No evidence of formal construction was noted in either profile.

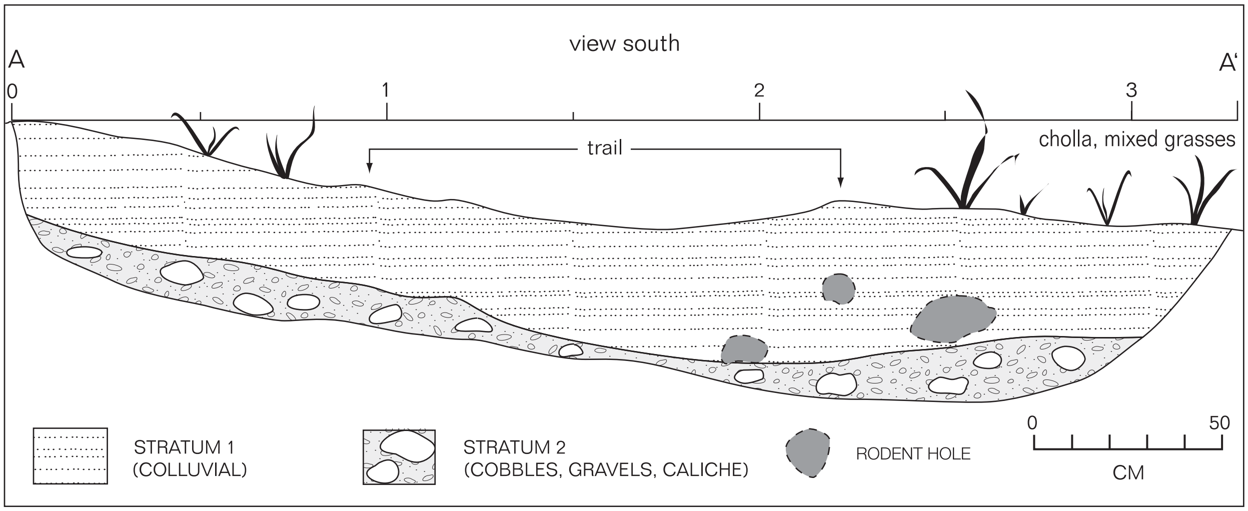


Figure 17.24. Profile of Backhoe Trench 1, LA 118549.

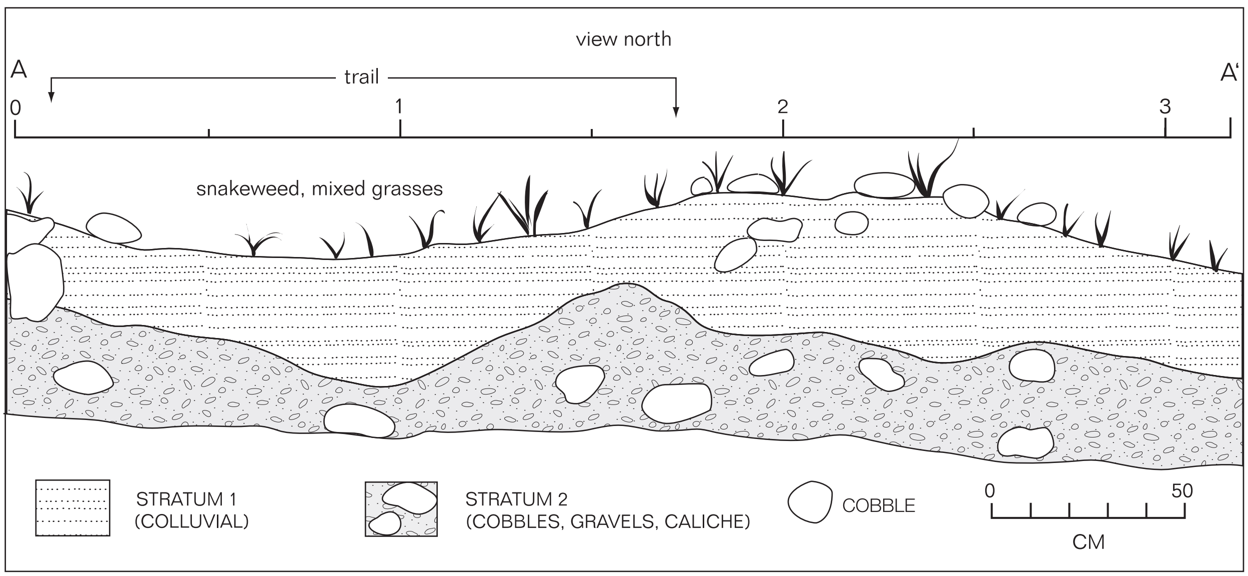


Figure 17.25. Profile of Backhoe Trench 2, LA 118549.

Several lines of evidence suggest that LA 118549 represents a culturally built feature of the prehistoric landscape rather than a historic trail or road-related construct. Interviews with long-term Hispanic residents of the Gavilan area failed to elicit any information concerning LA 118549. There simply seemed to be no folk memory of the trail. Similarly, there is no evidence that a long linear landscape feature of this type was related in any way to road construction. During a field inspection in which several members of the team that was supervising construction along this segment of the highway were shown the sites to aid in protecting them, a section of LA 118549 was pointed out. All agreed that it was not related to road construction. In addition, plans from the initial construction and paving of U.S. 285 in 1939 were obtained and examined (NMSHTD 1939). Nothing remotely resembling the location or configuration of LA 118549 was scheduled for construction in those plans.

In a further attempt to provide a minimum date for LA 118549, two junipers were sectioned within the existing right-of-way in areas scheduled to be removed by slope cuts. One sample was taken from a juniper growing on the east side of the trail below Feature 9 on LA 105709. The second came from the center of the trail below LA 118547. Two counts at different locations were made for the first sample, yielding totals of 80 and 82 rings. The latter was considered the most accurate. Five counts at different locations were made for the second sample, yielding totals of 70, 65, 64, 57, and 56 rings. The first three were considered the most accurate. This sample was very convoluted, and different axes produced different counts because of the way the tree had grown. If LA 118549 was built in conjunction with highway construction, neither tree should predate those building episodes. Since the samples were obtained in 1998, Sample 1 would have begun growing sometime around 1916 to 1918, and Sample 2 around 1928 to 1934. Both trees began growing before the initial construction and paving of U.S. 285, as well as all subsequent road-building episodes.

Harrington (1916) presents a detailed discussion of Tewa ethnogeography, but while he describes numerous trails in the region, there is no mention of any in the Ojo Caliente Valley. This is an interesting omission, but he does note that it was difficult to obtain adequate information on old trails from the Tewas (Harrington 1916:107). Certain ancient trails may have come to be considered sacred, no matter how mundane their original nature might have been. This may have been especially true of trails leading to important shrines or used for ceremonial purposes. One such feature, recorded near San Ildefonso (Moore and Levine 1987), was said to be a sacred hunting trail. Interestingly, that trail was similar in cross section and traversed landforms similar to those crossed by LA 118549.

Harrington (1916:157) notes that the Tewas consider the Ojo Caliente region to be their original homeland. The hot spring at Ojo Caliente is one of the most sacred places in the Tewa world, and it is closely associated with Poseyemu, the Tewa culture hero (Harrington 1916:164). Residents of San Juan Pueblo indicated that they drank water from the hot spring and that this practice probably extended into the past (Harrington 1916:164). The importance extended to the hot spring at Ojo Caliente suggests that visits to that feature were probably common and associated with ritual in prehistoric as well as historic times.

The way in which LA 118549 crosses landforms and certain variations in structure suggests that this trail may have been used for mundane as well as ceremonial purposes. As noted in several segment descriptions, the trail traverses the west face of the terrace that borders the east side of the Ojo Caliente Valley. Whenever it reaches one of the many drainages that dissect that edge of the terrace, the trail curves to the northeast, drops into the valley, and disappears. The trail usually reappears on the opposite side of the valley, curving up the terrace edge to again traverse the west slope. This route seems indicative of foot traffic, with detours up the valleys and, presumably, around the heads of the gullies draining them.

It seems very significant that nearly any time the trail crosses the terrace top it is both wider and more elaborate in form. A berm tends to occur along the downslope side of the trail when it crosses the terrace top, in some cases beginning on the adjacent terrace slope as the trail approaches the top and ending a bit downslope as the trail drops back down to its more usual position. Much of the material used to build the berms probably came from the trail itself, since it often forms a depressed swale in these locations. The most elaborate approaches were seen at LA 105709, where the trail ascended to the terrace top near a shrine then dropped back down the slope just before the shrine was reached. The second example was at LA 105708, where the trail ran past an elaborate borrow pit (Feature 11), which had a second pit in its center that was mostly surrounded by a presumed spoils pile. From these examples, it seems likely that the trail tended to top out on the terrace in ritually significant locations. More mundane approaches to fields were probably similar to the side trails noted along the segments adjacent to LA 105705 and possibly LA 105708.

Thus, the very structure and routing of the trail argue for a prehistoric affinity. No modern highway construction-related feature would become more elaborate as it approached and crossed the terrace top, nor would it be expected to leave the terrace slope. A historic trail built and used by the Spaniards also would not demonstrate those tendencies. This is especially true since the elaborate sections of trail tend to occur near features of probable ritual importance to the prehistoric Pueblo occupants of the region. LA 118549 seems to represent a prehistoric trail linking several large villages and associated fields on the west side of Rio Ojo Caliente. It may have also served as a ceremonial route at times, linking ritually important locales together, perhaps for pilgrimages to the sacred hot spring at Ojo Caliente, though the latter possibility remains tenuous in the absence of more direct evidence of such use.

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Living on the Northern Rio Grande Frontier: Eleven Classic Period Pueblo Sites and an Early Twentieth-Century Spanish Site near Gavilan, New Mexico

Volume 2: Artifact Analysis and Interpretations

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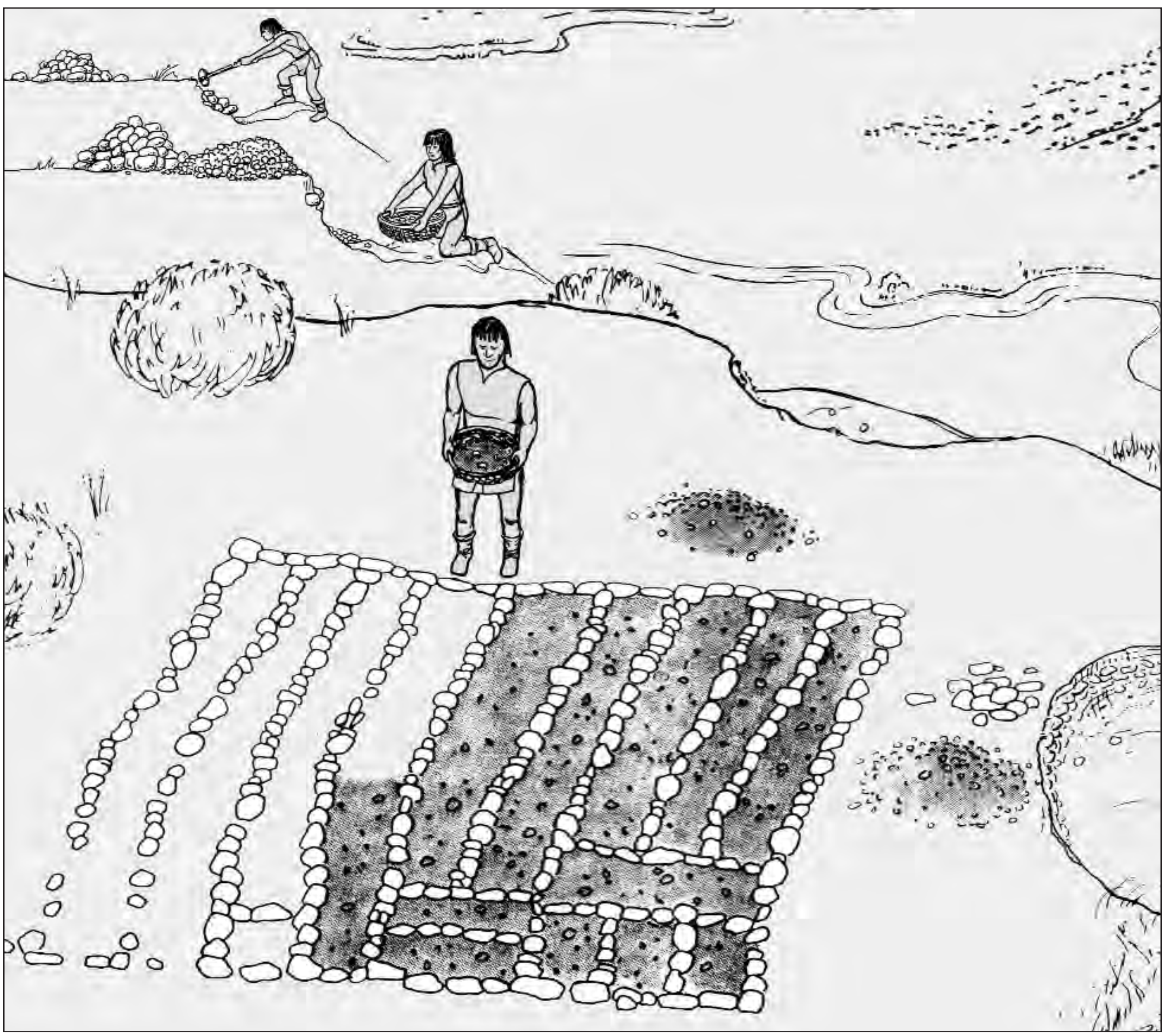


Chapter 18. Chipped Stone Artifacts

James L. Moore

Analytic Methods

Chipped stone artifacts were analyzed using a standardized format developed by the Office of Archaeological Studies (OAS 1994). The OAS chipped stone analysis includes a series of mandatory attributes that describe material type, artifact type and condition, cortex, striking platforms, and dimensions. In addition, several optional attributes have been developed that can be used to examine specific questions. Both mandatory and optional attributes were examined in this analysis.

The main areas that the intensive analysis is designed to explore are material selection, reduction technology, and tool use. These topics provide information about ties to other regions, mobility patterns, and site function. While material-selection studies cannot reveal *how* materials were obtained, they can usually provide some indication of *where* they were procured. By studying the reduction strategy employed at a site, it is possible to determine how its occupants approached the problem of producing usable chipped stone tools from raw materials, and how the level of residential mobility affected reduction strategies. The types of tools recovered from a site can be used to assign a function, especially to artifact scatters that lack features. Tools can also be used to assess the range of activities that occurred at a locale. In some cases chipped stone tools provide temporal data, but unfortunately they are usually less time-sensitive than other artifact classes like pottery and wood.

Each chipped stone artifact was examined using a binocular microscope to aid in defining morphology and material type, examine platforms, and determine whether it was used as a tool. However, surface artifacts were not examined for evidence of tool use, because traffic across the sites combined with high surface densities of gravel resulted in a considerable amount of edge damage that was totally unrelated to tool use. Virtually every chipped stone artifact recovered from the surface was damaged in this way. Since this level of noncultural damage would have rendered any definition of cultural edge damage suspect, we opted to simply eliminate this part of our analysis for surface artifacts. The level of magnification used to examine artifacts varied between 15x and 80x, and higher magnification was used to identify wear patterns and platform modifications. Utilized and modified edge angles were measured with a goniometer; other dimensions were measured with a sliding caliper.

General Analytic Methods and Chipped Stone Attributes

Four classes of chipped stone artifacts were recognized in this analysis: flakes, angular debris, cores, and tools. Flakes are debitage exhibiting one or more of the following characteristics: definable dorsal and ventral surfaces, bulb of percussion, and striking platform. Angular debris are debitage that lack these characteristics. Cores are nodules from which debitage has been struck and on which three or more negative flake scars originating from one or more platforms are visible. Tools are debitage or cores whose edges were damaged during use or were modified to create specific shapes or edge angles for use in certain tasks. Attributes recorded for all artifacts included material type and quality, artifact morphology and function, amount of surface covered by cortex, portion, evidence of thermal alteration, edge damage, and dimensions. Platform information was recorded for flakes only.

Material type. This attribute was coded by gross category unless specific sources or distinct varieties were recognized. Codes are arranged so that major material groups fall into specific sequences of numbers, progressing from general material groups to specific varieties.

Material texture and quality. Texture was used as a subjective measure of grain size within rather than across material types. Texture was scaled from fine to coarse for most materials. Fine textures exhibit the smallest grains and coarse the largest. Obsidian was classified as glassy by default, and this category was applied to no other material. *Quality* refers to the presence of flaws that could affect flakeability and included crystalline inclusions, fossils, visible cracks (incipient fracture planes), and voids. Inclusions that would not affect flakeability, such as specks of different colored material or dendrites, were not considered flaws. These attributes were recorded together.

Artifact morphology and function. Two attributes were used to provide information about artifact form and use. The first was morphology, which categorized artifacts by general form. The second was function, which categorized artifacts by inferred use. These attributes were coded separately.

Cortex. Cortex is the chemically or mechanically weathered outer rind on nodules. It is often brittle and chalky and does not flake with the ease or predictability of unweathered material. The amount of cortical coverage was estimated and recorded in 10-percent increments for each artifact—for flakes the percentage of the dorsal surface covered by cortex was estimated, while for all other artifact classes the percentage of the total surface area that was covered by cortex was estimated (since other artifact classes lack definable dorsal surfaces).

Cortex type. The type of cortex on an artifact can be a clue to its origin. Waterworn cortex indicates that a nodule was transported by water and that its source was probably a gravel or cobble bed. Nonwaterworn cortex suggests that a material was obtained where it outcrops naturally. Cortex type was identified for artifacts on which it occurred; when identification was not possible, cortex type was coded as indeterminate.

Portion. All artifacts were coded as whole or fragmentary; when broken, the portion was recorded if it could be identified.

Flake platform. This attribute refers to the shape and modifications to the striking platform on whole flakes and proximal fragments.

Platform lipping. The presence or absence of a lip at the ventral edge of a platform provides information on reduction technology and can often be used to help determine whether a flake was removed from a biface or core. Platform lipping was coded as present or absent.

Platform width. This attribute refers to reduction strategy. The maximum distance between the ventral and dorsal edges of platforms is measured.

Thermal alteration. Chert can be modified by heating at high temperatures, improving its flakeability. This process can realign the crystalline structure and sometimes heals minor flaws like microcracks. Heat treatment can be difficult to detect unless mistakes are made. When present, the type and location of evidence of thermal alteration was recorded to determine whether an artifact was purposely altered.

Wear patterns. Use of a piece of debitage or core as an informal tool can result in edge damage, producing patterns of scars that may indicate the way it was used. Cultural edge damage denoting use as an informal tool was recorded and described when present on subsurface debitage. A separate series of codes was used to describe formal tool edges.

Edge angles. The angles of modified formal and informal tool edges were measured. Edges lacking cultural damage were not measured.

Dimensions. Maximum length, width, and thickness were measured for all artifacts. On angular debris and cores, length was the largest measurement, width was the longest dimension perpendicular to the length, and thickness was perpendicular to the width and the smallest measurement. On flakes and formal tools, length was the distance between the platform (proximal end) and termination (distal end), width was the distance between edges paralleling the length, and thickness was the distance between dorsal and ventral surfaces.

Flake Categories

Several types of flakes may be present in an assemblage, and one analytic goal was to distinguish between flakes removed from cores and bifaces. Flakes were divided into these categories using a polythetic set of variables (Fig. 18.1). A polythetic framework is one in which fulfilling a majority of conditions is both necessary and sufficient for inclusion in a class (Beckner 1959). The polythetic set contains an array of conditions that model an idealized biface flake and includes data on platform morphology, flake shape, and earlier removals from the parent artifact. To be considered a biface flake, an artifact needed to fulfill at

Whole Flakes

1. Platform:
   a. has more than one facet.
   b. is modified (retouched and abraded).
2. Platform is lipped.
3. Platform angle is less than 45 degrees.
4. Dorsal scar orientation is:
   a. parallel.
   b. multidirectional.
   c. opposing.
5. Dorsal topography is regular.
6. Edge outline is even, or flake has a waisted appearance.
7. Flake is less than 5 mm thick.
8. Flake thickness is relatively even from proximal to distal end.
9. Bulb of percussion is weak (diffuse).
10. There is pronounced ventral curvature.

Broken Flakes or Flakes with Collapsed Platforms

1. Dorsal scar orientation is:
   a. parallel.
   b. multidirectional.
   c. opposing.
2. Dorsal topography is regular.
3. Edge outline is even.
4. Flake is less than 5 mm thick.
5. Flake thickness is relatively even from proximal to distal end.
6. Bulb of percussion is weak.
7. There is pronounced ventral curvature.

Artifact is a biface flake when:

- If whole, it fulfills 7 of 10 attributes.
- If broken or platform is collapsed, it fulfills 5 of 7 attributes.

Figure 18.1. Polythetic set for distinguishing biface flakes from core flakes.

least 70 percent of these conditions in any combination. Those that did not match that percentage of conditions were classified as core flakes by default. This percentage was considered high enough to isolate flakes produced during the later stages of biface production from those removed from cores, while at the same time it was low enough to permit flakes removed from a biface that did not fulfill the entire set of conditions to be properly classified. While not all flakes removed from bifaces could be identified in this way, those that were can be considered definite evidence of biface reduction. Instead of rigid definitions, the polythetic set provided a flexible means of categorizing flakes and helped account for some of the variation in flake form and attributes that has been observed during flintknapping experiments.

Other flake types were identified by certain distinguishing characteristics. Two subvarieties of biface flakes were categorized separately. Notching flakes were produced when the hafting elements of bifaces were notched. This type of flake generally exhibits a recessed, U-shaped platform and a deep, semicircular scallop at the juncture of the striking platform and dorsal flake surface. Resharpening flakes were removed from formal tool edges that became dull from use and usually fit the polythetic set for biface flakes. They are often impossible to separate from other biface flakes but can sometimes be identified by an extraordinary amount of damage on the platform and the dorsal surface adjacent to the platform. Bipolar flakes, the only subvariety of core flakes that was separately categorized, are evidence of nodule smashing. They usually exhibit signs of having been struck at one end and crushed against an anvil at the other.

Other flake categories are evidence of removals from tools or indicate inadvertent damage during thermal processing—ground stone flakes are debitage struck from a broken piece of ground stone, hammerstone flakes are debitage that were detached from a hammerstone by use, and potlids are debitage that were blown off the surface of a chipped stone artifact during thermal alteration.

Core and Tool Categories

Cores are nodules of raw lithic material that were modified by the removal of debitage during reduction. Some cores were efficiently reduced in a standardized fashion, while flakes were removed from others in a more haphazard manner. Core shape and size are often clues to the relative availability of materials. Materials represented by small, carefully reduced cores may have been uncommon or highly desired. Materials represented by large cores, often with haphazard or badly planned flake removals, tend to be common and not highly prized.

Cores were classified by the direction of removals and in rare circumstances by shape. Unidirectional cores have a single platform from which flakes were removed in one direction or along one continuous surface. Blade cores are pyramidal in shape, with specially prepared platforms that allow the consistent removal of long, narrow flakes (blades). This category tend to only occur in Paleoindian assemblages in the Southwest. Pyramidal cores are a subdivision of the unidirectional category and resemble blade cores in form but lack evidence of the platform preparation that typically occurs on them. This type represents an attempt to maximize the number of flakes removed from a core by reducing it systematically from one platform. Bidirectional cores have two opposing platforms or a single platform from which flakes were removed from two opposing surfaces. Multidirectional cores exhibit multiple platforms, and flakes are struck from any suitable edge. Bipolar cores tend to be rare and result from the smashing of small or exhausted cores or nodules between a hammerstone and an anvil. This is usually done when materials are rare or highly prized, or nodules of high-quality materials are small and difficult to flake in other ways.

Tools are separated into two basic categories—formal and informal. Formal tools are debitage or cores that were intentionally altered to produce specific shapes or edge angles. Alterations take the form of unifacial or bifacial retouch, and artifacts were considered intentionally shaped when retouch scars obscured their original shape or significantly altered the angle of at least one edge. Informal tools are debitage that were used in various tasks without being purposely altered to produce specific shapes or edge angles. This class of tool was defined by the presence of marginal attrition caused by use.

Evidence of informal use was further divided into two general categories—wear and retouch. Retouch scars were at least 2 mm long, while wear scars were shorter than 2 mm. While informal tools can also provide direct evidence of the reduction process, formal tools tend to provide indirect evidence unless they were discarded before being finished.

Formal tools were divided into three basic categories—cobble tools, unifaces, and bifaces. Cobble tools were usually massive in size and unmodified or shaped. The former included tools that did not require modification for use, such as hammerstones. The latter exhibited unifacial or bifacial flaking along one or more edges while retaining enough unflaked surface that their original form remained recognizable. Unifaces were pieces of debitage that had one or more edges modified by flaking across a single surface. Bifaces were pieces of debitage that were flaked across two opposing surfaces. In all three of these tool categories, flaking was purposely done to alter edge shape or angle into a needed or desired form.

Cores and formal tools represent nuclei from which flakes were removed, but they differ in the reason for those removals. Flakes were struck from cores for use as informal tools or to be modified into formal tools. Flakes were removed from formal tools to create desired shapes or edge angles. Thus, cores were classified with debitage as by-products of the reduction process. Formal tools were considered separately because they are usually evidence of other unrelated tasks. Since all chipped stone artifacts result from similar reductive processes, this division is in many ways artificial, and some formal tools can also be used to provide evidence of reduction strategy.

Analysis of the Chipped Stone Assemblages

For the most part, this analysis focuses on the artifacts that were collected from the Gavilan sites, but at times the more limited data from assemblages recorded outside the right-of-way is used to amplify this information. Only LA 105713 is not directly represented in this analysis because no chipped stone artifacts were collected from that site. The overall assemblage can also be broken into three basic subsets: artifacts recovered from habitation sites, artifacts recovered from the surface of farming sites, and artifacts recovered from subsurface deposits at farming sites. The first category includes materials from LA 66288 and the north section of LA 105710, which appear to reflect the redeposition of trash eroding down the slopes adjacent to Hilltop Pueblo. These materials are combined in the following discussion. Artifacts from the south section of LA 105710 may also be related to this habitation site, but it is more likely that they were derived from quarrying activities on the nearby terrace slope below the farming features at LA 105709. Artifacts recovered from subsurface deposits at farming sites may reflect activities that occurred in the fields while they were in use. Examination of these artifacts may show whether they were created by raw-material quarrying or if they reflect the agricultural function of these sites. Artifacts recovered from the surface of farming sites were discarded while the fields were in use or after they were abandoned. Field observations suggest that most of these artifacts were created by raw-material quarrying. Since none of the living areas observed at several of these sites extended into the right-of-way, none of those materials were available for detailed analysis. However, some contrasting data are available from the field inventories.

Material Type and Quality Selection

Information on the range of materials used at these sites is shown in Tables 18.1 and 18.2. It should be remembered that chipped stone artifacts from the north part of LA 105710 are included with the LA 66288 assemblage. Both rhyolite categories combine aphanitic and nonaphanitic varieties because specimens were not consistently assigned to the former by all analysts. Most varieties of rhyolite are aphanitic, and the nonaphanitic varieties are almost invariably fine-grained. Most specimens of red aphanitic rhyolite visually resemble rhyolitic tuff from the Picuris Mountains. Similarly, most of the andesite visually resembles types from the Taos Plateau. Unfortunately, we were unable to substantiate these comparisons.

Though not all of the collected assemblages

Table 18.1. Material type by site in the collected assemblage (count and column percentage)

Material Type	LA 66288	LA 105703	LA 105704	LA 105705	LA 105706	LA 105707	LA 105708	LA 105709	LA 105710	LA 118547	LA 118549	Total
Chert	64	4	-	-	-	-	1	21	1	3	1	95
	9.7%	0.4%	-	-	-	-	0.8%	1.0%	4.0%	0.5%	1.2%	1.9%
Pedernal chert	93	3	-	-	-	1	2	5	1	3	1	109
	14.1%	0.3%	-	-	-	3.0%	1.6%	0.2%	4.0%	0.5%	1.2%	2.2%
Silicified wood	1	-	-	-	-	-	-	-	-	-	-	1
	0.2%	-	-	-	-	-	-	-	-	-	-	0.0%
Obsidian	12	1	-	-	-	-	-	4	-	2	-	19
	1.8%	0.1%	-	-	-	-	-	0.2%	-	0.3%	-	0.4%
Igneous undifferentiated	3	1	-	-	-	-	-	-	-	3	-	7
	0.5%	0.1%	-	-	-	-	-	-	-	0.5%	-	0.1%
Gabbro	1	-	2	-	-	-	2	-	1	-	-	6
	0.2%	-	10.5%	-	-	-	1.6%	-	4.0%	-	-	0.1%
Red rhyolite	51	26	2	6	2	4	16	126	2	38	6	279
	7.8%	2.3%	10.5%	24.0%	28.6%	12.1%	12.9%	5.7%	8.0%	5.9%	7.2%	5.6%
Gray rhyolite	218	1,055	12	10	2	28	90	1,399	14	466	72	3366
	33.1%	93.0%	63.2%	40.0%	28.6%	84.8%	72.6%	63.5%	56.0%	71.8%	86.7%	67.8%
Andesite	174	18	1	5	-	-	11	543	4	113	2	871
	26.4%	1.6%	5.3%	20.0%	-	-	8.9%	24.6%	16.0%	17.4%	2.4%	17.6%
Welded tuff	-	4	-	-	-	-	-	6	-	1	-	11
	-	0.4%	-	-	-	-	-	0.3%	-	0.2%	-	0.2%
Limestone	1	-	-	-	-	-	-	-	-	-	-	1
	0.2%	-	-	-	-	-	-	-	-	-	-	0.0%
Quartzite	19	13	1	4	-	-	-	22	-	17	1	77
	2.9%	1.1%	5.3%	16.0%	-	-	-		-	2.6%	1.2%	1.6%
Massive quartz	21	10	1	-	3	-	2	77	2	3	-	119
	3.2%	0.9%	5.3%	-	42.9%	-	1.6%	3.5%	8.0%	0.5%	-	2.4%
Total	658	1,135	19	25	7	33	124	2,203	25	649	83	4961
Percent	13.3%	22.9%	0.4%	0.5%	0.1%	0.7%	2.5%	44.4%	0.5%	13.1%	1.7%	100.0%

Table 18.2. Material type by site in the field-inventoried assemblages (count and column percentage)

Material Type	LA 105703	LA 105704	LA 105705	LA 105706	LA 105707	LA 105708	LA 105709	LA 105713	LA 118547	Total
Chert	1	-	-	-	2	3	28	-	4	38
	0.2%	-	-	-	0.5%	0.3%	4.9%	-	1.3%	1.0%
Pedernal chert	1	-	1	1	7	21	7	1	3	42
	0.2%	-	0.3%	1.5%	1.7%	1.9%	1.2%	0.2%	1.0%	1.1%
Silicified wood	-	-	1	-	-	-	-	-	-	1
	-	-	0.3%	-	-	-	-	-	-	0.0%
Obsidian	-	-	1	-	-	10	4	-	3	18
	-	-	0.3%	-	-	0.9%	0.7%	-	1.0%	0.5%
Red rhyolite	32	-	18	5	11	22	7	12	12	119
	5.5%	-	5.4%	7.6%	2.7%	2.0%	1.2%	2.9%	3.8%	3.1%
Gray rhyolite	508	8	244	52	347	742	342	378	198	2819
	86.8%	61.5%	73.7%	78.8%	85.0%	67.9%	59.3%	91.5%	63.1%	74.2%
Andesite	18	1	59	3	31	292	182	13	94	693
	3.1%	7.7%	17.8%	4.5%	7.6%	26.7%	31.5%	3.1%	29.9%	18.2%
Quartzite	4	4	1	3	2	1	6	4	-	25
	0.7%	30.8%	0.3%	4.5%	0.5%	0.1%	1.0%	1.0%	-	0.7%
Massive quartz	21	-	6	2	8	2	1	5	-	45
	3.6%	-	1.8%	3.0%	2.0%	0.2%	0.2%	1.2%	-	1.2%
Total	585	13	331	66	408	1,093	577	413	314	3800
Percent	15.4%	0.3%	8.7%	1.7%	10.7%	28.8%	15.2%	10.9%	8.3%	100.0%

are statistically comparable because of the large disparity in their sizes, several observations can be made. When combined, rhyolites are the most common material in all assemblages and comprise less than 60 percent of only two—LA 66288 and LA 105706 (Table 18.1). The former is the only habitation site, and the latter yielded the smallest assemblage. Thus, LA 66288 would be expected to deviate from the pattern recognized in the farming sites and trail. The collected assemblage from LA 105706 probably deviates from this pattern because of sample error caused by small sample size—rhyolites made up over 86 percent of the much larger field inventory assemblage from this site (Table 18.2), showing that they are also dominant there. Though no artifacts were collected from LA 105713, rhyolites also dominated the field-inventoried artifacts from that site, comprising over 94 percent of that assemblage.

Andesite is usually the second most common material in the collected assemblages, comprising at least 15 percent of five assemblages. In five cases where andesite either does not occur or comprises less than 15 percent of the total, assemblage size is less than 124 artifacts, so sample error may be responsible for this deviation. The sixth case is LA 105703, which yielded over 1,100 artifacts but contained only 1.6 percent andesite. In the latter case, this discrepancy may be due to landform variability. LA 105703 was the only farming site that was not situated along the edge of a series of related gravel terraces. Thus, the gravel beds under LA 105703 may have been deposited at a different time, resulting in a somewhat different lithic makeup, which is perhaps reflected by the very small percentage of andesite used there. Andesite is also the second most common material in six of nine field-recorded assemblages (Table 18.2). When collected and field-recorded assemblages are combined, andesite is the second most common material in ten cases, and the third most abundant in the remaining two.

Other materials comprise smaller percentages of these assemblages. Cherts and obsidians tend to be uncommon except at LA 66288 and in habitation areas on farming sites. Silicified wood is particularly rare and is therefore combined with the cherts. Only a single example of limestone was identified, at LA 66288.

Except for LA 66288, imported materials are fairly rare or nonexistent. Though observations made in the field suggested that most of the gravels at these sites were composed of quartzite and various igneous materials, a few unworked chert nodules were also seen. Thus, the only exotic materials documented were Pedernal chert and obsidian. Exotics comprise nearly 16 percent of the LA 66288 assemblage. Nonlocal materials were much rarer in the overall assemblages from the farming sites and trail—none occurred in two assemblages (LA 105704 and LA 105705), less than 1 percent occurred in three assemblages (LA 105703, LA 105709, and LA 105713), and less than 2 percent occurred in four assemblages (LA 105706, LA 105707, LA 118547, and LA 118549). Only two of the overall assemblages contained more than 2 percent exotic materials—LA 105708 had 2.7 percent, and LA 105710 had 4 percent.

Of the six assemblages that contained more than 1 percent exotic materials, sample error is probably responsible for comparatively high proportions in three cases—LA 105706, LA 105710, and LA 118549—each of which contained only a single exotic specimen. Two of the three remaining assemblages (LA 105708 and LA 105709) are from sites that contain occupational areas, which is where most of the exotic materials were observed. Thus, with the exception of sample error, sites containing more than 1 percent exotic materials tend to be habitations or farming sites with associated occupational zones. The only exception to this is LA 118547, which could indicate the presence of undefined occupational zones at that site, though this is unlikely.

Slightly more than 80 percent of the overall collected assemblage consisted of glassy and fine-grained materials, indicating a clear selection preference for the better grades of materials. Medium-grained materials comprised another 18.7 percent of this assemblage. Glassy and fine-grained materials, and medium-grained materials to a certain extent, are best suited for activities involving cutting and scraping because they can produce very sharp edges when fractured. Glassy and fine-grained materials are also best suited for the manufacture of formal tools by soft hammer percussion and pressure flaking.

Coarse-grained materials account for only 1.2 percent of the overall collected assemblage: over 75 percent of these artifacts are massive quartz, 14.5 percent are nonaphanitic rhyolites, and 4.8 percent are quartzite. Nearly half (48.4 percent) of the artifacts made from coarse-grained materials were recovered from LA 105709. Since LA 105709 also accounts for more than 44 percent of the overall collected assemblage, this high percentage is in proportion to the collected assemblage from that site. However, 25.8 percent of the artifacts made from coarse-grained materials were recovered from LA 66288, which comprises only 11.3 percent of the overall collected assemblage. In this case, coarse-grained materials are more common than expected and may have been purposely selected. About two-thirds of the coarse-grained materials from LA 66288 are massive quartz and quartzite, which may have been selected because large grain size made them durable for chopping or pounding.

Reduction Strategy

Debitage assemblages were examined to determine whether there was evidence of efficient or expedient reduction. Efficient reduction usually entailed manufacture of tools in anticipation of need, allowing them to be transported from camp to camp until required. In the Southwest, this strategy usually involved the manufacture of large bifaces that could be used for multiple purposes. Kelly (1988:731) defines three types of bifaces: those used as cores as well as tools, long use-life tools that can be resharpened, and bifaces made to replace parts of existing composite tools. Specialized bifaces can be added to this list. They were made for a single purpose and mostly associated with the expedient strategies used by sedentary peoples, where efficiency and conservation of weight were not important. Bifaces with multiple functions or long use-lives were usually associated with mobile lifestyles, where efficiency was critical. However, these categories were not exclusive: mobile people made and used specialized bifaces, while sedentary people manufactured general-purpose bifaces. The difference is a matter of degree. There was less use of specialized bifaces by mobile people, and less use of general-purpose bifaces by sedentary people. Thus, it is not necessarily the amount of evidence of biface manufacture in an assemblage that is indicative of reduction strategy and lifestyle, but the types of bifaces that were made and used.

Bifaces in the first two categories defined by Kelly (1988) were large by necessity. Bifaces functioning as cores, general-purpose tools, and blanks for the replacement of broken or lost tools had to be large to be useful. Similarly, bifaces made with long use in mind had to be large enough to be resharpened. Specialized bifaces needed to be no larger than required by the task at hand. Projectile points provide a good contrast between these categories. In an efficient tool kit, broken projectile points can be replaced with the blanks that also served as cores and general-purpose tools. Large projectile points could be used as knives, since they possess a fairly long edge and were usually set into detachable foreshafts. When broken they could often be reworked into a new form. Small projectile points are evidence of a different focus. They were not very useful as cutting tools because their edges were short and therefore awkward and inefficient, even when set into foreshafts. The thinness of these tools and the point of weakness created by notching often caused them to break during use, and because of their small size and the location of most breaks they usually could not be resharpened. Thus, small projectile points were effectively limited to a single function, and quite often to only one use.

Therefore, we differentiate between the manufacture of large bifaces and small bifaces in this analysis. Archaic hunter-gatherers tended to use large projectile points and large general-purpose bifaces. We know little of later peoples who may also have been hunter-gatherers. However, we can suggest that hunter-gatherers in the Northern Rio Grande probably adopted the bow and arrow when it was introduced. If so, large projectile points would no longer have been produced, but large general-purpose bifaces should have continued in use. Thus, late hunter-gatherers would use a combination of large general-purpose bifaces and small specialized bifaces, the latter as tips for projectiles.

Efficient and expedient debitage assemblages modeled. Several attributes can be used to assess an assemblage and determine whether the reduction strategy was efficient, expedient, or a combination of both. Unfortunately, no single indicator can provide this information, so a range of attributes must be used.

Debitage assemblages reflecting a purely expedient strategy should contain lower percentages of noncortical debitage than those in which a purely efficient strategy was employed. Cortex is usually brittle and chalky and does not flake with the ease or predictability of unweathered material. This can cause problems during tool manufacture, so cortex is usually removed during the early stages of tool production. The manufacture of large bifaces is rather wasteful, and quite a bit of debitage must be removed before the proper shape is achieved. These flakes are carefully struck and are generally smaller and thinner than flakes removed from cores. Thus, as bifaces are manufactured, large numbers of interior flakes lacking cortical surfaces are removed, and the percentage of noncortical debitage increases. Cortex removal is not as high a priority in expedient reduction, so the chance that a given piece of debitage will possess a cortical surface is higher.

The presence of biface flakes is good evidence that tools were manufactured at a site, though it is usually impossible to determine absolute number or type. Biface flake length is indicative of the size of the tool being made, and lengths of 15–20 mm or more suggest that large bifaces were manufactured. However, when only small biface flakes are found, the reverse is not necessarily true. While the presence of small biface flakes may be evidence of the manufacture of small specialized bifaces, the possibility that they are debris produced by retouching large biface edges must also be considered. High percentages of biface flakes in an assemblage suggest that tool production was an important activity. When those flakes are long, it is likely that large bifaces were made or used, and this in turn suggests an efficient reduction strategy. Though a lack of these characteristics is not definite proof of an expedient strategy, it does suggest that reduction did not focus on tool manufacture.

While platform modification is used by the polythetic set to help assign flakes to core or biface categories, it can also be used as an independent indicator of reduction strategy. This is because the polythetic set only identifies ideal examples of flakes removed during tool production. Many flakes produced during initial tool shaping and thinning are difficult to distinguish from core flakes. However, even at this stage of manufacture, platforms were usually modified to facilitate removal. While core platforms were also modified on occasion, this technique was not as common because the same degree of control over size and shape were unnecessary unless a core was being systematically reduced. Since this rarely occurred in the northern Southwest, a large percentage of modified platforms in an assemblage is indicative of tool manufacture, while the opposite implies core reduction. When there is a high percentage of modified platforms but few definite biface flakes, an early stage of tool manufacture may be indicated.

Since tool manufacture is usually more controlled than core reduction, fewer pieces of recoverable angular debris are produced in that process. Thus, a high ratio of flakes to angular debris is considered indicative of tool manufacture, while a low ratio implies core reduction. Unfortunately, this is a bit simplistic, because the production of angular debris also depends on material type, the reduction technique used, and the amount of force applied. Brittle materials shatter more easily than elastic materials, and hard hammer percussion tends to produce more recoverable pieces of angular debris than do soft hammer percussion or pressure flaking. Use of excessive force can also cause materials to shatter. In general, though, as reduction proceeds the ratio of flakes to angular debris should increase, and late-stage core reduction as well as tool manufacture should produce high ratios.

Flake breakage patterns are also indicative of reduction strategy. Experimental data suggest that there are differences in fracture patterns between flakes struck from cores and tools (Moore 2001b). Though reduction techniques are more controlled during tool manufacture, flake breakage increases because debitage get thinner as reduction proceeds. Thus, there should be more broken flakes in an assemblage in which tools were made than in one that simply reflects core reduction. However, trampling, erosional movement, and other post-reduction impacts can also cause breakage and must be taken into account.

Much flake breakage during reduction is caused by secondary compression, in which outward bending causes flakes to snap (Sollberger 1986). Characteristics of the broken ends of flake fragments can be used to determine whether breakage was caused by this sort of bending. When a step or hinge fracture occurs at the proximal end of distal or medial fragments, they were broken during manufacture. Characteristics diagnostic of manufacturing breaks on proximal fragments include "pieces à languette" (Sollberger 1986:102), negative hinge scars, positive hinges curving up into small negative step fractures on the ventral surface, and step fractures on dorsal rather than ventral surfaces. Breakage by processes other than secondary compression causes snap fractures. This pattern is common on debitage broken by trampling or erosion, but it also occurs during reduction. Core reduction tends to create a high percentage of snap fractures, while biface reduction creates a high percentage of manufacturing breaks. But since snap fractures can also indicate post-reduction damage, this may be the weakest of the attributes used to examine reduction strategy.

The presence of platform lipping is indicative of reduction technique and is marginally related to strategy. Platform lipping usually implies pressure flaking or soft-hammer percussion, though it sometimes occurs on flakes removed by hard hammers (Crabtree 1972). The former techniques were usually used to manufacture tools, so a high percentage of lipped platforms suggests a focus on tool manufacture rather than core reduction.

The pattern of scars left by earlier removals on the dorsal surface of a flake can also help define reduction strategy. Since bifacial reduction removes flakes from opposite edges, some scars originate beyond the distal end of a flake and run toward its proximal end. These opposing scars indicate reduction from opposite edges. Opposing dorsal scars are indicative of biface manufacture but can also occur when cores are reduced bidirectionally (Laumbach 1980:858). Thus, this attribute is not directly indicative of tool production, but it can help define the reduction strategy used.

The ratio of flakes to cores on a site is another potential indicator of reduction strategy. As the amount of tool manufacture increases, so does the ratio between flakes and cores. The opposite should be true of assemblages in which expedient core reduction dominated; in that case the ratio between flakes and cores should be relatively low. A potential problem, of course, is that cores were often carried to another location if still usable while debris from their reduction was left behind. This would inflate the ratio and suggest that tool manufacture rather than core reduction occurred. The systematic reduction of cores can also produce high flake to core ratios.

Few of the attributes examined during this study are accurate independent indicators of reduction strategy. However, when combined, they allow us to fairly accurately characterize how materials were reduced at a site. A purely efficient debitage assemblage should contain high percentages of noncortical debitage, biface flakes, modified platforms, manufacturing breaks, lipped platforms, and flakes with opposing dorsal scars, and they should have high flake to angular debris and flake to core ratios. Purely expedient debitage assemblages should contain lower percentages of noncortical debitage and low percentages of biface flakes, modified platforms, manufacturing breaks, lipped platforms, and flakes with opposing dorsal scars. They should also have low flake to angular debris and flake to core ratios. Unfortunately, "pure" assemblages are rare, and most can be expected to combine tool manufacture and core reduction.

Dorsal cortex and reduction stage. Cortex is the weathered outer rind on nodules, and it is rarely suitable for flaking or tool use. Outer sections of nodules transported by water often contain microcracks created by cobbles striking against one another, producing a zone with unpredictable flaking characteristics. Chemical weathering can change the structure of the outer surface of a nodule, making it more brittle or powdery and unsuitable for flaking. Because of these factors, cortical zones are typically removed and discarded because they flake differently than nodule interiors and may be flawed. Flakes have progressively less dorsal cortex as reduction proceeds, so dorsal cortex data can be used to examine reduction stages. Early stages are characterized by high percentages of flakes with much dorsal cortex, while the opposite suggests the later stages of reduction.

Reduction can be divided into two basic stages—core reduction and tool manufacture. Flakes are removed for use or modification during core reduction. Primary core reduction includes initial core platform preparation and removal of the cortical surface. Secondary core reduction entails removal of flakes from core interiors. This difference is rarely as obvious as these definitions make it seem. Both processes often occur simultaneously, and rarely is all cortex removed before secondary reduction begins. They represent opposite ends of a continuum, and it is difficult to determine where one stops and the other begins. In this analysis, primary core flakes have 50 percent or more of their dorsal surfaces covered by cortex, and secondary core flakes have less than 50 percent dorsal cortex. This distinction can provide data on the condition of cores used at a site. For example, a lack of primary flakes suggests that initial reduction occurred elsewhere, while the presence of few secondary flakes may indicate that cores were carried off for further reduction. Primary core flakes represent the early stage of reduction, while secondary core flakes and biface flakes represent the later stages.

Table 18.3 shows percentages of dorsal cortex on flakes from the collected assemblages. Four assemblages can be discounted from the outset because of small sample size: LA 105704, LA 105705, LA 105706, and LA 105710 each contain fewer than 20 flakes and are too small to provide reliable results. Even so, percentages of cortical flakes are very high for LA 105704 and LA 105706, and are comparatively low for LA 105705 and LA 105710.

Table 18.3. Dorsal cortex on collected flakes by site (count and row percentage)

Site	0%	1-49%	50-100%	Total
LA 66288	360	52	64	476
	75.6%	10.9%	13.4%	100.0%
LA 105703	420	124	170	714
	58.8%	17.4%	23.8%	100.0%
LA 104704	2	6	-	8
	25.0%	75.0%	-	100.0%
LA 105705	11	3	-	14
	78.6%	21.4%	-	100.0%
LA 105706	2	2	-	4
	50.0%	50.0%	-	100.0%
LA 105707	17	6	3	26
	65.4%	23.1%	11.5%	100.0%
LA 105708	39	27	22	88
	44.3%	30.7%	25.0%	100.0%
LA 105709	1073	184	169	1426
	75.2%	12.9%	11.9%	100.0%
LA 105710	12	3	1	16
	75.0%	18.8%	6.3%	100.0%
LA 118547	21.4	86	91	198.4
	10.8%	43.3%	45.9%	100.0%
LA 118549	18	13	10	41
	43.9%	31.7%	24.4%	100.0%

Considering the other assemblages, LA 66288 contains the highest percentage of noncortical flakes, and LA 105709 is a close second. Cortical flakes comprise about 35 percent or more of the six remaining assemblages. These percentages are very high and suggest that early-stage core reduction dominated these assemblages. This is especially true of LA 105703, LA 105708, LA 118547, and LA 118549, because primary flakes comprise 20 percent or more of each of these assemblages.

Flake platforms. Platforms are remnants of core or tool edges that were struck to remove flakes. Various types of platforms can be distinguished, providing information about the condition of the artifact from which a flake was removed and reduction technology. Cortical platforms are usually evidence of early-stage core reduction, especially when dorsal cortex is also present. Single-facet platforms can occur at any time during reduction but are most often associated with flakes removed from cores. Multifacet platforms are evidence of previous removals along an edge; they occur on both core and biface flakes, and they suggest that the parent artifact was subjected to a considerable amount of earlier reduction.

Platforms were often modified to facilitate flake removal. Two types of modification were used—retouch and abrasion. While abrasion occurs on all types of platforms (except cortical), retouch is a distinct platform type. Both modifications result from rubbing an abrader across an edge—movement perpendicular to the edge removes microflakes and retouches it, while parallel movement causes abrasion. These techniques increase the exterior angle of a platform, strengthening it and reducing the risk of shatter. Stronger platforms also increase control over the shape and length of flakes.

Platform types could not be defined in many instances. The most common reason was breakage, in which the proximal fragment was absent. Two other processes also obscure platforms during reduction. An unmodified or poorly prepared platform will sometimes crush when force is applied. Though the impact point may still be visible on a crushed platform, its original configuration is impossible to determine. Platforms can also collapse when force is applied, detaching separately and leaving a scar on the dorsal or ventral surface. Part of the platform is sometimes preserved on one or both sides of the scar. While these remnants are usually too small to allow identification of the original platform, they show where impact occurred and indicate that even though the platform is missing, flake dimensions may be complete. Platforms damaged by use or impact from natural processes were recorded as obscured.

The distribution of platform types for each site is shown in Table 18.4. Cortical platforms comprise 10 percent or more of six assemblages, 1–10 percent of three assemblages, and do not occur in two assemblages. Since the latter are some of the smallest assemblages represented, the lack of cortical platforms in those cases is probably due to sample error. Except for LA 105706, which contained only four flakes, single-facet platforms are the most common type or are tied for the most common type with cortical platforms. Multifacet platforms also tend to be common, especially in assemblages containing more than 20 artifacts. Modified platforms are very rare overall and were found in only four assemblages. It is probably significant that those assemblages came from the habitation site (LA 66288) or from farming sites with associated occupational zones (LA 105707, LA 105708, and LA 105709). Platforms were missing from large percentages of flakes in each assemblage, primarily through collapse or breakage.

These distributions suggest that core reduction dominated all of the collected assemblages. Platform types indicative of tool manufacture or resharpening were found in only four assemblages and are rare when they occur. Discounting missing and obscured platforms, modified platforms occur on only 4.0 percent of the flakes from LA 66288 (n = 11), 4.5 percent of the flakes from LA 105707 (n = 1), 1.6 percent of the flakes from LA 105708 (n = 1), and 1.0 percent of the flakes from LA 105709 (n = 9). Thus, only single examples occur in two of four cases. Though cherts comprise 31.8 percent of the modified platforms, most are on rhyolite or andesite flakes (40.9 percent and 27.3 percent, respectively). Thus, while flakes made from exotic materials might be expected to dominate the small assemblage of modified platforms, this is not the case. Over two-thirds are on flakes made from locally available igneous materials.

Debitage type and condition. Table 18.5 shows the distributions of debitage types by material types for the overall assemblage of collected chipped stone artifacts. Core flakes and angular debris predominate, especially when considering that bipolar and ground stone flakes are simply specialized types of core flakes. While biface flakes were identified in three material categories, they are very rare. Surprisingly, even though rhyolite was the most abundant material category (and some rhyolite flakes had modified platforms), no rhyolite biface flakes were identified.

The distribution of debitage types by site is shown in Table 18.6. While flakes with modified platforms were recovered from four sites, biface flakes were identified at only LA 66288 and LA 105709. Since the former contained deposits from the only prehistoric habitation site investigated during this project, and the latter contained the largest chipped stone assemblage, this is no great surprise. Freehand removal of debitage from cores dominated chipped stone reduction at these sites. Bipolar reduction was very uncommon and in two of three cases was performed on high-quality materials that were of exotic origin (Pedernal chert) or locally uncommon (chert). The single ground stone flake recovered from LA 105709 may reflect artifact recycling at a farming site that also contained a temporary occupational zone.

The ratio between flakes and angular debris can also be a good indicator of reduction strategy. Flake to angular debris ratios are generally low to very low for these sites, except for three of the four assemblages that contain less than 60 artifacts. In those cases, sample error associated with small assemblage size is probably responsible for comparatively high ratios. Thus, none of these small assemblages are further considered in this section.

The flake to angular debris ratio for the composite assemblage is 2.10:1—very low. The highest ratio for the larger assemblages was derived for LA 105708, while the lowest was derived for LA 118549. Perhaps not coincidentally, these are also the smallest assemblages of those being considered. Flake to angular debris ratios in Table 18.6 contrast greatly with those in Table 18.7, which presents artifact morphology data for the

Table 18.4. Flake platform type by site for the collected assemblage (count and row percentage)

Site	Cortical	Single Facet	Multifacet	Multifacet and Abraded	Retouched	Retouched and Abraded	Collapsed	Crushed	Absent	Broken in Manufacture	Obscured	Total
LA 66288	42	155	65	3	6	2	68	30	79	25	1	476
	8.8%	32.6%	13.7%	0.6%	1.3%	0.4%	14.3%	6.3%	16.6%	5.3%	0.2%	100.0%
LA 105703	61	263	166	-	-	-	65	2	100	55	2	714
	8.5%	36.8%	23.2%	-	-	-	9.1%	0.3%	14.0%	7.7%	0.3%	100.0%
LA 105704	1	2	3	-	-	-	1	1	-	-	-	8
	12.5%	25.0%	37.5%	-	-	-	12.5%	12.5%	-	-	-	100.0%
LA 105705	4	4	1	-	-	-	5	-	-	-	-	14
	28.6%	28.6%	7.1%	-	-	-	35.7%	-	-	-	-	100.0%
LA 105706	-	1	2	-	-	-	-	-	1	-	-	4
	-	25.0%	50.0%	-	-	-	-	-	25.0%	-	-	100.0%
LA 105707	-	11	10	-	1	-	1	1	2	-	-	26
	-	42.3%	38.5%	-	3.8%	-	3.8%	3.8%	7.7%	-	-	100.0%
LA 105708	10	31	19	-	1	-	8	4	13	2	-	88
	11.4%	35.2%	21.6%	-	1.1%	-	9.1%	4.5%	14.8%	2.3%	-	100.0%
LA 105709	95	532	273	-	8	1	149	49	235	80	4	1426
	6.7%	37.3%	19.1%	-	0.6%	0.1%	10.4%	3.4%	16.5%	5.6%	0.3%	100.0%
LA 105710	5	5	2	-	-	-	2	-	-	2	-	16
	31.3%	31.3%	12.5%	-	-	-	12.5%	-	-	12.5%	-	100.0%
LA 118547	40	161	87	-	-	-	22	4	54	23	-	391
	10.2%	41.2%	22.3%	-	-	-	5.6%	1.0%	13.8%	5.9%	-	100.0%
LA 118549	5	8	8	-	-	-	8	-	9	3	-	41
	12.2%	19.5%	19.5%	-	-	-	19.5%	-	22.0%	7.3%	-	100.0%

Table 18.5. Debitage type by material for the collected assemblages (count and row percentage)

Material Type	Angular Debris	Core Flake	Biface Flake	Bipolar Flake	Ground Stone Flake	Total
Chert	29	63	1	1	-	94
	30.9%	67.0%	1.1%	1.1%	-	100.0%
Pedernal chert	22	76	1	1	-	100
	22.0%	76.0%	1.0%	1.0%	-	100.0%
Obsidian	7	3	-	-	-	10
	70.0%	30.0%	-	-	-	100.0%
Undifferentiated igneous	7	12	-	-	1	20
	35.0%	60.0%	-	-	5.0%	100.0%
Rhyolite	1135	2323	-	1	4	3463
	32.8%	67.1%	-	0.0%	0.1%	100.0%
Andesite	258	589	7	-	-	854
	30.2%	69.0%	0.8%	-	-	100.0%
Limestone	-	1	-	-	-	1
	-	100.0%	-	-	-	100.0%
Quartzite	10	61	-	-	-	71
	14.1%	85.9%	-	-	-	100.0%
Massive quartz	57	59	-	-	-	116
	49.1%	50.9%	-	-	-	100.0%
Total	1,525	3,187	9	3	5	4729
Percent	32.2%	67.4%	0.2%	0.1%	0.1%	100.0%

Table 18.6. Debitage type by site for the collected assemblages (count and row percentage)

Site	Angular Debris	Core Flakes	Biface Flakes	Bipolar Flakes	Ground Stone Flakes	Total	Flake/Angular Debris Ratios
LA 66288	154	464	6	2	4	630	3.09:1
	24.4%	73.7%	1.0%	0.3%	0.6%	100.0%	
LA 105703	346	713	-	1	-	1060	2.06:1
	32.6%	67.3%	-	0.1%	-	100.0%	
LA 105704	1	8	-	-	-	9	8.00:1
	11.1%	88.9%	-	-	-	100.0%	
LA 105705	6	14	-	-	-	20	2.33:1
	30.0%	70.0%	-	-	-	100.0%	
LA 105706	1	4	-	-	-	5	4.00:1
	20.0%	80.0%	-	-	-	100.0%	
LA 105707	4	26	-	-	-	30	6.5:1
	13.3%	86.7%	-	-	-	100.0%	
LA 105708	23	88	-	-	-	111	3.83:1
	20.7%		-	-	-	100.0%	
LA 105709	731	1,422	3	-	1	2157	1.95:1
	33.9%	65.9%	0.1%	-	0.0%	100.0%	
LA 105710	5	16	-	-	-	21	3.2:1
	23.8%	76.2%	-	-	-	100.0%	
LA 118547	227	391	-	-	-	618	1.72:1
	36.7%	63.3%	-	-	-	100.0%	
LA 118549	27	41	-	-	-	68	1.52:1
	39.7%	60.3%	-	-	-	100.0%	
Total	1,525	3,187	9	3	5	4,729	2.10:1
Percent	32.2%	67.4%	0.2%	0.1%	0.1%	100.0%	

Table 18.7. Morphology of field-inventoried assemblages by site (count and column percentage)

Artifact Type	LA 105703	LA 105704	LA 105705	LA 105706	LA 105707	LA 105708	LA 105709	LA 105713	LA 118547	Total
Core flakes	370	10	254	53	299	831	324	295	221	2,657
	62.9%	76.9%	75.6%	81.5%	72.2%	76.2%	82.2%	71.4%	71.5%	73.4%
Angular debris	160	1	48	4	89	213	46	71	61	693
	27.2%	7.7%	14.3%	6.2%	21.5%	19.5%	11.7%	17.2%	19.7%	19.1%
Cores	52	-	32	8	19	28	19	45	25	228
	8.8%	-	9.5%	12.3%	4.6%	2.6%	4.8%	10.9%	8.1%	6.3%
Tested cobbles	6	1	-	-	-	10	1	-	2	20
	1.0%	7.7%	-	-	-	0.9%	0.3%	-	0.6%	0.6%
Projectile points	-	-	1	-	4	5	3	-	-	13
	-	-	0.3%	-	1.0%	0.5%	0.8%	-	-	0.4%
Bifaces	-	1	-	-	2	2	1	-	-	7
	-	7.7%	-	-	0.5%	0.2%	0.3%	-	-	0.2%
Hoes	-	-	-	-	-	-	-	1	-	1
	-	-	-	-	-	-	-	0.2%	-	0.0%
Drills	-	-	-	-	1	-	-	-	-	1
	-	-	-	-	0.2%	-	-	-	-	0.0%
Scrapers	-	-	-	-	-	1	-	-	-	1
	-	-	-	-	-	0.1%	-	-	-	0.0%
Choppers	-	-	-	-	-	-	-	1	-	1
	-	-	-	-	-	-	-	0.2%	-	0.0%
Total	588	13	336	65	414	1,090	394	413	309	3,622
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Flake/angular debris ratio	2.31:1	10.00:1	5.29:1	13.25:1	3.36:1	3.90:1	7.04:1	4.15:1	3.62:1	3.83:1

field inventoried assemblages. Flake to angular debris ratios for the field inventories correspond closely to those for the collected assemblages in only two cases—LA 105703 and LA 105708. In all other cases they are wildly divergent. This is probably the result of field inventory methods, which apparently led to an undercounting of angular debris in most cases. Thus, ratios for the field inventories can probably be discounted.

The flake to angular debris ratios for collected assemblages are consistent with a sedentary lifestyle when compared with other sites around New Mexico. Vierra (1990:67) provides flake to angular debris ratios for sites in northwest New Mexico, where the average ratio for Archaic sites is 4.34:1; Pueblo residential sites have a mean ratio of 2.52:1, while Pueblo limited-use locales have a mean ratio of 3.40:1. Ratios of 2.42:1 and 3.12:1 were derived for Valdez phase residential sites near Pot Creek Pueblo (Moore 1994) and are similar to those presented by Vierra. A study of assemblages from 25 Archaic through late Pueblo sites in the Mogollon Highlands provided flake to angular debris ratios of 4.71:1 for the Late Archaic, a range of 3.35:1 to 3.78:1 for the early Pithouse through early Pueblo periods, and 1.40:1 for the late Pueblo period (Moore 1999b). When a very brittle material (Luna Blue agate) was removed from consideration in that study, the late Pueblo period ratio was 2.78:1, more in line with those from Pueblo sites in other areas. Flake to angular debris ratios for late Archaic components at the San Ildefonso Springs site range from 6.68:1 to 14.55:1 (Moore 2001a). Two sites from the Taos area in which quarrying and initial core reduction were dominant activities had flake to angular debris ratios of 1.50:1 and 1.29:1 (Moore 2001b).

Three of the Gavilan sites had very low flake to angular debris ratios, consistent with those from the Taos quarries (LA 105709, LA 118547, and LA 118549). A slightly higher ratio was derived for LA 105703, but that assemblage probably should be included with the potential quarries. Three assemblages have ratios consistent with those from Pueblo habitation sites: LA 66288, LA 105708, and LA 105710. None of the flake to angular debris ratios for assemblages with at least 60 artifacts were consistent with Archaic habitation or workshop sites.

Platform lipping and dorsal scar orientation. These data are shown in Table 18.8. Lipped platforms are fairly common in six of the collected assemblages, though the three in which they are most common each contain fewer than 60 artifacts. Lipped platforms are uncommon or do not occur in five assemblages, and with the exception of the LA 105706 assemblage, which contains only five pieces of debitage, these are the assemblages with the lowest flake to angular debris ratios. Platform lipping usually occurs when flakes are struck from cores by soft hammer percussion or are removed from tool edges by pressure flaking (Crabtree 1972). Thus, much of the reduction at LA 66288, LA 105704, LA 105705, LA 105707, LA 105708, and LA 105710 may have been accomplished using soft hammer percussion, though in each case the majority of flakes were probably removed by hard hammer percussion. Little or no soft hammer percussion appears to have been used at LA 105703, LA 105706, LA 118547, and LA 118549. Some soft hammer percussion seems to have been used at LA 105709, but hard hammer percussion was by far the most common method used there. Platform lipping occurs in only four material type categories: cherts, Pedernal chert, rhyolite, and andesite. Coarser-grained materials all appear to have been reduced by hard hammer percussion.

As Table 18.8 illustrates, opposing dorsal scars are common in three assemblages: LA 66288, LA 105705, and LA 105707. They are absent or rare in three other assemblages: LA 105703, LA 118547, and LA 118549. Otherwise,

Table 18.8. Percentage of flakes with platforms and those with opposing dorsal scars by site for the collected assemblages

Site	Lipped Platforms	Opposing Dorsal Scars
LA 66288	31.7%	48.1%
LA 105703	2.2%	1.4%
LA 105704	33.3%	25.0%
LA 105705	33.3%	57.1%
LA 105706	0.0%	25.0%
LA 105707	40.9%	69.2%
LA 105708	29.5%	36.4%
LA 105709	11.1%	24.3%
LA 105710	25.0%	25.0%
LA 118547	0.7%	1.5%
LA 118549	0.0%	0.0%

opposing dorsal scars are moderately common. While this attribute can be indicative of biface reduction, opposing dorsal scars also occur during intense core reduction, where flakes are removed from multiple platforms on cores. Since biface flakes and modified flake platforms are quite uncommon in the same assemblages, it is unlikely that the moderate to high percentages of opposing dorsal scars are indicative of tool manufacture. Rather, they suggest that cores were often reduced to a high degree from multiple platforms. However, it is again interesting to note that three assemblages with the lowest flake to angular debris ratios also contain the lowest percentages of flakes with opposing dorsal scars.

Flakes to cores. Frequencies and percentages of core flakes and cores are shown in Table 18.9. Only whole flakes and proximal fragments are considered, providing a minimum number of individual removals. Biface flakes and bifaces are not considered because few of either were recovered. These data are difficult to interpret. The highest core flake to core ratios occur at LA 66288, LA 105709, and LA 118547, and cores seem to have been more intensively reduced at these sites. Low core flake to core ratios for the other sites probably suggest that cores were reduced and selected debitage was removed for use or modification elsewhere. Thus, rather than testing cobbles and transporting those that met the knappers' requirements to other sites for further reduction, most cores were reduced and abandoned, and usable debitage was transported away.

Table 18.9. Core flakes and cores by site for the assemblages (count and row percentage)

Site	Core Flakes	Cores	Total	Core Flakes/ Cores
LA 66288	241	15	256	16.07:1
	94.1%	5.9%	100.0%	
LA 105703	479	73	552	6.56:1
	86.8%	13.2%	100.0%	
LA 105704	8	10	18	0.80:1
	44.4%	55.6%	100.0%	
LA 105705	12	5	17	2.40:1
	70.6%	29.4%	100.0%	
LA 105706	2	2	4	1.00:1
	50.0%	50.0%	100.0%	
LA 105707	16	3	19	5.33:1
	84.2%	15.8%	100.0%	
LA 105708	50	13	63	3.85:1
	79.4%	20.6%	100.0%	
LA 105709	809	43	852	18.81:1
	95.0%	5.0%	100.0%	
LA 105710	5	4	9	1.25:1
	55.6%	44.4%	100.0%	
LA 118547	270	29	299	9.31:1
	90.3%	9.7%	100.0%	
LA 118549	29	15	44	1.93:1
	65.9%	34.1%	100.0%	

Cores

The types and conditions of cores can provide corroborative data concerning reduction strategy. Table 18.10 shows numbers of cores by morphology for the complete assemblage from each site. Tested cobbles are nodules with one or two flakes struck from them, unidirectional cores had flakes removed from only one platform, bidirectional cores had removals from two opposing platforms, and multidirectional cores had removals from two (nonopposing) or more platforms. Pyramidal cores reflect systematic reduction.

Multidirectional cores are the most common type in all 11 assemblages. Overall, unidirectional cores are the second most abundant type; they are the second most common type in five assemblages and are absent from five. Tested cobbles are the third most common type, though they comprise less than 10 percent of this assemblage; they rank second in one assemblage, third in four, and are absent from six. Bidirectional cores are fairly rare, occurring in only six assemblages. This type ranks second in three cases and fourth in three. The pyramidal type is represented by a single example from LA 105709.

Most cores (n = 180; 84.9 percent) are rhyolite, which is dominated by the multidirectional variety (63.3 percent), followed by unidirectional (22.8 percent), tested cobbles (8.9 percent), bidirectional (4.4 percent), and pyramidal (0.6 percent). Andesite cores are next in abundance but comprise only 7.5 percent of the core assemblage (n = 16). This material category is dominated by multidirectional cores (75.0 percent), followed by unidirectional (12.5 percent), tested cobbles (6.3 percent), and bidirectional (6.3 percent). Quartzite cores are next in abundance, comprising 2.8 percent of the core assemblage (n = 6). Types include unidirectional (33.3 percent), tested cobbles (33.3 percent), bidirectional (16.7 percent), and multidirectional (16.7 percent). Cores

Table 18.10. Core type by site (count and row percentage)

Site	Tested Cobble	Unidirectional Core	Bidirectional Core	Multidirectional Core	Pyramidal Core	Total
LA 66288	-	-	1	14	-	15
	-	-	6.7%	93.3%	-	100.0%
LA 105703	8	24	3	38	-	73
	11.0%	32.9%	4.1%	52.1%	-	100.0%
LA 105704	2	1	3	4	-	10
	20.0%	10.0%	30.0%	40.0%	-	100.0%
LA 105705	-	-	2	3	-	5
	-	-	40.0%	60.0%	-	100.0%
LA 105706	-	-	-	2	-	2
	-	-	-	100.0%	-	100.0%
LA 105707	-	1	-	2	-	3
	-	33.3%	-	66.7%	-	100.0%
LA 105708	-	-	-	13	-	13
	-	-	-	100.0%	-	100.0%
LA 105709	1	8	1	32	1	43
	2.3%	18.6%	2.3%	74.4%	2.3%	100.0%
LA 105710	-	-	-	4	-	4
	-	-	-	100.0%	-	100.0%
LA 118547	4	10	1	14	-	29
	13.8%	34.5%	3.4%	48.3%	-	100.0%
LA 118549	5	4	-	6	-	15
	33.3%	26.7%	-	40.0%	-	100.0%
Total	20	48	11	132	1	212
Percent	9.4%	22.6%	5.2%	62.3%	0.5%	100.0%

of various igneous materials make up 1.9 percent of this assemblage and include one specimen apiece of the multidirectional, unidirectional, bidirectional, and tested cobble varieties. Three massive quartz cores were recovered, including 2 (66.7 percent) multidirectional and 1 (33.3 percent) unidirectional. Cherts are represented by only three specimens; two (66.7 percent) are multidirectional, and one (33.3 percent) is unidirectional.

We assume that tested cobbles were reduced the least amount, followed by the unidirectional, bidirectional, multidirectional, and pyramidal types. We also assume that the most desirable materials were reduced to the greatest degree. Finally, we expect that cores on sites where people lived were reduced to a smaller size than on sites where they simply farmed. Table 18.11 presents information on cortical coverage and mean size for the collected assemblage that can be used to test these expectations.

Tested cobbles have the largest mean size and retain the most cortex, indicating that they were reduced the least amount of any of the core types. However, while unidirectional cores have the next largest mean size, they retain the same average amount of cortex as the multidirectional type. Though bidirectional cores have a smaller mean size than both the unidirectional and multidirectional varieties, they retain about twice as much cortex. Thus, the amount of reduction does not seem to directly increase with number of striking platforms. Reducing cores from single platforms or multiple platforms appear to be equally efficient, and deciding on which way a core should be reduced was probably more dependent on nodule shape than anything else. Bidirectional reduction seems to have been applied to smaller nodules and allowed removal of fewer flakes. The pyramidal type falls where predicted in both size and amount of retained cortex, but since only a single specimen of this type was recovered, not much reliance can be placed on this.

Table 18.11. Core data by morphology, material type, and site for the collected assemblages

Morphology

Attribute	Tested Cobbles	Unidirectional Cores	Bidirectional Cores	Multidirectional Cores	Pyramidal Cores
Percentage of cortical coverage	69.0%	24.8%	49.1%	24.8%	10.0%
Mean size (cu cm)	320.1	256.4	223	243	63

Material Type

Attribute	Chert	Pedernal Chert	Igneous Undifferentiated	Rhyolite	Andesite	Quartzite	Massive Quartz
Percentage of cortical coverage	30.0%	15.0%	50.0%	29.9%	20.0%	55.0%	33.3%
Mean size (cu cm)	39	12.5	443.5	260.8	75.6	456.3	204.7

Site

Attribute	LA 66288	LA 105703	LA 105704	LA 105705	LA 105706	LA 105707	LA 105708	LA 105709	LA 105710	LA 118547	LA 118549
Percentage of cortical coverage	24	27.4	51	54	20	40	34.6	20.5	27.5	35.2	42
Mean size (cu cm)	76.3	297	371.6	210.4	111.5	78.7	119.5	128	52.8	331	558.9

Reducing cores from multiple platforms was obviously the most favored technique; 62.3 percent of the core assemblage was reduced in this way. Reducing cores from a single platform was the second most common method selected; 22.6 percent of the assemblage was reduced in this way. These methods were probably considered the most efficient ways in which to reduce cores and may have been applied to larger nodules, with essentially the same sizes of nodules considered amenable to these reduction techniques. Bidirectional reduction was much less common, and bidirectional cores comprise only 5.2 percent of the assemblage. As noted above, smaller nodules seem to have had this reduction technique applied to them. Though nearly 10 percent of the core assemblage is comprised of tested cobbles, they can probably be considered rejects. Removal of one or two flakes presumably allowed a knapper to judge whether a nodule was of the requisite texture and relatively free of flaws. If not, it would have been rejected and another selected for testing.

Pedernal chert is the only exotic material in the core assemblage. As might be expected, the Pedernal chert cores have the smallest mean size and retain the least cortex of any of the materials in this assemblage. Surprisingly, though other chert cores have the second smallest mean size, they retain more cortex than andesite and about the same amount as rhyolite, though they have a mean size that is less than half that of the former, and less than a fifth that of the latter. This suggests that chert nodules, rare in the gravel deposits that most of the sites are on, tended to be much smaller than nodules of other materials selected for reduction. Andesite nodules also seem to have been smaller than rhyolite nodules, on the average, and perhaps represented a slightly more desirable material since they tend to retain less cortex. Most coarse-grained materials, such as the igneous undifferentiated category and quartzites, were usually reduced to a lesser extent than fine-grained materials. Massive quartz may be an exception to this, since it retains slightly more cortex than rhyolite and has a smaller mean size. Nodules of this material were probably smaller, on the average, than those of rhyolite and may have been considered more desirable than other coarse-grained materials. In general, these patterns tend to reflect our expectations—the most desirable materials were reduced to the greatest extent.

The expected pattern can also be seen in the distribution of these attributes by sites. Cores from LA 66288 and LA 105710 have the smallest mean sizes and among the lowest mean percentages of cortex. Cores from sites with occupational zones also tend to have comparatively small mean sizes. The largest mean core sizes occur in assemblages from sites with no associated occupational zones, including LA 105703, LA 105704, LA 118547, and LA 118549. The distribution of retained cortex percentages is not as well patterned but generally follows similar lines. Except in a few cases, where small sample size may have introduced some degree of error, the sites that lack associated occupational zones tend to have large percentages of cortex, while those with occupational zones usually have smaller percentages. LA 105703 is an exception to this and has a comparatively small percentage of retained cortex but lacks an occupational zone. However, as noted earlier, this site does not sit on the same series of gravel terraces as the other farming sites, and the gravel deposits in that area may have a different lithology. Since the average size of cores from LA 105703 is fairly large, it is possible that larger nodules occur in that area, which could be efficiently reduced to a greater extent than is the case for the other sites. LA 105705 and LA 105707 do not follow the predicted pattern for sites with associated occupational zones, and LA 105706 does not follow the pattern for sites that lack them. These assemblages contain only five, three, and two cores, respectively, so sample error is probably responsible for this deviation.

Tool Use

Both formal and informal tools are discussed in this section, because few of either category were recovered from these sites. Tools were collected from four sites (Table 18.12) and field inventoried at three of those sites as well as four additional sites (see Table 18.7). LA 66288 and LA 105708 are the only sites for which informal debitage tools were recorded. As discussed earlier, debitage from farming sites was not assigned to this category if it was found on the surface because of the high degree of incidental damage caused by traffic across site surfaces that are primarily com-

Table 18.12. Formal and informal tools by site (count)

Tool Type	LA 66288	LA 105703	LA 105708	LA 105709	LA 118547
Hoes	-	2	-	-	-
Unifaces	1	-	-	-	-
Bifaces	12	-	-	2	-
Projectile points	-	-	-	1	2
Utilized debitage	58	-	2	-	-
Utilized cores	2	-	-	2	-
Total	73	2	2	5	2

posed of gravels. Informal tools were found in subsurface contexts at only these two sites.

As might be expected, most of the tools in the collected assemblage are from LA 66288 and are primarily biface fragments and informal tools. The only formal tools collected from LA 105703 were two small hoes, both of which were very crudely shaped. Two informal tools were recovered from subsurface contexts at LA 105708. Five tools were collected from the surface of LA 105709, including a complete biface whose function could not be defined, and an unidentifiable biface fragment. The projectile point from LA 105709 is a medial section of a small dart or large arrow point. Both projectile points from LA 118547 are fragments of small corner-notched arrow points.

Nearly all formal tools in the collected assemblage are made from materials that are locally rare or imported. The exceptions are two rhyolite hoes from LA 105703 and an andesite biface from LA 105709. Other bifaces in the collected assemblage are made from Pedernal chert (six), obsidian (six), and chert (one). Two of three projectile points are obsidian, and the third is Pedernal chert. The only unifacial tool recovered was made from obsidian.

As Table 18.7 indicates, more formal tools were recorded during field inventory on the farming sites than were recovered during surface collection and excavation. A quartzite biface of undetermined function was the only tool noted on the surface of LA 105704. Similarly, part of a Pedernal chert projectile point was the only tool found at LA 105705. Seven tools were identified at LA 105707, including two obsidian arrow point tips, two obsidian corner-notched arrow points, an obsidian drill base, a Polvadera obsidian retouched tool discarded after it was broken during manufacture, and a Pedernal chert biface fragment. Tools inventoried on the surface of LA 105708 included five obsidian arrow points (three corner-notched, one side-notched, one tip), an obsidian biface, a Pedernal chert drill, and a Pedernal chert scraper. Formal tools noted at LA 105709 included a Pedernal chert side-notched arrow point, a Polvadera obsidian medium-sized corner-notched dart point, a Polvadera obsidian arrow point tip, and an obsidian biface fragment. Both the hoe and chopper noted on the surface of LA 105713 were made from andesite.

Considering the formal tools from both the collected and field inventoried assemblages, the distribution of material types is quite striking. Except for a quartzite biface from LA 105704, an andesite biface from LA 105709, and a chert biface fragment from LA 66288, all of the bifacial tools and the only uniface fragment recovered are made from exotic materials—either Pedernal chert or obsidian. Conversely, the cobble tools (three hoes and one chopper) are made from rhyolite or andesite—dense, durable materials that are locally available.

Material-selection parameters were somewhat different for the informal tools. More than half (51.6 percent) of the informal tools from LA 66288 and LA 105708 were made from locally available and abundant materials, and another 11.3 percent were made from generic cherts that were probably available locally but were comparatively rare. Only 35.5 percent of the informal tools were made from imported materials—Pedernal chert in 20 cases and obsidian in 2. Both utilized cores from LA 66288 are andesite, so locally available materials comprise 63.3 percent of the informal tools in those assemblages. Wear patterns on the edges of informal tools are consistent with cutting or scraping activities except for the edges of three core flakes from LA 66288 that are rounded, probably from working soft, pliable materials such as leather.

Material selection for formal and informal tools in the Gavilan assemblages is very interesting because of the high degree of reliance on materials imported from outside the Ojo Caliente Valley. In particular, 94.9 percent of the bifaces and unifaces were manufactured from Pedernal chert or obsidian. Though local materials dominate the informal tool assemblage, exotic materials still comprise slightly more than a third of those tools as well. Conversely, the cobble tools that would have been used in tasks requiring durable edges were made from locally available igneous rocks. This distribution suggests several possibilities. Materials amenable to careful shaping into desired tool forms by soft hammer percussion and/or pressure flaking seem to have been rare locally, leading to heavy reliance on imported materials for these purposes. If local materials, such as aphanitic rhyolite, were heavily used as informal tools, those materials were much tougher than cherts and obsidians, and consistent edge damage is more difficult to define on them. The presence of very small percentages of exotic materials in the farming site assemblages suggests that the formal tools made from imported materials at those locations were probably not made on-site. Instead, they were probably produced at residential sites and transported to farming sites for use and eventual discard.

What It All Means: Summaries, Conclusions, and Speculations

The array of sites investigated during this study can be divided into three basic groups. The first consists of habitation sites and contains only LA 66288 and probably LA 105710. Farming sites with associated occupational zones make up the second group and include LA 105707, LA 105708, LA 105709, and probably LA 105705. Farming sites that lack associated occupational zones are the third group and include LA 105703, LA 105704, LA 105705, LA 105706, LA 105713, and LA 118547. LA 118549 can probably be added to the third group because the activities reflected along the trail are much the same as those seen in the chipped stone assemblages from the sites that lack occupational zones.

Several topics remain to be discussed that can all be approached by structuring the array of sites in this way. The first question concerns the range of activities that occurred at these sites and how activities might have differed between groups. The second concerns the relationship between surface materials and the small numbers of subsurface materials recovered from several farming sites. Finally, we need to ask what relationship there was between the chipped stone artifacts found on the surface and the use of most of these sites for farming.

Activities Reflected in the Assemblages

By using data provided by analysis of reduction-related debris and tools, it is possible to define the range of activities involving chipped stone that occurred at these sites. However, it should be remembered that this will only be part of the story. In many instances, formal tools used in the fields were carried back to camps or villages unless they were broken or worn out during use and discarded. Many informal tools may not have been recognized at these sites because of difficulties involved in distinguishing between cultural and natural edge damage. In addition, the assemblage recovered from LA 66288 represents only a minute percentage of the artifacts present at that site, most of which are in deposits outside the right-of-way and thus outside our excavation areas. Indeed, only a small percentage of the artifacts from that site within the right-of-way were recovered because the strata that contained them were not culturally deposited, so more extensive studies were not pursued. Also, occupational zones defined at farming sites were outside the right-of-way and could not be investigated in detail. Thus, only the most obvious of the chipped stone using activities performed at these sites can be defined.

Core-reduction. The types of materials selected for reduction can be indicative of functional differences between sites. Materials that are well suited to pressure flaking should be more abundant at habitation sites, where formal tools were produced and used. They should be less common at sites used for temporary habitations and rare at sites that mostly served as loci for raw-material acquisition.

LA 66288 was the only definite habitation site investigated during this project, but materials recovered in and around the García store foundations at the south end of LA 105710 might also have been associated with the occupation of LA 66288, rather than LA 105709, which sits above that area. Thus, LA 105710 is tentatively also considered a habitation site.

Material-selection parameters at LA 66288 differed greatly from those observed at the farming sites and trail, and differ slightly for LA 105710 (Table 18.13). Cherts and obsidians comprise just over a quarter of the LA 66288 assemblage. In contrast, LA 105710 contains only 8.0 percent cherts and no obsidians, and the next highest percentage is in the LA 105707 assemblage, which contains 3.0 percent cherts. LA 66288 also contains the highest percentage of andesite and the lowest percentage of rhyolite. Though LA 105710 does not replicate this pattern, the comparatively high percentage of cherts in that assemblage may set it apart from the farming sites.

Table 18.13 shows that the assemblages from these sites mostly fit the expected pattern, especially when data from both the field-inventoried and -collected assemblages are combined into composite assemblages. The presumed habitation sites contain the largest percentages of cherts and obsidians, the materials that are best suited for formal tool manufacture. Composite assemblages from the farming sites with occupational zones contain very similar percentages of cherts and obsidians, ranging from 2.3 to 3.0 percent. Farming sites without occupational zones consistently contain the lowest percentages of cherts and obsidians, ranging from 0.0 to 1.9 percent. Interestingly, the percentage of these materials recovered along LA 118549 is consistent with percentages from the farming sites with occupational zones, which is contrary to the predicted pattern.

Since cores are expected to have been reduced to a greater extent at habitation sites than at farming sites, habitation site assemblages should contain higher percentages of flakes that lack dorsal cortex. Assemblages from farming sites with occupational zones should contain somewhat smaller percentages of noncortical flakes, and farming sites without occupational zones should contain the smallest percentages of noncortical flakes. Unfortunately, since dorsal cortex was not monitored during the field inventory, only the collected assemblage can be examined for this attribute. This reduces sample size significantly in several cases and eliminates LA 105713 from consideration.

As Table 18.13 shows, these tendencies are reflected at most of our sites. Overall, assemblages from habitation sites contain the highest proportion of noncortical flakes, an average of 75.3 percent. Assemblages from farming sites with occupational zones have the next highest mean, 65.9 percent. Farming sites without occupational zones have the smallest mean percent-

Table 18.13. Material-selection parameters by site category (composite assemblages)

Site Category	Site	Cherts and Obsidians (%)	Noncortical Flakes (%)	Modified Platforms (%)
Habitation sites	LA 66288	25.8	75.6	4.0
	LA 105710	8.0	75.0	0.0
Farming sites with occupational zones	LA 105705	0.0 (2.5)	78.6	0.0
	LA 105707	3.0 (2.3)	65.4	4.5
	LA 105708	2.4 (3.0)	44.3	1.6
	LA 105709	1.4 (2.5)	75.2	1.0
Farming sites without occupational zones and the trail	LA 105703	1.2 (0.8)	58.8	0.0
	LA 105704	0.0 (0.0)	25.0	0.0
	LA 105706	0.0 (1.4)	50.0	0.0
	LA 105713	0.2	-	-
	LA 118547	1.2 (1.9)	54.7	0.0
	LA 118549	2.4	43.9	0.0

age, 46.5 percent including LA 118549. Since the percentage only increases to 47.1 percent when LA 118547 is eliminated, the assemblage from the trail seems to fit with the farming sites without occupational zones for this attribute.

Platforms are often modified by abrasion during biface manufacture. While some platform modification can occur during core reduction, it generally takes a different form and is rarely extensive enough to be identified. Thus, the presence of modified platforms in an assemblage is an indication that some biface manufacture or modification may have occurred there. Since platforms were not monitored during field inventories, our assemblage size is again limited, and no data are available for LA 105713 when this attribute is considered.

We expect habitation site assemblages to contain the highest percentages of modified platforms, followed by farming sites with occupational zones. Farming sites without occupational zones should have the lowest percentages. As Table 18.13 shows, the sites essentially follow these predictions. Only flakes with intact platforms were used to calculate percentages. LA 66288 has one of the highest percentages of modified platforms, though none were found at LA 105710. Three of four farming sites with occupational zones yielded flakes with modified platforms, but no modified platforms were found at the farming sites without occupational zones or the trail.

Since the polythetic set used to define biface flakes took several other attributes into account, not all of these flakes were considered removals from bifaces. Definite biface flakes were only recovered from LA 66288 and LA 105709 (Table 18.6), constituting 1.0 and 0.1 percent of those assemblages, respectively. Combining both of these attributes, the reduction of bifaces large enough to produce recoverable flakes seems to have occurred only at habitation sites and farming sites with occupational zones, but it was quite rare when it occurred at all.

The ratio of flakes to angular debris is indicative of both reduction strategy and reduction technique, and it can also be affected by material characteristics. Reduction strategies that focus on efficiency tend to produce much larger flake to angular debris ratios than do strategies that focus on expediency. Hard hammer percussion produces much higher percentages of recoverable angular debris than does soft hammer percussion, and hence lower flake to angular debris ratios. In the same way, pressure flaking produces less recoverable angular debris and consequently higher flake to angular debris ratios. Materials that are brittle tend to produce more shatter than materials that are more elastic and less brittle; thus they have smaller flake to angular debris ratios as well.

Flake to angular debris ratios for the collected assemblages are shown in Table 18.6. Even though the use of only these data results in smaller assemblage sizes, dramatically so in some cases, the field inventories are considered less reliable for this attribute because much of the angular debris may have been missed since rocks that were broken by cultural means and those that were naturally fractured could not always be differentiated by cursory examination. Both habitation sites have flake to angular debris ratios that are larger than 3:1. However, ratios for the other sites are scattered all over the place because of a large variation in sample size. The largest ratios all occur in assemblages that contain 30 or fewer artifacts. To even this out, assemblages were combined for the three site categories to produce more accurate ratios. When combined, the habitation sites have a flake to angular debris ratio of 3.09:1, the farming sites with occupational zones have a ratio of 2.03:1, and the farming sites without occupational zones plus the trail have a ratio of 1.92:1. There is no appreciable change in the latter when LA 118549 is eliminated from consideration. In general, all three of these ratios are low, but as might be expected, the ratio for farming sites with occupational zones is about a third lower than the ratio for habitation sites, and the farming sites without occupational zones have the lowest ratio.

In general, flake to angular debris ratios suggest that expediency dominated the reduction strategy used in all three site categories, and that hard hammer percussion was probably the dominant technique used. If soft hammer percussion was used, evidence of this technique should be most common at the habitation sites, followed by the farming sites with occupational zones. The farming sites without occupational zones are expected to demonstrate the least use of this technique. As discussed earlier, platform lipping is generally considered a good indication of soft hammer percussion. These data are shown in Table 18.8, but variance in sample size again partly obscures patterning. By combining data into site categories, this variation can be smoothed. When this is done, the proportion of lipped platforms for habitation sites is 45.7 percent; farming sites with occupational zones contain 15.1 percent lipped platforms, and farming sites without occupational zones contain only 1.9 percent lipped platforms. Thus, quite a bit of soft hammer percussion was performed at the habitation sites, about a third as much was done at the farming sites with occupational zones, and very little was performed at the farming sites without occupational zones.

Opposing dorsal flake scars can be evidence of biface reduction, and in that case they are indicative of flakes removed from opposing tool edges. They can also be indicative of the degree to which materials were reduced at a site. Since there was very little biface reduction performed at any of these sites, the latter is applicable. In general, unless cores were reduced systematically, the further they were reduced, the more platforms were used for striking flakes. Since only one example of a systematically reduced core was identified, core reduction was not specifically structured to produce the maximum number of flakes. Thus, percentages of opposing dorsal scars should increase as cores were more intensively reduced because the likelihood that flakes were struck from opposing platforms increases as the number of platforms increases. Again combining sites into the three categories defined earlier, we find that flakes with opposing dorsal scars comprise 47.4 percent of the habitation site flake assemblages, 26.0 percent of those from farming sites with occupational zones, and only 1.6 percent of those from farming sites without occupational zones.

These data suggest that cores should have been reduced to the greatest extent at the habitation sites, to a lesser degree at farming sites with occupational zones, and the least amount at farming sites without occupational zones. This appears to be the case, as shown in Table 18.14. Habitation site contain the highest percentage of multidirectional cores and no tested cobbles, farming sites without occupational zones are at the opposite extreme, and farming sites with occupational zones fall in between. Cores on habitation sites have the smallest mean size and mean cortical coverage, while farming sites without occupational zones have the largest mean core size and cortical coverage. Again, farming sites with occupational zones fall between these extremes.

The various data presented in this discussion suggest that early-stage core reduction dominated on the farming sites without occupational zones. Overall, these sites had the lowest flake to angular debris ratios, somewhat higher than those derived for quarries near Taos (Moore 2001b). They contained little or no chert and obsidian, and no flakes had modified platforms. Nearly all reduction seems to have been accomplished by hard hammer percussion, with little evidence of the use of soft hammers at these sites. Cortical flakes comprise 53.5 percent of the overall flake assemblage, a very high percentage, which suggests that primary core reduction dominated at these sites. Cores from the farming sites without occupational areas have the largest mean size and remaining cortical coverage, suggesting they were reduced to a lesser extent than those recovered from the other site categories. Cores from farming sites without occupational areas are an average of 4.7 times larger than those from habitation sites and 2.6 times larger than those from farming sites with occupational zones. The evidence presented in this discussion suggests that, besides serving as locations for growing crops, the farming sites without occupational zones were also places where lithic materials were acquired and initially reduced. Quarrying occurred on farming features as well as at the edge of the terraces that these sites sit upon. Many cores were probably transported away for further reduction elsewhere, but there is also evidence that some cores were reduced as far as desired in situ, and usable flakes were probably carried off. This would account for the very low flake to angular debris ratios seen in most of these assemblages.

The habitation sites represent the opposite extreme. Some biface manufacture seems to have occurred at them (LA 66288 in particular), and soft hammer percussion was common, though slightly more than half of the reduction seems to have been accomplished with hard hammers. Cores were reduced to the greatest extent at these

Table 18.14. Core attribute by site category

Attribute	Habitation Sites	Farming Sites with Occupational Zones	Farming Sites without Occupational Zones
Percent multidirectional cores	94.7	78.1	49.6
Percent tested cobbles	0	1.6	14.7
Mean cortical coverage per core (%)	24.70%	26.90%	32.60%
Mean size per core (cu cm)	71.4	130.4	338

sites, and there is no evidence of in situ materials acquisition and initial reduction. The habitation site assemblages contained only 24.7 percent cortical flakes, a moderate percentage, which suggests that secondary core reduction dominated at those sites. This is corroborated by core data, which indicate that cores were reduced further at the habitation sites than they were at the others. The habitation sites were locales where cores (and perhaps nodules) that were obtained elsewhere (presumably nearby) were reduced to produce debitage to use as informal tools or knap into formal tools.

The farming sites with occupational zones fall in between these extremes, but in most cases they seem closer to the habitation sites. This resemblance may be a function of domestic activities requiring chipped stone that were not restricted to the occupational zones, but occurred all across the associated fields. Since we were unable to investigate any of the occupational zones in detail, most of our data reflect support activities that occurred on and around the fields. Thus, there is some evidence of raw-material acquisition and initial reduction, though it is not as strong as it was for the farming sites without occupational zones. There is also evidence of some domestic tasks, as shown by the presence of modified flake platforms on three of the four sites that fall into this category and definite biface flakes on at least one. Other evidence includes the somewhat higher percentages of chert and obsidian in comparison with the farming sites without occupational zones. However, these percentages are much lower than those recorded for the habitation sites.

To summarize, farming sites without occupational zones seem to have been primarily used as quarries. Some initial core reduction occurred at them, but no tool manufacture. Farming sites with occupational zones were also used as quarries, but in addition to this function, there may have been a limited amount of tool manufacture (or modification) occurring at these sites, and there is more of a domestic character to their assemblages than there was to the assemblages from the farming sites without occupational zones. Chipped stone assemblages from the habitation sites have a distinct domestic character to them. There is no evidence of in situ quarrying, and secondary core reduction is dominant. Some formal tool manufacture almost certainly occurred at these sites. Indeed, separating these assemblages may be artificial, and the few chipped stone artifacts recovered from around the García store at LA 105710 may actually represent a trail-off of the artifact scatter associated with Hilltop Pueblo.

Formal and informal tools. Formal tools were recovered during excavation and were recorded during field inventories, allowing us to generate composite assemblages for most of the sites. Table 18.15 presents an inventory of all formal tools for each site. Only three of the composite assemblages contain no tools, and they are three of the four assemblages that contain fewer than 100 artifacts. The LA 105710 assemblage lacks formal tools, but it is probably part of a habitation site; LA 105706 is a farming site without an occupational zone; and LA 118549 is a trail. Farming sites without occupational zones mostly contained the lowest percentages of formal tools, but not always. For instance, LA 105704 had the highest percentage of formal tools, but this is a result of small assemblage size, since only one formal tool was recovered from that site.

Thus, variation in assemblage size may be skewing the picture somewhat, and it can be smoothed by examining sites by category rather than as individuals. When this is done, formal

Table 18.15. Composite formal tool assemblages by site

Tool Type	LA 66288	LA 105703	LA 105704	LA 105705	LA 105706	LA 105707	LA 105708	LA 105709	LA 105710	LA 105713	LA 118547	LA 118549
Projectile points	-	-	-	1	-	4	5	4	-	-	2	-
Bifaces	12	-	1	-	-	2	2	3	-	-	-	-
Hoes	-	2	-	-	-	-	-	-	-	1	-	-
Drills	-	-	-	-	-	1	1	-	-	-	-	-
Unifaces	1	-	-	-	-	-	-	-	-	-	-	-
Scrapers	-	-	-	-	-	-	1	-	-	-	-	-
Choppers	-	-	-	-	-	-	-	-	-	1	-	-
Total number of formal tools	13	2	1	1	0	7	9	7	0	2	2	0
Percentage of composite assemblage	2.0%	0.1%	3.1%	0.3%	0.0%	1.6%	0.7%	0.3%	0.0%	0.5%	0.2%	0.0%
Field-inventoried assemblage	-	588	13	336	65	414	1,090	394	-	413	309	-
Collected assemblage	658	1,135	19	25	7	33	124	2,203	25	-	649	83
Total assemblage	658	1,723	32	361	72	447	1,214	2,597	25	413	958	83

tools comprise 1.9 percent of habitation site assemblages, 0.5 percent of assemblages from farming sites with occupational zones, and 0.2 percent of assemblages from farming sites without occupational zones. Most formal tools from the farming sites are not directly associated with agricultural pursuits. An exception to this are three hoes from LA 105703 and LA 105713, which would have been used for farming. Thus, formal tools with no direct association with farming were recovered from only two of five farming sites without occupational zones and comprise only 0.1 percent of that composite assemblage. This distribution is consistent with site types and the chipped stone reduction activities discussed in the preceding section. Habitation sites contain the highest percentage of formal tools. Farming sites with occupational zones contain some formal tools that are not directly associated with agriculture, but formal tools are much more common in the habitation site assemblage. Formal tools are rare at farming sites without occupational zones, and when tools associated with farming are discounted, they become even rarer.

Only a few domestic activities are reflected in the LA 66288 assemblage, and by extension, the LA 105710 assemblage. All formal tools in this assemblage are fragmentary, and functions could not be assigned to most of them. The three exceptions are two probable drill fragments and a projectile point preform that is missing its tip and may have been broken and discarded during manufacture. At least two other bifaces were discarded during manufacture because of mistakes. One exhibits a lateral snap, which is indicative of manufacturing breakage, and the second is badly step fractured on one surface, and it was probably discarded because of that. From these data we can suggest that small bifacial tools were made at the habitation site, projectile points were used for hunting and/or defense, and drills were used as perforators. Otherwise, the bifaces and unifaces from LA 66288 reflect generalized cutting and scraping activities.

The formal tools were augmented by an array of informal tools, the large number of which suggests that most activities requiring the use of stone tools were probably accomplished with unmodified debitage. In general, these activities would involve cutting or scraping, and suggest general maintenance and production tasks. However, three pieces of utilized debitage exhibit rounded edges and were probably used to scrape soft materials like leather. A surprising find was two pieces of debitage that might have been used as strike-a-light flints. Both were recovered from subsurface contexts (Levels 3 and 5) from a hand-dug exploratory trench. Since much of this area has also seen fairly heavy use during the historic period by Spanish settlers, the presence of strike-a-light flints is not a complete surprise, though the depths at which they were found is. The damage on the edges of these artifacts is not definitive, only suggestive of such use. Thus, their presence in subsurface deposits indicates a greater degree of sand buildup during the historic period than was expected, deeper mixing of materials than was thought to be the case, or a misidentification of tool function. A few pieces of ground stone were also recovered from LA 66288 and are indicative of vegetal food processing, presumably corn grinding.

Projectile points were identified at all four farming sites with occupational zones and at one of the farming sites without an occupational zone (LA 118547). These tools are evidence of hunting, probably of herbivores tempted by crops growing in nearby fields. Hoes were found at two of the farming sites without occupational zones and are directly indicative of farming. The only other formal tools identified at farming sites without associated occupational zones were a biface on LA 105704 and a chopper on LA 105713. The former could have functioned in a variety of capacities; thus, only a generalized cutting /scraping /core function can be assigned to it. The latter was probably used for collecting plant materials for consumption or as raw materials for the manufacture of other implements made from perishable materials.

Besides the projectile points discussed above, the farming sites with occupational zones also yielded several other types of formal tools. Two bifaces and a drill were identified in the LA 105707 assemblage. All three of these tools were fragmentary; one biface was discarded after being broken during manufacture. These artifacts are indicative of formal tool manufacture and use in maintenance and production tasks. In addition to the chipped stone tools from this site, several pieces of ground stone were also noted, including an andesite mano fragment of undetermined form, a quartzite one-hand rocker mano, and parts of two trough metates (andesite and granite). These tools are indicative of vegetal food processing, the grinding of corn in particular.

Other formal chipped stone tools from LA 105708 included two bifaces, a drill, and a scraper. Specific functions could not be assigned to the bifaces. The drill was used to perforate materials, probably wood. The scraper would have been used to scrape soft to semihard materials, most likely hides. Thus, the formal chipped stone tools in this assemblage (other than projectile points) were probably used in production and maintenance tasks. Four informal tools were also recovered from this site. Two had rounded edges, suggesting that they were used to scrape soft materials like hides. The other informal tools from this site were used for cutting or scraping. A few ground stone tools were also noted at LA 105708, including fragments of a slab metate and a trough metate, both made from quartzite. As discussed above, these tools would have been used for food processing, most likely the grinding of corn.

Only two formal chipped stone tools other than projectile points were identified in the assemblages from LA 105709. These tools are bifaces: a complete small andesite biface and an obsidian tool fragment, both of undetermined function. The presence of these tools at LA 105709 in addition to several biface flakes indicates that some use and manufacture of bifacial tools occurred there. Since the function of neither biface could be identified, they are simply considered part of the tool kit used for general production and maintenance tasks. Since these artifacts were in the collected assemblage, that task was at least partly accomplished outside the occupational zone. No ground stone tools were found at this site.

Table 18.16 illustrates the range of tasks represented in the chipped stone assemblages, including the few ground stone tools that were recovered or inventoried. Sites used for habitation, whether long-term or temporary, had the largest number of tasks performed on them. Farming sites without occupational zones and the trail had the fewest tasks performed on them. In particular, evidence of domestic tasks is lacking from the latter. Other than raw-material quarrying and initial processing, the main tasks evidenced in the chipped stone assemblages from the farming sites without occupational zones are farming and hunting, and perhaps some vegetal material acquisition or processing. One tool that can be considered evidence of general production or maintenance was recovered from these sites, suggesting that such tasks were rarely (if ever) performed on them.

There is evidence of multiple tasks at most of the farming sites with occupational zones. Many of these tasks are of a domestic nature, especially vegetal food processing, and suggest that farmers used the occupational zones for extended periods rather than just resting during the heat of the day and occasional overnight stays. Unfortunately, we lack detailed information from these areas, so a deeper discussion of the type of use they reflect is not possible. However, we should note that a dense chipping area collected at LA 105709 was not in the occupational zone, indicating that some chipped stone reduction occurred elsewhere on these sites. Since this area also contained evidence of biface reduction, tool manufacture was apparently not restricted to occupational zones.

The Relationship between Surface and Subsurface Materials at the Farming Sites

Both surface and subsurface artifacts were recovered from four farming sites: LA 105703, LA 105708, LA 105709, and LA 118547. These are also the farming sites with the largest collected assemblages. Chipped stone artifacts recovered from the surface of farming features at these sites are considered to postdate the period of feature construction and possibly use. Those found in Stratum 1, which is postoccupational buildup, certainly postdate the period of feature construction but may have been deposited while the features were in use. Artifacts found within the gravel mulch (Stratum 2) may relate to the use of an area for quarrying that predates feature construction, but they could also have been deposited while the fields were in use. Finally, artifacts recovered from the base of the gravel mulch almost certainly predate feature construction. It is now necessary to sort the chipped stone artifacts that were found in subsurface contexts into these categories.

Artifacts recovered from excavation units

Table 18.16. Tasks associated with chipped stone and ground stone tools by site

Task	LA 66288 and LA 105710	LA 105703	LA 105704	LA 105705	LA 105706	LA 105707	LA 105708	LA 105709	LA 105713	LA 118547	LA 118549
Quarrying and initial reduction	-	x	x	x	x	x	x	x	x	x	x
Secondary chipped stone reduction	x	-	?	x	-	x	x	x	-	-	-
Biface manufacture	x	-	-	-	-	x	-	x	-	-	-
Hunting	?	-	-	x	-	x	x	x	-	x	-
Perforating	x	-	-	-	-	x	x	-	-	-	-
Chopping	-	-	-	-	-	-	-	-	x	-	-
Farming	-	x	-	-	-	-	-	-	x	-	-
Vegetal food processing	x	-	-	-	-	x	x	-	-	-	-
General production and maintenance	x	-	x	-	-	x	x	x	-	-	-
Fire making	?	-	-	-	-	-	-	-	-	-	-
Leather working	x	-	-	-	-	-	x	-	-	-	-

comprise fairly large percentages of the collected assemblages for three sites: 6.8 percent for LA 105703, 18.5 percent for LA 105708, and 18.6 percent for LA 118547. Only a few chipped stone artifacts were recovered from excavation units at LA 105709, and they comprise 0.3 percent of that assemblage. However, not all of these artifacts were from farming features, nor were all from subsurface contexts. EU-B at LA 105709 was used to investigate Feature 3, which turned out to be a temporary historic structure. EU-E at LA 105708 was in an area that did not contain a farming feature. Both of these excavation units yielded chipped stone artifacts that cannot be considered with the assemblage from farming features. Thus, they are added to the assemblage of surface artifacts. Also added to the surface assemblage are a few artifacts recovered from the surface of excavation units.

Table 18.17 shows corrected counts for each site by stratum. From 1 to 31 subsurface artifacts were recovered from 12 of 14 excavation units at LA 105703. The greatest number of chipped stone artifacts was recovered from EU-K, which was one of two excavation units used to investigate Feature 22. The second largest number of chipped stone artifacts, 12, came from EU-L, which was one of eight excavation units used to investigate Feature 18.

All subsurface artifacts from LA 105703 are rhyolite. They include 45 core flakes, 28 pieces of angular debris, and 4 cores. Rhyolite was by far the dominant material overall at LA 105703, comprising 92.3 percent of the complete assemblage, so this is not surprising. Twenty artifacts (26.3 percent) were recovered from Stratum 1, and 56 (73.7 percent) were from Stratum 2. The Stratum 1 assemblage contained 8 pieces of angular debris, 10 core flakes, and 2 cores. The Stratum 2 assemblage contained 20 pieces of angular debris, 34 core flakes, and 2 cores. Seventy percent of the flakes from Stratum 1 were noncortical, as were 64.7 percent of those from Stratum 2. Both of these percentages are rather high when compared with the overall percentage for the site (Table 18.13). There are no modified or lipped platforms on these flakes. Flake to angular debris ratios are 1.25:1 for Stratum 1 and 1.70:1 for Stratum 2. Both ratios are a bit low when compared to the overall flake to angular debris ratio for the site (Table 18.6).

When these data are combined, fairly early-stage core reduction is indicated for the chipped stone artifacts from both subsurface strata at LA 105703. Of course, it must be remembered that these artifacts undoubtedly represent numerous reduction episodes. Stratum 1 artifacts represent chipping episodes that occurred after the farming features were built, while they were in use or after they were abandoned. Chipping episodes represented by the Stratum 2 artifacts occurred before the features were built or while they were in use.

From two to six chipped stone artifacts were recovered from all five of the excavation units that were used to examine farming features at LA 105708. Two of the three EUs that were used to examine Feature 9 contained the largest and second largest numbers of artifacts. Six were recovered from EU-A, and five from EU-B. Most sub-

Table 18.17. Chipped stone artifacts recovered from excavation units on farming sites that yielded subsurface artifacts (count and column percentage)

Provenience	LA 105703	LA 105708	LA 105709	LA 118547
Surface	1,059	102	2,198	529
	93.3%	82.3%	99.8%	81.5%
Stratum 1	20	6	3	47
	1.8%	4.8%	0.1%	7.2%
Stratum 2	56	15	2	27
	4.9%	12.1%	0.1%	4.2%
Stratum 3	-	1	-	46
	-	0.8%	-	7.1%
Total	1,135	124	2,203	649

surface artifacts from LA 105708 are rhyolite. The only exceptions are a piece of chert from EU-B and a piece of Pedernal chert from EU-F. At 88.8 percent, the proportion of rhyolite in this small assemblage is nearly equivalent to the percentage in the assemblage as a whole. However, the presence of cherts in subsurface contexts is surprising, since the collected assemblage contained only three chert artifacts. Three artifacts (16.7 percent) were recovered from Stratum 1, 14 (77.8 percent) from Stratum 2, and 1 (5.6 percent) at the top of Stratum 3.

The Stratum 1 assemblage includes 2 core flakes and 1 piece of angular debris. Most of the subsurface artifacts were recovered from Stratum 2, including 11 core flakes, 2 pieces of angular debris, and 1 core. The single artifact found at the top of Stratum 3 was a core flake. Both flakes from Stratum 1 are noncortical, as are 36.4 percent of those from Stratum 2. The only core flake in Stratum 3 is cortical.

Only Stratum 2 contained enough flakes for comparison to the overall assemblage, and the percentage of noncortical flakes from this layer is somewhat lower than it was for the assemblage as a whole. There were no modified platforms on these flakes, and only two (one each from Strata 1 and 3) had lipped platforms. Flake to angular debris ratios are 2.00:1 for Stratum 1 and 5.50:1 for Stratum 2. Neither of these ratios is consistent with the overall flake to angular debris ratio for this site (Table 18.6). One possible utilized flake was recovered from Stratum 2, but the wear on that artifact was questionable since it came from a matrix that contained large amounts of gravel.

The data presented for the subsurface assemblage from LA 105708 are difficult to interpret because the assemblages from each stratum are so small, especially those from Strata 1 and 3. Artifacts from Strata 1 and 3 represent chipping episodes that occurred before (Stratum 3) and after (Stratum 1) the farming features were built. Chipping episodes represented by the artifacts from Stratum 2 occurred before the features were built or while they were in use.

Chipped stone artifacts were recovered from two of three EUs used to examine farming features on LA 105709. Three pieces of debitage were recovered from Stratum 1 in EU-A, and two were found in Stratum 2 in EU-C. All of these artifacts are rhyolite. Stratum 1 contained a core flake and two pieces of angular debris, while Stratum 2 contained a core and a piece of angular debris. This is rather surprising, since rhyolite comprised only about 60 percent of the overall assemblage from this site. The core flake was a noncortical lateral fragment with a crushed platform.

The data presented for the subsurface artifacts from LA 105709 are difficult to interpret because the assemblages from each stratum are so small. Artifacts from Stratum 1 probably represent a single chipping episode that occurred after Feature 1 was built. Artifacts from Stratum 2 may have been present in the gravels used to mulch Feature 4, or they represent the mixing of a few artifacts into the mulch from a chipping episode that occurred after this feature was built.

Between 1 and 50 subsurface artifacts were recovered from all 12 excavation units at LA 118547. The greatest number of chipped stone artifacts was recovered from EU-C, and the second largest number (12) came from both EU-D and EU-K. All excavation units on this site were used to examine Feature 15. Rhyolite was the most common material type in the subsurface assemblage and comprised 87.5 percent of those artifacts. Other materials included chert (1.7 percent), igneous undifferentiated (0.8 percent), andesite (9.2 percent), and quartzite (0.8 percent). These percentages are out of proportion to the makeup of the overall assemblage. Rhyolite is overrepresented, and andesite is underrepresented (Table 18.2).

Forty-seven artifacts (39.2 percent) were recovered from Stratum 1, 27 (22.5 percent) from Stratum 2, and 46 (38.3 percent) from the top of Stratum 3. The Stratum 1 assemblage includes 15 pieces of angular debris, 31 core flakes, and 1 core. The Stratum 2 assemblage contains 9 pieces of angular debris, 16 core flakes, and 2 cores. Stratum 3 contained 12 pieces of angular debris, 31 core flakes, and 3 cores. Noncortical flakes comprise 58.1 percent of the Stratum 1 assemblage, 56.3 percent of the Stratum 2 assemblage, and 41.9 percent of the Stratum 3 assemblage. These percentages for Strata 1 and 2 are similar to the percentage for the overall assemblage, while the percentage for Stratum 3 is somewhat lower (Table 18.13). There are no modified or lipped platforms on these flakes. Flake to angular debris ratios are 2.07:1 for Stratum 1, 1.78:1 for Stratum

2, and 2.58:1 for Stratum 3. The ratio for Stratum 2 is very close to that for the overall assemblage, while the others are a bit higher (Table 18.6).

Subsurface data from LA 118547 are a bit easier to interpret than those from the other sites, because more information on the positioning of artifacts is available from the field notes. In three cases (EU-E, EU-H, and EU-J) the excavator noted that artifacts from Stratum 2 were found near the top of that layer. Though no chipped stone artifacts were recovered from Stratum 2 in EU-H, these data provide a much needed clue. All artifacts from Stratum 1 and most, if not all, of those from Stratum 2 undoubtedly were deposited after the farming features were built. Conversely, the occurrence of a large number of artifacts at the top of Stratum 3 in EU-C shows that this area was also used as a quarry before the farming features were built. Data for all three strata suggest early-stage core reduction consistent with the raw-material quarrying that was considered to be the main activity involving chipped stone for the site as a whole.

While it has not been possible to definitively determine the relationship between surface and subsurface chipped stone artifacts at these sites, several tendencies are clear. Overall, these small assemblages fit, albeit not very neatly, with the complete assemblages from these sites. Though numerous chipping episodes are represented in each assemblage, raw-material quarrying and initial core reduction seem to have been the focus of those episodes. Artifacts in Stratum 1 were deposited after farming features were built. Considering the data from LA 118547, most or all of the chipped stone artifacts recovered from Stratum 2 are probably related to similar chipping episodes, and they were worked down into the gravel mulch by natural processes or prehistoric cultivation techniques. Since most of the gravel used to mulch these features was obtained from borrow pits, the chance that many chipped stone artifacts would be included in those materials is fairly low.

At least two quarrying episodes that occurred before farming features were built were defined. Earlier chipping episodes in areas selected for field construction may also account for some of the chipped stone artifacts in Stratum 2, especially those recovered near the bottom of the mulch layer. In some cases, multiple layers of mulch may have been applied, and material acquisition occurring between applications could also be responsible for some subsurface chipped stone artifacts.

Thus, we conclude that most of the subsurface chipped stone artifacts from these sites resulted from chipping episodes that occurred before and after features were built. Others may have been deposited between applications of mulch, but this possibility is considered to be much less likely in most cases.

Relationship between Surface Artifacts and Farming Activities

Only three artifacts collected from or inventoried at the farming sites were directly related to farming activities—the hoes found at LA 105703 and LA 105713. Assemblages that are spread across farming features or occur at the edges of the gravel terraces that these sites occupy were probably not directly related to farming activities but may represent raw-material acquisition embedded in farming activities. Four of these sites also have occupational zones associated with the farming features. Analysis showed that the assemblages from these sites have a different character than those from the farming sites that lack occupational zones. When occupational zones occur there tend to be more cherts and obsidians in chipped stone assemblages, as well as more formal tools representing a larger variety of activities. The types of pottery found in subsurface contexts mostly tend to match those recovered on the surface of these sites. This suggests that field construction, use, and exploitation of the area for raw chipped stone materials may have occurred at pretty much the same time.

Unfortunately, there is no way to determine whether there is any correspondence between surface and subsurface assemblages. The resemblances between them may be indicative of a close relationship, but this remains uncertain. Undoubtedly, both earlier and later occupants of the Ojo Caliente Valley exploited some of the same material sources, as did the prehistoric pueblo farmers. Indeed, at least some of the chipped stone artifacts on our sites probably derive from quarrying episodes that predated and postdated construction and use of the fields. However, we feel that most of the chipped stone assemblages reflect material acquisition embedded in farming activities, as noted above. Lack of evidence of much primary reduction at the habitation site(s) provides some support for this possibility. Unfortunately, those assemblages were too small to provide any real substantiation.

Summary and Conclusions

This chapter has examined the collected assemblages from 12 sites in the Ojo Caliente Valley, with additional detail from the field-recorded assemblages at those sites and the thirteenth site. Assemblage characteristics allowed us to divide this array of sites into three basic groups: habitation sites (LA 66288 and LA 105710), farming sites with associated occupational zones (LA 105705, LA 105707, LA 105708, and LA 105709), and farming sites without associated occupational zones (LA 105703, LA 105704, LA 105706, LA 105713, and LA 118547). The last site—LA 118549—is a trail, and it was included with the latter group because of assemblage similarities.

Our analysis found that imported materials were fairly rare in all assemblages, and the largest percentages occurred in the habitation site assemblage(s). Though some imported materials were found at both categories of farming sites, they were more common at the farming sites with occupational zones. Analysis of attributes indicative of reduction strategy and techniques showed that chipping on the farming sites without occupational zones focused on material quarrying and initial core reduction. This was almost entirely accomplished by hard hammer percussion, and some data suggest that selected flakes may have been carried off for use elsewhere. Other data suggest that material acquisition was probably embedded in farming activities. Formal tools were rare to nonexistent at the farming sites, and most were related to farming activities or field hunting.

Quarrying and initial core reduction was also common at the farming sites that had associated occupational zones. However, an array of domestic tasks is also reflected in these assemblages. Since none of the occupational zones extended into the right-of-way, those areas were not studied in detail. Even so, differences were noted between collected assemblages from both categories of farming sites, which indicates that domestic tasks associated with temporary habitation were not restricted to occupational zones. Reduction activities that were not strictly related to quarrying and initial core reduction also sometimes occurred on farming features and at the edge of the gravel terraces they occupy. Substantial amounts of reduction at these sites was accomplished by soft hammer percussion, though hard hammer percussion was probably dominant.

The assemblage from the habitation site(s) differed greatly from those recovered from the farming sites. However, it should be remembered that these materials represent a minuscule part of the Hilltop Pueblo assemblage and that none seemed to be in situ. Rather, the artifacts recovered at LA 66288 and in the northern section of LA 105710 appear to have been redeposited, limiting the conclusions that can be drawn from these materials. Even so, there is little evidence of the early stages of core reduction in this assemblage, suggesting that most cores were probably transported to the habitation site in a partly reduced state. Material selection was more focused on imported materials and materials that are rare in local gravel deposits. Soft hammer reduction was very common but may still have been dominated by hard hammer reduction. Evidence of formal tool manufacture and use was more common in this assemblage than in any of those from farming sites.

The differences in these assemblages are fairly easy to explain. LA 66288 and LA 105710 formed parts of a residential site where local farmers and their families lived and performed myriad domestic tasks, many of which used chipped stone. Farming activities seem to have required some people to reside near their fields for at least part of the year, though not every group of farming features seems to have needed this level of tending or protection. Perhaps the distribution of occupational zones is more indicative of the land tenure system than the requirements of agriculture, but this remains uncertain at this time. In any case, the occupational zones that occur near several field systems were a focus of domestic tasks, many of which used stone tools, and those tasks often spilled across the fields to the terrace edge, where lithic raw materials were readily available. Where occupation zones do not occur next to fields, we found the simplest chipped stone assemblages, which were mostly indicative of raw-material acquisition. The farmers that tended these fields probably collected cores and suitable flakes while working in their fields, perhaps for transport back to the main residence or to field structures in occupational zones associated with other fields.

Chapter 19. Pottery Analysis

C. Dean Wilson

During surface collection and excavation at the Gavilan sites, 3,078 sherds were recovered, including 1,864 from LA 66288, 47 from LA 105703, 181 from LA 105708, 35 from LA 105709, 940 from LA 105710, and 11 from LA 118547 (Table 19.1). No sherds were collected from the other seven sites that were examined, which included six farming sites and the trail. Distributions of various pottery forms, as reflected in typological categories and descriptive attribute classes, provide a framework to determine the dates of site occupation and examine a range of issues such as the influence of cultural tradition and resource use on local ceramic technologies, exchange of pottery vessels between different areas, and the use of ceramic vessels and tools in various activities.

Attribute Analysis Categories

Descriptive attribute categories recorded during this study include temper type, pigment, interior and exterior surface manipulation, vessel form, and postfiring modifications. In addition, refired paste color was recorded during analysis of small subsamples of selected sherds.

Temper

Temper categories were recorded by examining freshly broken sherd cross sections through a binocular microscope. *Temper* refers to aplastic particles that were intentionally added to the clay or fragments naturally occurring in the clay that would have served the same purpose. Temper categories were distinguished by combinations of color, shape, size, fracture, and sheen of observed particles. It is often not possible to differentiate rock types based on microscopic analysis of temper fragments, so the categories employed here are best considered groups with similar visual characteristics rather than specific rock and mineral types. Still, recognition of such categories provides information on the basic types of resources used by potters in a particular area.

Almost all of the sherds examined during this study contained some type of igneous rock temper. *Tuff/ash* or *vitric tuff* refers to fine volcanic rock fragments, presumably derived from ash or tuff deposits. This category includes small, clear, dark, vitreous, angular to rod-shaped particles and light-colored dull pumice fragments. The presence of such particles may indicate the use of self-tempered ash-derived clays or the addition of crushed or weathered tuff or ash to the clay. Most examples of this temper occurred along with rounded quartz grains and were classified as fine tuff or ash and sand.

Other tempers include various classes of crushed igneous porphyries. *Granite* refers to crushed leucocratic igneous rock dominated by white to light gray fragments with smaller amounts of black fragments. The minerals visible in this category include quartz, feldspar, brown biotite, and mica, and this type of temper was commonly used in utility wares through much of the Rio Grande Valley. Similar tempers were assigned to categories based on the frequency of mica fragments and included granite with mica, granite without mica, and granite in highly micaceous paste.

Sand refers to rounded or subrounded, well-sorted sand grains that are usually light-colored to transparent. This category was distinguished from the sandstone category by the presence of large, even-sized quartz grains and the absence of a matrix. Similar temper consisting of dark gray to black rounded sand grains was assigned to the dark sand category. Inclusions consisting of dull fragments representing the addition of crushed potsherds to the clay were assigned to the sherd category.

Pigment Type

Pigment categories were recorded for decorated sherds. *Organic paint* refers to the use of vegetal pigments that soak into the surface of a vessel

Table 19.1. Pottery type by site (count and column percentage)

Pottery Type	LA 66288	LA 105703	LA 105708	LA 105709	LA 105710	LA 118547	Total
Unpainted biscuit paste	111	1	124	-	52	-	288
(slipped both sides)	6.0%	2.1%	68.5%	-	5.5%	-	9.4%
Unspecified painted biscuit ware	19	6	-	-	27	-	52
	1.0%	12.8%	-	-	2.9%	-	1.7%
Biscuit A	85	2	-	3	35	8	133
	4.6%	4.3%	-	8.6%	3.7%	72.7%	4.3%
Biscuit B	410	30	7	31	257	3	738
	22.0%	63.8%	3.9%	88.6%	27.3%	27.3%	24.0%
Unpainted biscuit ware	51	5	-	-	45	-	101
(slipped one side)	2.7%	10.6%	-	-	4.8%	-	3.3%
Micaceous utility undifferentiated	857	1	43	1	51	-	953
	46.0%	2.1%	23.8%	2.9%	5.4%	-	31.0%
Sapawi Micaceous-Washboard	324	2	-	-	459	-	785
	17.4%	4.3%	-	-	48.8%	-	25.5%
Potsuwi'i Incised	3	-	-	-	-	-	3
	0.2%	-	-	-	-	-	0.1%
Classic nonmicaceous	1	-	7	-	8	-	16
	0.1%	-	3.9%	-	0.9%	-	0.5%
Tewa Buff undifferentiated	-	-	-	-	1	-	1
	-	-	-	-	0.1%	-	0.0%
Kapo or Tewa Black	-	-	-	-	4	-	4
	-	-	-	-	0.4%	-	0.1%
San Juan Red-on-tan	-	-	-	-	1	-	1
	-	-	-	-	0.1%	-	0.0%
Glaze Red body (unpainted)	1	-	-	-	-	-	1
	0.1%	-	-	-	-	-	0.0%
Largo Glaze Polychrome	2	-	-	-	-	-	2
	0.1%	-	-	-	-	-	0.1%
Total	1864	47	181	35	940	11	3078

rather than remaining unabsorbed on its surface. Thus, streaks and polish are often visible through the paint. The painted surface is generally lustrous from surface polishing, and the pigment may be gray, black, bluish, and occasionally orange in color. Edges of painted designs are often fuzzy when an organic paint was used.

Matte mineral paint refers to the use of ground minerals such as iron oxide as pigments. These are usually powdered compounds applied with an organic binder. This type of pigment forms a physical layer that rests on the vessel surface, often thick enough to exhibit visible relief. Mineral pigments usually cover and obscure surface polish and irregularities. The firing atmospheres to which mineral pigments were exposed affected their color. Mineral pigment categories identified during the present study were classified as mineral black.

Glaze paint refers to the use of lead as a fluxing agent to produce a vitreous paint. Glaze-painted surfaces exhibit a heavy sheen or gloss and are often black or green, but they may be brown, yellow, or red. Glaze pigments are often very thick and runny, and bubbles may protrude through the surface. The glaze paint may weather from the surface of a sherd, leaving a thin organic layer.

Manipulation

Manipulation refers to the type of treatment noted on a sherd surface. *Plain unpainted* refers to surfaces with no evidence of textured treatments, polishing, or painting. *Polish* implies intentional smoothing with a polishing stone to produce a compact and lustrous surface. Evidence of polishing over an unslipped surface was recorded as plain polish. Similar manipulations over a low-iron slip were recorded as polished white slip, while that over a high-iron slip was recorded as polished red slip. Lustrous black surfaces resulting from intentional sooting of a polished surface were classified as polished smudged. Textures reflecting various treatments of coils that were not completely obliterated on corrugated utility wares included narrow coil, clapboarded, smeared indented corrugated, and smeared wide neck-banded.

Vessel Form

Sherds were assigned to vessel form categories based on their shape and the portion of the vessel from which they were assumed to have originated. The consistent placement of all sherds into similarly defined vessel form categories allows basic interpretation of functional trends represented by sherd assemblages. *Indeterminate* refers to cases where the type of vessel from which a sherd originated could not be determined. *Bowl rim* refers to rim sherds exhibiting inward curvature indicative of bowl forms. *Bowl body* refers to body sherds exhibiting polish or painted decoration on the interior surface indicating they were fragments of bowls. Bowl rim sherds exhibiting significant flaring or eversion toward the rim were classified as flared bowl rim.

Most of the sherds examined during this study were unpolished body sherds for which no precise vessel form could be determined. While all unpolished gray body sherds were assigned by default to the jar body category, some could actually have been parts of bowls. *Jar neck* includes sherds with a curvature that indicated they originated somewhere along the upper portion or neck of a jar. *Jar rim* refers to forms with relatively wide rim diameters that could have been used for cooking or storage. *Seed jar rim* refers to sherds from spherical vessels that do not exhibit distinct necks but have small openings near the top. Other vessel forms included dipper with handle and curved pipe.

Modified Sherds

Modified sherd categories indicate the presence of postfiring modifications resulting from shaping, wear, or repair. These categories incorporate information concerning item shape and size as well as processes of shaping and use. While most of the sherds examined did not exhibit postfiring modifications and were coded as none, those that did provide information about the actual use and modification of sherds and vessels. *Drilled hole for repair* refers to the presence of holes drilled along fractures that allowed a broken vessel to be repaired by lacing the fragments together. Repair holes are usually within 2 cm of a break. Sherds exhibiting shaping and wear patterns indicative of use in pottery vessel manufacture were classified as ceramic scrapers. Those exhibiting at least one shaped edged were classified as beveled edge. Those that had been shaped on all sides were assigned to the shaped object category. Another category recognized during this study was large sherds used as scoops or digging tools. Sherds exhibiting spalls or pitting from exposure to repeated cooking cycles were assigned to distinct categories.

Pottery Types

Pottery from the Gavilan sites was overwhelmingly comprised of Northern Rio Grande types typical of Classic period occupations (Cordell 1978; Fallon and Wening 1987; Hibben 1937; Wendorf 1953b). These include sherds assigned to white ware, gray ware, and glaze ware types. Table 19.1 shows distributions of prehistoric pottery types by site, while Table 19.2 illustrates the distributions of ware groups associated with these types.

White wares. Five prehistoric white ware categories were identified during this analysis. Most categories represent Northern Rio Grande pottery types from the Tewa white ware series that date to the Classic period (Fallon and Wening 1987; McKenna and Miles 1990; Wendorf 1953b). During the Classic period, similar Tewa series white wares were produced in the Pajarito Plateau, Tewa Basin, and Chama Valley areas (Mera 1934). Tewa White wares from different time periods are characterized by similar tuff temper, high iron pastes, and painted decorations executed in organic paint. Thus, variations in paste surface treatment and design styles, which are known to have changed through time, were used to place white wares into types.

All of the white wares sherds recovered during this study appeared to be from biscuit ware vessels. Biscuit wares were the dominant types of decorated pottery produced at Classic period sites in the Northern Rio Grande (Mera 1934).

Table 19.2. Ceramic ware group by site (count and column percentage)

Ware Group	LA 66288	LA 105703	LA 105708	LA 105709	LA 105710	LA 118547	Total
Gray ware	1185	3	50	1	518	-	1757
	63.6%	6.4%	27.6%	2.9%	55.1%	-	57.1%
White ware	676	44	131	34	416	11	1312
	36.3%	93.6%	72.4%	97.1%	44.3%	100.0%	42.6%
Glaze ware	3	-	-	-	-	-	3
	0.2%	-	-	-	-	-	0.1%
Historic plain ware	-	-	-	-	6	-	6
	-	-	-	-	0.6%	-	0.2%
Total	1864	47	181	35	940	11	3078

They are often referred to as black-on-gray, apparently because of their dark surface color relative to other white ware types. However, this study follows more recent conventions in identifying biscuit wares as black-on-white types (Lang 1997). Biscuit wares are characterized by the use of bentonitic clays and vitric tuff or ash temper (Fallon and Wening 1987; Kidder and Amsden 1931). Their pastes are very porous and lightweight, and biscuit ware sherds tend to be very soft and weather easily. Surfaces are often white, light gray, tan, or buff. Vessel walls tend to be very thick, particularly when compared to earlier decorated types. Biscuit ware bowl rims exhibit a distinct flare or eversion, and thickness may vary considerably over short distances from the rim.

Biscuit wares were decorated using a sharp black to blue-black organic paint that was applied to a white- to buff-colored slip. Plain bowl rims are generally ticked, and standing rims are embellished with repeating dashes or zigzag lines on the interior below the lip. Painted designs are often organized in bands with panels of repeating hatched or solid geometrical elements that include ticked edges, parallel or rectilinear lines, and stylized Awanyu motifs.

Two biscuit ware types can be distinguished by the presence of painted or slipped surfaces (Kidder and Amsden 1931). The earlier type is known as Biscuit A (Abiquiu Black-on-white) and was defined by the presence of slip and/or painted designs on interior surfaces only. Bowls are the only vessel form that occur in this type. The manufacture of Biscuit B (Bandelier Black-on-white) began somewhat later, and this type is distinguished from Biscuit A by yellowish pastes as well as slip and/or painted decorations on jar exteriors and both surfaces of bowls. The latter type dominated the identifiable decorated ceramic assemblages from our sites (Fig. 19.1). Decorated biscuit ware sherds that could not be assigned to a specific type were categorized as unspecified painted biscuit ware. Unpainted sherds that clearly exhibited traits indicative of biscuit wares were categorized as unpainted biscuit paste slipped on both sides or unpainted biscuit ware slipped on one side.

Prehistoric gray wares. Gray utility wares, also dominated by types produced during the Classic period, were differentiated by paste and textured treatments. *Smeared corrugated* refers to gray wares with partly obliterated coils on exterior surfaces. The corrugations on this type are shallower and more obliterated than they are on earlier corrugated types. This textured treatment generally covered the entire exterior surface of a vessel. Rio Grande gray wares that exhibit this type of treatment have been previously labeled Tesuque Smeared or Tesuque Gray (Habicht-Mauche 1993; Mera 1935). Surface color varies from dark gray, gray, or brown to tan. Pastes are usually gray or dark gray and turn yellow-red and red when refired in an oxidizing atmosphere. Tempers include various types of crushed granite and sand. This type is almost exclusively comprised of jars. Smeared corrugated was the last form of corrugated vessel treatment in the Northern Rio Grande and was most common at about A.D. 1350, remaining popular into the 1400s (Habicht-Mauche 1993; Lang 1997).

Sapawe Micaceous-Washboard was the dominant utility ware at many Classic period sites in the Northern Rio Grande and appears to be the dominant type at most of our sites. This type is

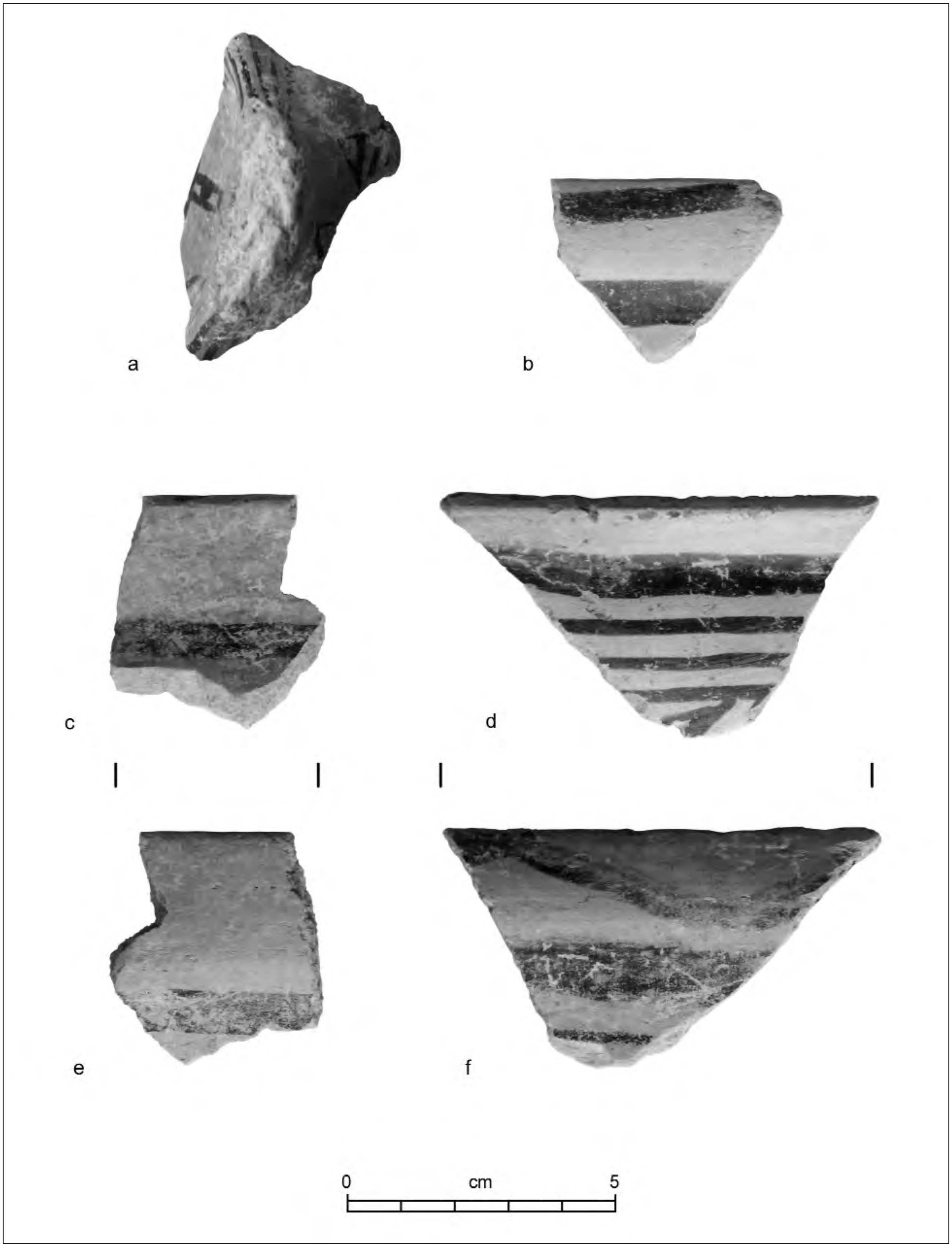


Figure 19.1. Biscuit B sherds from LA 66288: (a) effigy; (b) bowl sherd; (c, d) sherds from same bowl, interior; (e, f) exterior of c and d.

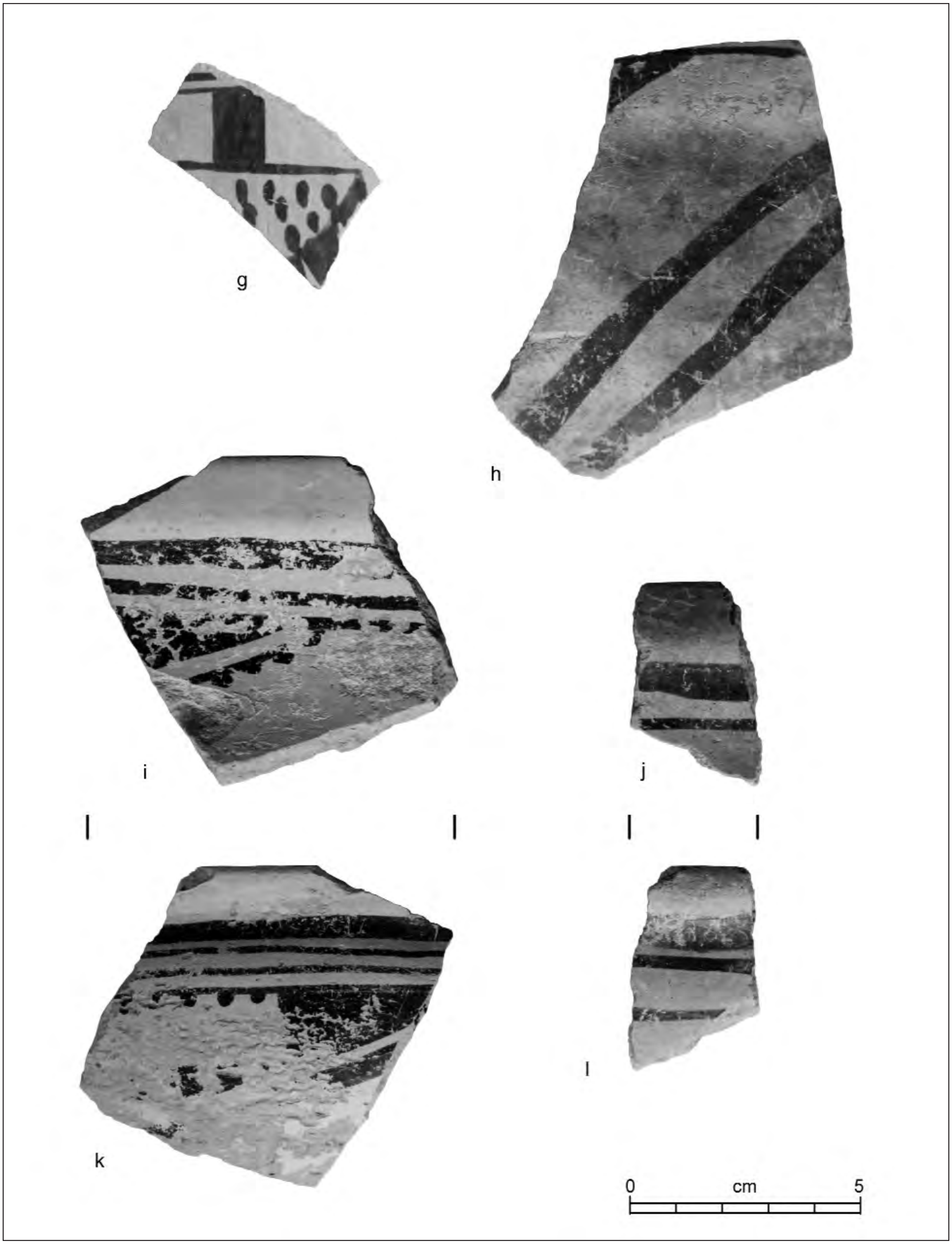


Figure 19.1 (continued): (g, h) sherds from same bowl; (i, j) sherds from the same bowl, interior; (k, l) exteriors of i and j.

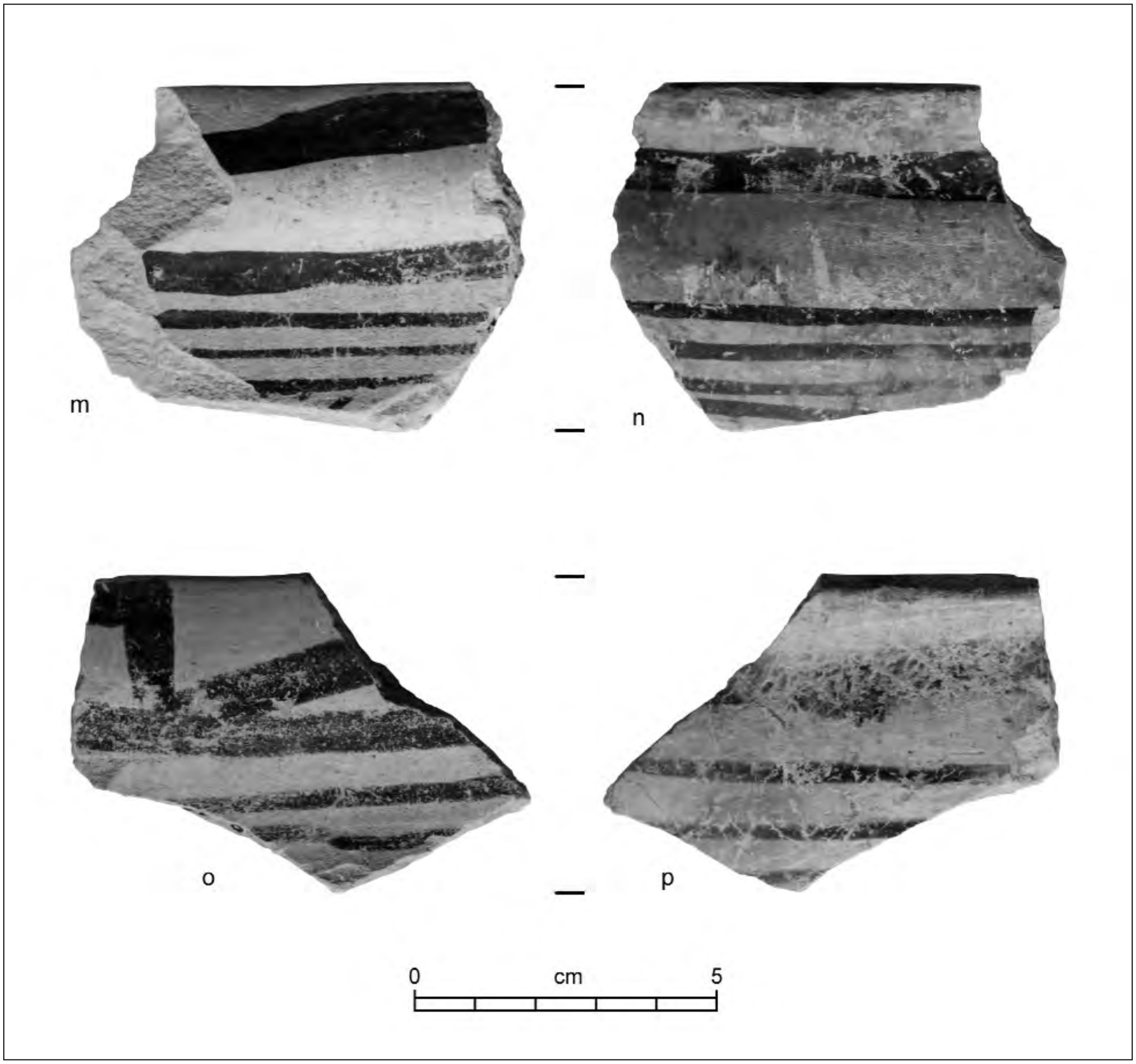


Figure 19.1 (continued): (m, n) interior and exterior of bowl sherd; (o, p) interior and exterior of bowl sherd.

characterized by a distinct exterior treatment (described below) and a very micaceous paste. Surfaces may be covered with a micaceous slip and are tan or dark brown to gray. Pastes are dark gray or black to dark brown, tend to be silty in appearance, and are often vitrified. Sherds of this type are nearly always from jars and tend to be hard, dense, and thin (Fig. 19.2). Sapawe Micaceous-Washboard is tempered with micaceous schist or granite that is most likely a natural constituent of the clay (Fallon and Wening 1987). Surface treatment consists of slightly obliterated coils, creating a series of parallel ridges without distinct junctures between coils. Sherds that exhibited pastes and tempers similar to those of Sapawe Micaceous-Washboard but with plain surfaces were categorized as micaceous utility undifferentiated. Plain gray ware sherds that were similar to Sapawe Micaceous-Washboard but lacked mica were categorized as Classic non-micaceous gray.

Potsuwi'i Incised is a type of utility ware that exhibits a combination of attributes seen in both Classic period Tewa white wares and Rio Grande utility wares (Mera 1932). This type is typified by jars with very smooth or polished exterior sur-

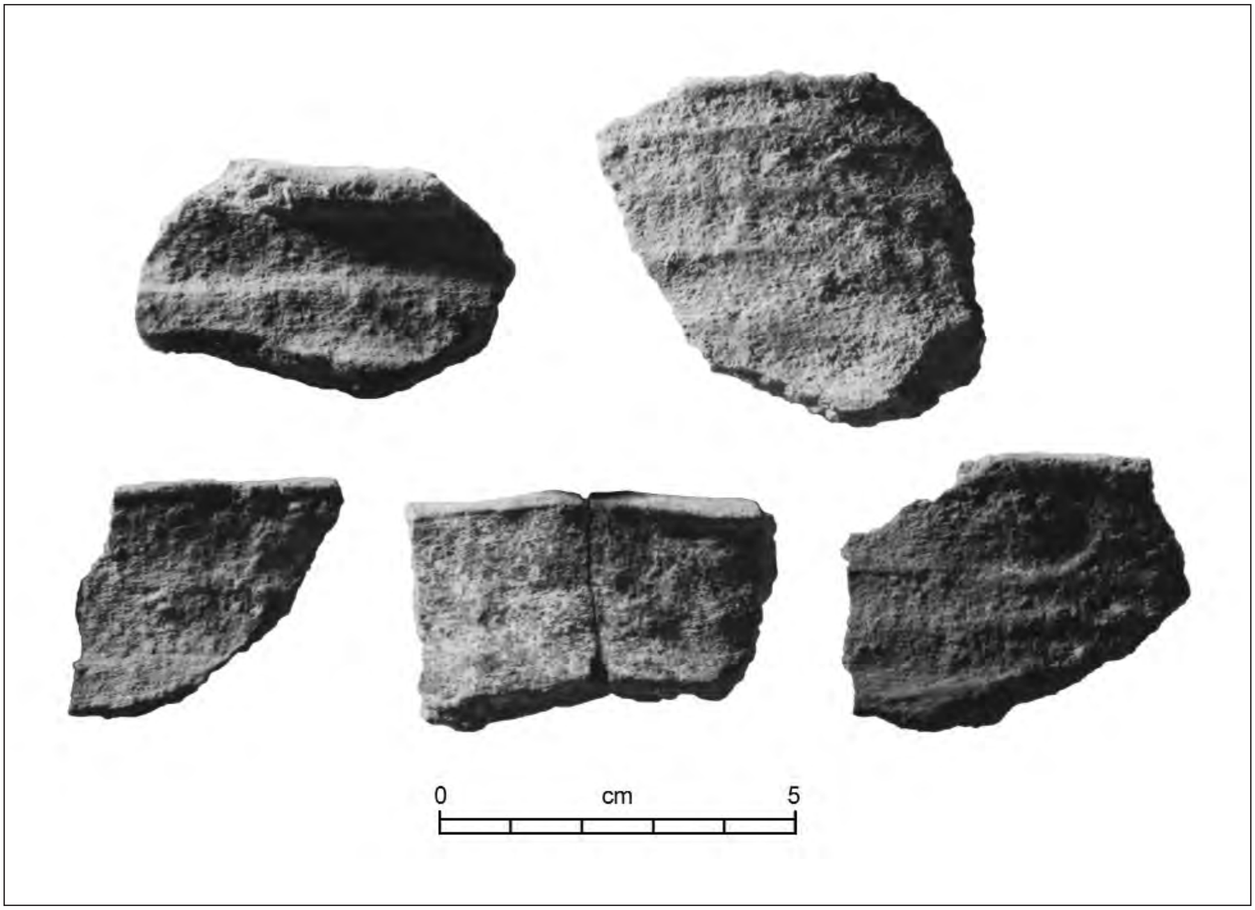


Figure 19.2. Sapawe Micaceous-Washboard jar sherds from LA 66288.

faces. Vessel walls tend to be thin, and exterior surfaces are sometimes covered with a thin micaceous slip and are dull and gray. Pastes are cream or tan and contain a fine tuff or ash temper similar to that used in biscuit wares. Decorations consist of fine incised lines. Designs are variable but often consist of combinations of parallel horizontal and vertical lines, sometimes with punctates.

Historic plain wares. The remaining utility wares are historic plainwares produced by the Northern Tewa, though similar types may have been made by Hispanic potters (Carrillo 1997; Dick 1968; Hurt and Dick 1946). Manufacture of these types began after the Spaniards settled in New Mexico and are common at Hispanic settlements dating to the eighteenth and nineteenth centuries (Batkin 1987). Sherds with unslipped surfaces that are fairly well polished and range in color from buff or tan to light orange were categorized as Tewa Buff undifferentiated. This type is tempered with a fine tuff that is common in historic plain wares.

Kapo or Tewa Polished Black refers to polished and smudged utility wares that were mostly produced by Tewa potters. This type is distinguished by a thick black soot deposited over a red slip that covers the entire vessel surface. The very high iron content of the red slip allows vessel surfaces to be highly polished, which is a characteristic of Kapo Black. Paste profiles are usually gray to brown, and cores are absent. Vessel surfaces that are not sooted are light gray to gray. These pastes refire yellow-red to red, and the slip refires to a dark red. Temper was very similar in all sherds of this type that were examined, consisting of a fine vitric tuff or pumice. Common vessel forms include jars with curved profiles, bowls, and flared bowls.

San Juan Red-on-tan utility ware vessels have a red slipped band just below their rims. Slip color ranges from red to dark brown, and unslipped surfaces are buff to tan. Surfaces tend to be highly polished. The temper is a fine tuff similar to that noted in other plain wares, with some mica particles visible through the surface. Flared bowls were the most common form in our assemblage.

Glaze wares. Glaze wares were produced over much of the middle Rio Grande region from about A.D. 1325 to the early 1700s (Franklin 1997; Kidder and Shepard 1936; Mera 1933). Only two glaze ware categories were used in this study. Most specimens were unpainted, red-slipped sherds that were clearly derived from glaze ware vessels and were categorized as unpainted red body glaze ware. The second type was defined by rim shape and consisted of two specimens of Largo Glaze Polychrome based on a fairly even rim profile that was slightly flattened toward the base of the rim (Fig. 19.3). Decorations were applied to a yellow slip and occur on both exterior and interior surfaces. Designs consisted of a combination of solid triangles and step triangles executed in red mineral paint and outlined in black glaze paint.

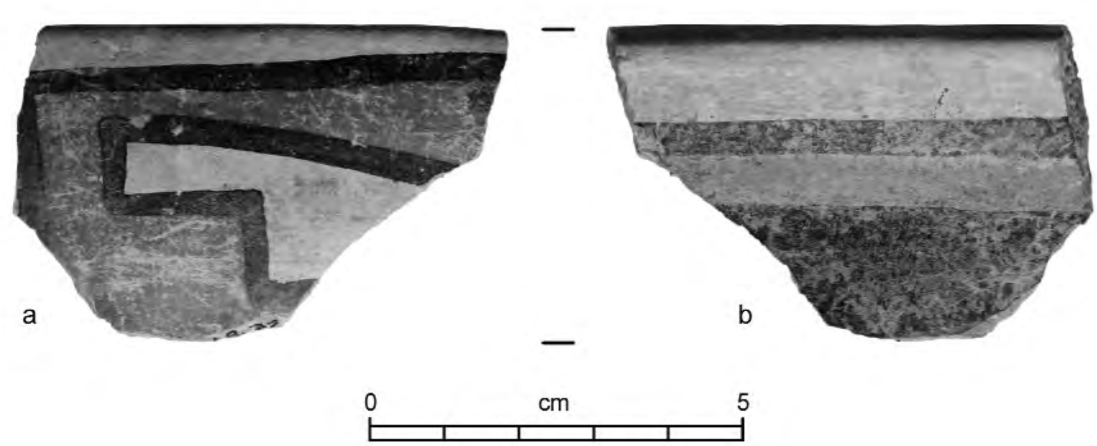


Figure 19.3. Largo Glaze Polychrome bowl sherds from LA 66288: (a) interior; (b) exterior.

Ceramic Trends

Information on the distribution of ceramic types and traits from six sites excavated during this study provide clues about period of occupation, cultural affiliation, patterns of vessel production and exchange, and the way in which pottery was used at different types of sites. Most of the pottery from these sites are types that commonly dominate Classic period assemblages in the Northern Rio Grande (Table 19.1). White ware assemblages from all six sites in this sample were dominated by Biscuit B, though Biscuit A is often present in much lower frequencies. Utility wares are dominated by highly micaceous types that appear to mostly represent Sapawe Micaceous-Washboard vessels, though a few sherds classified as Potsuwi'i Incised and Classic nonmicaceous gray also occur. Glaze ware types including Largo Glaze Polychrome were found at one site.

This combination of types is indicative of occupations dating to the later half of the Classic period. Dating schemes proposed for Biscuit B vary, but taken together they indicate a possible range beginning just after 1400 and lasting until about 1550 and possibly as late as 1600 (Breternitz 1966; Harlow 1973; Lang 1997; Orcutt 1999b; Smiley 1951; Wendorf 1953b). Similar pottery types and vessel forms occur at other Late Classic period sites in the Chama Valley (Fallon and Wening 1987; Hewett 1938; Jeançon 1923; Wendorf 1953b). Potsuwi'i Incised tends to be present in assemblages containing Biscuit B and Sapawe Micaceous-Washboard, but it is rare. The only other dated type in these assemblages is Largo Glaze Polychrome, which appears to date to the fifteenth century (Franklin 1997). Thus, most ceramic types identified in assemblages from these sites indicate occupations ca. A.D. 1450–1550.

The only ceramic evidence of another occupational period is the presence of a small number of historic sherds in an otherwise Classic period assemblage at LA 105710 (Table 19.1). This is not surprising since this site contained Classic period materials washing downslope from Hilltop Pueblo (LA 66288) as well as historic structures.

Ceramic-Related Trends

The ceramic assemblages from these sites contain gray wares and white wares that are typical of Late Classic period occupations through much of the Chama Valley and associated drainages (Fallon and Wening 1987; Hewitt 1938; Hibben 1937). Local production of these very distinct wares reflects the culmination of prehistoric Northern Rio Grande pottery manufacturing technology. Despite the very different combination of traits noted in sherds assigned to these wares, the various types included in each ware exhibit little variation in paste and stylistic characteristics. These intergroup similarities and intragroup differences ultimately reflect interrelated aspects of various conventions associated with the production and use of ceramic vessels, including perceived identity and affiliation, relationships and interaction between groups occupying different areas, and use of ceramic vessels in the overall economic system (Blinman 1988; Pool 1992). For example, as the way in which ceramic vessels were used in various tasks changed, it influenced the development of traditions and manufacturing techniques that were associated with the various wares. These developments may have influenced interaction and exchange between groups who shared complex technologies and decorative styles as well as the exchange of elaborate pottery forms that may have only been produced in one specific area. Thus, much of the remaining discussion will focus on variation between the different ware groups (Table 19.2).

Except for the three glaze ware sherds that appear to have been produced in areas south of Santa Fe, all decorated sherds in our sample seem to be fragments of biscuit ware vessels. While the production of biscuit wares represents a continuation of the use of self-tempered volcanic clays that began during the Late Developmental and Coalition periods, more specific and distinct types of clays were selected for the production of biscuit wares. These clays tended to be very porous, contained extremely fine ash inclusions (Table 19.3), and could be successfully fired at lower temperatures than were possible for earlier pottery types. This combination of porosity and lower firing temperatures allowed decorations executed in organic paint to be retained, even in slightly oxidizing atmospheres. The dominance of decorated bowls in this type suggests that the manufacture of biscuit wares focused on the production of vessels that could be used for serving and consumption.

As part of this study, clays were collected from a probable prehistoric clay mine excavated into a weathered ash flow south of Posi'ouinge, just a few kilometers from many of the sites examined during this project. Types of inclu-

Table 19.3. White ware temper types by site (count and column percentage)

Temper Type	LA 66288	LA 105703	LA 105708	LA 105709	LA 105710	LA 118547	Total
Highly micaceous paste	-	-	4	-	-	-	4
	-	-	3.1%	-	-	-	0.3%
Tuff/ash	2	-	1	-	5	-	8
	0.3%	-	0.8%	-	1.2%	-	0.6%
Fine tuff and sand	673	44	126	34	411	11	1299
	99.6%	100.0%	96.2%	100.0%	98.8%	100.0%	99.0%
Ash (vitric tuff)	1	-	-	-	-	-	1
	0.1%	-	-	-	-	-	0.1%
Total	676	44	131	34	416	11	1312

sions, color when refired, and overall appearance of the clay all appear to be identical to those used in biscuit wares. Like the biscuit ware clays, this material is extremely porous and fires to similar pink colors. Inclusions consist of fine tuff with sand identical to the temper seen in the biscuit wares from our sites (Table 19.3) and the surrounding area. Most biscuit ware sherds from our sites were fragments of thick bowls, though some jars are also represented (Table 19.4). Most of these sherds are thick and exhibit surface treatments and decorative styles characteristic of Biscuit B. The similarity of the clay from the probable mine to the sherds in our study suggest that the late biscuit wares (at least) were manufactured from specific clays occurring in weathered ash deposits.

The vast majority of the utility wares examined during this study also seem to reflect the use of very specific resources and manufacturing techniques. The earliest gray wares produced in the Tewa Basin and adjacent parts of the Northern Rio Grande were tempered with micaceous granite (Anderson 1999; McNutt 1969; Warren 1979). This basic technology continued into the Classic period, when the gray wares reflect use of highly micaceous alluvial clays and crushed granite temper, which is the dominant temper in the gray wares recovered from our sites (Table 19.5). By the Classic period, Northern Rio Grande micaceous wares were dominated by distinct types like Sapawe Micaceous-Washboard. The paste of this type tends to contain more mica than earlier gray wares, fires to the same range of red to yellow as micaceous alluvial clays collected along the Rio Chama and Rio Grande, and has a similar texture. Thus, those deposits appear to be the source of clays used to make gray utility wares in this region. Low-relief surface textures were created by smearing the coils. Vessel walls are usually very thin, and most sherds of this type identified in our study are from jars (Table 19.6). Mica inclusions in the temper may have increased the durability of vessels for cooking. These utility wares reflect a focus on the production of cooking and storage vessels.

Thus, different techniques were used to manufacture the white wares and gray utility wares from our sites. Each was made from a different type of clay, and each was tempered with different materials. Self-tempering clays forming in

Table 19.4. White ware vessel form by site (count and column percentage)

Vessel Form	LA 66288	LA 105703	LA 105708	LA 105709	LA 105710	LA 118547	Total
Indeterminate	16	9	-	-	1	-	26
	2.4%	20.5%	-	-	0.2%	-	2.0%
Bowl rim	13	-	-	-	2	-	15
	1.9%	-	-	-	0.5%	-	1.1%
Bowl body	568	29	131	28	385	11	1152
	84.0%	65.9%	100.0%	82.4%	92.5%	100.0%	87.8%
Seed jar	2	-	-	-	-	-	2
	0.3%	-	-	-	-	-	0.2%
Jar neck	1	-	-	-	-	-	1
	0.1%	-	-	-	-	-	0.1%
Jar rim	-	-	-	-	2	-	2
	-	-	-	-	0.5%	-	0.2%
Jar body	29	5	-	-	12	-	46
	4.3%	11.4%	-	-	2.9%	-	3.5%
Dipper with handle	-	-	-	-	1	-	1
	-	-	-	-	0.2%	-	0.1%
Curved pipe	1	-	-	-	-	-	1
	0.1%	-	-	-	-	-	0.1%
Flared bowl rim	46	1	-	6	13	-	66
	6.8%	2.3%	-	17.6%	3.1%	-	5.0%
Total	676	44	131	34	416	11	1312
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 19.5. Gray ware temper type by site (count and column percentage)

Temper Type	LA 66288	LA 105703	LA 105708	LA 105709	LA 105710	Total
Sand	-	-	7	-	8	15
	-	-	14.0%	-	1.5%	0.9%
Granite and mica	2	-	-	-	3	5
	0.2%	-	-	-	0.6%	0.3%
Granite	9	-	-	-	-	9
	0.8%	-	-	-	-	0.5%
Highly micaceous paste	1167	3	43	1	507	1721
	98.5%	100.0%	86.0%	100.0%	97.9%	98.0%
Sherd	3	-	-	-	-	3
	0.3%	-	-	-	-	0.2%
Fine tuff and sand	3	-	-	-	-	3
	0.3%	-	-	-	-	0.2%
Dark sand	1	-	-	-	-	1
	0.1%	-	-	-	-	0.1%
Total	1185	3	50	1	518	1757
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 19.6. Gray ware vessel form by site (count and column percentage)

Vessel Form	LA 66288	LA 105703	LA 105708	LA 105709	LA 105710	Totals
Indeterminate	23	-	-	-	-	23
	1.9%	-	-	-	-	1.3%
Bowl body	6	-	-	-	-	6
	0.5%	-	-	-	-	0.3%
Jar neck	100	-	1	-	32	133
	8.4%	-	2.0%	-	6.2%	7.6%
Jar rim	17	-	-	-	8	25
	1.4%	-	-	-	1.5%	1.4%
Jar body	1039	3	49	1	478	1570
	87.7%	100.0%	98.0%	100.0%	92.3%	89.4%
Totals	1185	3	50	1	518	1757
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

weathered volcanic ash were used for the manufacture of white wares, while micaceous alluvial clays with added granitic temper were used for the gray wares. Both surfaces of white ware vessels were smoothed and often polished. Slips were applied to one or more of the smoothed surfaces, and decorative motifs were created using an organic paint. In contrast, only the inner surface of gray ware vessels was completely smoothed, and the outer surface was textured by partly obliterating the coils.

These distinct manufacturing techniques are indicative of the range of pottery that was required in daily activities: vessels for cooking and storage, as well as those for serving and consumption. Both clay types were probably widely available to potters in the Gavilan area and elsewhere in the Northern Rio Grande. Though both wares seem to have been manufactured in the same area, given the specialized nature of the manufacturing techniques associated with them, it is possible that the different wares were made by potters from different households or villages. The only pottery recovered from our sites that was clearly not produced in the Gavilan area were the glaze wares, which reflect limited exchange with groups to the south.

Though the consistent occurrence of similar pottery types at our sites indicates that they date to the same occupational period, the proportions of assemblages comprised of the different ware groups varied significantly. Given the small size of the area excavated at the two habitation sites, the number of sherds recovered from each was fairly large: 1,864 sherds were recovered LA 66288 and 940 from LA 105710. Most of the pottery from these sites consisted of sherds from gray ware jars, which comprised 63.6 percent of the LA 66288 assemblage and 55.1 percent of the LA 105710 assemblage. Very different distributions were noted for the four farming sites from which pottery was recovered. Biscuit wares comprised 93.6 percent of the sherds recovered from LA 105703, 72.4 percent of the LA 105708 assemblage, 97.1 percent of the sherds from LA 105709, and 100 percent of the small assemblage from LA 118547. Similar trends were noted at other farming sites in the Northern Rio Grande, which are also dominated by biscuit wares (Mensel in prep.; Wilson in prep.).

These proportional differences suggest that pottery was used differently on different types of sites. The dominance of gray ware cooking jars combined with a high percentage of biscuit wares (of various vessel forms) indicates that pottery was used in a wide range of activities at habitation sites. In contrast, the dominance of biscuit ware bowl sherds at farming sites was initially difficult to explain, since there seemed to be no good reason why bowls were more desirable than other forms.

A cache of three ceramic tools made from fragments of a single Biscuit B bowl provided important clues concerning the use of pottery at the farming sites (Fig. 19.4). These items were found together under a small boulder in a gravel-mulched field at LA 105709. The largest measured about 20 by 12 cm and had fairly straight edges, one of which was an unworked rim. This tool was somewhat rectangular, though one end was wider. Sharp angles between modified edges formed points that could have been used for digging. The second tool measured 13 by 11 cm, had curved edges, and was roughly oval in shape. At least one edge exhibited wear from heavy use that included spalling on the exterior surface. The third tool was rectangular in shape and measured 14 by 9 cm. Each edge was fairly straight and exhibited heavy wear from use, including one that was originally a rim. Evidence of heavy use was not only indicated by wear along edges, there was also spalling on the interior surface and breakage along the most heavily used sections of the tool.

These tools were probably used as scoops or shovels in gravel-mulched fields. A review of photographs and descriptions of biscuit ware sherds from similar sites in the region indicates that this type of usage may have been widespread (Lang 1997). There were probably several reasons that biscuit wares were selected for this use rather than utility wares. Utility wares were not well suited to this use because they were comparatively thin, brittle, and easy to break. In contrast, though biscuit wares are usually soft, they were thicker and less brittle, and therefore less likely to fracture while being used for scooping or shoveling. While some biscuit ware sherds recovered from other contexts were shaped, many were not. The former probably represent sections of ceramic scoops/shovels, while the latter may be parts of broken tools that do not include sections of edges or were not used extensively enough to cause distinct shaping or wear.

Conclusions

Variation in the makeup of ceramic assemblages from Late Classic period sites in the Ojo Caliente Valley indicates that pottery was used in different activities at habitation versus farming sites. Ceramic vessels were used in a variety of tasks at habitation sites that included cooking, storage, serving, and consumption. This balance of activities usually resulted in assemblages that were dominated by utility ware jars and contained a significantly lower percentage of decorated biscuit ware bowls. In contrast, the small ceramic assemblages recovered from features on farming sites are dominated by sherds from biscuit ware bowls. The recovery of three ceramic scoops or shovels from a cache in a field at LA 105709 provided a possible explanation for this discrepancy. The greater durability of biscuit ware sherds apparently made them more suitable for this type of use, leading to their dominance on fields in comparison to the utility wares.

Figure 19.4. Ceramic tools recovered from a cache at LA 105709.

Chapter 20. Faunal Remains

Susan M. Moga

Faunal remains were collected from three of the eight sites excavated at Gavilan. Only one piece of bone was recovered from a prehistoric farming site (LA 118547) dating to the Classic period. Some bone from Hilltop Pueblo (LA 66288), which dates to the same time period, probably washed down a hilltop into the north end of LA 105710, creating a multicomponent site. Only a moderate amount of bone was recovered from these two sites: 21 pieces from LA 66288, and 93 from LA 105710.

Analysis Methods

A complete analysis was performed on the 115 bones recovered from the Gavilan sites. Every bone from a provenience was assigned a field specimen number in the field and an additional lot number during analysis for individual identification. Faunal information was recorded using an established coding format that records the taxon; count; age of the animal; element (body part); side; portion of the bone represented; environmental, animal, thermal alteration; and potential processing and modification information.

When bones are extremely fragmented, bone can only be distinguished as indeterminate taxa and portions of long bones, flat bones, or undetermined elements. Long-bone fragments include all tubular bones (e.g., tibia, femur, humerus), as well as metatarsals, ribs, and phalanges. Flat bone fragments are from the cranium, sternum, vertebrae, innominate, carpals, tarsals, and scapula. Some elements fragment in such a way that it is difficult to determine whether they come from long or flat bones. These are classified as indeterminate elements.

Specimens are aged according to size, compact tissue porosity, and epiphyseal union. The age range choices include: newborn or fetal-neonate, where the element is less than one-third mature size, unfused, and extremely porous; immature, where bones are less than two-thirds mature size, somewhat porous, and unfused; juvenile, where bones are two-thirds to mature size and the epiphysis is partially attached to the shaft or completely separated; and mature, where elements are full size and completely fused.

Animal, environmental, and thermal conditions affect bone. These alterations are individually outlined in the taphonomy section of this chapter. Evidence of human processing and modification of the bone are also discussed later in the text. Faunal identifications were made using the Office of Archaeological Studies comparative collections. Works on New Mexico fauna (Bailey 197l; Findley et al. 1975) were consulted to determine which wild species inhabited the site area.

Taxa Recovered

Unidentifiable mammal remains dominate the faunal assemblage, with few domesticated and wild animals (Table 20.1). Frequencies and descriptions are provided for each taxon represented. In this analysis, the MNI (minimum number of individuals) is the estimated number of animals from an identified taxon in the assemblage.

Unidentified Taxa

Most of the bones recovered from these sites are highly fragmented and could only be categorized by size of the animal (Table 20.1). The categories of unidentified taxa found include small mammal (n = 1), small to medium mammal (n = 1), medium to large mammal (n = 19), and large mammal (n = 27). A single very large mammal bone came from the vicinity of the historic structure, and it could be cow, horse, elk, or bison.

Canis sp. (Dog, Coyote, Wolf)

A fragmented humerus and lumbar vertebrae from a mature canid was recovered from LA

Table 20.1. Faunal bone by site (count and column percentage)

Taxon	Common Name	LA 66288	LA 105710	LA 118547
Small mammal	Rodent to jackrabbit size	1	-	-
		4.8%	-	-
Small-medium mammal	Rodent to dog size	-	1	-
		-	1.1%	-
Medium-large mammal	Dog to deer size	5	14	-
		23.8%	15.1%	-
Large mammal	Sheep to deer size	7	20	-
		33.3%	21.5%	-
Very large mammal	Cow, horse, elk size	-	1	-
		-	1.1%	-
Canis sp.	Dog, coyote, wolf	-	2	-
		-	2.2%	-
Canis latrans	Coyote	-	1	-
		-	1.1%	-
Small to medium artiodactyl	Sheep to deer size	-	10	-
		-	10.8%	-
Medium artiodactyl	Deer, pronghorn, bighorn sheep	6	17	-
		28.6%	18.3%	-
Large artiodactyl	Cow, horse, elk, bison	-	1	-
		-	1.1%	-
Cervidae	Deer or elk	-	1	-
		-	1.1%	-
Odocoileus hemionus	Mule deer	-	3	-
		-	3.2%	-
Antilocapra americana	Pronghorn	1	-	-
		4.8%	-	-
Bos taurus	Cattle	-	3	-
		-	3.2%	-
Ovis / Capra	Domestic sheep or goat	-	1	-
		-	1.1%	-
Equus caballus	Horse	-	1	-
		-	1.1%	-
Medium-large bird	Quail to turkey size	-	2	-
		-	2.2%	-
Very large bird	Turkey or larger	1	-	-
		4.8%	-	-
Buteo cf. *jamaicensis*	Red-tailed hawk	-	-	1
		-	-	100.0%
Gallus gallus	Domestic chicken	-	1	-
		-	1.1%	-
Eggshell	Bird eggshell	-	14	-
		-	15.1%	-
Total		21	93	1

105710. The specimens are similar in size and attributes to both dog and coyote. Both pieces exhibit soil pitting, and the humerus has a spiral fracture.

***Canis latrans* (Coyote)**

Coyotes inhabit all regions of New Mexico and occupy dens dug into the ground (Findley et al. l975:281–282). A root-etched but complete second metacarpal from a mature individual was recovered from LA 105710.

Small to Medium Artiodactyl

Indeterminate bone fragments that resemble animals ranging in size from sheep to deer are included in this category. These fragments (n = 10) are from mature individuals and could be from wild or domesticated animals, since both are present in the prehistoric and historic components at LA 105710. Two of the bone fragments are calcined (burned white).

Medium Artiodactyl

Medium artiodactyl fragments were recovered from LA 66288 (n = 6) and LA 105710 (n = 17). Artiodactyls in this size range include deer, pronghorn, bighorn sheep, as well as large varieties of domestic sheep, goat, and pig. The LA 66288 assemblage includes fragments (n = 6) of long and flat bones, a rib, and a phalanx, all from mature artiodactyls. All of these bones are weathered, pitted, or exfoliated. The bone fragments from LA 105710 are also from mature artiodactyls and include long and flat bones and fragments of a tooth, a mandible, vertebrae, a rib, and an astragalus. One bone is rodent gnawed and another is scatological. Thirteen bones are environmentally altered, either through pitting, exfoliation, or root etching. A spiral fracture was noted on a long-bone fragment.

Large Artiodactyl

Large artiodactyls include elk, cattle, bison, and horse-sized animals. A fragmented rib from a mature individual was the only specimen in this size range recovered from LA 105710. It came from either a wild or domesticated artiodactyl. Abrasion from scraping or butchering is visible on a portion of the rib.

***Cervidae* (Deer or Elk)**

An antler fragment from a deer or elk was assigned to the Cervidae category. This single specimen from a mature individual was heavily exfoliated and was found in a trench at LA 105710. Both species inhabit the area, so it could belong to either animal. The antler could have been brought to the site as residue from a hunting excursion or as a manuport.

***Odocoileus hemionus* (Mule Deer)**

Mule deer range throughout most of New Mexico, except for the eastern grasslands (Findley et al. 1975:328). Portions of a mature mule deer were recovered from LA 105710, including fragments of a mandible (n = 2) and a tibia.

***Antilocapra americana* (Pronghorn)**

Pronghorns inhabit arid and semiarid grasslands throughout New Mexico (Findley et al. 1975:333–334). Half of a calcaneum from a mature individual was found at LA 66288.

***Bos taurus* (Cattle)**

The Spaniards brought cattle into New Mexico in 1598, but it took almost 200 years to get them established. It was not until 1880, when the railroad was built through New Mexico, that cattle began to be shipped from Texas to the remote areas of New Mexico. This new industry soon became very lucrative, causing the value of sheep to rapidly decline (Carlson l969:26, 35). A few fragmented cow bones (n = 3) were recovered from LA 105710. Elements include two pieces of a mandible and a portion of a metacarpal, all of which exhibit exfoliation and pitting.

***Ovis/Capra* (Domestic Sheep or Goat)**

New Mexican missions were provided with sheep, which were used for meat and wool. In turn, the missionaries taught the practice of sheep husbandry to the Pueblo Indians (Carlson l969:26). The vast rangelands of New Mexico were eventually exploited by the sheep industry as the demand for meat dramatically increased in the West. The California gold rush drew men by the thousands to work in the mines. They needed to be fed, so the production of mutton became a lucrative business for New Mexican ranchers (Carlson 1969:28). Starting in 1849, flocks of up to 25,000 sheep were driven to California from New Mexican ranches. By 1860 the sheep trade completely subsided because of hostilities and raiding by the Navajos and Apaches. The hostilities ceased by 1880, and the sheep population in New Mexico increased to approximately four million (Carlson 1969:28, 31, 34).

Goats, which were also introduced into New Mexico by the Spaniards, are heartier than sheep and can survive on diverse terrain with minimal supervision. Goat by-products such as milk, cheese, butter, and meat were additional assets to Spanish households (Scurlock 1998:8–11). Male goats were used as "point goats" or leaders of sheep flocks, because they were more dependable than rams and vocalize warnings when intruders approach. A single black goat, called a *marcadero* (marker) was stationed among every 100 sheep to help herders keep track of their flocks (Scurlock 1998:9–10).

By the early 1900s sheep and goats had severely overgrazed the rangelands of New Mexico and Arizona. Much of this land was eventually designated as national forest by the United States government. Residents living near national forest land were asked to replace their flocks with cattle. Permitting of animals on national forest land continued for another 50 years before it was discontinued in 1972 because of extreme environmental damage (Scurlock 1998:17.19). Sheep and goat bones are difficult to distinguish osteologically, so with the exception of a few elements, they are usually categorized as sheep or goat (Bossneck l970:331). Only one element, a scaphoid from a mature sheep or goat, was recovered from LA 105710.

Equus caballus (Horse)

A horse herd of approximately 1,350 head was introduced into New Mexico by Oñate during his l598 expedition. It is believed that Old World livestock did not occur in New Mexico before his arrival (Baxter l993:101–103). A complete vestigial metapodial from a mature horse, which displays pitting, was found at LA 105710.

Medium to Large Bird

Highly fragmented pieces of bird bone (n = 2) from LA 105710 could belong to a medium or large bird. Considering the prehistoric/historic components at the site, they could be wild bird, chicken, or a small turkey. The bones are from a mature individual. One bone is exfoliated and the other is root-etched.

Very Large Bird

A fragment of a femur from a bird that is turkey-sized or larger was recovered from LA 66288. This fragment is from a mature individual and displays root etching.

Buteo cf. jamaicensis (Red-tailed Hawk)

Red-tailed hawks are the most widely distributed of the *Buteo* hawks in New Mexico. They prey on rodents, squirrels, and rabbits (Lignon l96l:64). A talon from a large hawk, probably a red-tailed, was recovered from a gravel-mulched field at LA 118547. It is from a mature bird and is heavily sun-bleached.

Gallus gallus (Domestic Chicken)

Chickens are domesticated fowl that have descended from the wild jungle fowl of Asia (Hargrave l972:16). Juan de Oñate probably brought chickens along with other domesticated animals during his settlement of New Mexico in 1598. A complete chicken femur was recovered from the prehistoric/historic component at LA l05710. It is from a mature individual, and is slightly root-etched.

Eggshell

Fragments of eggshell (n = 14) were recovered from LA 105710. There is no way to determine whether they came from one egg or several. Because a chicken femur was found at the site, the eggshell is probably chicken.

Taphonomy

The natural processes that affect the condition of bone are collectively referred to as taphonomic processes (Lyman l994:1). These processes can be environmental, animal, or thermal. Each process affects a percentage of the bone in this assemblage.

Environmental Alteration

Environmental variables recorded in this assemblage include pitting, sun-bleaching, exfoliation, and root etching (Table 20.2). A good portion (n = 51, or 44.3 percent) of the faunal assemblage displays pitting, which is caused by soil erosion affecting the exterior surface of the bone. Exposure to sun causes bone to dehydrate, splinter, and turn white. The claw from a red-tailed hawk found at LA 118547 is sun-bleached. A good number (n = 18, or 15.6 percent) of bones are exfoliated, the external compact tissue has fine cracked lines, and the tissue flakes away from the bone. Root etching was observed on 12 bones (10.4 percent). Plant roots excrete humic acid, and when they come in contact with bone, the bone dissolves. (Lyman 1994:375).

Animal Alteration

Types of alteration by animals recorded in the assemblage include scatological bone, tooth puncture marks, and gnawing by rodents and carnivores. These alterations only occur on bone from LA 105710. These specimens were recovered from the trash-filled store and lower levels of several excavated grids. Fauna from LA 66288 and LA 118547 had no animal alterations.

Table 20.2. Environmentally altered faunal bone (count)

Taxon	Pitted or Corroded	Checked or Exfoliated	Root-etched	Sun-bleached
LA 66288				
Small mammal	1	-	-	-
Medium-large mammal	4	-	-	-
Large mammal	6	1	-	-
Medium artiodactyl	5	1	-	-
Pronghorn	1	-	-	-
Very large bird	-	-	1	-
LA 105710				
Small-medium mammal	-	-	1	-
Medium-large mammal	6	2	1	
Large mammal	14	2	-	-
Very large mammal	1	-	-	-
Dog, coyote, wolf	2	-	-	-
Coyote	-	-	1	-
Small-medium artiodactyl	1	4	-	-
Medium artiodactyl	5	3	5	-
Large artiodactyl	-	-	1	-
Deer or elk	-	1	-	-
Mule deer	2	1	-	-
Cow	1	2	-	-
Domestic sheep or goat	1	-	-	-
Horse	1	-	-	-
Medium-large bird	-	1	1	-
Domestic chicken	-	-	1	-
LA 118547				
Red-tailed hawk	-	-	-	1
Total	51	18	12	1

Scatological bones have passed through the digestive tract of an animal. In this alteration, stomach acids produce a thinning of the bone table and smoothing of edges. Two fragments of long bones from a large mammal and a medium to large mammal, and an astragalus and a second phalanx from a medium artiodactyl were recorded as scatological. Two indeterminate fragments from a medium to large mammal may also be scatological.

Puncture marks are usually made by carnivores and are often found on the ends of bones. Carnivores start gnawing on the soft cancellous parts of bone, then on the shaft (Binford 1981:46). Only one puncture mark was visible on the end of a very large mammal long-bone fragment.

Short parallel grooves are incised on rodent-gnawed bone, and their dimensions will vary according to the size of the rodent (Fisher l995:40). Rodent gnawing was observed on one medium artiodactyl rib fragment.

Thermal Alteration

Calcined bone becomes white and has a chalky consistency when all the organic material in the bone is depleted (Lyman 1994:384–385). Four bones (3.5 percent) in the assemblage were affected by thermal activity. Individually excavated grids at LA 105710 contained two small to medium artiodactyl bones that were thermally altered, one flat and one long bone. Two medium to large mammal bones, one flat and one long, were calcined after being exposed to a high and continuous heat.

Processing

Evidence of human processing is rather limited, but it may have been obscured by the environmental conditions that affected almost half of the assemblage. The few occurrences of processing came from LA 66288 and LA 105710. Transverse cuts (n = 1) and chop marks (n = 2) are visible on a few medium to large animal bones and probably resulted from dismembering carcasses. Spiral fractures (n = 5) are visible on bones from a medium to large mammal, a dog or coyote, a medium artiodactyl, and a very large bird. They can be intentional or result from unintentional human or animal trampling (Marshall 1989:19). Abrasion in the form of irregular scratch marks was apparent on one large artiodactyl rib.

Modification

A minute portion of a very large bird femur from LA 66288 exhibits modification. This bone has a spiral fracture as well as intentional cuts and grooves. Because it is so highly fragmented, it can only be classified as manufacturing debris or a small tool fragment, not as a specific tool.

Discussion

The original research design divides the Gavilan sites into two groups: habitation sites (prehistoric and historic) and prehistoric agricultural sites (Wiseman and Ware l996:51). A historic store and the surrounding area at LA 105710 produced a variety of wild and domesticated animal remains, including dog or coyote, sheep or goat, cow, horse, and deer or elk. A number of eggshell fragments and bones from a chicken and a medium to large bird were recovered. Almost half of the fauna recovered from this site (n = 42, or 39.0 percent) came from the store, which was apparently used for trash disposal after abandonment. Refuse from Hilltop Pueblo (LA66228) washed down into the north end of LA105710, creating a multicomponent situation.

Some faunal remains were recovered from three test pits excavated at LA 105710, near the base of Hilltop Pueblo. The number of bones recovered was small (n = 21) but included a variety of species: unidentifiable small, medium, and large mammal, medium artiodactyl (deer, pronghorn, or bighorn sheep), pronghorn, and very large bird (turkey size or larger). These specimens were probably all of prehistoric derivation.

Nine prehistoric agricultural sites were examined during this project, but only LA 118547 produced bone: a talon from a large hawk, probably a red-tailed hawk, was recovered from Feature 15. The talon could have been left in the field by a human or carnivore and exposed long enough to become sun-bleached.

Too few faunal remains were recovered from these sites to allow us to determine any distinct patterns of procurement or consumption. Only eight bones display evidence of processing (chop or cut marks). Several fragments have spiral fractures, but it is difficult to determine whether they were intentional or occurred from natural processes. Trampling by cattle could also cause spiral fractures on exposed bones. Thus, butchering practices could not be defined.

Contemporary archaeological investigations in northwestern New Mexico have focused primarily on Abiquiu and El Rito. Less attention has been paid to the Ojo Caliente Valley (Wiseman and Ware l996:60). Faunal samples recovered from many of the sites excavated in these areas are minimal, with the exception of the historic Trujillo House (LA 59658) near Abiquiu. The large amount of bone (n = 18,043) from this site came from domestic species (91.8 percent). The species identified were comparable to those found in our assemblage: cattle, sheep or goat, horse, pig, chicken, and medium to large bird. Pig is the only domestic animal from this array that is missing from the Gavilan assemblage (109 pig bones were collected from the Trujillo House). Nondomestic species (8.2 percent) from the Trujillo House include deer, elk, squirrel, and rodents. The rodents (n = 200) were most likely postoccupational intruders or human commensals (Moore and Boyer 2004).

Testing at San Juan Pueblo (LA 59 and LA 60) in the early l990s produced only 15 pieces of animal bone from two test pits. All but fourteen specimens were identified as large mammal, and one was believed to be cattle, bison, or horse. All bones exhibit some degree of weathering (Lent and Goodman 1992:61).

When large enough and representative, faunal assemblages can reveal valuable dietary and butchering information regarding site inhabitants. The García store at Gavilan was in business for only a few years. Since the family resided across the road, it is unlikely that the bone recovered is a representative sample of their animal use, especially because debris from Hillside Pueblo contributed to the sample.

Chapter 21. Analysis of Euroamerican Artifacts from LA 105710

Natasha Williamson

The OAS uses a function-based analysis (Boyer et al. 1994), which we believe to be more flexible and more informative than other analytic approaches, such as those based on material types or simple inventories and date ranges. Each artifact was assigned to a functional category, and each category was subdivided into a series of types, each containing items of related, though often quite different, functions. Within each type, specific functions were assigned. This created a hierarchical framework, linking items at specific, general, and very general levels of relationship.

The function-based approach allowed comparisons between sites, which facilitated studies of ethnicity and site function. However, the analytic framework has evolved over the years and recently underwent a fairly extensive modification. This is the first analysis undertaken with the new system, which had as one of its goals a reduction in the percentage of artifacts included in the unassignable category. The major differences are found in the definition of activities included in the economy/production category; a recasting of the furnishings category to include heating, cooking, and fuel-related artifacts as a new type; the description of ceramic ware decoration; and the inclusion of activities and artifacts not previously considered historic but which are becoming so, such as entertainment systems. Nor did we formerly have any way to categorize artifacts usually considered prehistoric but which sometimes occur on historic sites as well, such as chipped stone implements or glass chipped for use as tools. This lack has been rectified, and an entirely new category was created for communication devices.

Certain economic activities important in New Mexico history had also been invisible because the associated artifacts were left unclassified. Thus, wool production, pottery and jewelry making, and the above-mentioned chipped stone technology were added to the economy/production category. Another oddity of the former system was that all artifacts related to horses, oxen, and mules were assigned to the economy/production category, at the expense of recognizing their specific function in transportation. Therefore, an animal power type was added to the transportation category. This allowed a distinction to be made between stock supplies and animal husbandry tools (which were left in the economy/production category) and harness and shoes (which allowed the animal to do its job and belonged in the transportation category).

Another aim of the reorganization was to eliminate certain logical absurdities, which will creep into any analytic system. For instance, coal was previously placed in the unassignable category because there was no other place to put it. Yet coal in an archaeological context has only one function, fuel for heating and/or cooking. This led to the creation of a new type—heating, cooking, and lighting—which now contains coal and other materials related to this function. In the former version, arms and ammunition were included in the economy/production category because they were used for hunting, which produced the absurdity of a cannonball's being considered a means of economic production. Nor was there a way to categorize other military equipment, which usually ended up in the personal effects category if it came off the man, or the economy and production category if it came off the horse. Yet New Mexico has a long military history that was essentially invisible under the previous system. Therefore, arms and ammunition were removed from the economy/production category and combined with explosives and military accouterments to make a new category—arms, explosives, and military.

It is hoped that the new system more accurately reflects the range of human activity, but of course it complicates the comparison of sites analyzed under the different systems. The present site, LA 105710, is unusual in that one component was a small commercial establishment, the García store. The following discussion focuses on the García store rather than the site as a whole. Since such a site has never before been analyzed under this system, comparisons are not a concern.

METHODOLOGY

Minimal processing was performed on historic artifacts prior to analysis. Dry brushing with toothbrushes to remove most of the adhering soil was the usual method of cleaning. Glass was occasionally rinsed in water. When necessary, metal artifacts were rinsed in clear water and sometimes scraped gently with a dental pick to remove any encrustations. If warranted, usually to examine lettering, metal objects were immersed in a mild Sparex solution to remove severe corrosion.

Some 25 variables were monitored during analysis, including material type, manufacturer and brand, size, evidence of aging, color, condition or modification, shape, reuse, decorative techniques and design styles, reconstructability, etc. In the case of ceramics, paste and ware were monitored, as were decorative techniques and design. Comparative collections were used where possible. Otherwise, antique catalogues, books for collectors, resources of the public library, and the Internet were used to identify unusual artifacts or obtain dates for companies, brands, and manufacturing techniques.

EUROAMERICAN ARTIFACTS FROM LA 105710

A total of 1,623 artifacts were available for analysis, excepting adobe samples. Artifacts belonging to all functional categories except economy/production and communication were present, although most occurred in small percentages, as shown in Table 21.1. Table 21.2 displays the functional types occurring in each category. The various categories are discussed separately below, where additional tables display the functions and fragments recorded for each type. This presentation format allows us to ask different questions about the data in each category and design tables presenting that information.

Numerous artifacts show some degree of burning. The variable that allows us to monitor burning, among other things, is condition, which was recorded for 1,538 (94.8 percent) artifacts. Of the artifacts for which condition could be determined, 1.0 percent were burned, melted, or crazed, and another 40 percent had multiple modifications, usually including burning. In addition, 142 nails and pieces of hardware (9.2 percent of the artifacts with condition recorded) exhibited the condition we call "dissolved," wherein the individual iron fibers crack and expand outward from the central axis. This condition has generally been found to be associated with burning, although under the proper conditions, long, slow rusting might produce a similar effect. Thus at least 47.4 percent of the total assemblage exhibited some degree of heat alteration.

Table 21.1. Functional categories of Euroamerican artifacts, LA 105710 (count and column percentage)

Category	No.	Percent
Unassignable	349	21.5%
Foodstuffs	5	0.3%
Indulgences	16	1.0%
Domestic routine	24	1.5%
Furnishings	37	2.3%
Construction/maintenance	1,157	71.3%
Personal effects	12	0.7%
Transportation	5	0.3%
Arms/explosives/military	18	1.1%
Total	1,623	100.0%

Unassignable Category

Unassignable artifacts (Table 21.3) are always a large component of any historic assemblage, either because their fragmentary nature makes their function unidentifiable or because so many types of products formerly came in glass or metal containers that, without other distinguishing characteristics, no specific function can be assigned to the fragments available for analysis. No analyst can be familiar with the millions of types of artifacts produced during the technological explosion of the past two centuries. Oakes (1983) found that an average of 36.47 percent of artifacts from excavated historic sites in New Mexico could not be categorized by function, with a range of 18.67–39.09 percent. At 21.5 percent, our revamped analysis seems to have realized the goal of reducing the size of this category.

Most of the unassignable category artifacts are fragments of ferrous metal (n = 248) and glass (n = 83). The ferrous metal artifacts are almost all

Table 21.2. Type and category of artifacts at the García store (count and percentage of total assemblage)

Type	Unassignable		Foodstuffs		Indulgences		Domestic Routine		Furnishings		Construction/ Maintenance		Personal Effects		Transportation		Arms/Explosives/ Military		Total	%
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%		
Unassignable	349	21.5%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	349	21.5%
Miscellaneous unidentifiable	-	-	2	0.1%	6	0.4%	1	0.1%	-	-	25	1.5%	-	-	-	-	-	-	34	2.1%
Canned goods	-	-	3	0.2%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	0.2%
Beer	-	-	-	-	3	0.2%	-	-	-	-	-	-	-	-	-	-	-	-	3	0.2%
Liquor	-	-	-	-	1	0.1%	-	-	-	-	-	-	-	-	-	-	-	-	1	0.1%
Smoking	-	-	-	-	1	0.1%	-	-	-	-	-	-	-	-	-	-	-	-	1	0.1%
Candy	-	-	-	-	5	0.3%	-	-	-	-	-	-	-	-	-	-	-	-	5	0.3%
Dishes	-	-	-	-	-	-	1	0.1%	-	-	-	-	-	-	-	-	-	-	1	0.1%
Glassware	-	-	-	-	-	-	2	0.1%	-	-	-	-	-	-	-	-	-	-	2	0.1%
Canning	-	-	-	-	-	-	20	1.2%	-	-	-	-	-	-	-	-	-	-	20	1.2%
Heating, cooking, lighting	-	-	-	-	-	-	-	-	37	2.3%	-	-	-	-	-	-	-	-	37	2.3%
Tools	-	-	-	-	-	-	-	-	-	-	2	0.1%	-	-	-	-	-	-	2	0.1%
Hardware	-	-	-	-	-	-	-	-	-	-	207	12.8%	-	-	-	-	-	-	207	12.8%
Building material	-	-	-	-	-	-	-	-	-	-	918	56.6%	-	-	-	-	-	-	918	56.6%
Electrical	-	-	-	-	-	-	-	-	-	-	3	0.2%	-	-	-	-	-	-	3	0.2%
Fencing	-	-	-	-	-	-	-	-	-	-	2	0.1%	-	-	-	-	-	-	2	0.1%
Clothing	-	-	-	-	-	-	-	-	-	-	-	-	6	0.4%	-	-	-	-	6	0.4%
Boots and shoes	-	-	-	-	-	-	-	-	-	-	-	-	4	0.2%	-	-	-	-	4	0.2%
Jewelry	-	-	-	-	-	-	-	-	-	-	-	-	1	0.1%	-	-	-	-	1	0.1%
Money/tokens	-	-	-	-	-	-	-	-	-	-	-	-	1	0.1%	-	-	-	-	1	0.1%
Cars and trucks	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	0.2%	-	-	3	0.2%
Animal power	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.1%	-	-	2	0.1%
Small arms	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	1.1%	18	1.1%
Total	349	21.5%	5	0.3%	16	1.0%	24	1.5%	37	2.3%	1157	71.3%	12	0.7%	5	0.3%	18	1.1%	1623	100.0%

Table 21.3. Unassignable artifacts by material type and function (count)

Material Type	Unassignable	Bottle	Can	Jar	Total
Aluminum	3	-	-	-	3
Cellophane	1	-	-	-	1
Glass	39	43	-	1	83
Paper	1	-	-	-	1
Rock	12	-	-	-	12
Rubber	1	-	-	-	1
Indeterminate coating on ferrous metal	4	-	5	-	9
Ferrous metal	111	1	126	1	239
Total	172	44	131	2	349

can fragments, and the glass artifacts are generally bottle fragments. While most of these artifacts probably belong in the foodstuffs category, this analysis erred on the side of caution and did not assign them to that category without some evidence of what they originally contained.

Another class of artifact represented in the unassignable category is mineral specimens (n = 12), including pumice, gypsum, quartz, scoria, and a few burned rocks. Although the scoria can be identified by function, i.e., highway maintenance, it was not recorded under construction/maintenance because it represents intrusive materials from activities that were not associated with the García store. The gypsum was probably related to whitewashing or plastering. The burned rocks, most of which are pebbles, are probably indicative of burning as a means of trash disposal.

Several other items in this category warrant further discussion. Eleven very thin glass shards are probably from a light bulb or kerosene lamp chimney. The glass ranges in thickness from 0.01 to 0.055 inches, with an average of 0.015 inches. The shards may well be associated with a light bulb base (and therefore could have been placed in the electrical type in the construction/maintenance category), but they were considered unassignable because we cannot be sure of this identification.

One unassignable item is of special interest. It consists of a portion of the base of a small rectangular bottle, probably paneled. The maker's mark, a single unadorned "A," is present. Unfortunately, several companies used this maker's mark. The Adams Co. (1861–91) did not make bottles, so it can be eliminated. John Agnew and Son (1854–1866) is a possibility, but the only product manufactured by that company that is mentioned by Toulouse (1971) is fruit jars. Arkansas Glass Container Corp. (1958–present) postdates the occupation of this site. The most likely candidate is P&J Arnold, Ltd., of London (1724–present), which used the solo A as a maker's mark between ca. 1890 and 1914. They are best known for ink bottles, particularly stone ones, but since this company is discussed in Toulouse (1971), one assumes that they made glass bottles as well. Of particular interest is the fact that their bottles were used for both regular ink and "duplicating ink." The latter was used to make pressed copies of documents prior to the introduction of carbon paper. This use may be indicative of the commercial nature of the García store. This item, like most other datable artifacts, seems to predate the store, although ink bottles were often refilled from a master ink bottle.

A hand-finished bead-and-ring bottleneck also predates the occupational span of the store, since it is made of manganese decolorized glass, and the finish was designed for use with a cork. Manganese makes glass turn amethyst over time, and its use in glass formulas generally ended around 1920. The finish, made with an improved lipping tool, probably dates between 1870 and 1915 (Deiss 1981). Another specimen represents part of the finish, neck, shoulder, and body of an amber bottle with a great deal of decorative molding. Unfortunately, none of the decoration was identifiable. This specimen may be from a bitters, fancy whiskey, or patent medicine bottle. It has a screw thread finish, added above what would have been a brandy finish on an earlier model, which may have been an effort to retain customer recognition of an earlier shape when the new finish was adopted. The thread appears to be the standard screw thread, which would date it after 1919–25 (Lief 1965).

As can be seen in Table 21.4, very little amethyst or aqua glass was found at the store. The preponderance of clear and brown glass is consistent with a date after 1930. The blue and multicolor categories in Table 21.4 represent one piece of cobalt blue glass and several fragments of a possible glass sign, which is discussed under the economy/production category.

Several metal fragments represent the remains of a large-diameter, squat can about 3 inches high that may have been a coffee can. Another specimen is a fragment of a large-diameter can lid, which was opened with an early type can opener.

Economy/Production Category

The economy/production category is interesting for its absence. Even though commercial establishment is a type within this category, nothing was found that could confidently be assigned to that type. However, there were several fragments of a piece of plate glass (unassigned category) that had applied-color in blue and red, and was then coated with a substance that rendered it barely translucent. The color is only visible through the untreated side. These shards are possibly part of a glass sign, perhaps designed to be lit from behind. The few pieces that were recovered exhibited no lettering to assist in identification. Had the fragments been assignable to the commercial establishment type, the economy/production category still would have constituted less than 0.5 percent of the total assemblage, which illustrates how elusive small-scale commercial activities can be in the archaeological record.

Foodstuffs Category

Foodstuffs are represented by a pint jar lid and parts of a meat can and a sardine can. The meat can is a soldered hole-in-top type, with a very wide and irregular soldered seam that exhibits small blobs. This type of can could predate the store by at least 5 years or as much as 40 years. The hole-in-top can went out of style about 1920, and the thick soldered seam was replaced by about 1880, except in home canning. Either way, this artifact must predate the store. It may be an old piece of road trash, since it comes from Level 1, 0–10 cm below the modern ground surface. The sardine can was evidently a three-piece can, but the entire top was removed by an unknown method. The virtual lack of items in the foodstuffs category supports the nonresidential nature of the site.

Table 21.4. Unassignable glass by color and function (count and sample percentage)

Function	Fragment	Aqua	Blue	Brown	Clear	Amethyst	Multicolor	Total
Unassignable	Unidentified	-	5	1	10	-	2	18
	Body	1	-	1	17	-	-	19
	Spall/flake	-	-	-	2	-	-	2
Bottle	Unidentified	-	-	3	5	1	-	9
	Base	-	-	-	1	-	-	1
	Body	-	-	3	12	-	-	15
	Finish	-	-	-	-	1	-	1
	Shoulder	1	1	4	7	-	-	13
	Base and body	-	-	-	1	-	-	1
	Lip	-	-	-	1	-	-	1
	Lip and neck	-	-	-	1	-	-	1
	Lip, neck, shoulder, and body	-	-	1	-	-	-	1
Jar	Base	1	-	-	-	-		1
Total		3	6	13	57	2	2	83
Percent		3.6%	7.2%	15.7%	68.7%	2.4%	2.4%	100.0%

Indulgences Category

The indulgence category contained some road trash, which was included in the analysis, but the dates were removed from the sample before calculating mean assemblage dates. The rest of this category included a tobacco tin that postdates the site, since it has an "invisible" hinge, which was introduced in 1948 (*Modern Packaging* 21[11], July 1948), and portions of several candy wrappers, all from the Curtiss Candy Company. The labels read PEPPERMINT PATTIE /CANDY/DELICIOUS FOOD/ENJOY SOME EVERY DAY. CURTISS CANDY CO. CHICAGO/ OTTO SCHNERING, PRESIDENT. We have given these items a 1916 beginning date, based on the founding of the company, which is still in business as part of Standard Brands, Inc. The Curtiss Company is more famous for its Baby Ruth candy bars and a lawsuit with Babe Ruth instigated by the name. One wrapper was virtually intact, and another was represented by a large fragment. Several aluminum foil remnants from the burned trash were probably also Peppermint Pattie wrappers. They may well represent items offered for sale in the store.

Domestic Routine Category

The domestic routine category was represented by canning jar sealer lids and screw bands. These fragments were all unassignable by manufacturer or brand, but based on the shape and remains of the sealant, they are probably from the Kerr seal system, which would give them a beginning date of 1915 (Toulouse 1971:307). Canning jars themselves have a beginning date of 1858, based on Mason's patent. The lack of jars, coupled with the presence of the sealing system, suggests that the latter items were offered for sale to people who already owned jars. Conversely, they may have been part of the foodstuffs brought for meals by the proprietor, who would have thrown away the nonreusable sealers and possible the bands as well.

Only one ceramic sherd was found, an eroded piece of undecorated white ware with a clear glaze. The erosion pattern, a series of small pits caused by the glaze spalling off, is very similar to that undergone by annular ware, a white ware type often found at nineteenth-century sites. Under microscopic examination, the paste is also very similar to that of annular ware. Although there is very little visual difference in pastes between annular ware and the later granite wares, the latter very seldom spall. This piece is of a thickness more common to annular ware. While a form of annular ware with a yellow paste was made until about 1930 (Noel-Hume 1972:131), it is not usually found in New Mexico, where the white paste variety is most often associated with sites dating to the Santa Fe Trail period (1821–80).

Glassware was represented by two pieces of a pressed glass vessel rim. The rim is very thick (0.163 inches), but the body of the vessel was even thicker (0.245 inches). Its diameter was about 8 cm (3.15 inches). The decoration consists of a molded sunburst with an impressed band below it. This specimen may be from a water tumbler or a decorative piece such as a vase or toothpick holder.

Furnishings Category

The furnishings category was represented by mica or isinglass fragments that are probably from a heating stove, a common fixture in a country store. Ethnographic interviews indicated that the store did have a stove.

Construction/Maintenance Category

The construction/maintenance category percentage is unusually high for an adobe structure (Table 21.1) and probably reflects demolition of the building. Almost half of these artifacts (47.8 percent) are tar paper fragments (Table 21.5). Even with these items removed from consideration, nearly half of the assemblage falls into the construction/maintenance category, which is very high for an adobe structure. Window glass was also very common, comprising 25.1 percent of the total assemblage.

Only one tool was recovered, a screwdriver with a handle and blade made of iron. No reference to solid iron screwdrivers has been found, although Sears and Roebuck offered a cast-iron hammer around the turn of the last century that was called "strictly no good" (Israel 1968:78). Perhaps the screwdriver was discarded for the same reason. The handle was completely separat-

Table 21.5. Construction/maintenance artifacts from the García store (count and sample percentage)

Type	Function	Fragment	No.	Percent
Unidentifiable	Wire	strand	25	2.2%
Tools	Screwdriver, slot	handle	1	0.1%
	Screwdriver, slot	point and shank	1	0.1%
Hardware	Bolt, indeterminate	whole	1	0.1%
	Bolt, indeterminate	threads	1	0.1%
	Bolt, stove	whole	1	0.1%
	Nail, roofing	whole	45	3.9%
		head	8	0.7%
		point and shank	8	0.7%
		head and shank	4	0.3%
	Nail, barbed roofing	whole	12	1.0%
		shank	1	0.1%
		head	4	0.3%
		point and shank	1	0.1%
	Nail, indeterminate	whole	1	0.1%
	Nail, indeterminate wire	whole	16	1.4%
		shank	33	2.9%
		shank fragments	10	0.9%
		head	14	1.2%
		point and shank	14	1.2%
		head and shank	5	0.4%
	Nail, box	whole	5	0.4%
	Nut	whole	1	0.1%
	Washer, lock	whole	1	0.1%
	Nail, common	whole	7	0.6%
		head and shank	1	0.1%
	Keyhole plate	whole	1	0.1%
	Tack, indeterminate	whole	1	0.1%
		head	2	0.2%
		head and shank	1	0.1%
	Nail, casing	head and shank	1	0.1%
	Tack, gimp	whole	1	0.1%
		shank	1	0.1%
		head	1	0.1%
	Screw, sheet metal	whole	1	0.1%
	Screw, oval head flat	whole	2	0.2%
	Nail, flooring	head and shank	1	0.1%
Building material	Unidentifiable	unidentifiable	3	0.3%
	Brick	whole	1	0.1%
		body	3	0.3%
		spall/flake/fragment	7	0.6%
	Linoleum	scrap	2	0.2%
	Plaster	spall/flake/fragment	40	3.5%
	Roofing tar	scrap	7	0.6%
	Window glass	shard	290	25.1%
	Viga	body	2	0.2%
	Putty	spall/flake/fragment	8	0.7%
	Roofing felt	scrap	554	47.9%
	Fire brick	whole	1	0.1%
Electrical	Connector loop	whole	1	0.1%
	Light bulb	base	1	0.1%
	Uninsulated copper wire	strand	1	0.1%
Fencing	Staple	whole	1	0.1%
	Gate hook	whole	1	0.1%
Total			1157	100.0%

ed from the shank at the time of analysis and in needle-sized fragments.

The most common form of nail (n = 73+) in the assemblage was the roofing tack, two varieties of which (American felt and large head barb) were recovered. No date was available for either variety, although the barbed type at least is known to date from the 1890s (Israel 1968:23). As expected, there were few nails and, of those recovered, none were larger than 16 penny. Only 21 of the 50 nails recorded were assignable to a pennyweight because of the extreme degree of dissolution. Roofing tacks do not appear in the pennyweight chart because they are sold by length. While the assemblage of galvanized roofing tacks did undergo some dissolution, in general they are in much better condition than the nails. The smaller sizes shown in Table 21.6 may represent nails used in packing crates, window moldings, door frames, or counters and shelves.

An elderly interviewee suggested that the roofing paper may have covered the floor of the store. Tar paper does indeed make a good and surprisingly long-lasting covering for a dirt floor, but it must be nailed into the dirt to be effective. No nails were found in situ in the floor, nor would the roofing tacks—the only type of nail present in any quantity—have had sufficient holding power to keep the tar paper in place. The excavators first thought that two locations on the floor contained adobe patches over slumped areas. In one of these locations, tar paper fragments were found under the adobe patch. However, the adobe was pinkish, like the plaster used on adjacent walls. What is more likely is that the roof was removed, littering the inside of the structure with tar paper fragments, then rain-caused erosion pulled adobe and plaster off the walls, depositing it in slumped and low areas. Thus, there is no direct evidence for the use of tar paper as a floor covering.

The only other item of interest in this category is the base of a 30 watt light bulb, composed of a copper shell and either a graphite or hard rubber liner. It bears several legends embossed into the rubber, including "5.27 ????/ PENDING" and the letters NE, which may be part of the word ONE or NEW. Other letters are visible but no longer distinguishable. The PENDING is no doubt PAT. PENDING, probably for a new type of base. There was also a connector loop and some very fine wire cable that may or may not be electrical in nature.

Overall, the construction/maintenance category provided little interpretable information, considering the large number of artifacts in it. The presence of two kinds of fired brick at the site is interesting, since there is no indication that bricks were used in construction of the store. They may have formed part of the stove complex, as the firebrick suggests, or they may have been used for patching or propping up a counter, shelving, or other feature on the uneven dirt floor. The electric light bulb is a problematic artifact, since ethnographic interviews (see Chapter 25) indicated that the store had no electricity, nor were electrical supplies mentioned among the goods sold there. Either electricity was added later, or the light bulb came from another source, for example, having arrived at the site in a load of trash. The two scraps of linoleum could have arrived in the same way, or the proprietor may have had a linoleum piece behind the counter as a mat.

The interviews threw some light on roof construction techniques. The store had a shed roof covered with corrugated metal, no trace of which appears in the archaeological record, apart from one sheet metal screw, which may or may not have been part of the roof. The current practice

Table 21.6. Type and pennyweight of nails from the García store

Type	2	3	3.5	4	6	7	8	9	10	12	16	Total
Nail, indeterminate	-	-	-	-	1	-	-	-	-	-	-	1
Nail, indeterminate wire	-	-	1	1	1	1	3	1	2	1	-	11
Nail, box	1	1	-	-	-	-	1	-	-	-	-	3
Nail, common	-	-	-	-	-	-	1	2	-	1	2	6
Total	1	1	1	1	2	1	5	3	2	2	2	21

for installing corrugated roofing involves laying down tar paper under the metal, and the practice may have been the same in the 1930s. The roofing and the vigas were removed and recycled when the store was dismantled, leaving only the tar paper fragments behind.

Personal Effects Category

The personal effects category included shoes, buttons, a snap, a stocking supporter, a 1935 New Mexico tax token, and a brooch or lace pin featuring a glass cat's head set in brass (Table 21.7). With the exception of the tax token, the well-used nature of the artifacts indicates that they were not being offered for sale at the store.

The array of buttons recovered included three shell, one vegetable ivory, and one ceramic. Buttons were often used many times over, so only beginning dates could be assigned to them. Shell buttons were introduced into the United States during the 1850s and enjoyed increasing popularity until the early 1920s, when they were almost run off the market by the explosion of the plastics industry after World War I. The small shell buttons, or "pearls" as they were known in the trade, would have been used on underwear, shirts and blouses, and children's clothing, while ceramic buttons were mostly used on cheap dresses and underwear (Pool 1991:6–7). Ceramic buttons enjoyed their greatest popularity in America from the mid-1840s to about 1910 (Albert and Kent 1949; Pool 1991). This ceramic button is of a type often misidentified as milk glass, but it has small dimples on the reverse surrounding the holes that are characteristic of the fused-porcelain process (Pool 1991:7). Vegetable ivory buttons began to be produced in 1859 and lasted through the 1940s. According to Pool (1991:7), they are "absent from the archaeological record" because they are subject to attack by moisture. This button came from Level 4, and a quick burial in a dry climate is no doubt responsible for its survival. Buttons were usually securely sewn to cards for sale, so these specimens were probably lost from clothing. One broken shell button fractured across the holes, a common pattern in button loss.

One of the shoes is a classic child's leather sandal with two buckles and a cut-out vamp. It has a rubber sole and another type of rubber or composition heel. The shoe is well worn, especially at the toe, where it exhibits one nail, probably a repair. The heel has also been repaired or replaced with large headed nails. Sandals of this type are very much a twentieth-century style of footwear. The term *sandal* does not even appear in the 1897 Sears Roebuck Catalogue (Israel 1968). Sandals are mentioned in the 1902 version of the Sears catalogue (1969), but not in reference to the style as we know it today. The shoes so described have solid toes, even high heels, and are more what a present-day catalogue would term a pump. Rubber heels were introduced in 1895; soles somewhat later. Cemented rubber heels and soles became practicable in 1926 with the invention of an improved glue (Anderson 1968:62). If the sole of this shoe were cemented and then repaired by nailing, it would postdate 1926. If the nailed heel is original, the shoe would

Table 21.7. Personal effects from the García store (count and sample percentage)

Type	Function	Fragment	No.	Percent
Clothing	four-hole button	whole	3	23.1%
	two-hole button	whole	2	15.4%
	snap	whole	1	7.7%
	stocking supporter	whole	1	7.7%
Boots and shoes	shoe	insole	1	7.7%
	child's shoe	whole	2	15.4%
	child's shoe	sole and counter	1	7.7%
Jewelry/insignia	brooch/lace pin	whole	1	7.7%
Money/tokens	N.M. school tax token	whole	1	7.7%
Total			13	100.0%

date no earlier than about 1910, based on the style and rubber sole.

Another sole and counter of an infant's shoe has stitching on the foot side of the sole, characteristic of the McKay stitching process, which was invented in 1862. The counter exhibits a coating that may be the remains of white dye. Another shoe recovered from the store is a nearly complete child's oxford. It seems to have a welt, which was invented by Charles Goodyear in 1875. The welt is not between the upper and sole, but was laid on top of the upper, then stitched. This shoe was also repaired with four nails in the toe, which were driven into the stitching line. The heel exhibits the same kind of large nails that were observed in the sandal. The size of these nails is most unusual, since shoe nails have small heads. Large nails may have been used to prolong the life of the child's shoes, or they may reflect the quality of shoe repair available in Gavilan. The large-headed nails would have caused serious damage to wooden floors, so they probably do not represent original manufacture.

Other items in the personal effects category included a clothing snap and a stocking support clip. The most important artifact, however, was a 1935 New Mexico tax token, which was undoubtedly associated with the store. Tax tokens, and coins in general, are considered personal effects because they are usually found at residential sites, where they were dropped or fell between floorboards.

Transportation Category

The transportation category was represented by five items: two related to horses, and three motor vehicle parts. The automotive parts were a cable adjuster, a spring shackle, and the switch from a generator/regulator cutout relay or circuit breaker. The latter is copper and marked with a Ford emblem. The emblem is unusual in that the lettering is somewhat different from the well known logo, and it is not surrounded by the familiar oval. We have dated this artifact to ca. 1903–27, based on Ford histories and the appearance of the oval. It probably actually dates closer to the end of that time frame, or even later.

One of the horse-related items is a leather concho of a kind often used on saddles to hide the joint between saddle and thongs. The other artifact, tentatively identified as a harness ring, consists of an iron ring with an inside diameter of about 1.87 inches. Riveted to it are four leather strips. One end of each strip is rounded; the other end appears to have been cut. We have not identified the type of harness rig that would use four strips, but three strips is a very common combination. Since there is no good reason for a piece of horse harness to have been at the store, it is likely that this artifact was reused for some other purpose.

Arms, Explosives, and Military Category

The arms, explosives, and military category is comparatively large (n = 18), especially considering the commercial nature of the site. All of the ammunition types predate the occupational period of the store. The end dates, based on head stamps and company histories, range from 1900 to 1910, making the ammunition, if associated with the store, over 20 years old. Many people do not hesitate to use old ammunition, but 20 or 30 years seems excessive. Three slugs were found: two .22 caliber slugs and an expended hollow slug that may originally have been a flat point, which weighed 4.9 g (75.6168 grains). Based on weight, this specimen could be a .30 Long rimfire, dating from 1873 to around 1914; or a .35 Smith & Wesson dating from 1913 to 1921 (Barnes 1985). The rest of this category consists of one .38 center-fire case from Union Metallic Cartridge and 14 .22 short cases, all with an "H" head stamp. None of the .22 cases exhibit characteristics of modern cartridges such as slight knurling around the top, which began in 1904 (Barnes 1985). The Union Metallic Cartridge case dates no later than about 1902, when the company merged with Remington. According to Barnes (1985), the .38 long center-fire cartridge was obsolete by about 1900.

What is interesting about this assemblage, other than its age, is the fact that nonmatching slugs and cases were found. One possible explanation for this is that the slugs were fired into the structure and the shells were fired from the structure. If the firing episodes took place after the building was abandoned and dismantled, the ammunition would be even older, most of it no younger than 40 years. Another explanation is that both shells and slugs arrived at the site incorporated in the adobes themselves. In this case, we could be comfortable with the early dates, since the artifacts would have entered the archaeological record before the store was built.

Dating the García Store Assemblage

An ethnohistoric study of the García store indicates that it was in operation during the 1930s, beginning in 1930 and ending in 1936 or 1937 (see Chapter 25). These dates, which are almost certainly accurate, enable us to test our usual dating methods. The results of this test are modestly encouraging. Three venues were examined: all dated artifacts, selected dated artifacts (excluding ammunition), and a specialized analysis of window glass. Window glass dates are not included in the category of all dated artifacts, since no individual fragment can be directly dated. Three additional factors influenced the outcome. The first is that the store was both built and dismantled during the Great Depression. The second is that the store was in northern New Mexico. It is well known that material culture in that area lagged behind that of the country as a whole and even the larger urban areas in New Mexico. The third factor is that the store was often closed for months at a time or opened on an occasional basis.

Not all artifacts are temporally diagnostic, and some that are datable are not helpful in a specific case. For instance, wire nails can be generally dated to after 1890, but that information is scarcely relevant to the García store. Datable artifacts were found in six categories, not including construction/maintenance, which are dealt with in a different analysis. The categories that yielded the most dates were unassignable and arms/explosives/military. It is a peculiarity of the analysis system that glass artifacts that cannot be assigned to a specific functional category can often be dated on the basis of manufacturing technology or maker's marks. Only about 30 percent of the datable artifacts have both a beginning and an ending date.

All Datable Artifacts

For the assemblage of all datable artifacts, the site's mean beginning date was 1889.99, with a standard deviation of 22.75. The mean ending date was 1912.26, with a standard deviation of 16.64. A T-test was run on these data (Table 21.8). Only by adding the full standard deviation and error to the mean can the known dates be approached, which seems an abuse of the statistic, but perhaps accurately reflects conditions in Northern New Mexico in the first half of the twentieth century. In the case of all dated artifacts, if we add the full standard deviation and error mean, we can arrive at a beginning date range for the site of 1910.07 to 1920.76, and an ending date range of 1925.78 to 1937.99, which approaches the actual date range of 1930 to 1937.

Table 21.8. T-test one-sample statistics for all datable artifacts from the García store

Beginning Date	No.		Mean	SD	SD Error Mean	
	72		1889.99	22.75	2.68	
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of Difference	
					Lower	Upper
	704.964	71	.000	1889.99	1884.64	1895.33
Ending Date	No.		Mean	SD	SD Error Mean	
	32		1913.44	17.68	3.13	
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of Difference	
					Lower	Upper
	639.796	30	.000	1912.26	1906.15	1918.36

Selected Artifacts

If we accept that the ammunition artifacts are not associated with the store and can be excluded from the datable assemblage, the dates derived for selected temporally diagnostic artifacts come even closer to the actual dates. A T-test was also run on these data (Table 21.9). Again, it is necessary to use the full standard deviation and error to arrive at a relatively realistic beginning date. Using the full deviation and error, we can arrive at 1920.76 as a mean beginning date and a range from 1914.94 to 1926.58. In the case of the ending date, using the upper end of the 95-percent confidence level and the standard error alone would give us a date of 1936.29, remarkably close to the actual date. Taking the lower end of the 95-percent confidence level and adding the full standard deviation and error again gives a date within a few years of the actual date (1935.03). Being forced to do these statistical manipulations to bring the dates for the assemblage in line with the known dates for the García store, we can conclude either that the proprietor was selling used products; or that most of the materials in our assemblage represent the personal property of the store owner, who brought older, unneeded goods from home to use while working there. Since the latter is likely, most of our assemblage probably does not reflect the commercial nature of the store.

Window Glass

Window glass has been found to vary in thickness through time in a consistent enough manner that assemblages can be temporally diagnostic (Chance and Chance 1976; Roenke 1978; White 1990). Window glass may be the most temporally sensitive construction material, especially for an adobe structure, since few other manufactured construction materials are used in this type of building. Chance and Chance (1976) assert that the mode is the most important statistic when dealing with a single structure. Teague et al. (1977) believe that the mean is most valid for small samples.

The sample of window glass from LA 105710 is relatively small (n = 295) and from a single structure, so both methods can be tested (Table 21.10). Most researchers have measured specimens in inches for these calculations, since glass was originally sold in fractions of an inch, and three decimal places is the accepted level of precision. It is a common practice in this type of analysis to trim 5 percent from both the top and bottom of the range to ensure that only window glass is being measured, as opposed to fragments of mirrors, car windows, or other flat glass artifacts. The aim of this type of analysis is to determine both the mean thickness and the modal points around which the artifact measurements cluster. The researchers mentioned above have generally used a midpoint of the arbitrarily

Table 21.9. T-test one-sample statistics for selected artifacts from the García store

Beginning Date	No.		Mean	SD	SD Error Mean	
	57		1895.93	21.93	2.9	
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of Difference Lower	Upper
	704.964	56	.000	1895.93	1890.11	1901.75
Ending Date	No.		Mean	SD	SD Error Mean	
	16		1921.38	19.05	4.76	
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of Difference Lower	Upper
	403.43	15	.000	1921.38	1911.22	1931.53

Table 21.10. Window glass modes at the García store

True Range	No. of Specimens	Class Total	Midpoint	Mode
.0630-.0690	6	6	0.065	dropped
.0702-.0727	5	9	0.075	dropped
.0773-.0797	4			
.0800-.0848	66	187	0.085	primary (63.39 percent of total;
.0850-.0898	121			69.26 percent of adjusted total)
.0900-.0948	64	83	0.095	secondary (28.14 percent of total;
.0950-.0997	19			30.74 percent of adjusted total)
.1002-.1035	10	10	0.1	dropped
Total	295	295		

determined measurement classes to account for the variation in thickness in individual specimens. For this analysis, three thickness measurements were taken on each specimen and averaged. The overall range was from .0630 to .1035 in, which were then rounded to three decimal places before arriving at the measurement class midpoints. Thus, all measurements between .0800 and .0899 are considered to be .085.

The unadjusted mean window glass thickness for LA 105710 was .0878 in; the adjusted thickness mean was .0881 in. At three decimal places, both fall within the primary mode of .085. The median, at .0882 in, is virtually identical to the adjusted thickness mean. Over 90 percent of the sample falls within the two contiguous modes of .085 and .095. The primary mode is simply the measurement with the greatest number of samples; the secondary mode is the next largest number of samples.

Roenke (1978:116) provides a date of 1855–85 for a primary mode of .085 in and 1870–1900 for a primary mode of .095 in; Chance and Chance (1976) use the same date ranges. Teague et al. (1977), working in a mining town that lasted only from 1883 to 1888, found a primary mode of .095 in, which fits into the 1870–1900 date range. Applied to the García store, such date ranges strongly imply that older glass was used in its construction.

One other possibility has been recognized, namely, that the progression toward thicker glass does not carry on into the mid-twentieth century. Blee (1988), investigating a cabin and later house at a site in Skagway, Alaska, found that the cabin, dating from 1888, had a modal window glass thickness of .094 in, whereas the house, dating after 1896, had a thickness mode of .078 in. As Blee (1988:165) points out, "Thinner window glass is cheaper window glass both to produce and to purchase."

The first specifications for window glass were adopted by the Federal Specifications Board in 1924 (Roenke 1978:38–39). Single-strength glass was expected to fall between .080 and .100 in, double strength between .111 and .125 in; other classes of glass were even thicker. Roenke states that this confirms the idea of a general thickening through time, but considering that glass with a thickness of .085 in dates as early as 1855 in all the published date ranges, this generalization is questionable. By these standards, the glass at LA 105710 would have been perfectly acceptable in 1924, and by extension, in 1930. More twentieth-century sites need to be studied, and certainly more Depression-era sites need to be looked at before this problem can be resolved.

Other facets of window glass that were considered included edge color and patination. Such studies have no chronological value and are considered difficult to undertake because edge color is dependent on the size of the shard. However, only the saturation value changes with shard size, not the basic color. With one analyst conducting the examination, it is possible to come to some basic conclusions concerning these variables. A sample of 175 pieces of window glass was examined for edge color and patination. Four basic colors were recognized: green, blue, blue-green, and clear. Since window glass color is determined by impurities in the basic materials and by decolorizers and other elements in the glass batch, it would seem that four different sources of supply or very different batches were used. There was no strong correlation with thickness for any of the colors. Both green and clear glass were patinated. However, only the clear glass was heavily patinated.

The degree of patination is related to soil moisture and alkalinity, but the tendency to patinate is inherent in the glass itself and is a function of high amounts of soda or low amounts of lime in the glass batch. From 1844 through at least the 1870s, a tendency to patinate, or "rust," was a "marked characteristic of American glass" (Roenke 1978:22). Some glasses cannot be made to patinate. The blue color can be caused by the use of salt cake (sodium sulphate) instead of soda ash (sodium carbonate) in the mix, or by the use of cobalt as a decolorizer. Interestingly, there was a craze for blue-tinted window glass in America during the 1870s, perhaps as a reaction to the rusty glass endured for the previous thirty years. Blue glass is much harder and does not devitrify, the process that leads to patination. The blue glass from LA 105710 bears this out. Though buried for the same amount of time at the same depth in the same soil as the clear and green glass, no patination was observed on any piece of blue-tinted glass.

Conclusions

The commercial nature of the site is all but invisible in the artifact assemblage, showing more in the absence of items from the domestic routine and furnishings categories than the presence of specific artifacts. The paucity of artifacts that can be attributed to the store may be a function of the short time span it was in existence—fewer than ten years. Only one datable artifact, the 1935 tax token, can be confidently ascribed to the occupation of the store. The applied-color glass almost certainly belongs to the store as well, but with a time range of 1915 to the present, it is not much help in dating the deposits.

The fact that all chronological indicators predate the store indicates the following hypotheses: (1) The store was built with recycled materials. (2) The store was built, without much ground disturbance, over preexisting trash deposits. (3) There is much we don't understand about site formation during the Depression.

Any or all of the above may be true. The fact that most of the window glass falls into only two classes (.085 and .095) certainly suggests one building episode with a possible remodel following very shortly thereafter, but with the window glass coming from at least four different sources or batches, based on the colors, scavenging is also a definite possibility. The earliest date for the window glass, 1855–70, can be rejected on the grounds that there was scarcely any window glass in New Mexico during those years. When the United States army occupied New Mexico in 1846, the Palace of the Governors was the only building in the capital with glass windows (Edwards 1847:24). It seems reasonable to suppose that the population centers absorbed any increase in the supply for many years before the hinterlands acquired a supply. Using the 1885–1900 range still has any recycled glass predating the structure by thirty to fifty years, which incidently would be an acceptable time span for many adobe structures in the area to receive window glass, go through their life cycle, and be abandoned.

Chapter 22. Vegetation Transects

Pamela J. McBride and Mollie S. Toll

Six gravel-mulch garden sites along the edge of the first terrace overlooking the floodplains of the Rio Ojo Caliente provided an opportunity to examine modern vegetation characteristics as clues to prehistoric manipulations of growing conditions. The garden sites included LA 105703, LA 105705, LA 105706, LA 105708, LA 105709, and LA 118547. A vegetation survey was conducted in January 1998 within and adjacent to garden plots for purposes of comparison.

The terrace gravel deposits at Gavilan qualify as Great Basin (or Intermountain) grassland, dominated by perennial sod-forming short-grass species (Brown 1994:115–121). Whereas overgrazing in more diverse semidesert grasslands of lower elevations will frequently result in restructuring of the landscape by invasion of a much taller layer of shrubs (mesquite, juniper), overgrazed Great Basin grassland "retains a more or less evenly statured low canopy of plants" (Brown 1994:119), including snakeweed and other short grasses. We see evidence of the short-grass community at Gavilan, where pockets of more intensive grazing impact interdigitate with soil texture variability. Centuries-old human efforts to manipulate growing conditions for crop plants still have a measurable effect today on species composition, plant density, and vigor.

Nine transects were laid out at the six terrace sites: eight were 20 m long, and one was 15 m long (due to failing light at the end of the day). Two of the transects included a 10 m section on the gravel-mulch garden plot and a 10 m section considered to be off the garden. Plant and nonplant intercept lengths were measured to the nearest 0.1 cm along the meter tape. Nonplant categories (bare ground, gravel, cobbles, boulders, and litter) were also recorded.

In the description of results, total cover was calculated as the sum of the intercepts of a given plant taxon or nonplant category (Cox 1975:46). Relative cover was determined by taking the total cover of a particular taxon and dividing by the total cover of all taxa on a transect. To calculate a measure of frequency, each transect was divided into five equal segments, and the presence of a given taxon in the segments was summed and converted to a percentage (e.g., a taxon occurring in three of the five segments has a frequency of 60 percent). *Ecological dominance* refers to the relative importance of a species or group of species in a community. By virtue of their numbers, size, or production, these species "largely control the energy flow and strongly affect the environment of all other species" (Odum 1971:143).

Plant species encountered in the Gavilan transects were identified with the aid of comparative specimens in the collections of the University of New Mexico Herbarium, Department of Biology. In particular, a reference collection of lichens from El Malpais National Monument (DeBruin 2000) enabled us to identify the lichen species occurring on several garden plots.

A single flotation sample from LA 105709 was analyzed. The sample totaled 3.2 liters of soil and was processed using the bucket method of flotation used for all other projects at the OAS (Bohrer and Adams 1977). The sample was scanned under a binocular microscope at 7–45X, producing relative abundance data (rather than actual counts) by botanical taxon and plant part.

Results

As Lightfoot (1993:116) observed for the Northern Rio Grande Valley, appropriate sites for gravel-mulch gardens are typically dominated by native short grasses. At nearly every Gavilan site, both on and off the prehistoric garden plots, the plant found most consistently and occupying the highest proportion of the landscape was blue grama (*Bouteloua gracilis*). LA 105705 was an exception, in that snakeweed (*Gutierrezia sarothrae*) and lichen shared that role on the garden transect, while snakeweed was actually the dominant plant on the control transect (Tables 22.1 and 22.2).

LA 105705 transects are anomalous for sever-

Table 22.1. Vegetation transect results: LA 105703, LA 118547, and LA 105709

Transect	LA 105703						LA 118547						LA 105709				
	1: Control			2: Garden Plot			3: Garden Plot			4: Garden Plot			5: Garden Plot			6: Contrc	
	TC	RC	F	TC	RC	F	TC	RC	F	TC	RC	F	TC	RC	F	TC	RC
Bare	3	-	60	9	-	100	8	-	100	9	-	100	7	-	100	6	-
Gravel	31	-	100	39	-	100	22	-	100	26	-	100	28	-	100	19	-
Cobble 10-25 cm	-	-	-	2	-	40	1	-	20	1	-	20	2	-	40	-	-
Boulder >25 cm	-	-	-	-	-	-	-	-	-	-	-	-	1	-	20	-	-
Litter	23	-	100	6	-	100	31	-	100	18	-	100	16	-	100	28	-
Grasses:																	
Aristida	1	2	20	2	5	40	2	4	40	1	3	20	3	7	80	3	6
Bouteloua gracilis	28	65	100	40	90	100	24	62	100	40	87	100	34	77	100	37	79
Gramineae (Unknown D)	<1	1	20	1	1	20	-	-	-	-	-	-	-	-	-	-	-
Hilaria jamesii	-	-	-	-	-	-	-	-	-	-	-	-	1	1	20	-	-
Muhlenbergia torreyii	6	14	100	-	-	-	<1	1	40	2	4	20	1	1	20	-	-
Sporobolus	2	3	20	-	-	-	5	12	40	2	4	40	1	1	20	-	-
Shrubs:																	
Chrysothamnus nauseosus	2	4	20	-	-	-	1	3	20	-	-	-	<1	1	20	-	-
Gutierrezia sarothrae	3	8	100	1	1	20	5	13	100	-	-	-	3	6	80	-	-
Other:																	
Boraginaceae	-	-	-	-	-	-	-	-	-	-	-	-	<1	<1	20	-	-
Chaetopappa ericoides	-	-	-	-	-	-	1	2	40	-	-	-	-	-	-	-	-
cf. *Mammillaria*	-	-	-	<1	1	40	-	-	-	-	-	-	-	-	-	-	-
Opuntia sp.	-	-	-	-	-	-	<1	1	20	1	1	20	2	3	20	-	-
Opuntia imbricata	1	3	40				-	-	-	-	-	-	-	-	-	-	-
Opuntia macrorhiza	<1	<1	20	1	2	40	-	-	-	-	-	-	-	-	-	-	-
Unknown B	-	-	-	-	-	-	1	2	20				1	2	40	<1	<1
Unknown C	-	-	-	-	-	-	<1	<1	20	<1	1	20	-	-	-	-	-
Xanthoparmelia chlorochroa	-	-	-	-	-	-	-	-	-	-	-	-	<1	<1	20	7	15

TC = total cover (percent of occurrence in total length of transect).
RC = relative cover (percent of occurrence relative to other species).
F = frequency (percent of occurrence in five sections of equal or nearly equal lengths of transect).

Table 22.2. Vegetation transect results: LA 105708, LA 105705, and LA 105706

Transect	LA 105708			LA 105705						LA 105706					
	7: Garden Plot			8a: Control			8b: Garden Plot			9a: Control			9b: Garden Plot		
	TC	RC	F	TC	RC	F	TC	RC	F	TC	RC	F	TC	RC	F
Bare	7	-	100	55	-	100	10	-	100	41	-	100	8	-	100
Gravel	39	-	100	2	-	20	28	-	100	-	-	-	17	-	100
Cobble 10-25 cm	2	-	80	1	-	20	-	-		-	-	-	2	-	20
Litter	15	-	100	15	-	80	19	-	100	15	-	100	23	-	100
Grasses:															
Bouteloua gracilis	20	54	100	10	38	60	21	51	80	39	89	100	39	79	100
Gramineae (Unknown D)	1	2	60	-	-	-	-	-	-	-	-	-	-	-	-
Gramineae (Unknown G)	-	-	-	-	-	-	-	-	-	-	-	-	5	9	80
Muhlenbergia torreyii	8	21	100	3	11	80	11	26	60	<1	1	20	1	2	20
Sporobolus	-	-	-	1	2	20	-	-	-	-	-	-	-	-	-
Shrubs:															
Eurotia lanata	<1	<1	20	-	-	-	-	-	-	-	-	-	-	-	-
Gutierrezia sarothrae	1	4	60	11	42	40	3	8	40	4	9	100	-	-	-
Other:															
Chaetopappa ericoides	1	4	80	-	-	-	-	-	-	<1	<1	20	1	1	40
Opuntia sp.	<1	1	20	1	3	20	-	-	-	-	-	-	2	4	20
Unknown E	3	10	80	-	-	-	-	-	-	-	-	-	3	5	60
Xanthoparmelia chlorochroa	1	4	60	1	4	40	6	15	100	<1	<1	20	-	-	-

TC = total cover (percent of occurrence in total length of transect).
RC = relative cover (percent of occurrence relative to other species).
F = frequency (percent of occurrence in five sections of equal or nearly equal lengths of transect).

al reasons. Of all the transects placed on garden plots, the fewest number of taxa occur at LA 105705, along with the highest density of lichen (there was a dramatic change at the edge of the garden, where the lichen disappeared). On the control transect for this site, the percentage of blue grama was lowest, snakeweed was the dominant plant, the percentage of bare ground was highest (55 percent as compared to 3–7 percent elsewhere), and the percentage of gravel was only 2 percent (as opposed to 19–31 percent on other control transects).

During the vegetation survey, our impression was that the off-garden area of LA 105705 displayed a notable degree of disturbance, together with a high density of snakeweed and prickly pear cactus. Four-legged visitors to a water tank and corrals at the western edge of the site may be largely responsible. Trampling of the ground by cattle may have caused compaction and serious changes in soil structure. This is supported by the significant difference in total vegetation coverage between the control (26 percent) and on-garden (42 percent) transects.

Lichens were most evident at LA 105705. The symbiotic association between fungi and algae or cyanobacteria enables lichens to live in some of the harshest habitats on earth. Lichens are often the first to colonize newly exposed rocky areas (Raven et al. 1986). The lichen that occurred in and around garden plots was a foliose or leafy variety, *Xanthoparmelia chlorochroa* (tumbleweed shield lichen), whose distribution is restricted to siliceous rock (Brodo et al. 2001). Sites without lichens include LA 105703, the northernmost garden, and LA 118547. Total vegetation coverage was equal for on- and off-garden transects at LA 105703 and, like LA 105705, there was actually lower taxonomic diversity on the garden transect than on the control.

The control transect at LA 105706 bears some similarities to LA 105705 (just to the south). Here there is a comparatively high percentage of bare ground (41 percent) and an absence of gravel altogether. Although this site follows the pattern we observed repeatedly of higher total vegetation coverage within the gravel-mulched garden area, there is less of a difference between on- and off-garden transects, with only a 7 percent higher coverage for the on-garden transect.

Garden plots at LA 118547 and LA 105709 displayed the highest taxonomic diversity, including purple awn grass (*Aristida* sp.), blue grama, ring muhly (*Muhlenbergia torreyii*), dropseed grass (*Sporobolus* sp.), galleta grass (*Hilaria jamesii*), borage family, lichen, snakeweed, prickly pear cactus (*Opuntia* sp.), rabbitbrush (*Chrysothamnus nauseosus*), and several unknown species (Table 22.1). A flotation sample from LA 105709 expands the list of modern vegetation taxa associated with the site, providing some documentation of the fuller list of taxa to be found during the growing season (Table 22.3). Flotation taxa which reiterate those encountered in our winter vegetation survey are grasses and perennials. Additional taxa revealed by flotation include seven weedy annuals.

LA 105708, bilevel gardens at the edge of the terrace, were just north of a small but deep arroyo. This area looked more disturbed than the complex of gardens to the south (LA 105709 and LA 118547). The presence of several disturbance indicators confirms this characterization, including abundant snakeweed and significant

Table 22.3. Flotation plant remains, LA 105709 (all noncultural)

Taxon	FS 347
Annuals:	
Amaranthus	+
Chenopodium	+
Descurainia	+
Euphorbia	+
Lappula	+
Physalis	+
Portulaca	+
Grasses:	
Gramineae	+++ whole plant
Oryzopsis	+
Sporobolus	+
Other:	
Boraginaceae	+ fruit
Unidentifiable	+
Perennials:	
Cactaceae	+ pad, + spine
Juniperus	+♂ cone, + twig
Platyopuntia	++ embryo, ++
Sphaeralcea	+

Plant remains are seeds unless indicated otherwise.
+ less than 10/liter; ++ 11-25/liter; +++ 25-100/liter.

amounts of prickly pear and cholla cactus. Of the nine taxa identified, blue grama grass was dominant, followed by ring muhly grass. This transect and Transect 3 at LA 118547 had the lowest total vegetation coverage of all transects that passed through prehistoric gravel-mulch gardens.

Sites LA 105703, LA 105709, and LA 118547 were on BLM land with no recent evidence of grazing. Blue grama grass dominated both on and off prehistoric garden plots at these sites. Total vegetative cover and taxonomic diversity both tended to be higher on gardens, compared to nearby nonmulched areas. Anomalies noted at LA 105705, LA 105706, and LA 105708 can be primarily attributed to modern land tenure and range management parameters. These sites are on State Trust land that was actively being grazed at the time of fieldwork.

Vegetation Communities at Gavilan and Medanales

Gravel-mulch gardens and "dot matrix" gardens (pattern of noncontiguous, evenly spaced elements) on terrace and mesa margins were investigated in 1986 at Medanales, about 10 km west of the Gavilan sites in the Rio Chama drainage. Due to funding and scheduling problems, these studies have never been reported. When comparing Medanales vegetation transect results with those of Gavilan, it must be noted that the transects were conducted at different times of the year. The Medanales transects were completed at the peak of the growing season in July, while the Gavilan transects were recorded in January, when plants are dormant (substantially reducing the observable taxonomic diversity), and the winter floral remnants are difficult to identify. Certain taxa identified at Medanales (such as *Astragalus*, *Linum*, *Euphorbia*, *Gilia*, and *Hymenopappus)* would not have been evident during the Gavilan winter survey.

Gravel-mulch gardens at Medanales were primarily along terrace margins, but one transect on the second terrace (LA 48679, identified as a hilltop garden) had the highest taxonomic diversity (12 taxa, versus 5–8 elsewhere) both on and off the garden plot (Table 22.4). The distinct difference between the hilltop garden and those on the first terrace could relate to postgarden land use, such as cattle grazing. Indeed, the control for the hilltop garden had the highest percentage of snakeweed, considered to be an indicator of overgrazing (Elmore and Janish 1976:82). Though continued heavy grazing can have a distinct negative ecological impact, there is evidence that moderate grazing can actually increase plant diversity and land health (White 2001:27).

At both Gavilan and Medanales, grama grasses were the dominant species on and off garden plots in most transects. The exception at Medanales was the control transect at the hilltop garden, where snakeweed was dominant (Table 22.4). The biggest difference between Gavilan and Medanales was that the percentage of bare ground, rocks, and litter was consistently higher in control transects than in garden transects at Medanales, while at Gavilan this relationship varied somewhat. Gavilan included cases where gardens had a slightly higher percentage of nonvegetation (LA 105703), where controls had a higher nonvegetation component (LA 105705 and LA 105706), and where there was no significant difference (LA 105703). Anomalies found on the Gavilan transects at LA 105705 were not present at Medanales. A few individual differences occurred, including a high percentage of bare ground (71 percent) at Control Transect 2, high relative cover of *Bouteloua hirsuta* at Transect 1 (70 percent), and the aforementioned high percentage of snakeweed on the hilltop control transect (55 percent).

Summary and Conclusions

Vegetation analysis using the line intercept technique was carried out at six gravel-mulch garden sites along U.S. 285 near Gavilan, New Mexico. Total vegetation coverage was highest in garden transects, suggesting that gravel mulch provides a more favorable environment for plant germination and primary production. There was considerable repetition in characteristics of the substrate and in composition and distribution of contemporary vegetation at the gravel-mulch and cobble gardens at Medanales.

A tiny body of contemporary agronomic research provides some corroboration of the apparent effectiveness of gravel mulch in addressing farming woes of a limited segment of

Table 22.4. Medanales vegetation transect results

Transect	1: Garden Plot			2: Control for Transect 1			3: Dot Matrix Garden			4: Garden Plot		
	TC	RC	F	TC	RC	F	TC	RC	F	TC	RC	F
Bare	24	-	100	71	-	100	10	-	100	6	-	100
Rock	32	-	100	5	-	60	36	-	100	38	-	100
Litter	6	-	80	1	-	100	4	-	100	9	-	100
Grasses:												
Bouteloua curtipendula	7	19	80	-	-	-	1	3	100	4	8	60
Bouteloua eriopoda	-	-	-	-	-	-	21	40	100	18	36	100
Bouteloua hirsuta	26	70	100	10	43	80	14	27	100	19	38	100
Hilaria jamesii	-	-	-	9	41	100	-	-	-	-	-	-
Sporobolus contractus	<1	<1	20	<1	1	20	-	-	-	-	-	-
Stipa spartea	1	2	20	-	-	-	-	-	-	-	-	-
Shrubs:												
Gutierrezia sarothrae	2	5	60	2	9	40	1	1	20	-	-	-
Other:												
Astragalus brandezii	-	-	-	<1	<1	20	-	-	-	-	-	-
Chaetopappa ericoides	-	-	-	1	4	40	-	-	-	<1	1	20
Linum puberulum	-	-	-	<1	1	20	-	-	-	-	-	-
Moss / lichen?	-	-	-	-	-	-	15	28	100	9	18	100
Opuntia sp.	1	3	20	<1	<1	20	1	1	20	-	-	-

Table 22.4 (continued).

Transect	5: Control for Transect 4			6: Hilltop Garden			7: Control for Hilltop Garden		
	TC	RC	F	TC	RC	F	TC	RC	F
Bare	16	-	100	11	-	100	47	-	100
Rock	41	-	100	39	-	100	3	-	100
Litter	5	-	100	4	-	100	14	-	100
Grasses:									
Aristida sp.	-	-	-	2	4	60	1	2	20
Bouteloua curtipendula	-	-	-	-	-	-	<1	<1	20
Bouteloua eriopoda	18	43	100	17	34	100	<1	<1	20
Bouteloua hirsuta	14	34	100	23	47	100	3	7	60
Hilaria jamesii	-	-	-	-	-	-	7	18	100
Muhlenbergia sp.	-	-	-	-	-	-	1	4	60
Sporobolus contractus	-	-	-	-	-	-	3	7	80
Stipa spartea	-	-	-	-	-	-	<1	<1	20
Shrubs:									
Gutierrezia sarothrae	4	10	80	1	3	80	20	55	100
Other:									
Astragalus brandezii	-	-	-	-	-	-	-	-	-
Chaetopappa ericoides	-	-	-	-	-	-	1	3	60
Compositae	<1	<1	20	<1	<1	20	-	-	-
Euphorbia fendleri var. *chaetocalyx*	1	3	40	1	2	40	1	3	60
Gilia risida	-	-	-	1	2	40	-	-	-
Hymenopappus bilifolius var. *cinereus*	-	-	-	1	2	40	-	-	-
Linum puberulum	-	-	-	<1	1	20	<1	1	40
moss / lichen?	2	6	60	2	4	40	-	-	-
Opuntia sp.	1	3	20	<1	1	20	-	-	-
Unknown	-	-	-	<1	<1	20	-	-	-

TC = total cover (percent of occurrence in total length of transect).
RC = relative cover (percent of occurrence relative to other species).
F = frequency (percent of occurrence in five sections of equal or nearly equal lengths of transect).

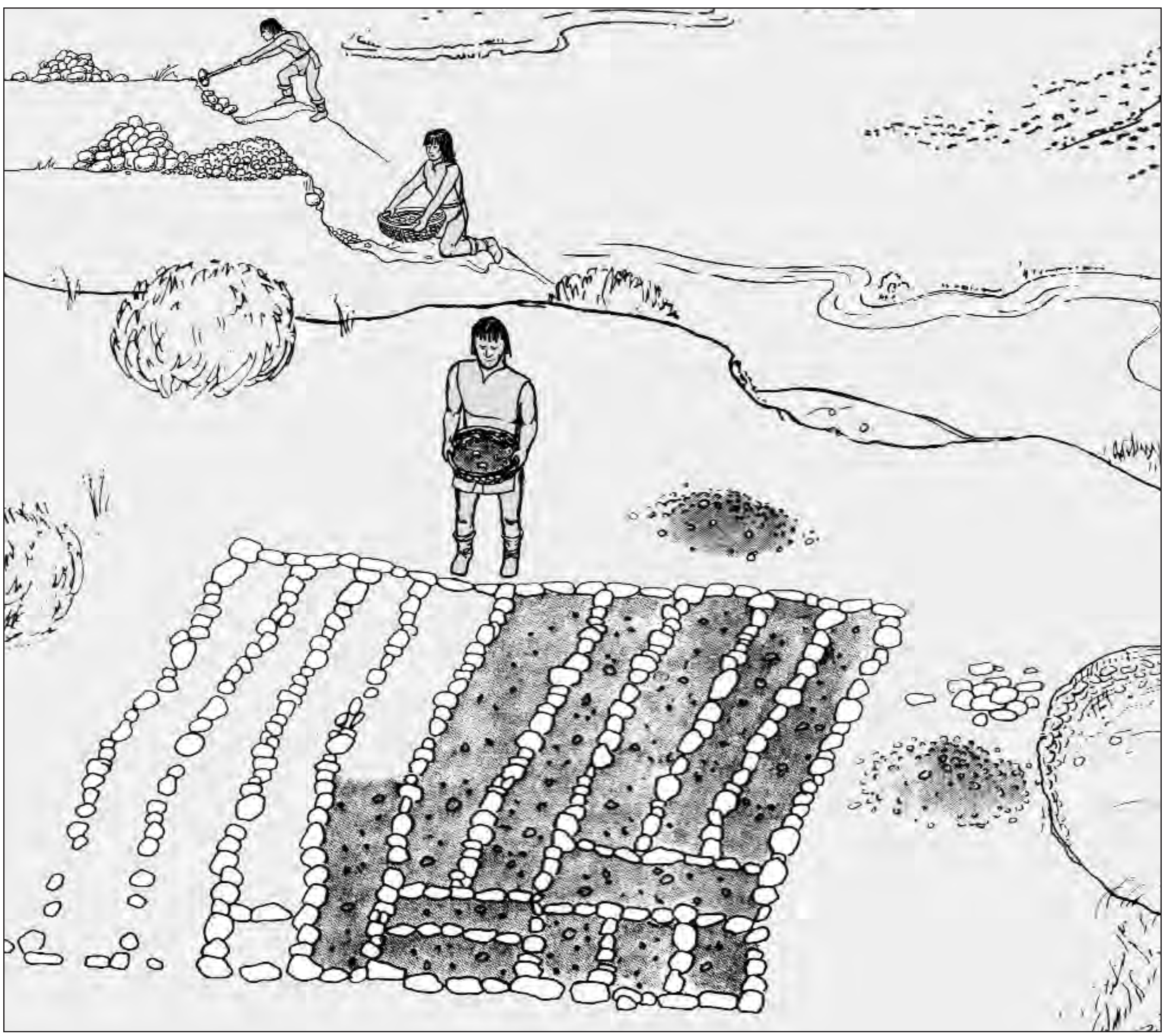
the late prehistoric period in northern New Mexico. In a laboratory study of factors affecting evaporation from soil surfaces, Corey and Kemper (1968:3) found that when gravel was used as a mulch, conductivity at ground surface is "virtually zero and water is by vapor diffusion only." In an experiment conducted at Fort Collins, Colorado, Fairbourn (1973:928) found that gravel mulch reduces soil water evaporation rates and increases soil temperatures at a depth of 15.0 cm by 2–4 degrees C, resulting in higher crop yields. During drought, crop yields from gravel-mulch gardens can be as much as two to four times higher than those grown in bare soil.

Third and fifth grade students who visited the Gavilan prehistoric gardens constructed experimental gardens at Gonzales School in Santa Fe to test potential functions of the gravel mulch. They were able to demonstrate that higher germination rates, larger plants, and earlier fruit production were all associated with their gravel-mulch plot, compared to their nonmulched control plot (Young Investigators in Santa Fe, New Mexico 1999).

There are good reasons to suspect gravel-mulch gardens were more of a survival mechanism than a tool for maximizing production. Both the geographic and chronological distribution of prehistoric gravel-mulch gardens are clues. These gardens have been recorded north of La Bajada in the upper Rio Grande Valley, with major concentrations in the Galisteo Basin and the Chama–Ojo Caliente area (Lightfoot 1993). La Bajada coincides with a significant increase in elevation over the middle Rio Grande Valley, and a critical drop in nighttime temperatures and growing season length. The gardens are further limited to uplands with natural gravel deposits, adjacent to fertile bottomlands in river valleys. These fields are primarily associated with major Classic period settlements for a 200-year period (A.D. 1350–1550 in the Chama–Ojo Caliente drainages, and A.D. 1400–1500 in the Galisteo Basin). Coalition period fields have also been documented in the Rio del Oso drainage (Anschuetz 1998).

Part 4

Interpretations



Chapter 23. Prehistoric Agriculture in the Ojo Caliente Valley

James L. Moore

Though archaeologists identified farming features in the Ojo Caliente Valley long ago, few formal studies of these sites have been completed. A similar array of features is better known and somewhat better studied in the Chama Valley, to which the Rio Ojo Caliente is tributary. Since these sites tend to be extensive, excavation is a difficult proposition, and simply documenting the extent and types of features present can be daunting. While we are beginning to derive a basic understanding of how these fields worked, some of the crops grown in them, and their value to prehistoric Pueblo farming, we still have much to learn about land tenure systems, how fields were tended, and more than just the basics concerning their construction. Beyond this, the overall areal distribution of gravel-mulched fields, the most common type of farming feature in the study area, remains unclear. Currently, archaeological and anecdotal sources suggest that the distribution of this type of field is mostly limited to the Chama and Ojo Caliente Valleys, the Tewa Basin, and the Galisteo Basin. All of these areas are traditionally considered to be the homeland of the Tewas. Thus, a question that will need to be addressed at some point is whether or not the use of gravel mulch in the Northern Rio Grande was limited to a single ethnic group.

Adolph F. Bandelier was the first archaeologist to identify and describe farming features in the Ojo Caliente Valley (Bandelier 1892; Lange et al. 1975). Making comparisons to similar features noted while conducting fieldwork in Sonora and southern Arizona, Bandelier described grids and contour terraces near Hupobi and Posi'ouinge in the Ojo Caliente Valley, and Sapawe in the nearby El Rito Valley, noting heavy gravel mulching in the latter (Lange et al. 1975:91). According to one of his informants, there were traces of "ancient ditches" close to a ruin that lay near the road to Abiquiu, possibly Poshu'ouinge (Bandelier 1892:53). Conversely, he was assured by other informants that no prehistoric "irrigation ditches" had been found in the Ojo Caliente Valley (Bandelier 1892:40).

Hewett (1905, 1906) noted farming sites near Abiquiu but mistook many of them for the foundations of ancient structures whose adobe walls had completely eroded away. This mistake was repeated in the Ojo Caliente Valley in 1910, when an expedition led by Hewett noted extensive farming sites but once again identified them as structural foundations (Morley 1910a, 1910b). Bandelier (1892:51) recognized this problem early on, noting that the linear stone alignments he characterized as gardens were frequently mistaken for foundations. Rather than foundations, Jeançon (1923:71) apparently misidentified some farming features around Poshu'ouinge as shrines. However, he did recognize the remains of fields near Peseduinge, describing linear stone alignments with associated ditches that may have been the remains of water harvesting systems (Jeançon 1911).

During investigations in the Chama Valley between 1929 and 1933, Greenlee (n.d.) described many farming features, mistaking several for the remains of villages. Thus, his Frijoles Creek Ruin, upper Abiquiu Ruin, Plaza Colorada Ruin, and "foundation type" ruins along El Rito Creek were probably farming complexes rather than villages. Greenlee (n.d.) discussed the fields near Hupobi that Bandelier (1892) had also described, noting their resemblance to his "foundation type" ruins, but rejecting the possibility that they were anything other than villages.

Hibben (1937) noted extensive grids during his Chama Valley survey and concluded that they were fields. Luebben (1951, 1953) identified gravel-mulched fields around Leafwater Pueblo (Kap), extending in both directions along the mesa edge from that site. A probable borrow pit was trenched, as was a grid system next to the village. The grids were built on slumped material from the outer wall of the pueblo and thus postdated its occupation, suggesting that the area continued to be used for farming after Leafwater was abandoned (Luebben 1951). A few contour terraces were also found near Leafwater, and Peckham (1981) noted one near Palisade Ruin.

Several researchers have examined farming features near Sapawe. Skinner (1965) described 24 fieldhouses and two rectangular cobble bordered fields. Ellis (1970) documented contour terraces, cobble-bordered and gravel-mulched fields, checkdams, diversion walls, and possible canals. Tjaden (1979) located 20 grid systems, 8 of which had associated one-room fieldhouses. Numerous undocumented fields containing gravel-mulched grids have also been observed around Sapawe.

Fiero (1978) examined gravel-mulched grids and cobble-bordered fields at three sites on a terrace north of the Rio Chama, opposite Abiquiu Mesa. Cobble-bordered fields, gravel-mulched grids, and stone-lined channels associated with floodwater fields were recorded near Ponsipa'akeri in the Ojo Caliente Valley (Bugé 1978, 1979, 1984). Gravel-mulched grids, checkdams, and contour terraces were found near Howiri (Fallon and Wening 1987), and a gravel-mulched grid complex was recorded near Te'ewi (Lang 1980).

Within the last two decades, the Museum of New Mexico has conducted several studies of farming sites in the Chama and Ojo Caliente Valleys. Anschuetz et al. (1985) studied field systems near Medanales in the Chama Valley. Moore (1992) examined similar farming features west of Abiquiu. Ware and Mensel (1992) completed a detailed study of fields in the lower Ojo Caliente Valley. To round out this list of agricultural studies for the region, two dissertations focusing on this topic have been completed. Anschuetz (1998) examined farming systems in the Rio del Oso Valley, another tributary of the Rio Chama, and Maxwell (2000) looked at field systems around Hupobi in the Ojo Caliente Valley.

Addressing the Research Issues

A series of research issues were generated for this study by Wiseman and Ware (1996; see Chapter 5). Two additional research issues that developed during our field studies were also presented in that chapter. Each research issue is further considered in this section in light of data recovered during our field studies and analyses.

Research Issue 15: Dating and Chronometrics

Dating prehistoric fields is very difficult, as Wiseman and Ware (1996:67–68) note. Though fields were a part of everyday activities for much of the year, the tasks performed there were restricted compared to those in the villages where farmers lived and the other types of limited-activity sites that were used. Thus, materials that can provide absolute dates tend to be rare on farming sites.

The only temporally sensitive artifacts recovered from the farming sites investigated during this study were sherds from ceramic vessels. No hearths that were definitely associated with the fields were identified within project limits, so no radiocarbon or archaeomagnetic dates are available. Even if hydration dates from obsidian artifacts recovered from the surface were reliable, so little obsidian was found in the chipped stone assemblages that this dating method would have had little use in our study.

Tables 23.1 and 23.2 list the types and quantities of pottery recorded on the surface or recovered from excavation units and from the surface within the right-of-way at the farming sites. Most of the types recovered were prehistoric, though three historic sherds were found on the surface of LA 105708, and one at LA 105713. In each of these cases the historic sherds undoubtedly represent intrusive materials. Prehistoric sherds were recorded on the surface of all nine farming sites and collected from EUs or within the right-of-way at four.

The most common temporally diagnostic types were Biscuit A and Biscuit B. When both data sets are combined, Biscuit B predominates in four assemblages (LA 105703, LA 105705, LA 105713, LA 118547), and both types occur in equal or nearly equal numbers in three assemblages (LA 105706, LA 105708, and LA 105709). No sherds were collected from the two remaining sites, and very few sherds were recorded on their surfaces (one sherd at LA 105704 and four at LA 105705). Following Wilson's conclusions in Chapter 19, distributions of pottery types suggest that these farming sites were used during the Late Classic period between ca. A.D. 1450 and 1550. This date range is supported by excavational data from several sites. Biscuit B sherds were recovered from the gravel mulch in two excava-

Table 23.1. Pottery recorded on the surface of the farming sites (count)

Ceramic Type	LA 105703	LA 105704	LA 105705	LA 105706	LA 105707	LA 105708	LA 105709	LA 105713	LA 118547
Biscuit A	2	1	1	3	14	10	65	18	5
Biscuit B	10	-	3	3	5	3	39	32	13
Unidentified biscuit ware	1	-	1	-	3	-	17	-	-
Glaze Red	-	-	-	-	1	1	-	-	-
Tewa Gray	-	-	-	-	-	3	-	-	-
Potsui'i Micaceous	-	-	-	-	-	-	-	1	-
Micaceous undifferentiated	-	-	-	-	-	1	3	-	-
Tewa polychrome	-	-	-	-	-	-	-	1	-
Unidentified	-	-	-	-	-	-	5	6	1

Table 23.2. Pottery collected from the farming sites (count)

Ceramic Type	LA 105703	LA 105708	LA 105709	LA 118547
Biscuit A	2	-	3	8
Biscuit B	30	7	31	3
Unidentified biscuit ware	12	124	-	-
Sapawe Micaceous	2	-	-	-
Micaceous undifferentiated	1	43	1	-
Classic period utility ware, undifferentiated	-	7	-	-

tion units at LA 105703, and one EU each at LA 105708, LA 105709, and LA 118547, suggesting that those fields were all in use during the Late Classic period.

Research Issue 16: Crop Mix

Wiseman and Ware (1996:68–69) considered determination of the types of crops grown in these fields to be of critical importance to our understanding of how they functioned in the prehistoric Pueblo economy. In addition to this question, they raised the possibility that borrow pits may also have been used for growing crops, as suggested by several other researchers (Bugé 1981; Lang 1979, 1980; Lightfoot 1990). Pollen samples were obtained from fields and a sample of borrow pits to address these questions. The pollen analysis is fully discussed in Appendix 1. The observations made here are primarily based on pollen concentration values provided in Appendix 1, which combine the counts and the low-magnification scan of samples and are presented in Table 23.3.

Corn and cotton are the definite domesticates in Table 23.3. Corn pollen was identified in all 45 samples, and cotton was found in 24 (53.5 percent). Since both of these pollens are large-grained and are not transported far from flowers by wind, it is certain that these crops were grown in the area. Corn cultivation seems to have taken place in every examined field location at one time or another. The distribution of cotton pollen is not quite as ubiquitous, but the high percentage of samples in which this type of pollen occurs suggests that it was a common crop. Cotton pollen was recovered from half the LA 105703 samples and four of five of the features examined. This crop was also identified in a third of the samples from LA 105704, accounting for one of the two features examined at that site.

Cotton pollen was found in only one of six samples from LA 105708, suggesting that it was grown in at least a section of one of the two features examined at that site. Similarly, cotton was identified in one of two samples from LA 105709, and it was grown in at least one of the two features studied there. Cotton pollen was most commonly found at LA 118547, where it was identified in eleven of twelve samples (91.7 percent) from Feature 15. It may be important that cotton was not found in either of the pollen samples recovered from backhoe trenches.

As Holloway notes in Appendix 1, it is not possible to differentiate pollen from wild and domesticated cucurbits, so we can not determine for certain whether or not the cucurbita pollen identified in four samples (8.9 percent) represents domesticates. However, the presence of this type of pollen in agricultural fields is suspicious and may indeed be an indication that cucurbits were sometimes grown in gravel-mulched fields.

The three remaining pollen types listed in Table 23.3 represent potential crops or plants that might have been encouraged to grow in fields because they were of economic value. Prickly pear occurs in only three samples (6.7 percent), all from LA 105708. The distribution of cholla pollen is much more ubiquitous, occurring in 40 samples (88.9 percent) from all five of the excavated sites. Since both of these plants currently occur naturally on farming sites in the study area, it is doubtful that they were ever purposely cultivated. Evening primrose pollen is also fairly common in samples from these sites, occurring in 22 samples (48.9 percent), and it is represented at all five sites. Though this plant was used in ritual and medicinally (see Appendix 1), it is questionable whether it was purposely grown in these fields. Thus, we have two and possibly three domesticates represented among the pollens identified in samples from the farming sites. A few other types of pollen could represent plants that were intentionally cultivated or at least encouraged, but since this is questionable, they are currently considered evidence of the natural plant community.

Five paired samples were submitted for analysis from LA 105703. Each pair came from an excavation unit that contained two separate layers of mulch, a lower cobble mulch and an upper gravel mulch, and one sample came from each mulch layer. We were hoping that these samples would provide evidence of variability in the crops grown in these mulches, but this does not seem to be the case. However, the paired samples may provide evidence of successive cropping in these features. Both corn and cotton pollen was identified in four of the five pairs. While corn was found in both samples from each pair, the occurrence of cotton was less ubiquitous. Indeed, in three of four pairs in which cotton pollen

Table 23.3. Economic pollen identified during ISM analysis of samples from the farming sites

Site	Feature	EU	Corn	Cotton	*Cucurbita*	Cholla	Prickly Pear	Evening Primrose
LA 105703	2	B	+++	+	+	-	-	-
		C	+++	+	-	+	-	-
		D	++	+	-	-	+	+
	8	A	++	-	-	-	-	-
	18	E[1]	+	-	-	+	+	+
		E[2]	+	+	-	+	-	-
		F[1]	++	-	-	+	-	+
		F[2]	++	+	-	+	-	-
		G	++	-	-	+	-	-
		H[1]	++	+	-	+	-	+
		H[2]	+	-	-	+	-	-
		I	+	-	-	+	-	+
		L	+	-	-	+	-	-
		N	++	-	-	+	-	+
		O	+	+	-	+	-	-
	21	M	++	+	-	+	-	-
	22	J[1]	++	-	+	+	-	-
		J[2]	+++	-	-	-	-	-
		K[1]	+++	+	-	++	-	+
		K[2]	++	+	-	++	+	-
LA 105704	1	A	+++	+	-	+	-	+
		B	++	-	-	+	-	+
	2	C	++	-	-	+	-	-
LA 105708	3	D	++	-	-	+	-	-
		E	+++	-	+	+	-	+
		F	++	-	-	+++	-	+
	9	A	++	-	-	+	-	+
		B	++	-	-	+	-	-
		C	++	+	-	+	-	+
LA 105709	1	A	+++	-	-	+	-	-
	4	C	+++	+	-	++	-	+
LA 118547	15	A	+++	+	-	+	-	+
		B	++	+	-	+	-	+
		C	+++	+	-	+	-	+
		D	+	+	-	+	-	
		E	++	++	-	-	-	+
		F	++	+	-	+	-	+
		G	+	+	-	+	-	-
		H	++	+	+	+	-	+
		I	+	+	-	+	-	-
		J	+	-	-	+	-	-
		K	++	+	-	+	-	-
		L	++	+	-	+	-	-
		BT-1	++	-	-	+	-	+
		BT-2	++	-	-	+	-	+

[1] Sample taken from gravel mulch layer.
[2] Sample taken from cobble mulch layer.
+ = present (<1-10 grains).
++ = moderate concentration (11-30 grains)
+++ = high concentration (>30 grains).

occurred, it was found in only one sample. Cotton pollen came from the cobble mulch in two cases, while in the third it came from the gravel mulch. Cotton pollen occurred in both samples from the fourth pair.

So what do the data from the paired sampled suggest? Since cotton pollen was recovered from both types of mulch, there is no evidence of the restriction of cotton cultivation to a specific type. These data seem to indicate the successive cropping of fields. Although the fields may have been multicropped with corn and cotton, this is less likely than their being grown in the same field successively. During the Valverde investigation of Oñate's colony at San Gabriel, Ginés de Herrera Horta testified that he had "seen the cotton next to the maize fields of the Indians" (Hammond and Rey 1953:653). Though these were probably irrigated fields, the early Spanish colonists were living among the northern Tewas, who consider the villages in the Ojo Caliente Valley to be ancestral. Horta's observation that he had seen cotton growing *next* to the corn fields implies that these crops were not grown together in the same fields. This source provides a thin thread of evidence suggesting that the historic Tewas did not grow corn and cotton together in the same field. The more likely scenario is that corn was the main crop, and cotton was substituted for it in some years.

The lack of cotton pollen in borrow pit samples may be significant. Both of the sampled borrow pits were at LA 118547, and cotton was identified in nearly every sample from the adjacent field. The borrow pit samples came from eolian and colluvial sediments that had built up over time, so it is possible that the corn pollen came from those adjacent fields. However, if the corn pollen was from nearby fields, why wasn't cotton pollen also found in those samples? After all, both crops were grown in those fields. Though this is slim evidence, the lack of cotton pollen in the borrow pit samples may indicate their use as subsidiary farming plots, and that corn was grown in sediments deposited after the pits were used as sources of building materials.

Research Issue 17: Characterization of Field Structure and Dynamics

Wiseman and Ware (1996:69) note that questions pertaining to field dynamics—how gravel-mulched fields were built, how they functioned, their potential productivity, their life expectancy, and other characteristics—represent important issues that have not been adequately addressed. When discussing these issues, most researchers have extrapolated from data produced by modern experiments in the use of gravel mulch to explain past field dynamics. There is a lack of replicative experiments concerning prehistoric gravel-mulched fields in northern New Mexico, so published accounts can only be used as a general guide. However, to adequately conduct experiments on prehistoric gravel mulching, detailed information on field-construction techniques are needed. Data on field-construction sequences and methods, gravel size, raw-material sources, and surface treatment variation are also needed.

Thus, this study was not structured to provide definitive answers to questions about field structure and dynamics. Rather, it was envisioned as an initial step in gathering data that can be used to design replicative experiments aimed at exploring these issues. As such, data concerning gravel sizes, mulch thickness, and construction sequencing were collected.

Gravel sizes. Observationally, there seems to have been minimal sorting of materials used to mulch the fields examined during this study. In most cases, excavators encountered materials sized from pea gravels to cobbles in individual excavation units. Cobbles that from surface indications were often thought to be part of an alignment were instead found to be floating in a gravel matrix. Field observations suggested that only larger elements were sorted out for use in building boundary and internal subdividing alignments. Spoils piles adjacent to and within some borrow pits probably represent stockpiles of potential building materials.

Samples of mulch were also obtained from most features. Unfortunately, the largest size of screen used to differentiate gravel sizes was 1 inch, so larger materials were not separated out. Our tabulation of material sizes was consistent with the procedure designed by Ware and

Mensel (1992) for their examination of field systems in the lower Ojo Caliente Valley. Since that experiment used screens measured in English rather than metric units, the former are also used in this discussion. The mean distribution of gravel sizes for materials from the gravel mulch is shown in Table 23.4.

Experiments by Corey and Kemper (1968:14) suggested that the thickness of a gravel-mulch layer should exceed 0.5 inch, but except where the diameter of the mulch exceeds 0.25 inch, the thickness of the mulch does not need to exceed 1 inch. If the diameter of the mulch exceeds 0.25 inch, then the thickness of the mulch layer should be greater than 1 inch (Corey and Kemper 1968:14). As Table 23.4 shows, 53.3 percent of the gravels used to mulch the fields investigated by this study were larger than 0.25 inches. This contrasts with samples taken from strata in borrow pits (Table 23.5), where only 37.6 percent of the gravels were larger than 0.25 inch. In contrast, 40.5 percent of the gravel-mulch samples were smaller than an eighth of an inch, and 53.7 percent of the gravel strata samples fell into that category.

Most of the materials that were less than 1/8 inch in diameter were sands that had infiltrated the mulch in the centuries since these fields were used. This has probably diluted the percentages of larger gravel sizes. For this reason, particles smaller than 0.125 inch in diameter were dropped from consideration, and Table 23.6 compares the remaining gravel sizes for the farming sites and the small group of samples from borrow pits. The largest percentage of gravels in samples from the farming sites is in the 1+ inch category, and the second highest percentage is in the 0.5 to 1.0 inch category. Except for LA 105704, at least 70 percent of the gravels from these samples were larger than 0.5 inch in diameter, and LA 105704 falls short of that mark by less than 2 percent. The borrow pit samples are more dominated by smaller fractions, and over half the gravels in these samples are smaller than 0.5 inch in diameter. Interestingly, the fraction in the 0.5 to 1 inch diameter category is quite similar for the borrow pits and field samples. These data suggest that Pueblo farmers were purposely selecting larger gravels at the expense of materials smaller than 0.5 inch in diameter.

Mulch thickness. Because larger gravels were selected for mulch, the mulch itself needed to be deeper than 1 inch, or 2.54 cm (Corey and Kemper 1968:14). Overall, the thickness of gravel-mulch layers encountered in excavation units varied between about 1 and 20 cm. Because of this variance, and since erosion undoubtedly rearranged the mulch somewhat after the fields

Table 23.4. Size of gravel samples from the gravel mulch

Gravel Size	No. of Samples	Mean Percentage	SD
1+ inch	36	31.57	12.28
0.5-1 inch	36	14.51	5.87
0.25-0.5 inch	36	7.26	4.04
0.125-0.25 inch	36	6.18	2.45
<0.125 inch	36	40.49	12.26

Table 23.5. Size of gravel samples from borrow pits

Gravel Size	No. of Samples	Mean Percentage	SD
1+ inch	5	17.58	17.24
0.5-1 inch	5	11.36	9.2
0.25-0.5 inch	5	8.64	4.97
0.125-0.25 inch	5	8.68	3.94
<0.125 inch	5	53.74	33.46

Table 23.6. Size of gravel samples from fields and borrow pits (particles <0.125 inch eliminated)

Gravel Size	LA 105703	LA 105704	LA 105708	LA 105709	LA 118547	Borrow Pits
1+ inch	51.92%	44.45%	61.78%	52.69%	47.98%	24.96%
0.5-1.0 inch	21.43%	24.16%	21.55%	25.95%	28.15%	21.43%
0.25-0.5 inch	12.94%	14.14%	8.59%	10.97%	14.18%	23.6%
0.125-0.25 inch	13.71%	17.25%	8.08%	10.4%	9.69%	30.01%
No. of cases	14	2	5	6	11	5

were abandoned, especially at their edges, mean mulch thicknesses are probably more accurate estimations of original thicknesses. These figures are available for 13 EUs at LA 105703 and range from 3.4 to 11.2 cm, with a mean of 8.2 cm. Only three gravel-mulch thicknesses are available for LA 105704, ranging from to 6.3 to 11.6 cm, with a mean of 8.4 cm. In the five EUs at LA 105708, the gravel mulch ranges from 5.6 to 9.4 cm thick, with a mean of 7.3 cm. Only two thicknesses are available for gravel mulch from LA 105709: 8.3 cm and 9.0 cm, which average out to 8.7 cm. Finally, gravel-mulch thicknesses are available from 12 EUs at LA 118547 and range from 4.5 to 12.1 cm, with a mean of 9.0 cm.

The mean thickness of gravel mulch at these five sites is 8.4 cm, ranging from a low of 7.3 cm at LA 105704 to a high of 9.0 cm at LA 118547. This is a tight range, though the variance in measurements from individual excavation units is larger. If the upper and lower 11 percent of the means for EUs are dropped to account for some of the more extreme variation that may be due to erosive processes, we are left with an overall range of 6.2 to 10.6 cm, and our mean thickness remains at 8.4 cm. This is still a fairly tight range, with a variance both above and below the mean of 2.2 cm, which is somewhat less than 1 inch.

The relatively thick layers of gravel mulch that were used at these sites were necessitated by particle sizes. The mean mulch layer for our sites is 3.3 times thicker than is recommended by Corey and Kemper (1968:14). Since over half of the gravel used to mulch these fields exceeded the size used in Corey and Kemper's (1968) experiments, these greater mulch thicknesses were probably necessitated by the size of the materials selected for use.

Construction sequencing. As discussed in individual site reports, some evidence of the sequenced construction of fields was collected. Though nearly all was gathered through surface observations, enough data exist to allow a preliminary discussion of this topic. Evidence of sequenced construction is first discussed for each site where it occurs and then summarized for the project. A few of the farming sites yielded no evidence of the staged construction of fields. While there is no reason to suspect that these sites were built in single construction episodes, we cannot demonstrate in this case that separate features were built at different times.

LA 105703 provided four types of evidence for sequenced construction. First, Feature 3 was built along the east edge of Feature 2 and distinctly mounded above the surface of the earlier feature. Second, the lobed shape or overlapping configuration of several borrow pits suggest that they were used as material sources on multiple occasions, though this type of evidence is not as strong as that for overlapping fields. The third type of evidence is the existence of material stockpiles—one between Features 2 and 5, and a second at the southeast edge of Feature 10. These probable stockpiles suggest that some parts of the field system were still being built or modified at the time it was abandoned. Finally, there are several examples of gravel mulch overlying cobble mulch. Unfortunately, this construction style is not well understood. While it could be evidence for the remulching of features with gravel that were originally mulched with a layer of cobbles, it could also simply be a more elaborate mulching technique. Further study of this type of mulch is needed before conclusions concerning its use can be drawn. Thus, alternate layers of cobbles and gravel cannot at this time be assumed to demonstrate sequenced construction.

Three lines of evidence of sequenced construction are available from LA 105705. First, Feature 11 partly overlays Feature 9 and is distinctly mounded above its surface, indicating that it was built after Feature 9 was in use, and perhaps after that plot was abandoned. Second, the presence of both terrace-edge and terrace-interior borrow pits may be evidence of at least two main field-construction episodes, as discussed below for other sites. Finally, a rock pile between Features 9, 11, and 13 represents a probable material stockpile, suggesting that field construction was still occurring when this site was abandoned.

Though evidence of sequenced field construction is not abundant at LA 105707, it does exist. This site is on a fairly narrow terrace finger, and there was not much room for field construction except at the terrace edge. While there were no terrace interior borrow pits, evidence of sequenced field construction was noted in three sections of Feature 13. The first was an unmulched area in the south leg of this field, which probably represents a planned extension that was never completed. The second is an area that contains material stockpiles represented by separate concentrations of cobbles and gravels, which may indicate another planned extension that was never finished. Directly north of the stockpiles in Feature 13 is a well-preserved field that partly covers another plot and is mounded 5 to 10 cm above its surface.

Quite a bit of evidence of multiple field-building episodes was found at LA 105708. When compared to most of the other farming sites, LA 105708 is rather wide and contains many terrace-interior borrow pits ringed by gravel-mulched fields that display a definite mounding above the natural terrace surface. Gravel-mulched fields that follow the edge of the terrace are not as highly mounded and are in a worse state of preservation than those on the interior. Thus, there seem to be two bands of fields at this site. The original band mostly follows the edge of the terrace and was apparently built with materials from terrace-edge borrow pits. A second band was built at a later time next to terrace-interior borrow pits. This band is represented by Features 7, 14, and 16, which overlap fields of the first band and are mounded above their surfaces. The highly deteriorated nature of some parts of the first band of fields suggests that materials were salvaged from them for building later fields. Further evidence of this was found when EU-A was excavated into Feature 9. That area contained a cluster of cobbles on the surface, which probably represented materials stockpiled for further field construction. Since these cobbles were piled on top of a field surface, that part of Feature 9 was abandoned when the stockpile was made.

The only evidence of sequenced field construction from LA 105709 was found in Feature 6, which appeared to be an unfinished plot. Feature 6 was not visibly mounded above the adjacent terrace surface, it was not mulched, and it included two cobble concentrations that seemed to represent material stockpiles. Thus, this plot remained unfinished at the time the site was abandoned.

The configuration of farming features at LA 118547 was quite striking and provides good evidence of multiple construction episodes. Two bands of features were visible across the northern three-quarters of this site—one along the terrace edge and a second toward the terrace interior, adjacent to the first. The terrace-edge band was the first one built, and it was primarily comprised of Feature 15, which undoubtedly represents many originally separate plots that eventually grew together. Feature 16 was included in the terrace-edge band, but it was built after Feature 15 and partly overlaps it. Thus, the terrace-edge band of fields almost certainly attained its current form through accretional growth. Most, if not all, of the terrace-edge borrow pits seem related to construction of the terrace-edge band.

In contrast, terrace-interior borrow pits at LA 118547 were all adjacent to a second (interior) band of fields, and they were probably sources for the materials used to build them. The interior band includes Features 18, 20, 22, and 23, as well as several unmapped fields. All recorded fields in the interior band were qualitatively distinct from those in the terrace-edge band. Their boundary alignments were better preserved and more visible, and their surfaces were clearly mounded above those of the terrace-edge band. Interior band fields overlapped those of the terrace-edge band in some instances. Boundary alignments in the interior band may be better preserved because construction materials were salvaged from the earlier (terrace-edge) band for use in the newer (interior) band.

As this discussion shows, there was overt evidence of sequenced field construction for at least six of the ten farming sites examined during this study. The most convincing evidence came from LA 105708 and LA 118547. Both of these sites contain two bands of farming features—an early band running along the terrace edge and a later band toward the interior of the terrace but adjacent to the back edges of the earlier fields. We were able to determine which band was earlier and which was later because plots in the interior band often overlap those of the terrace-edge band and are distinctly mounded above their surfaces. The presence of unfinished fields at several sites also indicates sequenced construction, in that some fields were planned but uncompleted when these sites were abandoned. Material stockpiles adjacent to fields on other sites may be more evidence of this, but they are not as strong an indicator. Similarly, the presence of both terrace-edge and terrace-interior borrow pits is not by itself direct evidence of sequenced field construction, but the similarity of this configuration to that of LA 105708 and LA 118547 suggests that the same process was at work. Perhaps the strongest evidence of sequenced construction is overlapping fields. When a field overlaps another field and is mounded above its surface, it is obvious that it was built later and is good evidence of sequenced construction.

More circumstantial evidence comes from the large and irregular shapes of many of the features examined during this study. Good examples of this are Feature 13 at LA 105707 and Feature 15 at LA 118547. These fields are very large and irregularly shaped, with numerous interior subdivisions. They seem to have been built in multiple construction episodes, and plots grew together through time. Some evidence of this process was seen at LA 118547, as noted earlier: Feature 16 overlapped Feature 15 but otherwise represented an extension of the earlier plot. Most of the large gravel-mulched field complexes examined during this study probably began as several smaller plots near one another and grew outward from those cores.

Research Issue 18: Embedded Lithic-Extraction and -Processing Activities

Wiseman and Ware (1996) note that some studies of gravel-mulched fields have concluded that chipped stone artifacts indicative of raw-material quarrying were common on field surfaces. Indeed, Ware (1995) wrote that lithic raw-material extraction and initial core processing were important activities embedded in field construction and use at sites further south in the Ojo Caliente Valley. Part of our chipped stone analysis was directed at determining whether this pattern pertains to farming sites in the northern valley as well.

As detailed in Chapter 18, this pattern extends to the sites included in this study. Raw-material extraction seems to have been the main activity in which chipped stone artifacts functioned at the five farming sites that had no associated occupational areas (LA 105703, LA 105704, LA 105706, LA 105713, and LA 118547). Raw-material extraction was also important at the four farming sites that had associated occupational areas (LA 105705, LA 105707, LA 105708, and LA 105709). However, raw-material extraction at the latter was not simply embedded in farming and field construction; it was also part of the domestic routine associated with part-time residence at those sites.

Research Issue 19: Methods of Field Tending

Scatters of artifacts, sometimes with associated features, that represent temporary occupational areas were found at four farming sites: LA 105705, LA 105707, LA 105708, and LA 105709. These occupational areas provide some information on field tending and, possibly, prehistoric land tenure systems. Though we identified no definite structures that were occupied by Pueblo farmers while tending fields, temporary structures were almost certainly built in the occupational areas. Indeed, Feature 21 at LA 105707 is a heavy concentration of cobbles, small boulders, fire-altered rock, and chipped stone artifacts that appears to represent one or more temporary field shelters. In close association are at least three deflated thermal features and a much larger scatter of artifacts (Feature 24).

The possible occupational zone at LA 105705 consists of a comparatively heavy concentration of chipped stone artifacts, which lacks evidence of thermal features or temporary structures. LA 105708 is bisected by an occupational area (Feature 18) that contains numerous chipped stone artifacts, between four and six probable thermal features, and a few sherds. Though no structures were defined from surface indications, temporary shelters probably existed in this area. The occupational area on LA 105709 consists of a fairly heavy scatter of chipped stone and ceramic artifacts, but no associated thermal features or structural remains were defined.

As discussed in Chapter 18, the four farming sites that contain occupational areas also exhibit evidence for the performance of a wider range of activities than were defined for the farming sites that lack occupational areas. Most of these tasks can be considered indicative of a residential function. In particular, fragments of ground stone tools were found on LA 105707 and LA 105708, indicating that vegetal foods were processed for consumption at those sites. Occupational areas probably contained temporary residences used during the growing season. The lack of substantial shelters supports the assumption of warm-season use. Year-round occupation was undoubtedly in the large Classic period villages that occur nearby: Ponsipa'akeri, Nute/Hilltop Pueblo, or Posi'ouinge.

Even though residential villages were fairly close to the field complexes, Pueblo farmers obviously felt a need to maintain a presence near their gravel-mulched fields during at least part of the growing season. Since fields attract herbivores, farmers probably maintained a presence near their crops to protect them from the depredations of deer and rabbits. Projectile points are fairly common at the farming sites with occupational areas and also occur at some of those that lack occupational areas. This suggests that large herbivores attracted to the fields were hunted, protecting crops and providing meat that could be easily transported back to the residential village.

Some of the farming sites in our sample that lack associated occupational areas are comparatively small and occur near farming sites that do have occupational areas. The boundaries between sites are artificial and assigned for the ease of archaeological recording, and they do not replicate prehistoric land tenure patterns. Thus, there is really no separation between LA 118547 and LA 105709 to the north, and LA 118548 to the south. The latter, outside our study area, is another large complex of gravel-mulched fields (Levine 1997). The fields at LA 118547 and LA 105709, at least, may have been tended from the occupational area on the latter site and thus could represent part of the landholdings of a single corporate group. LA 105705, LA 105706, LA 105707, and LA 105708 represent a sequence of fields that is broken only occasionally by natural topographic features, similar to the situation at LA 105709, LA 118547, and LA 118548. However, in this case, at least three occupational areas are represented. This suggests that LA 105705–LA 105708 may represent part of the farmlands of at least three groups. Further examination of areas in which other sites without occupational areas (LA 105703, LA 105704, and LA 105713) occur should provide evidence of similar land tenure patterns.

Conclusions

Data collected during our study of farming sites near Gavilan allowed us to examine all of the questions posed for this site type in the project research design (Wiseman and Ware 1996), as well as a few other lines of inquiry developed through field observations. Research Issue 15 concerned the dating of these farming sites. The only accurate type of chronometric data available was provided by pottery. Most assemblages contained mixtures of Biscuit A and Biscuit B sherds, suggesting that the fields were primarily used during the Late Classic period between ca. A.D. 1450 and 1550. According to Orcutt's (1999a) climatic reconstruction for the Northern Rio Grande, most years between 1450 and the mid-1480s saw drought conditions. The climatic model developed by Rose et al. (1981) follows a similar pattern, with mostly below-average precipitation levels between 1449 and 1485. Maxwell's (2000) reconstruction for the Chama River Basin also agrees with this pattern, with below-average precipitation levels between 1452 and 1486.

Even though our chronometric data are weak, it is probably no coincidence that these fields may have been initially built during a 30+

year period of drought. The heavy use of water-conserving farming technology was probably a response to both an expanding population and below-average rainfall. This is not to say that gravel-mulched fields were not built in the area before 1450, because this is clearly not true. Anschuetz (1998) recorded gravel-mulched fields dating to the Coalition period in the Rio del Oso Valley, so this technology was used almost from the beginning of Pueblo occupation in the Chama–Ojo Caliente Valleys. However, drought conditions in the second half of the fifteenth century may have provided an impetus for a much greater use of this technology to feed an expanding population.

Research Issue 16 concerned the types of crops grown in these fields. Direct evidence for the cultivation of corn, cotton, and possibly cucurbits was recovered by the analysis of field sediments for pollen content. While other common species could feasibly represent plants that were either semidomesticated or at least encouraged, there is currently little real evidence of this. The recovery of both corn and cotton pollen in several samples may be evidence for the sequenced planting of these crops in different years. However, it could also be evidence that the plots containing these plants were next to one another. Our scale of analysis cannot differentiate between these patterns, though we consider the former to be more likely.

An ancillary question the pollen analysis may have helped address concerns the use of borrow pits for farming. No cotton pollen was found in samples taken from borrow pits at LA 118547, though most samples from the adjacent Feature 15 did contain cotton pollen. If the corn pollen in these samples reached the borrow pits through erosion, why was no cotton pollen also washed down to them? It seems more likely that corn pollen in the borrow pit samples reflects the use of those features as small farming plots, probably (though not definitely) after sediments had begun to build up in them.

Research Issue 17 concerned the characterization of field structure and dynamics. Noting that insufficient data exist for the implementation of accurate replicative experiments in prehistoric gravel-mulch technology, Wiseman and Ware (1996) designed this question to collect information on gravel sizes and mulch thickness. An additional inquiry into field-construction sequencing was added during this study.

Examination of gravel sizing suggested that prehistoric Pueblo farmers selected for elements larger than 1 inch in diameter. Observations made during the field study corroborate this, and in most cases it seemed that only larger elements were chosen for use as building materials. Comparison with samples obtained from borrow pits suggest that much of the smaller fraction of gravels was discarded before the mulch was applied. Thus, Pueblo farmers were selecting gravels that were larger than the size considered optimal in experiments by Corey and Kemper (1968).

The comparatively large size of elements used in the gravel mulch probably directly contributed to the thickness of the layer applied to fields. Our data indicate that the overall mean thickness of gravel-mulch layers at these sites was 8.4 cm, ranging from a low of 7.3 cm at LA 105704 to a high of 9.0 cm at LA 118547. This range is tight, though variance in individual excavation units is much larger. This mean is 3.3 times the optimal thickness suggested by Corey and Kemper (1968), and this greater thickness was necessitated by the much larger gravel used in the fields versus the size of gravel used in Corey and Kemper's (1968) experiments.

Our analysis of construction sequencing indicated that these fields were not built in a single planned episode but grew by accretion through time. Fields were initially placed along terrace edges, probably at least partly because building elements were obtained more easily there. When there was no more terrace edge available for exploitation, and probably as the yields from those fields began to decline, a new band of fields was built when there was enough space. The new band of fields was situated toward the interior of the terrace but adjoined and often overlapped the earlier fields of the first band. Indeed, the more highly deteriorated condition of the terrace-edge bands versus the terrace interior bands suggests that some of the building materials used to construct the new fields were salvaged from older plots. In several instances, planned fields were not completed when these farming sites were abandoned.

Research Issue 18 was designed to examine chipped stone technology on the farming sites to determine whether there was evidence of embedded raw-material extraction and processing. As our analysis of the chipped stone assemblages indicated, raw-material extraction and initial processing were important at all of these sites, and they were carried out by the farmers who used the fields. In addition, however, we determined that a suite of activities using chipped and ground stone occurred at farming sites with associated occupational areas, and that evidence of those activities was mostly missing from sites lacking occupational areas. This suggested a part-time residential function for the sites with occupational areas, the use of which focused on the growing season.

Finally, we examined evidence of field-tending methods, suggesting that the occupational areas indicate temporary residence by farmers in areas next to some fields. These task groups probably mixed field tending with hunting herbivores attracted to their crops. That such duty entailed fairly lengthy stays at the fields is indicated by the occurrence of ground stone in two occupational areas, large scatters of chipped stone debris, and formal chipped stone tools indicative of a variety of tasks. We also suggested that the distribution of occupational zones in relation to fields might provide some information on land tenure systems, though the data we collected were insufficient for an in-depth study of this question.

Though we were able to address all of the issues posed in the research design, this discussion has raised more questions than it has answered. This is usually the case in such a study. The identification of occupational areas at several sites may be one of its most important contributions. This is not the first study to identify artifact scatters adjacent to fields, but it is the first to suggest a direct association between those scatters and farming in adjacent fields. A large-scale areal study of the distribution of fields and associated occupational areas could provide a much more detailed understanding of prehistoric Pueblo land tenure in this region and allow comparison of that system to its modern equivalents.

Chapter 24. Shrines and Trails in the Northern Rio Grande

James L. Moore

Types and Functions of Shrines in the Chama–Ojo Caliente Valleys

Shrines can be one of the most difficult aspects of Pueblo culture to understand and document. In many cases, shrines may have served multiple purposes. In addition to being places of veneration, they may also have served to mark the routes of pedestrian corridors and territorial boundaries. In form, shrines range from particular trees, rocks, or geological formations to elaborately constructed enclosures. While the latter are generally recognizable, more ephemeral types of shrines can be misidentified or missed during archaeological survey or excavation. Pueblo peoples are also usually reluctant to provide information on shrine location and use, especially when access to certain shrines is restricted. Parsons (1939:307) provides a very broad definition of Pueblo shrines:

> Shrines range from a mere boulder shelter or rocky ledge or cave to a ring or cairn of stones, from a miniature stone-slab house to an elaborately carved and painted tabernacle (Zuni Shalako roof box), from the great crater pit in Laguna's "southeast corner" or at Zuni Salt Lake to the small depression near the Taos house door devoted to filth boy. In fact, any place which is visited habitually to pray and make offerings may be considered a shrine: a tree, a spring or pool, a housetop (Oraibi).

Modern pueblo shrines tend to be physically and visually understated (Swentzell 1997:186). Important points in the Pueblo cosmos are marked by an inconspicuous stone or group of stones (Swentzell 1997:187). Since everything is sacred in the Pueblo world, there is little need to create distinctions between people, objects, or even places (Swentzell 1997:187). Thus, Pueblo shrines tend to have low visibility.

Harrington (1916) describes many shrines in the Tewa Basin, and Ortiz (1969) explains the structure of shrines around modern Tewa villages. However, both of these studies concentrate on the nature and locations of historic shrines. How similar to their modern counterparts are prehistoric shrines, did they serve the same function, and were they placed in similar locations? Obviously, most shrines represented by trees, shrubs, or geological formations are difficult or impossible to identify unless they have been modified in some lasting manner. Built shrines are usually more easily identified, though it may be difficult to establish their ritual function.

Though no attempt at a comprehensive study of shrines will be attempted in this chapter, we will examine types of built shrines to demonstrate similarities and differences between prehistoric and historic Tewa shrines of the study area and those of other regions. Shrines consisting of perishable materials (trees, shrubs, etc.) and those represented by unmodified geological formations are not considered.

Shrines of the San Juan Region

The most common types of shrines identified in the Chaco area are stone circles and *herraduras* (horseshoes). Windes (1978) presents the most comprehensive study of the former, noting that at least 20 stone circle shrines have been identified in Chaco Canyon. These are massive structures along the lines of Chacoan great houses. They usually consist of a double-coursed uncored masonry wall up to 1 m high and 7-30 m in diameter. All occur on exposures of bedrock along high cliff edges, and nearly all have one or more cut bedrock basins in association. Though most of these structures are round, a few rectangular examples have also been found. While the enclosing walls are thought to have been pierced by openings, only one shrine has a definite opening—the rest were obscured by collapse. Visibility seems to have been an important aspect of feature location, and they were placed where great kivas and other shrines were visible. A few similar structures have been noted at Chacoan outliers in the San Juan Basin and are described by Marshall et al. (1979). One has a southerly entrance, while a questionable shrine has an easterly entrance. There is a possible circular shrine near Guadalupe Ruin in the Rio Puerco Valley, though no construction details are available.

Herraduras are massive, low, circular or U-shaped masonry walls, and tend to be located near Chacoan roads (Nials et al. 1987). They range from 3.5–12 m in diameter, but most are between 5 and 7 m in diameter. In about 60 percent of known cases, herraduras open to the east (Nials et al. 1987:11). These structures are consistently located on major topographic breaks where there is extended visibility in both directions along the associated road segment (Nials et al. 1987:11). A similar type of shrine is the *zambullida*, which may be an elaborate form of the herradura (Kincaid et al. 1983).

Hayes (1981) recorded several other types of shrines in Chaco Canyon, though some may have been built by Navajos. Stone cairns, a very common type of shrine in the region, range from low, carelessly piled stone mounds to carefully built, truncated, conelike pylons up to 1.65 m tall (Hayes 1981:40). In addition to shrines, some cairns may represent stockpiles of building materials or trail markers, and others may have been built by Navajos (Hayes 1981:40). Open-faced boxes made of upright slabs or masonry about 1 m square were found at several sites (Hayes 1981:41; Kincaid et al. 1983). They resemble a common type of shrine used by the Hopis as a repository for offerings (Fewkes 1906). Also common are stone arcs or U-shaped walls about knee high and 30 ft across their open ends (Hayes 1981:41–42). Two "gateway" shrines have been identified in the Chaco area (Hayes 1981; Kincaid et al. 1983). These structures are 5–7 m in diameter and have openings on their east or south sides. Both are built of massive compound masonry, with walls about 1 m high and occur in elevated situations where access is difficult and visibility is good. Massive Bonito-style (carefully stacked, cored masonry) cairns occur in association with both of these structures, in one case consisting of a series of 13 cairns running along a cliff edge from the stone circle for nearly a quarter of a mile toward the southeast (Hayes 1981:43). Kincaid et al. (1983:9–21) feel that these shrines served as boundary markers for Chaco Canyon; hence the name "gateway shrines."

Rohn (1977) describes several shrines on Chapin Mesa at Mesa Verde. While they do not exactly replicate those identified in the Chaco area, they are often situated on bedrock exposures at cliff edges. Three examples are U-shaped masonry constructions built on sandstone ledges with features identified as associated hearths that could be basins similar to those at Chaco. A possible fourth example is a low round masonry enclosure built on a slight promontory. At least five thick-walled rectangular structures with walls less than a story tall are tentatively classed as shrines, though most may consist of multiple connected enclosures. Other shrine types include low masonry arcs, sometimes with associated hearths, and possible small niche or vault shrines. The latter, however, are similar to kilns or slab-lined hearths, and so they are doubtful. Hayes (1964:113) recorded several small shrines on Wetherill Mesa, mostly consisting of monuments of carefully stacked stones, all on cliff edges or projecting ledges.

There are some resemblances in form and location between the major types from the Chaco and Mesa Verde regions, suggesting a similarity in function and cultural derivation. Visibility seems to have been an important aspect of shrine location in both areas. Though circular shrines are common in parts of the Northern Rio Grande, they are built and situated differently, and they tend to date much later. There is also a great difference in the formality of shrine construction. Many of those described for the Chaco and Mesa Verde areas were carefully built, massive, coursed stone walls. There are few analogues to this form in the Northern Rio Grande, where shrines tend to be physically and visually understated (Swenzell 1997). Thus, there seems to be little direct relationship between the shrines of the San Juan region and those of the Northern Rio Grande except in the concept behind their use.

Classification of Shrines in the Rio del Oso Valley

Anschuetz (1998) summarizes data on shrines associated with ancestral Tewa sites in the Rio del Oso Valley, defining seven types.

Shrine Type 1 consists of large cobbles or boulders with cupules pecked or ground into them (Anschuetz 1998:460). The cupules tend to be 2–5 cm in diameter and 1–2 cm deep, and they occur singly or in clusters of up to 100 (Anschuetz 1998:460). Though he estimates that over 100 such shrines occur in his study area, Anschuetz (1998:460) indicates that this type only occurs at habitation sites with associated ash piles and are mostly situated at breaks in slope and at the edges of ash piles.

Shrine Type 2 consists of boulders with large oblong ground facets and is limited to the large villages of Ku, Te'ewi, and Peseduinge, where they occur in clusters that enclose the village's physical limits (Anschuetz 1998:467).

Shrine Type 3 consists of small cobble structures, all but one of which occur at Classic period sites (Anschuetz 1998:468). One example is a small keyhole-shaped construction with a south-facing stone-bordered path. Two other examples are small (1.5–2.5 m diameter) semicircular rock alignments that open toward the east and resemble a historic Tewa shrine that was also recorded in the area. These varieties occur among gridded and terraced field complexes. Another variety consists of large stone rings up to 5 m in diameter, which occur around the large villages of Te'ewi, Ku, and Peseduinge. These shrines are typically full of ash and only one course high. Three small rings comprised of piled basalt gravel and cobbles were identified at Peseduinge and may represent postoccupational features (Anschuetz 1998:468).

Petroglyphs are Shrine Type 4 (Anschuetz 1998:468). All of his examples occurred in association with visible field complexes. Examples of Shrine Type 5 are shaped stones, two of which are reported from Rio del Oso: a small boulder with an incised keyhole-shaped motif, and a possible *timponi*, or Corn Mother (Anschuetz 1998:469). Large world-quarter or middle-place rock rings exemplify Shrine Type 6. They tend to occur near some Classic period villages (Anschuetz 1998:469). Shrine Type 7 is represented by a single ethnographically documented example—a large upright gray boulder next to a cleared area.

Other Types of Tewa Shrines

Several other categories of shrines are mentioned in ethnographic studies of the Tewas. All springs are considered sacred, but certain springs and certain caves are deemed places of emergence. The Tewa place of emergence is a small brackish lake in the sand dunes north of Alamosa, Colorado (Harrington 1916:564–565; Hewett and Dutton 1945:23). The Tewas consider a pair of caves near La Cueva in the Ojo Caliente Valley to be the emergence place of the Keres (Devereaux 1966; Harrington 1916:166; Hewett and Dutton 1945:24). Sacred waters, associated with the four cardinal directions, occur in the Tewa Basin; for example, the sacred spring of the west is less than a mile southwest of Perage (Hewett 1938), a Classic period village across the Rio Grande from San Ildefonso. The hot spring at Ojo Caliente is one of the most sacred Tewa shrines and has several connections to Poseyemu, the Tewa culture hero (Harrington 1916:164; Hewett and Dutton 1945:40). Another sacred hot spring is associated with a shrine complex on top of Tsikomo Peak (Douglass 1917:345). Douglass (1917:364–365) discusses a cave shrine on Black Mesa, but he never visited it.

One of the most common types of shrine in the Tewa area, and indeed for the Pueblos in general, is the rock pile (Ellis 1969:173). These shrines vary greatly in size and sometimes incorporate perishable materials. Douglass (1912, 1917) describes a large rock pile as part of the Tsikomo Peak shrine complex. This rock pile was 3 m in diameter by 1.5 m tall and had a peeled spruce pole protruding from its top. A similar rock pile, without the spruce pole, is on top of a peak at the southwest corner of the Baca Location 1 Grant, within view of Tsikomo (Douglass 1917:358), and it is also part of a shrine complex.

Ellis (1969:168–169) and Parsons (1929:238) discuss a type of Tewa rock pile shrine referred to as a *kaiye*, which contain elongated stones that are often white and set upright. This is one of the most common types of Tewa shrines. Examples of this type are also known in the Pecos area and the Chama–Ojo Caliente Valleys (Ellis 1969:174). Every hill in the San Ildefonso Pueblo grant is said to have a shrine on it, usually consisting of a pile of rocks on its crest (Douglass 1917:367). A rock pile shrine also occurs on top of a hill sacred to Tesuque Pueblo (Harrington 1916:389). Numerous small rock pile shrines have been noted near Nambe Pueblo (Harrington 1916:366).

Stone-enclosure shrines are quite varied in form and size, ranging from small alignments less than 0.6 m in diameter to massive rings over 15 m in diameter. Stone-enclosure shrines can be circular, oval, U-shaped, and rarely V-shaped. This category includes the type often called world-quarter shrines, though it is not limited to those features. Anschuetz (1998) also refers to world-quarter shrines as "middle-place rock rings." Ortiz (1969:141) calls them earth navels, and defines three types for the Tewas. Examples of one type of earth navel, a large rock ring with an opening pointing toward the village, are at the summit of each of the four sacred directional mountains and hills. Another type, the mother earth navel, represents the spiritual center of the village and therefore the world. At San Juan Pueblo it is a loose circle of stones in the south plaza (Ortiz 1969:21). At Nambe the mother earth navel is represented by a flat stone in the middle of the plaza (Parsons 1929:246). The third type of earth navel occurs on hilltops at about the same elevation as the sacred hills or in open places in the lowlands, and they are hunting shrines (Ortiz 1969:24). The latter type is smaller than the directional variety, and Ellis (1969:170) indicates they open toward the east. However, this is the modern scheme, which could differ somewhat from the types and classifications used in the past.

The best known of the directional earth navels (or world-quarter shrines) is part of a complex on top of Tsikomo Peak (Douglass 1912, 1917). Ortiz (1969:19) notes that lakes or ponds are associated with each of the sacred directional mountains. At Tsikomo the body of water is a nearby hot spring (Douglass 1917:345). This earth navel is an enclosure of loosely placed unshaped stones that measures 4.6 by 3.4 m, with several openings in the east section of wall. There was a saucerlike depression in the center of the shrine, and when it was first described, several prayer sticks and a jar set into the ground were observed west of the depression (Douglass 1912:172). Reportedly, this shrine is used by Tewas, Keres, Towas, Northern Tiwas, and Navajos. As discussed earlier, a large rock pile containing a peeled spruce pole forms a separate component of the shrine complex.

Jeançon (1923:70–73) identified numerous shrines around the ancestral Tewa village of Poshu'ouinge in the Chama Valley, though some of the features he classified as shrines may in fact have been gravel-mulched farming plots. All four of the hilltop directional earth navels related to this village were found, and a large earth navel he referred to as a "world shrine" was located just over 1 km southeast of the village. The latter was a large stone circle 12.2 m in diameter with an opening to the east, which Jeançon suggests might once have been topped with an adobe wall. Eight minor shrines, placed on and between the cardinal points around the earth navel, consisted of circles, squares, and a triangle, presumably outlined in cobbles. Similar large shrines also occur near the villages of Hupobi and Posi'ouinge in the Ojo Caliente Valley. Both of these large shrines (15+ m in diameter) are formed of cobbles and boulders piled in a circle. Upright slabs and boulders line the interiors of both shrines, and they open to the east. In both cases, the surrounding walls seem to have collapsed and thus were probably once much higher. A similar earth navel was also found 0.8 km southwest of Sapawe in the El Rito Valley (Ellis 1994:108). It is possible that mother earth navels were originally placed outside villages but were moved into plazas during the historic period and built to make them unrecognizable to outsiders. If so, then these large stone circles may represent the original locations and forms of the mother earth navel.

Jeançon (1923:71) briefly describes possible stone enclosure shrines associated with a series of three tanks 228 m northeast of the world shrine at Poshu'ouinge. All around the tanks were stones in V-shaped alignments, squares, circles, and triangles, as well as other undescribed shapes. The V-shaped alignments pointed toward the village and seem similar to a shrine described by Harrington (1916:222) near San Juan Pueblo. A hill sacred to that village has two peaks, each with a shrine on its summit. On top of the north peak is a hilltop directional earth navel about 1 m long, while the shrine on the south peak is V-shaped, with its opening toward the pueblo and a large slab of yellow stone where the lines of the V meet.

Small stone circles also served as shrines in the region. Jeançon (1923) noted numerous examples of this type around Poshu'ouinge but does not describe them. Douglass (1917) noted several small stone circle shrines on top of Black Mesa that ranged between 0.5 and 1.5 m in diameter. Ellis (1994:109) notes, "Many, though not all shrines have a stone pile or a stone-outlined area a few feet (a meter) across in or near them where prayers are said and a small offering is left." Thus, small stone enclosures as well as rock piles may be just one aspect of a shrine, and the actual shrine may be difficult to identify.

Cobble pavements are also mentioned as shrines by some investigators. Douglass (1917:364) describes a circular stone pavement 1 m in diameter on top of Black Mesa that was sacred to the village of San Ildefonso. Three cobble pavements were noted near a hill sacred to San Ildefonso, ranging from 0.3 to 1 m in diameter (Douglass 1917:366). At times, a single boulder can be a shrine, with or without human modification. These can include the boulders with pecked cupules in the Rio del Oso Valley (Anschuetz 1998). Douglass (1917) noted a similar shrine near San Ildefonso consisting of a semicircular wall of loose stones opening to the north with an associated boulder with 11 pecked cupules. Two of the shrines that mark the edge of San Juan Pueblo are comprised of single stones (Ortiz 1969:20).

A Tentative Classification of Tewa-Built Shrines Compared to Those of Other Groups and Regions

Rock pile shrines. This category can be broken into at least three subvarieties: large rock piles, small rock piles, and rock piles containing elongated cobbles. Few large rock piles have been reported, and those that are currently known occur on mountain tops, sometimes in association with other features to create a shrine complex. Small rock piles are common features, and if we are reading the literature correctly, they can occur both with and without elongated cobbles. When elongated cobbles (kaiye) occur, they are often set upright in modern shrines.

As Ellis (1969) notes, small rock pile shrines are fairly widespread, occurring among many Southwestern groups. Small rock piles are common in the Navajo Reservoir district, occurring as isolated features on the ends of ridges overlooking valleys (Dittert et al. 1961:43). As discussed earlier, they also occur in the San Juan region, usually in situations similar to those in the Navajo Reservoir district. Lang (1977) recorded simple probable rock pile shrines and rock pile shrines with elongated stones in the Galisteo Basin near villages ancestral to the Tanos (Southern Tewas). These shrines often occur at mesa edges. Several rock piles were part of a shrine complex in the Piro area of the Rio Abajo, which appear to have originally had elongated slabs set upright in them (Marshall and Walt 1984:187). Small rock piles, which have also been identified in the Southern Tiwa area (Schmader and Hays 1988), are commonly used as shrines by the Hopis (Fewkes 1906; Page and Page 1982). Indeed, Hopi farmers will sometimes build small rock piles in their fields as shrines (Parsons 1939:307–308).

Stone-enclosure shrines. While this category could doubtless be divided into numerous types, only two very general divisions are made here: earth navels and stone enclosures. Though the name and possibly function of earth navel shrines may differ from group to group, the general shape and construction style of this type is fairly consistent. Earth navels are round to horseshoe- or U-shaped enclosures with an opening in one side and vary considerably from small features about 1 m in diameter to large, elaborate structures up to 15 m in diameter. Construction style also varies, from a border of rocks a single element high and wide to massive piles of cobbles, sometimes bordered by upright slabs.

Small earth navels are common around Keres villages. Most open toward the east, but sometimes they open toward the village or to the north (Boas 1928:299; Ellis 1969:167; Goldfrank 1927:70; Starr 1900). The Towas of Jemez, who have borrowed numerous features of Keres religion, also use earth navels (Ellis 1969:167). At least one small earth navel is described for the Hopi Tewas (Fewkes 1906:358). Elaborate earth navels similar to the possible mother earth navels of the Chama–Ojo Caliente area occur near ancestral Tano villages in the Galisteo Basin, as do smaller earth navels (Lang 1977; Nelson 1914). The possible mother earth navels occur on the south sides of villages and open to the east (Nelson 1914). Small earth navels that open to the east or south have been recorded in the Southern Tiwa area near Albuquerque (Schmader and Hayes 1988). Earth navel–shaped shrines at Zuni consist of semicircular or rectangular stone enclosures open to the east and containing upright slabs on the west (Mindeleff 1891:86; Stevenson 1904:117). A few shrines of this type have also been noted in the Hopi area. Fewkes (1906:367) describes one that consists of a stone circle with an east-oriented opening and a large rock set on its west side. Page and Page (1982) illustrate a Hopi shrine on top of San Francisco Peak that is crescent-shaped and built of uncoursed stones.

Stone enclosures usually range from 0.5 to 1.5+ m in diameter and are generally represented by a border of rocks a single element high and wide. This type of shrine can be round, oval, square, or V-shaped. Stone-enclosure shrines appear to be common at Hopi, usually with a large rock on the west side (Fewkes 1906). The Zunis appear to use small stone semicircles and rectangular enclosures as shrines (Holmes 1989:19; Mindeleff 1891:92; Stevenson 1904).

Cobble pavements. Cobble pavements consist of collections of cobbles placed closely together in a rough circle, often less than 1 m in diameter. This type of shrine does not appear to have been recorded ethnographically among other Pueblo groups, though Starr (1900:220) illustrates at least one example from Cochiti that is similar to this type.

Isolated cobbles or boulders. This type consists of large isolated cobbles or boulders that have been assigned a ritual or sacred status. Anschuetz (1998) defined one such feature ethnographically in the Rio del Oso Valley, consisting of a gray boulder with an adjacent area that had been cleared. Ellis (1969:166) and White (1962:49) note that there are two or three such stones in the plaza of modern Zia. Certain boulders that appear to have been used as shrines at Taos Pueblo are considered to have indwelling spirits (Parsons 1936:104). Hopi farmers often plant their prayer sticks and spruce twigs obtained from kachinas at the foot of a small boulder in their fields, suggesting that this type of feature sometimes served as a field shrine (Parsons 1939:307–308).

Boulders with pecked cupules. As defined by Anschuetz (1998), this type of shrine consists of a boulder with one or more small cupules pecked into its surface. Though boulders with pecked cupules can occur as isolates, at times there may also be other features related to them nearby. Other than the ethnographic example reported by Douglass (1917) near San Ildefonso, examples of this type of feature are scarce in the literature. At Hopi, the shrine of Kwataka consists of a large petroglyph of a mythological bird containing three hollows for the placement of war medicine (Fewkes 1906:362–362). Starr (1900:222) describes several boulders near Cochiti with pecked cupules in them that appear to have had a hunting association.

Rock art. Shrines or sacred areas are often marked by rock art, sometimes in association with another feature and sometimes not. Anschuetz (1998) noted that all his examples of petroglyphs were associated with fields, suggesting that they might represent a type of farming shrine. Schaafsma (1990) describes a shrine in the Galisteo Basin consisting of two rock shelters containing numerous painted figures and notes that similar shrines are known in the Tiwa, Piro, and Tompiro areas. White (1935:166–167) illustrates "stone images" at eight sacred spring shrines used by Santo Domingo Pueblo. Though he does not specify what form the stone images take, his illustrations suggest that they are rock art. Examples of rock art associated with shrines have also been documented for the Hopis (Fewkes 1906; Page and Page 1982), Tanos (Nelson 1914), and Zunis (Stevenson 1904). Clusters of petroglyphs near the heads of small water courses in Petroglyph National Monument near Albuquerque probably mark the locations of Southern Tiwa shrines.

Shaped or carved stones. This type of shrine is comprised of a stone or stones that have been purposely altered into a new form. The examples provided by Anschuetz (1998) include a small boulder with an incised keyhole-shaped motif; and a possible timponi, or Corn Mother. Two carved human figures in different canyons near Otowi, an ancestral Tewa village, were probably used as shrines (Douglass 1917:369). Examples from other areas exist but are not common. Perhaps the best known is the Shrine of the Stone Lions, near the village of Yapashi in Bandelier National Monument. A second set of carved lions is also known from nearby Potrero de los Ídolos. Both shrines are enclosed in horseshoe-shaped stone enclosures open to the east (Douglass 1917:371, 373; Ellis 1969:166). They appear to have been used by the Keres residents of the Pajarito Plateau, and Harrington's (1916:420)

Tewa informants indicated that the Stone Lion shrine was still being used by Cochiti Pueblo in the early 1900s. A Zuni Shalako shrine contained a number of carved stone kachina images, some elaborately shaped and others barely altered (Parsons 1939:334).

Discussion

These seven basic types, some with subvarieties, seem to represent the main classes of built shrines used by the Tewas. Obviously, due to a reluctance of the subjects of ethnographic interviews to discuss sacred matters, all types of built shrines are certainly not included. This scheme may also oversimplify the subject, since important differences may be ascribed to different forms of shrines that were not revealed through ethnographic investigations and certainly cannot be discerned archaeologically. Finally, we reiterate that this discussion includes only built or otherwise artificially marked shrines. Many important types have been omitted because they would not be visible archaeologically, including shrines built of perishable materials, sacred trees, unmarked springs or ponds, unmarked caves or crevices, sacred geological formations, shrines built of earth, and formerly occupied villages.

None of the seven types defined above are restricted to the Tewas, so no specific type can be considered a good indication of cultural affinity. However, there are important differences in shrine type preferences and in the distribution of certain subtypes. Circular or U-shaped shrines with openings oriented in a certain direction have been used for at least 900 years. This form is fairly common in Chaco Canyon and along the roads that radiate from it, and it also seems to be common in the Mesa Verde area. Though two examples of this type, the "gateway shrines," may have been boundary markers, such use was probably unusual. Cairns are also common in these areas, but most seem to have been carefully stacked rather than simple rock piles, though the latter also occur. These types of shrines tend to occur in topography that is unlike that of most of the rock pile shrines of the Tewas. Stone arcs and other types of smaller stone-enclosure shrines have also been recorded in the San Juan region.

The earth navel shrine may have developed out of these early forms in the San Juan region, perhaps conveyed to the Northern Rio Grande during the Keres migrations into that region. However, while this form now appears to be universally used by Pueblo peoples, the elaborate constructions near several ancestral Tewa villages in the Chama–Ojo Caliente Valleys and ancestral Tano villages in the Galisteo Basin that may represent early versions of the mother earth navel do not seem to be replicated elsewhere. Though similar in form and elaborate construction to the circular shrines of Chaco Canyon, they were built and placed differently. This form of the mother earth navel appears to have fallen out of use, probably during the historic period. Smaller earth navel shrines are used by all Pueblo groups, though there are certain elaborations that may not be universal. For example, Ellis (1969) notes that many Keres earth navels she had seen contained pieces of petrified wood, which do not appear to be found in Tewa earth navels. Several of the Keres earth navels described by Starr (1900) contained boulders—again, something that is not described in studies of Tewa shrines. Among the Hopis and Zunis, most described earth navels have large stones or boulders on their west sides opposite the opening, which do not appear to occur in Tewa earth navels.

Vaults for offerings, common at Hopi and Zuni, also seem to occur prehistorically in the San Juan region (Fewkes 1906; Hayes 1981; Rohn 1977; Stevenson 1904). Though Steen (1977, 1982) reports observing this type on the Pajarito Plateau, none have been described ethnographically for the Keres or Tewas, which is why it was not listed above as a separate type. If this variety of shrine was actually built on the Pajarito Plateau, it probably fell out of use before the Classic period.

Other differences occur in subvarieties of the rock pile type of shrine. Though all Pueblos use simple rock pile shrines, the addition of elongated stones seems to be restricted to Tanoan groups, currently reported for the Tewa, Piro, and Towa (Pecos) regions, though the addition of upright slabs to earth navels in the Tano region may be a similar application. Ellis (1969:177) remarks on the modern Keres emphasis on petrified wood and the Tewa affinity for elongated stones, ascribing both to a common belief in Stone People.

Thus, the types of shrines used by various

Pueblo groups are both similar and different. Similar forms occur across most of the region, but there can be subtle differences in construction style and associated materials. The use of shrine type to assign cultural affinity could be a perilous endeavor, and it might be equally dangerous to draw analogies between the uses of modern and prehistoric shrines. Aspects of the religious systems of all Pueblo groups have changed through time, especially between 1250 and 1350, when populations were dislocated and migrated across the region on a large scale, and new religious and organizational concepts like the Kachina Cult were introduced (Adams 1991).

Changes in shrine use and distribution in the prehistoric Tewa region have been documented. Anschuetz (1998) found important differences in the occurrence and distribution of Coalition and Classic period shrines in the Rio del Oso Valley. Shrines seemed to be rare at Coalition period sites and did not demonstrate the patterned distribution described by Ortiz (1969) for the modern Tewas. The occurrence of two or three elaborate earth navels at the late Coalition period village of Ku, probably mother earth navels, may represent the development of a new kind of corporate ritual space (Anschuetz 1998:476). No similar features of comparable antiquity have been identified elsewhere in the Chama–Ojo Caliente region. There was a major change in the use and placement of shrines by the late fourteenth century (Anschuetz 1998:474). After that, more and larger shrines were built in direct association with visible field complexes that lacked livable structures (Anschuetz 1998:474). This change seems to reflect a need to permanently mark land-use areas by the late fourteenth century that was not a concern during the earlier period of occupation (Anschuetz 1998:473). It may have been stimulated by the growing population of the region and practical concerns over the distribution of arable lands (Anschuetz 1998:493).

Another important consideration in the development of boundary-marking shrines was probably the influx of Keres groups into the Northern Rio Grande and an accompanying competition for resources. Thus, the Tewas may not have been simply marking areas controlled by certain villages; they may also have been delineating the region they felt belonged to them in the face of the invading Keres. The formalization of the system of shrine boundary markers may have been related to direct competition for land with both the Keres and other Tanoans that were displaced by migrants. While these possibilities are offered quite tentatively, they provide a direction for future research into the intriguing changes noted by Anschuetz in shrine use and placement between the Coalition and Classic periods.

Shrines at Gavilan Project Sites

Shrines identified at the sites examined during this project fall into four categories: rock piles, cobble pavements, stone enclosures, and isolated boulders. Since we did not closely examine any of the large Classic period villages in the valley, the absence of boulders with pecked cupules or ground facets, and of ash-filled stone enclosures is not surprising. The lack of petroglyphs in field settings is a bit harder to understand, but since few boulders that were both large enough and of the right kinds of material for such use were seen on these sites, perhaps that lack is not really so surprising.

Twenty-one definite and possible shrines were identified on eight sites. The lack of shrines at the other sites is probably more a reflection of our inability to recognize them than an actual absence of this type of feature. Indeed, though we identified potential shrines on eight sites, we cannot be certain that all such features were recognized in those cases either. Not all of the possible shrines noted at these sites are discussed as such in the individual site reports.

Though no rock piles containing elongated cobbles were found, several probable simple rock pile shrines were identified, though most have been knocked over and scattered by grazing livestock. Because of this damage, we could not determine whether some of these features represented rock piles or cobble pavements. The only potential shrine identified at LA 105703 falls into this category. This was a simple rock pile on Feature 10, which could also feasibly represent a material stockpile.

The only possible shrines defined at LA 105705 were also of the rock pile variety. Feature 6 is a single element high and appears to be more of a cobble pavement than a rock pile. A small rock pile on Feature 11 is a single element high, with elements that appear to have tumbled over. This small feature, which seems to represent the remains of a rock pile shrine, measures 0.85 m north-south by 0.8 m east-west. Feature 12 is a cluster of rocks between Features 9, 11, and 13 that measures 1.4 m north-south by 1.5 m east-west. This rock cluster is a single element high and like Feature 6 seems to represent a cobble pavement rather than a rock pile.

The only possible shrine defined at LA 105706 was another cluster of rocks that seems to represent a collapsed rock pile. This cluster of rocks is between Features 3 and 4 and is now only a single element high, measuring 1.3 m by 1.35 m. Three possible rock pile shrines were identified at LA 105707. A cluster of rocks on the east side of an extension of Feature 13 represents either a collapsed rock pile or a cobble pavement. Two rock piles on the west side of the southern extension of Feature 13 may also represent shrines. The first is one element high and measures 1.15 m by 1.1 m. The second is a more questionable feature that is one element high and measures 1.2 m by 0.9 m.

Three possible rock pile shrines were identified at LA 105708. One is a cluster of rocks between Features 9 and 15 that is one element high and measures 1.3 by 1.0 m. The second is a low rock pile on the east edge of the trail (LA 118549) near the south end of Feature 3. The third possible rock pile shrine at this site is more problematic. This feature consisted of a pile of cobbles that was deliberately placed on top of Feature 9. Though this feature was investigated during the excavation of EU-A, no real structure could be defined. While this rock pile represents a possible shrine, it more likely was a materials stockpile created by salvaging cobbles from Feature 9.

Though no shrines were initially defined for LA 118547, upon further reflection we determined that Feature 26 might belong in this feature category. This is a roughly rectangular concentration of cobbles measuring 3.2 by 2.6 m that sits on top of the terrace surface and resembles possible historic graves recorded at LA 118548. It could be a cobble pavement shrine, but this is questionable. The condition of this feature suggests that if it does represent a shrine, it most likely postdates use of the farming features at LA 118547.

One definite and three possible isolated boulder shrines were defined on two sites. The definite example was found in Feature 4 at LA 105709 and consisted of a boulder set into a plot that was not part of a wall or alignment of noncontiguous large elements. This part of Feature 4 was investigated during the excavation of EU-C, and three crushed ceramic scoops that were probably used in farming activities were recovered from under the boulder. The deliberate placement of these tools in a situation where intact recovery was unlikely suggests that they were an offering of some sort, and that the boulder represented a field shrine. This was a fortuitous discovery, since the boulder was unmodified and could simply have been classified as a building element.

Three possible isolated boulder shrines were identified at LA 105707. A large boulder in Feature 1 initially seemed out of place and was thought to represent an isolated boulder shrine. However, upon further examination we determined that this boulder could have been part of an evenly spaced series of large noncontiguous elements. Thus, its true function remains uncertain. However, two boulders set in the southern extension of Feature 13 seemed truly isolated and are better candidates for shrines. Unfortunately, all three potential isolated boulder shrines were outside the highway right-of-way, so they could not be investigated in more detail.

The only stone-enclosure shrine identified on these sites was found at LA 105709. Feature 9 is an earth navel that opens to the east and is about 14 m in diameter. The placement of this feature suggests that it was not a directional shrine associated with a nearby village. Instead, it may have functioned as a hunting shrine as suggested by Ortiz (1969) for the modern Tewas. In possible association with the earth navel was a V-shaped cobble alignment that points toward that shrine. This alignment is on the south side of Feature 12, about 30–40 m north of Feature 9.

The two remaining possible shrines have no definite cognates in the literature examined. The first of these was Feature 11 at LA 105708, a large double borrow pit that was modified by the excavation of a smaller borrow pit near the west edge of the earlier pit. The second pit was surrounded by a spoils pile except on the north side, where it was open. The trail (LA 118549) truncated the west edge of Feature 11 and was bermed along its approach to this feature. The juxtapositioning of the trail, berming along its downslope side, and the elaborate borrow pit suggests that Feature 11 was modified into a ritually significant feature—a shrine. The spoils pile that surrounds the smaller interior borrow pit except on the north may have formed a type of earth navel that is ethnographically and archaeologically unknown.

The final feature in this category is also questionable. This possible shrine consists of a two element wide (0.45 cm) and 10 m long cobble alignment that crosses the segment of LA 118549 that is adjacent to LA 118547. No ethnographic cognates to this potential shrine are known, and it is possible that, as discussed in the report for this site, the cobble alignment actually represents a historic boundary marker. However, since it is the only such feature noted in the project area and crosses a trail that passes several ritually significant locations, we must consider the possibility that it represents another such feature.

Summary and Conclusions concerning Shrines

Research Issue 20 in Chapter 2 concerned the possible shrines defined at our sites and whether they match descriptions of modern shrines used by the Tewas. We also asked whether the shrines are integrated into field complexes, and how they compare to prehistoric shrines identified in other parts of the Southwest.

Two of these questions have already been addressed. With the exception of Feature 11 on LA 105708 and a double cobble alignment on LA 118549, the potential shrines documented during this study match types that are ethnographically known for the Tewas. The double cobble alignment at LA 118549 is a very questionable shrine and, except for its placement along a prehistoric trail, would not have been classified as such. In all likelihood, this feature was not a shrine and is probably unrelated to prehistoric use of the trail. Feature 11 at LA 105708 is another matter. The trail (LA 118549) truncated the west edge of this feature, and its approach from the south was bermed on the downhill side, an elaboration that also occurs as the trail approaches the earth navel on LA 105709. Added to this was the elaboration of the original borrow pit at Feature 11 with a second, interior pit that was bermed with spoils on all but the north side. This configuration turned what was originally a simple borrow pit into a possible earth navel of a style different from others documented archaeologically as well as ethnographically.

Most of the potential shrines documented at the Gavilan sites were integrated into field systems. This is especially true of the rock pile, cobble pavement, and isolated boulder types. In some cases these probable shrines were set into fields (the isolated boulder type). In other cases they were adjacent to fields or on top of field surfaces (rock piles and cobble pavements). Those occurring on top of field surfaces were probably built after the fields were abandoned, but while other nearby fields were still in use.

However, at least three of the probable shrines do not seem to have been directly affiliated with fields. The earth navel at LA 105709 (Feature 9) may have been a hunting shrine, if the functions listed by Ortiz (1969) can be projected back in time. The V-shaped cobble alignment nearby may have been related to the earth navel, but this is uncertain. Finally, though Feature 11 at LA 105708 represents a modified farming feature, its subsequent possible use as a shrine seems more related to the trail and/or one of the nearby Pueblo villages that were occupied at the time.

The third part of this question has also already been addressed. The most common shrine types defined in the study area seem to occur among all Pueblo groups in the northern Southwest. Rock piles are ubiquitous. Circular or U-shaped stone enclosures with openings on one side, most commonly to the east, also seem to have been used by the same groups. For the Tewas this is the earth navel type, and that term may be appropriate for most other Pueblo groups as well. Isolated boulders are also commonly used as shrines, though the cache of ceramic farming tools found under the boulder shrine in Feature 4 at LA 105709 seems to be a unique find. Simple cobble enclosures and patterns were also commonly used as shrines. Only the cobble pavement type seems to be unique to the Tewas, and this may simply be due to a lack of documentation elsewhere.

If Anschuetz (1998) is correct, the use of built shrines by the Tewas increased greatly in the Early Classic period. This included the construction of large elaborate earth navels at several villages in the Chama–Ojo Caliente and Galisteo Basin areas, which may have been the original form of the mother earth navels now in village plazas. In addition to their ritual function, shrines seem to have become used as boundary markers at this time, perhaps in response to a growing population, but more likely because of the movement of Keres into the Northern Rio Grande and the attendant competition for resources and territory.

In form, the earth navel type seems to be descended from the circular massive masonry shrines found in Chaco Canyon, as well as the herraduras associated with the system of roads emanating from Chaco. Yet, this similarity is mostly general in form, since the Classic period and historic earth navels of the Tewas occur in different physiographic situations. The only shrines that approach the elaborate construction of the Chacoan circular shrines are the possible early mother earth navels near some Classic period Tewa villages, but both types probably functioned differently in their respective ritual systems.

Perhaps the impetus for certain styles of shrines began in the San Juan region and moved outward from there, first as information traveling through the large integrated Chacoan system and its successor(s) in the San Juan region, and then with the San Juan population as it abandoned its homeland and moved elsewhere. However, there is currently little hard evidence of this possibility. Indeed, built shrines were probably far outnumbered by those represented by unmodified features of the landscape, including imposing pinnacles, caves, crevices, certain trees, etc. By studying the types of built shrines in an area and how they vary through time, we can document changes in both land tenure and ritual systems that may otherwise be difficult to see.

Trails in the Northern Rio Grande

Little information on trails has been gathered. An exception is the prehistoric "road" systems of the San Juan region, known predominantly in the San Juan Basin, but which extend into southwestern Colorado and southeastern Utah (Adler 1994; Kincaid 1983; Nials et al. 1987; Severence 1999). Segments in northwest New Mexico have been extensively documented. Rather than pedestrian corridors, they seem to be "cosmological corridors that link ceremonial architecture to various topographic features, horizon markers, and directional-astronomical orientations" (Marshall 1997:71). Most of the known trails in the Northern Rio Grande seem to have functioned primarily as pedestrian corridors and thus filled a different niche than the Chacoan roads, though some ritual pathways have also been documented for this region.

An example of ritual pathways in the Northern Rio Grande is at the well-documented directional earth navel on top of Tsikomo Peak. Douglass (1912, 1917) indicates that each pueblo that uses this shrine has its own trail, all radiating from the eastern shrine entrance. Parsons's (1929:241) drawing of the entrance to this shrine disagrees with Douglass's description, instead showing a single trail leading into the enclosure and several secondary trails joining it just before the main trail enters the shrine.

Jeançon (1923:70–71) describes the landscape around Poshu'ouinge in the Chama Valley, noting that paths lead out from the ruin in many directions, all apparently ending at shrines. While the features Jeançon saw at Poshu'ouinge may indeed have been formal trails leading to shrines, it is also possible that he was describing some of the cobble-bordered gravel-mulched fields that occur around that village. However, a similar trail seems to approach the mother earth navel shrine south of Posi'ouinge in the Ojo Caliente Valley. As we suggested for Jeançon's formal pathways at Poshu'ouinge, this trail is lined by cobble alignments that appear to border gravel-mulched fields. Thus, the formal-looking trail that approaches the shrine may simply represent an area that was left clear during field building to allow unrestricted access to the shrine. Then again, the formal appearance of this approach may not have been entirely unintentional.

Harrington (1916) documents several trails in the Tewa Basin but notes that it was difficult to obtain satisfactory information on the ancient trails of the region. He notes the existence of trails passing through Santa Clara and Guaje Canyons to the Jemez area, one in the El Rito region leading to the Tierra Amarilla area, and several others. The entire Cochiti region (including Frijoles Canyon) is said to be covered by a network of trails (Harrington 1916:421). One or two trails are noted in the Ojo Caliente area, but both cross Canoe Mesa, one continuing into Comanche Canyon and leading into Ute territory (Harrington 1916:199). Bandelier (Lange et al. 1975:86) found a well-defined trail leading to Posi'ouinge and barely perceptible trails heading north along the mesa that forms the west rim of the Ojo Caliente Valley.

Steen (1982:7) reports that trails are common on the Pajarito Plateau and are usually associated with habitations. However, near the upper end of Mortendad Canyon he found a trail that is deeply cut into tuff and lacks associated habitation sites (Steen 1982:7). At Bandelier National Monument, Powers and Van Zandt (1999:142) found seven structures associated with well-defined trail segments. Hewett (1906:16) wrote that a trail at Navaju, a prehistoric Pueblo village on the Pajarito Plateau, had been worn hip-deep by foot traffic.

Two basic types of corridors seem to be represented by trails. The most common type is a pedestrian corridor, usually leading from one residential site to another or to an area used for farming or that contains resources used on a regular basis. The second type is a ritual corridor, leading to a location of esoteric importance, usually a shrine or a source of important ritual materials. Some trails may have been used for both purposes. The Zunis had three trails that led to Acoma, which were both used as trade routes and to access sacred areas (Holmes 1989:18). The Zunis also used at least two trails for their pilgrimages to Zuni Salt Lake, one for foot traffic and a second suitable for burros (Kelley 1988:2–7). Acoma and Laguna had their own trail to Zuni Salt Lake (Kelley 1988:2–8). These trails had shrines along them where offerings were left by pilgrims on their way to gather salt (Kelley 1988). The Acoma-Laguna trail was marked in places by cairns, and the shrines along it were small earth navels that opened to the east (Kelley 1988:2–8). Another trail led from Zuni Salt Lake to the confluence of the Zuni and Little Colorado Rivers, where the Zunis say they originated (Kelley 1988:2–8). This trail is sacred to the Zunis and Acomas and has shrines along it (Kelley 1988:2–8).

Harrington (1916:164) indicates that the hot spring at Ojo Caliente, just below the ancestral village of Posi'ouinge, is one of the most sacred places of the Tewas. Springs and bodies of water are often held sacred, but this spring also has important associations with Poseyemu, the Tewa culture hero. Poseyemu is said to have occasionally entered the hot spring when he still lived among the Tewas of the area. The spring is also the home of Poseyemu's grandmother, and he is said to visit her once a year (Harrington 1916:164). People at San Juan Pueblo told Harrington (1916:164) that the Tewas still drank water from the hot spring and, presumably, had done so in the past.

The nature of the trail recorded during our study, LA 118549, suggests that it may not have simply been a pedestrian corridor. The route that it follows is certainly not the easiest way to traverse the Ojo Caliente Valley, since it mostly travels along a terrace slope, about halfway up. Normal pedestrian traffic would be expected to take an easier route, though the land tenure system may have helped determine where such corridors could be placed. If most of the valley floor and the rim of the terrace that forms the east edge of the Ojo Caliente Valley were covered with fields, the terrace slope may have been one of the few corridors open to pedestrian traffic that would not cause friction with local farmers. However, the fields that rimmed the terrace edge formed a comparatively narrow band, so a simple ascension of the terrace and a short walk to the other side of the band of gravel-mulched fields would have carried travelers to a fairly flat area where foot-travel was easy and no modifications to the corridor were needed.

If the trail was the main route to the gravel-mulched fields, one would expect it to ascend to the terrace top at fairly regular intervals. It does not do this. Indeed, the trail tops out in very few places within our study area, and when it does, there is usually a shrine or shrinelike feature at that point. The trail does not even ascend to the terrace top at the village of Ponsipa'akeri. Instead, two trails documented by Bugé (1978) lead down to it. A few faint traces of trails leading up to fields were noted during our study, but none of them were improved or as well defined as LA 118549 itself.

When all of this information is combined, our suspicion is that LA 118549 does not represent a simple pedestrian corridor. Rather, it seems more likely that it represents a ritual pilgrimage route to the hot spring at Ojo Caliente. The berming noted along segments that approach and cross the terrace top is similar in idea to earthworks noted along Chacoan roads as they approach great houses (Nials et al. 1987:15), though in both cases the reason for the berming may be mundane. The construction of more elaborate roads or trails as they approached ritually important locations could have generated spoils, most easily discarded by simply placing them along the road or trail. This would have further emphasized the corridor in these areas.

Though the trail does not connect with the earth navel (Feature 9) at LA 105709, the segment south of that shrine contains the longest and most elaborate approach to the terrace top of those that were documented. The trail next ascended to the terrace top at LA 105705 and was bermed along its downslope side as it approached and crossed the terrace top. The only possible shrines identified in this area were two rock piles, probably field shrines rather than ritually important locations accessed by the trail. The next point at which the trail ascended to the terrace top was adjacent to Feature 11 at LA 105708, and its downslope side was again bermed through that area. The next approach to the terrace top (heading north up the valley) was at LA 105707. A short section of trail crosses the terrace top at the edge of that site, and its downslope side was bermed, though much of the berm, the ascending section of trail, and probably whatever ritual feature occurred in that area were removed during earlier road construction. These were the only places that the trail ascended to the terrace top within our study area.

However, the descent of the trail and its disappearance in the area around Hilltop Pueblo and Nute suggests that a strictly ritual use cannot be assigned to this landscape feature. Part of its function must have been as a pedestrian corridor; otherwise, why would it disappear in this area? Like some of the trails between Zuni and Acoma, LA 118549 probably had many purposes. As we have seen, trails could be simple pedestrian corridors or paths linking important ritual locations, or they could serve both functions at different times. Our analysis suggests that LA 118549 may have served both purposes. This trail may have linked villages in the Ojo Caliente Valley together and provided local farmers with a route to their fields. It also probably served as a ritual route for pilgrimages to the sacred hot spring, providing access to other important shrines along the way.

Chapter 25. An Ethnohistoric Examination of LA 105710 and the Ojo Caliente/Gavilan Areas, Rio Arriba County, New Mexico

Linda J. Goodman

An ethnohistoric study was initiated to examine several historic structures and features found at LA 105710, a large multicomponent site. According to the original survey (Marshall 1995), the site included a morada, a house foundation (later discovered to be a small store), an old road, and the remains of an old "cattle guard." Oral interviews soon revealed several other structures at or near LA 105710 that were added to the study. These included livestock corrals and animal pens, another small store, a Via Crucis (Way of the Cross, a processional path), a Calvario (symbolic location of the crucifixion), and two oratorios (private chapels).

Research methods included site visits, a brief review of published sources relating to the region, an examination of historical documents and other archival materials, and interviews with knowledgeable individuals from the area. Upon completion of a preliminary site visit and discussion with several local residents, a questionnaire was developed that was designed to gather information on land ownership history, time of original construction, materials used, dates of occupation, functions and uses of sites and structures, activities conducted in or near them, information on families and/or individuals connected with these structures, identification of features not archaeologically visible, and the placement of the sites and features in a larger sociocultural context. To determine land ownership history and the general history of the region, there followed a limited review of the archival literature and relevant legal materials at the Bureau of Land Management Office, Santa Fe; the New Mexico State Archives and Records Center; the New Mexico State Historic Preservation Office; the Museum of New Mexico History Library; the Museum of New Mexico Photo Archives; and the Laboratory of Anthropology Library.

At and near LA 105710, a variety of structures supported activities related to religion, commerce, and economic subsistence—all essential for the survival of a small northern New Mexican Hispanic village in the nineteenth and early twentieth centuries. Therefore, the goals of the present research were to gather relevant material on the above topics (religion, commerce, and economic subsistence) as they related to the structures at LA 105710; and, as part of the original research design, to answer eight site-relevant questions related to the age, construction, and use of these structures.

Historical Overview of the Ojo Caliente Region

The Indian Presence

Long before the appearance of the first Europeans, local Indian tribes were well aware of the existence of mineral hot springs in the area now known as Ojo Caliente. Considered sacred, these springs were often visited by members of a number of American Indian tribes who lived in or traveled through the region. According to Harrington (1916), a greenish pool of hot water at Ojo Caliente was one of the Tewas' most sacred places. It was home to various mythological beings and provided an essential passage between this world and the spirit world. The Tewas considered this region, called Posipokwi (greenness spring), to be their cradleland (Harrington 1916:162–165).

Five large prehistoric Pueblo villages built nearby indicate that a sizable resident Pueblo Indian population formerly inhabited the area. The Tewa villages of Howiri and Hupobi were constructed about 3 km north of the springs; Nute and Ponsipa'akeri, a few kilometers south; and Posi'ouinge on a mesa just south of Posipokwi (Ojo Caliente Springs). Dating to A.D. 1300–1530, these prehistoric villages may have housed from 2,000 to 5,000 people at any one time (Beal 1987:10; Bugé 1981; Schaafsma 1999:1–7; pers. comm., C. Schaafsma, 1999). Using a variety of agricultural methods, all of these settlements successfully grew quantities of corn, beans, and squash in this arid environment (Schaafsma 1999:1–2; Schroeder 1984:283). In addition to farming, these prehistoric Pueblo peoples continued to gather useful wild plants, hunted game such as deer and rabbits, probably raised turkeys, and engaged in a variety of craft activities (Schroeder 1984:283; Schaafsma 1999:2). Their villages were mostly abandoned by the time the Spaniards entered New Mexico and certainly so by the time the first Spanish colony was established in 1598.

Two hypotheses have been presented concerning the abandonment of these large communities. C. Schaafsma (pers. comm., 1999; Schaafsma 1999:5–7) believes that a preponderance of the evidence indicates abandonment before the appearance of the Spaniards in the area in 1540. He feels the abandonment was largely due to the arrival of marauding Apaches from the east, who made life unsafe and unpredictable for the formerly stable Pueblo societies. Schroeder (1984:284–285), on the other hand, felt that Apaches were in the area about the time of the Spanish arrival and that Indian attacks, combined with other environmental stresses, caused the Pueblo abandonment somewhat later, perhaps in the late 1500s to early 1600s.

One piece of evidence strengthens Schaafsma's hypothesis. In 1598 the Spanish colonizer Juan de Oñate, having established a base of operations at Yuqueyungue (across the Rio Grande from present-day San Juan Pueblo), assigned eight priests to various Pueblo areas; none, however, were sent to the Ojo Caliente area, the location of the five large pueblos mentioned above (Schroeder 1984:284). Had these villages still been occupied, chroniclers certainly would have mentioned them, priests would have visited them, and the clergy probably would have tried to establish a mission in the vicinity. During the first Valverde investigation, Juan Rodríguez, a pilot and navigator who knew mathematics and was with Oñate between 1598 and 1602, testified that he had visited all the pacified pueblos and had also been on an expedition to the plains with the governor (Hammond and Rey 1953:289–290, 860–868). Valverde asked Rodríguez to guide a mapmaker (Martínez) in the creation of a map which showed all the existing pueblos as of 1602. The resultant map, which has been reprinted on the inside front cover of Hammond and Rey (1966), shows no pueblos at all along either the Chama or Ojo Caliente rivers at that time. In 1608 the Spaniards noted that a number of pueblos in this northern area had been destroyed and burned by Apaches (Hammond and Rey 1953:1059; Schroeder 1984:284–285). To date, no statements concerning occupied pueblos in the Ojo Caliente region have been discovered in existing Spanish documents.

During the early years of Spanish exploration and settlement, Utes, Comanches, Navajos, and Apaches continued to camp, hunt, and travel throughout the Chama and Ojo Caliente River Valleys, making the area inhospitable for Spanish settlers. In 1598, Oñate described some of these non–Pueblo Indian people as numerous, living in jacales, and farming in the upper Rio Grande (Hammond and Rey 1953:345, 485; Schroeder 1984:284). Even though members of some nomadic tribes were engaged in part-time agricultural activities, these groups never settled and became permanent residents. Other records state that nomadic groups were present west of Taos and in the vicinity of Abiquiu in the early 1600s, and in the region approximately one day's travel north of Santa Clara Pueblo in the 1620s (Beal 1987:20; Hodge et al. 1945:85, 89, 306; Schaafsma 1979; Schroeder 1984:284). In 1705, according to the Spanish governor, Don Francisco Cuervo y Valdez, these tribes were still nomadic most of the time, sedentary only for short periods, and constantly waging war against the settled communities (Hackett 1937:382).

The Spanish Occupation

The initial date of Spanish settlement in the Ojo Caliente area remains an open question. No existing records note any Spanish settlements in this area before the Pueblo Revolt of 1680 or as late as 1693. On July 14, 1694, the Don Diego de Vargas expedition, returning from Colorado, camped in the Ojo Caliente River Valley and made no mention of any settlement at all in this locale. In his writings, de Vargas described the area in some detail, the difficulty of protecting it because of its terrain, and precautions taken by his troops due to fears of Ute ambush or attack by Tewa rebels living 10 leagues away (Kessell et al. 1998:311). Any former or contemporary Spanish settlement in the area would certainly have been noted by him at this time. C. Schaafsma (pers. comm., 1999) feels that due to the continued presence of marauding Indians, settlers could not have survived here before approximately 1710–20. Since the first actual mention of settlers in the area occurs in writings of 1733, it is logical to assume that settlement began in the Ojo Caliente area sometime between 1694 and 1733.

Apparently a settlement had been established at Ojo Caliente by 1733 because the Spanish Archives of New Mexico (SANM 1735) include a record of a lawsuit concerning agricultural land and its use and ownership. Deposition statements from the involved parties indicate that people were already living at Ojo Caliente and beginning to clear the land by this time. One Antonio Martín had been given a royal grant for land there. This lawsuit provides the earliest recorded information concerning the existence of a Spanish settlement at Ojo Caliente.

For approximately the next 60 years, the history of Ojo Caliente is filled with strife and turmoil, caused mainly by frequent Indian attacks, lack of adequate protection by Spanish militia, and Spanish governors more intent on supporting and protecting the larger, better-established settlements at Santa Fe (established in 1610) and Santa Cruz de la Cañada (established in 1695) than the poor, isolated settlers on the fringes of Spanish territory. On numerous occasions, Ojo Caliente was abandoned when Indian raids made it unsafe to remain. Periods of resettlement occurred when the danger was perceived to have diminished. At times the Spanish governors, not fully understanding the gravity of the situation, ordered the settlers back to their land, with varying degrees of success.

Spanish reports confirm a series of occupations and abandonments of Ojo Caliente. In 1744, Father Miguel de Menchero provided a small amount of information regarding this settlement. Forty-six Spanish families lived at Ojo Caliente and survived by raising crops and herding sheep, as did some Indians, though he did not state how many or from which tribes. A chapel had already been built, and the families were ministered by the priest at the Taos mission, six leagues away (Thomas 1932:94; Hackett 1937, 3:399; Swadesh 1974:34). On March 28, 1748, permission was requested and shortly thereafter granted by Governor Joaquín Codallos y Rabal to abandon Ojo Caliente, Abiquiu, and Pueblo Quemado (a few miles from the mouth of the Rio del Oso, southwest of Ojo Caliente; Swadesh 1974:34) until danger of Indian attacks from Utes, Navajos, and other hostile tribes was lessened (SANM 1748; Adams and Chávez 1956:78 and n. 6). On March 15, 1751, a decree from a new official, Governor Cachupín, ordered the immediate resettlement of Ojo Caliente, since "the Ute Nation" had been "converted to friendship for us" (Boyd 1957:347). The occupants responded:

> We the undersigned residents of the settlement of Santa Cruz de Ojo Caliente, appear before the greatness of your excellency. . . . At the present time we are without means and oxen to plow the ground, and finding the houses and church tumbled down, and for other reasons of no less weight that prevent us from the present execution of this order, we petition your Excellency to extend the time for us to the month of October, a time which, God willing, is better for said resettlement. (Signed by Blas Martín Serano, José Martín Serano, Dyego Lucero, Manuel Díos del Castillo, and María de Herrera, 1751 [SANM 1753, as quoted in Boyd 1957:347–348])

As of January 18, 1752, the residents had not yet returned to their homes (SANM 1753, as quoted in Boyd 1957:348).

Other edicts and proclamations were issued in 1752 and 1753. A few families may have returned to Ojo Caliente, most, however, did not (SANM 1753). According to Abiquiu mission records, Genízaro pueblo land grants were established in Ojo Caliente in 1754 (Swadesh 1974:40). Genízaro grants provided "detribalized Indians who desired freedom from servitude in settlers' homes, with the means for an independent life—in exchange for active militia service" (Swadesh 1974:40). In 1765 the residents had once again deserted their houses and property due to renewed Indian attacks; only a few remained to tend the land. In 1766 there was more correspondence regarding these families and their presence or absence on the Ojo Caliente land (Boyd 1957:348-351; Jenkins n.d.:9). Some of it reverted to the Crown when owners refused to resettle, claiming their acreage was too small to support their families. This land was then regranted to new Spanish owners or given to "half-breed Indians who wished to settle at Ojo" (SANM 1768).

Spanish governors strongly supported settlement of the Chama and Ojo Caliente River Valleys to keep marauding Indians away from the more heavily populated areas of Santa Fe and Santa Cruz. Residents of Ojo Caliente, Abiquiu, and Pueblo Quemado provided this human barrier; not well protected by Spanish soldiers, they were left largely to fend for themselves. After a number of harrowing years, many settlers chose to lose their land rather than their lives. They moved elsewhere and started over. Troubles continued for those who remained at Ojo Caliente or moved there later. Each new governor of the territory had a somewhat different approach to the problem. None of these solutions, however, were very satisfactory to the people whose lives were constantly in danger (Boyd 1957:350–358; Ebright 1994:145-146).

The following quote is typical of the attitude of the Spanish governors of the time in regard to the necessity of settlement of Ojo Caliente and the lack of regard for the lives and safety of the inhabitants. On March 31, 1769, Governor Pedro Fermín de Mendinueta stated,

> Residents of the river of Ojo Caliente have abandoned their houses and possessions to live in different places of this kingdom on account of a panic of fear of the Comanches and past battles fought with this nation—all of which have been favorable by virtue of measures taken and constant detachments of soldiers maintained for their protection. There is urgent and clear need to maintain the frontier of Ojo Caliente, because if it is left unprotected none of the districts of Santa Cruz de la Cañada would be secure, but all of them would be exposed to total ruin on account of their dispersion and because there would be no fortress for their defense, and as the frontier of Ojo Caliente is such a fortress, as has been demonstrated by experience, I order all residents of said river and plaza who lived (there) through the month of October last past, to return to occupy same under penalty of two hundred pesos fine. (SANM 1769, as quoted in Boyd 1957:353)

Since the settlers usually could not read or write, they responded in person to the alcalde in charge, who then reported them to the governor (Boyd 1957:355). A typical reply, dated May 28, 1769, given by Diego Gómes, was recorded as follows:

> [He says] that he understands it all; that he obeys what he is ordered and has planted corn, but that he will not take his family up there on account of the many warnings he has experienced and seen at said Ojo Caliente, as in his presence five of his relatives have been killed and he was not able to prevent it. Thus he yields the right to the house and lands which he has at said Ojo Caliente. (SANM 1769, as quoted in Boyd 1957:354)

As a result of this type of response, on June 20, 1769, Governor Mendinueta personally inspected Ojo Caliente. He discovered the indefensibility of the location, which was exactly as the settlers had described. The governor then ordered that his previous decrees be suspended, the doors to the plaza, the houses, and the chapel be walled up, and Ojo Caliente be abandoned (Boyd 1957:356–357). On June 29, 1769, he noted that Ojo Caliente was

> dominated on the east by a ridge of hills which extends from said plaza about two leagues toward the south, the ravines of which allow the enemies to get near it without being seen and attack it from said hills. . . . On the west . . . it is similarly constituted and the high hills which dominate it form another ridge to the south which extends to an equal distance, and between the two they form a long, narrow pass composed of forests and arroyos where a very few enemies can stop travel even to seek help when attacked. On the north the obstacles are not less. (SANM 1769, as quoted in Boyd 1957:356)

Ten years later, on August 17, 1779, Governor Juan Bautista de Anza visited and described the deserted village of Ojo Caliente:

> The above mentioned pueblo is one of those

> abandoned on account of the hostilities of the enemy, as well as one proposed for the establishment of a presidio. For this reason I devoted myself today surveying it. I found it lacking all the conditions required for such an establishment. . . . Altogether there are twenty-five or thirty families scattered over more than four leagues, their houses unfortified. For this reason it is not strange that there were such attacks, as this disorder brought upon them the loss of their poor fields, to which, in substance, the possessions of the inhabitants were reduced. (Thomas 1932:124)

Subsequently, de Anza led an expedition against the Comanches, resulting in their defeat and the death of their leader, Cuerno Verde. Following this, nearly twenty years of peace ensued with the Comanches in the area (Boyd 1957:357; Thomas 1932:124).

No documents refer to Ojo Caliente again until 1790, when a group of Spanish citizens petitioned Governor Fernando de la Concha requesting that nineteen families be allowed to form a fortified settlement at Ojo Caliente. Even though the governor requested that the petitioners resettle the area known as "Viejo," north of Ojo Caliente on the outskirts of la Cañada de los Comanches, they refused, and no action was ultimately taken on their petition. However, the villagers remained where they had been living, and the settlement continued to develop in an informal pattern (Boyd 1957:358).

By 1793 the situation had changed dramatically. The Comanche threat had largely abated, and a number of families were living on the land. Fifty-three households under the leadership of Antonio José Espinosa, Juan Samora, and Salvador Maese petitioned Governor de la Concha for a community grant, which was soon approved and issued. Each petitioner was apportioned 150 varas of land by Manuel García de la Mora, chief alcalde and war captain of Santa Cruz de la Cañada. Boundaries, watering places, orchards, and communal land were also established. After all the years of battles with Indians as well as Spanish government officials, the settlers finally prevailed in choosing and settling on land adjacent to the river, where they wished to live, rather than where territorial governors ordered them to live (Bowden 1969:1190–1192; Boyd 1957:358–360; Jenkins n.d.:9–11; SANM 1793). The pattern of choosing one's own desired settlement was followed by many other early Spanish settlers along the Rio Grande and its tributary streams (Boyd 1957:360; Pratt and Snow 1988:223).

Fourteen years later, in 1807, Zebulon Pike, one of the early non-Spanish explorers who traveled through the Ojo Caliente region, left a written description of what he saw (Bowden 1969:1192; Twitchell 1911:462, 466–467):

> The village of Warm Springs or Agua Caliente (in their language) is situated on the eastern branch of a creek of that name, at a distance, and presents to the eye a square enclosure of mud walls, the houses forming the wall. They are flat on top, or with extremely little ascent on one side, where there are spouts to carry off the water of the melting snow and rain when it falls, which we are informed, has been but once in two years previous to our entering the country.
>
> Inside of the enclosure were the different streets of houses of the same fashion, all of one story; the doors were narrow, the windows small, and in one or two houses there were talc lights. This village had a mill near it, situated on the little creek, which made very good flour.
>
> The population consists of civilized Indians, but much mixed blood. . . . This village may contain 500 souls. The greatest natural curiosity is the warm springs, which are two in number, about ten yards apart, and each affords sufficient water for a mill seat. They appear to be impregnated with copper, and were more than 33 degrees above blood heat. (Pike 1810:206–207)

It appears that in 1807 there was indeed a regular village with streets, a plaza, and houses placed around it. This description differs markedly from earlier Spanish writings, which do not speak of a village and plaza organization but rather of individual ranchos (agricultural land and houses), unfortified, scattered over a large area along the river (Boyd 1957:351; SANM 1769; Thomas 1932:94, 124). As of 1750 there was neither a square plaza nor a solid row of houses with gates for entry and exit, as instructed by

Governor Cachupín (Swadesh 1974:35–36). However, in 1769 Governor Mindinueta spoke of boarding up the plaza and church at Ojo Caliente, and ten years later Governor Anza described the inhabitants as living in scattered, unfortified houses. Perhaps both the plaza and the rancho type of settlement patterns coexisted here for many years, though no official documents have been discovered which indicate that this was the case. Currently, no vestiges of an early plaza and town organization remain, and local residents have no memory of it. The rancho habitation pattern first mentioned by the early Spanish writers appears to be prevalent today. Agricultural land with access to the river and/or acequia dominates the landscape and usually includes a house on each family plot.

Population increased in the Ojo Caliente Valley during the early part of the 1800s. Some people purchased grant land, others squatted and never received official title. Confusion abounded by the 1820s, so in 1824, Francisco Trujillo of Abiquiu was ordered to Ojo Caliente to validate titles and measure individual allotments. This was successfully accomplished, and those who were not original grantees could, upon payment of a fee, receive an allotment (Jenkins n.d.:10–12).

Throughout the 1800s the settlers enjoyed periods of peace during which they traded and interacted with surrounding nomadic Indian tribes, followed by periods of raiding and general disturbance. Once the Indian threat finally subsided, settlement continued, as did an agricultural and pastoral way of life. Small towns such as Ojo Caliente were out of the mainstream during the Mexican occupation (1821–46) and the following American occupation (1846–present). These Hispanic/Genízaro enclaves were far removed from the primary trade routes, along which the Euroamerican newcomers tended to congregate. Therefore, for a number of generations, life in these small towns of northern New Mexico continued quietly, and the population experienced only modest changes, mostly in the areas of introduced materials and products (Campa 1979:121–128).

Hispanic Life in the Ojo Caliente Region

Settlement and Land-Use Patterns

The Spanish Crown was the ultimate owner of all the land in New Mexico that was claimed by Spain. Private individuals or groups were allowed to apply to the sovereign for land grants, which were issued in three categories: a municipal grant to an individual or group who wished to found a new community; a private grant to a farmer, stock raiser, or other person who agreed to develop rural land; and Pueblo Indian grants which awarded title to a particular tribe so members could maintain possession of all the lands they occupied or used (Simmons 1969:7–8).

Aside from the grant stipulations, Spanish citizens who wished to settle in New Mexico also had to adhere to certain rules and regulations established by the Spanish government. Regarding the creation of a new town, issues of health, climate, and defense had to be carefully considered before a specific site could be selected. Then, strict Spanish laws governed the organization of these towns. First, it was necessary to draw up a plan for a new community utilizing the grid system. This included straight, parallel streets with rectangular blocks and one or more rectangular plazas. The principal plaza was designated the *plaza mayor*. Land was to be reserved for government and church buildings, then lots were to be distributed to the settlers. As quickly as possible, the residents of a new town were also required either to build a palisade surrounding the main plaza or dig a large ditch around it to protect the inhabitants from Indian attack. In addition, each family was urged to fortify its own house (Simmons 1969:8). Sometimes a slightly different plan was followed. Compact settlements constructed around a central plaza included houses built wall-to-wall in a square with no windows on the outside, forming a protective fortress. Often a watch tower (*torreón*) was placed at one or more corners (Ebright 1994:25).

These rules and regulations applied to and affected the lives of the settlers in the Ojo Caliente region. It is interesting to note, however, that these people had the independent mind-set of many other early Spanish settlers in New Mexico. No matter what the laws and regulations stated, they knew where and how they wished to live and did not let the authorities deter them. Therefore, the actual settlements often took a form quite different from what was officially sanctioned. The general pattern that developed included a predominantly rural population living in numerous small, loosely organized communities scattered throughout northern New Mexico.

More specifically, as the population increased throughout the region, new villages were created in the Ojo Caliente River Valley. Settlers needed new irrigated lands, expanded ranges, and better opportunities for trade with the Utes (Swadesh 1974:72). Thus, small clusters of settlers cleared land and built houses more or less where they wished, usually adjacent to a river or stream. Traditional land-use patterns in this area did not include the development of large urban centers, and the settlement at Ojo Caliente never became a city. For many years, both Abiquiu and Ojo Caliente were described as *parajes* (encampments) or *puestos* (outposts) because settlement consisted of a few small, scattered ranches and lacked a local administrative machinery except for a *teniente* (deputy to the alcalde of Santa Cruz). Each family was responsible for its own economic survival and defense (Swadesh 1974:133).

The early settlers and their descendants raised cattle and sheep on their land, planted fruit trees, and prepared fields where they grew corn, wheat, beans, and a few vegetables. Subsistence agriculture was maintained mostly by the women, children, and elders, while the men were principally involved in herding livestock, buffalo hunting, trading, and fulfilling militia requirements (Pratt and Snow 1988:222; Swadesh 1974:133–134). As the good farmlands around the village and river were acquired by early settlers, later ones had to select locations farther away. Thus it is probable that outlier communities such as Duranes and Gavilan to the south were settled later than the principal village of Ojo Caliente.

Since early Spanish subsistence in New Mexico revolved around agriculture and livestock, the typical settlement pattern of isolated ranchos along a stream made good economic sense. It appears that initially, at least, the Ojo Caliente settlers ignored the Spanish government's legal requirements for a town and plaza constructed on the grid system. They built their houses near their fields to protect crops from Indians and wild animals, and for ease of access (Ebright 1994:22–26; Simmons 1969:17). This arrangement left them quite vulnerable to frequent Indian raids; thus, as mentioned earlier, for many years they were forced into a cycle of abandonment followed by reoccupation of their lands and houses. Eventually, however, for their own protection, some Ojo Caliente settlers evidently did build an actual village with a plaza ringed by homes, since such a place was described by Mendinueta in 1769 and Pike in 1807 (Bowden 1969:1192; Boyd 1957:356–357; Pike 1810:206–207; Pratt and Snow 1988:220–224; SANM 1769). The date and exact location of this formal plaza remains unknown, although it is likely that it was adjacent to the old church, which dates from 1793.

In 1793 residents of Ojo Caliente applied for and were officially awarded a community grant with the approval and blessing of the Spanish Crown (SANM 1793). Each settling family received an allotment of land for a house (*solar de casa*), an irrigable plot of farming land (*suerte*), and the right to use the remaining unallotted land on the grant (*ejido*) in common with other settlers for such things as pastures and watering places for livestock as well as areas for hunting, fishing, herb gathering, firewood gathering, rock quarrying, and log cutting. After four years of working the land a settler owned his allotment free and clear, and could then sell it as private property. The common lands, on the other hand, were owned by the community and could not be sold (Ebright 1994:24–25; Pratt and Snow 1988:234).

Settlements on a community grant usually included more intensive utilization of parcels adjacent to the river, where agricultural fields were cleared and planted and family homes built. Less intense use, such as for livestock grazing or firewood gathering, occurred on the common lands at a distance from the river. Grazing animals commonly moved onto and destroyed planted fields (Ebright 1994:26).

Irrigation ditches (acequias) were an essential component of each agricultural community. Though exact dates are unknown, several early acequias were dug in the Ojo Caliente Valley. The

6.4 km (4.0 mi) long Ojo Caliente Acequia is the oldest, perhaps dating to 1793, and was said to flow past the plaza. The 4.5 km (2.8 mi) long Duranes Acequia may date to 1793 or possibly 1824. The 5.0 km (3.1 mi) long Gavilan Acequia probably dates to 1824 and perhaps even earlier (Jenkins n.d.:12–13). Individuals were granted rights to irrigable lands running from the *acequia madre* (mother ditch) to the river (Pratt and Snow 1988:233–234). It is likely that ownership of long, narrow strips of land, called "long lots," developed from this system of irrigation. Water was drawn from the acequia and used to water the rows of crops through gravity flow. The excess was allowed to return to the river (Pratt and Snow 1988:233–234).

Trade between Spanish settlers and Indians constituted another significant activity in the area. Peaceful times allowed for more contact and increased transactions; trade necessarily decreased during periods of intensive raiding. Direct barter with Indians for contraband goods was often quite profitable. Official fairs also occurred annually. Taos held a trade fair each July for the Comanches, and Abiquiu held a similar one for the Utes. A trading post established in 1853 in Abiquiu to increase the Ute trade closed in 1872 (Ahlborn 1968:129). No mention is made of trade fairs or trading posts at Ojo Caliente. Trade also flourished in Indian territory. Young men known as *comancheros* traveled east onto the buffalo plains and developed profitable trade networks with the Comanches and other Plains tribes. Some of these networks lasted for generations (Goodman 1993:25; Swadesh 1974:3–4, 23–25).

Until some years after the opening of the Santa Fe Trail in 1821, cash was insignificant and generally did not circulate through the northern New Mexican villages. The populations in this area had insufficient quantities of goods to exchange for cash until much later. Thus, traditional ways of doing business continued here much longer than in other parts of the state. Not until the opening of a wage-labor market and the development of an effective transportation system in the region did cash become more prevalent, setting the stage for a number of cultural changes (Pratt and Snow 1988:68).

Since World War II, northern New Mexican villages like Ojo Caliente have undergone significant changes. Many people left to become part of the war effort. After the war, the young people in these villages began to leave in search of jobs and more comfortable lives elsewhere. Farming did not interest them, and good jobs were seldom available locally. Older people, however, have continued to live in these villages or return to them for their final years (Weber 1979:83–84). Radio, television, and, more recently, computers have increased knowledge of Anglo life and society. Improved highways and the easy availability of cars and trucks have increased contact with surrounding Anglo communities and desire to acquire material goods. In the past most village men farmed, ranched, or were hired as herders. These occupations were replaced after the war by wage work on the railroads and highways, seasonal migratory farm work, and a variety of other jobs in urban communities. All of this has led to the breakdown of many northern New Mexican Hispanic villages. The hope is that new economic endeavors will allow some of them to be repopulated and reestablish themselves as strong, viable communities (Swadesh 1974:198–203). Another recent trend with negative implications for the survival of village life is gentrification. Houses and land are being bought by developers and other wealthy Anglo outsiders who move in and change the character of the land and villages (Swadesh 1974:201–202). The formerly strong community and religious beliefs have, in many cases, been pushed into the background (Bunting et al. 1983:33; Knowlton 1969:465).

Religious Activities and Patterns

Even though the Franciscans set up Catholic missions in a number of Rio Grande pueblos after their arrival in the 1600s, the religious needs of Spanish settlers in the region were largely ignored by the Church. Perhaps this was due to the fact that the priests were specifically paid by the war fund (*ramo de guerra*) of the Spanish Empire to work in the Pueblo Indian missions and not with the Spanish populace, other than in major population centers such as Santa Fe. Most of the Spanish population during the 1600s lived in or near Santa Fe or near a Pueblo Indian mission; therefore, contact with priests and Catholicism could at least minimally be maintained (Steele and Rivera 1985:4–5).

During the 1700s two significant changes were instrumental in the development of an organization which came to be known as the Penitente Brotherhood. First, the Franciscans suffered a devastating decrease in numbers. Eventually this reduction affected the faithful in the Rio Grande region—mission priests who died or became too old to serve could not be replaced. Secondly, as the Spanish population in the area increased during the 1700s and on into the 1800s, the pressing need for land meant that new villages were created, often in isolated places that were hard to reach, even by horse or wagon. Thus, not only were fewer priests available, but the difficulty of traveling to outlying regions meant that the padres seldom came to minister to the local Spanish Catholic village populations (Steele and Rivera 1985:4–5; Swadesh 1974:72–74).

In order to fill this serious religious vacuum, a lay brotherhood called La Cofradía de Nuestro Padre Jesús Nazareno (Brotherhood of Our Father, Jesus the Nazarene), also known as the Penitentes, emerged in many villages of northern New Mexico, probably between 1790 and 1810. A variety of names have been used to refer to this group. Some of the more common are Cofradía, Confraternity, Hermandad, Brotherhood, Los Hermanos Penitentes, the Penitent Brothers, Los Hermanos, The Brothers, and Los Penitentes (Weigle 1976:xvii). The term *penitentes* has come to have pejorative connotations among certain groups of outsiders; however, in the past, it was a descriptive term which honored its members (Chávez 1954:97). A precise date and place of origin for this confraternity is unknown. (See Chávez 1954:97–98, n. 1, and 108–112; Steele and Rivera 1985:7, n. 11; and Swadesh 1974:75, n. 20, for more detailed discussions of possible Penitente origins, dates, and relationship to the Third Order of St. Francis, a Franciscan confraternity.)

The purpose of the organization, as related in an oath of the Cofradía in Taos in 1861, was

> to serve God our Creator in the belief that Jesus Christ is the Saviour of the World according to the teaching of the Holy Gospel; to keep the Ten Commandments of the Law of God; to live humbly; to abjure discord and unjust dealings with our fellow men; to shun saloons and all other temptations the world offers . . . ; to act toward one another with charity and mutual love like brothers in Jesus Christ; to provide a good example for each other, helping in illness, afflictions and time of need, pardoning one another's offenses, and mutually tolerating our weaknesses. (Kutsche and Gallegos 1979:91)

The Penitente Brotherhood was composed of Hispanic males. Women were not members but could and did serve as auxiliaries (Ahlborn 1968:124; Bunting et al. 1983:33). Each community developed its own local chapter of the Cofradía, which maintained two principal focuses: one religious, the other devoted to providing necessary aid to members of the community. Since continuous support from ordained priests was unavailable, the Brotherhood concerned itself with such tasks as caring for the sick and dying, leading prayer services and wakes for the dead and their families, and digging graves. Members also helped bereaved families with plowing, harvesting, and other heavy tasks; organized mutual welfare benefits at times of crisis; organized food sharing occasions during Lent and Holy Week; settled village disputes; and punished those who violated village norms. These activities were vital for community survival and unity (Bunting et al. 1983:31–32; Knowlton 1969:462; Swadesh 1974:74–75; Weigle 1976:xi, 139; Weigle and Lyons 1982:231–232).

The religious focus of the Cofradía was most readily seen during Lent and Holy Week, before Easter. At these times, aside from financial and organizational responsibilities, the Hermanos were principally occupied with specific religious duties, obligations, and rituals. Including both public and private events, the devotion of the members took the form of prayer, discipline, music, and ritual (Weigle 1976:154).

During Lent (which begins on Ash Wednesday, 46 days before Easter), various fasts and abstinences were observed by the Brotherhood. Every Friday, public recitations of the Stations of the Cross were held during the day and in the evenings. Customary activities included private meetings and/or flagellant processions (Weigle 1976:158–159). The last two weeks of Lent, known as Passion Week and Holy

Week, closely imitated the final days of Jesus's mortal life. Brothers spent most of Holy Week in retreat at their *morada*—literally, "dwelling," but this word denotes both the actual meeting house of the local Brotherhood and the chapter itself (de Cordova 1972:59; Weigle and Lyons 1982:231). Even though each morada had its own specific Lenten customs, there were similarities among them as well. In general, during their Holy Week retreat the Hermanos slept little, maintained constant vigils, welcomed and worshipped with many groups of visitors, visited other moradas, and at various times undertook public processions and services (Weigle 1976:158–162).

Throughout Lent and especially Holy Week, a number of physical penances were engaged in by some members. Frequently, these included self flagellation, the dragging of a large, heavy cross, or going from morada to morada on one's knees. The purpose of these penances was to strengthen spiritual discipline and to express religious devotion. Such exercises were carried out as part of a total worship complex and did not represent masochistic self-indulgences or sadistic tortures. Penitentes who undertook these activities were almost always accompanied by other members who were engaged in singing, praying, playing the *pito* (flute or whistle), and carrying sacred images as guides (Weigle 1976:160–162).

For the Penitentes, Holy Week focused on expressing the Passion of Jesus, which included both his internal and external suffering from the time of the Last Supper until his death on the cross. This Passion was often evoked through *alabados* (traditional religious hymns), the Via Crucis (Way of the Cross), penitential processions, and certain stylized, dramatic reenactments or tableaux. The performance of alabados was appropriate because many of them vividly described and recounted the Passion. The Via Crucis, outside the morada, was an important symbol of Christ's route to Mount Calvary. During Holy Week, a series of small crosses representing the Stations of the Cross was set up along the Via Crucis. A number of major processions, some along this route, usually took place on Wednesday, Thursday, and Friday of Holy Week (Weigle 1976:163–166).

One or more dramatic tableaux were enacted on Holy Thursday and Good Friday by Penitentes in each village. These enactments of the final events in Jesus's life were highly stylized and symbolic. They centered on a single incident and usually involved santos carried in a procession. For example, one of these dramatizations is called El Encuentro (The Encounter) and centers on the meeting between Jesus and his mother on the way to Calvary, the fourth Station of the Cross. This scene was often enacted during the late morning of Good Friday. The women processed from church or chapel, carrying an image of the Virgin Mary, usually Nuestra Señora de los Dolores (Our Lady of Sorrows). The Penitentes came from the morada bearing an image of the Cristo, usually Padre Jesús Nazareno. When the two groups met there was a recitation or an alabado commemorating the passion. At the appropriate time, the figures were tipped and brought close together in a symbolic last embrace of Mother and Son. Much weeping and intense emotion accompanied this dramatization (Weigle 1976:166–167).

In some communities, a simulated crucifixion took place on Good Friday afternoon—an event always carefully supervised by appropriate Penitente members. It was an honor to be selected as the person who would imitate the final suffering of Christ. The chosen Brother was usually bound by rope to the cross for 20 to 30 minutes. He often fainted fairly quickly, and when this happened, the others took him down, brought him into the morada, and gently revived him. Again this was a time of intense emotion, often with sobbing and wailing from the crowd (de Cordova 1972:46; Weigle 1976:171–173).

The Tinieblas (darkness) service of the Penitentes was usually held on Holy Thursday and Good Friday nights and was preceded by a rosary service. Villagers, families, and friends gathered either in the village church, the Penitente oratorio, or the morada and were soon followed by the Penitente members, many of whom were practicing penance in a variety of forms. The Tinieblas service symbolized the chaos following Jesus's death. Once all were inside, the door was quickly closed and all lights extinguished except for 15 candles in a triangular candelabra on the altar. A single singer from the morada stood next to the candelabra and began a haunting alabado. At the end of each verse, he put out one candle flame, and the interior slowly grew darker. Finally, after he extinguished the last candle, he quietly slipped out a nearby door, and the interior was in total darkness. Almost immediately a tumult and deafening noise of all kinds began, including hand clapping, beating drums, whirling *matracas* (wooden clackers), flutes, chains, foot stamping, and possibly Penitente self-flagellation. When the raucous noise died down, prayers for the dead were said in a semiwhisper by the assembled group. Then, in a few minutes, the ear-splitting noise picked up once again. This pattern of cacophony followed by quiet prayer was repeated a number of times in the pitch black interior for the duration of the service, which usually lasted about an hour. Finally, much to the relief of many attending, the lone singer reentered and the first candle was relit, followed shortly by the others, and the service came to an end. If the ceremony had been held in the church or oratorio, the Brothers quickly left and returned to their morada. If held in the morada, the non-Penitente visitors left immediately. Sounds of the pito and singing could be heard by the villagers all night long as various groups of Penitentes made *visitas* (formal visits) to nearby local religious sites and traveled along the road to moradas in other nearby villages (de Cordova 1972:42–44; Weigle 1976:174–175). When a repeat of this same service ended on Friday night (called Los Maitines), the rituals surrounding the Passion of Christ were ended until the following year (de Cordova 1972:46–47). No Penitente events occurred on Easter Sunday. Penitentes in the Ojo Caliente/Gavilan region engaged in most of the activities described above. Non-Penitente friends, relatives, and neighbors often participated in the less dramatic portions of these religious observances.

Social and Economic Patterns

In addition to its own religious activities, each Hispanic village in northern New Mexico also functioned as an autonomous social and economic unit. Largely in remote areas, isolated by hostile Indian tribes and, until recently, by impassable roads, each community was forced to develop coping mechanisms which relied heavily upon its own economic and cultural resources. Subsistence agriculture combined with livestock raising and, often, trade with nomadic Indian tribes sustained most families. On their family-owned land near acequias and rivers, villagers grew wheat, corn, beans, chile, fruit, vegetables, and sometimes alfalfa for livestock. Herds of sheep, cattle, and horses were kept on nearby communal ranges. *Ciboleros* (buffalo hunters) from each village hunted buffalo on the plains to the east to supply local families with extra meat and hides. As mentioned earlier, parties of comancheros made excursions onto the plains where they traded successfully for many years with the Comanches and other nomadic tribes. Some Spanish villagers engaged in an active contraband trade with the nearby Utes. This Ute trade, which continued from generation to generation for over 100 years, was often quite lucrative because Spanish or Mexican taxes were not paid. Hispanic villagers commonly received from the Utes such things as dressed hides, meat, and captive women and children. In exchange they provided the Indians with *punche* (a locally grown tobacco), horses, metal goods, and especially knives (Knowlton 1969:459; Swadesh 1974:24–25, 156, 163–165; Weber 1979:80).

The two organizing principles of Hispanic social organization in this area were the extended family and the village. Family unity was emphasized, but within it the males were always dominant over the females. The father was the principal authority figure, and his oldest son was second in command. Mothers and wives were expected to be obedient, tolerant, and faithful. Brothers protected and defended younger siblings. Often fathers were somewhat aloof and formal with their children; mothers were not. Endless hard work was essential for survival in this harsh environment, and from an early age the children were expected to help. As they grew older, their obligations grew. All members of an extended patriarchal family were expected to work closely together, mutually assist each other, and present a united front to the rest of the world. These local kin groups and also the Penitente Brotherhood maintained social control in the villages (Knowlton 1969:460–461; Swadesh 1974:152–155).

The extended patriarchal families were also intermeshed with the *compadrazgo* (ritual godparent) system. Parents chose godparents who would sponsor their children at important rites of passage such as baptism, confirmation, and marriage (Knowlton 1969:460–461; Swadesh

1974:189–192). These ties, sometimes but not always between members of different families, were for life, and "frequently unified an entire village population into a functioning system of religious and economic cooperation and responsibility" (Knowlton 1969:461).

Extended families, the compadrazgo system, and the Penitente Brotherhood were encompassed by the next larger social unit—the village. Until the last sixty years or so, the village comprised the total social universe of its inhabitants and met most of their social, economic, and religious needs. An individual felt safe and secure in his or her village and was reluctant to move elsewhere under most circumstances. Residents seldom identified with larger regional or national social, political, or religious units. The village, with its attached land and water rights, was essentially all they needed to sustain them (Knowlton 1969:458–460).

For over 300 years, the Spanish settlers of northern New Mexico have remained small landowners and maintained a mixed economy of agriculture, herding, and trading. They have always been tough, resilient people who took advantage of new opportunities, adapted to change when necessary, and traded with Apaches, Utes, Navajos, and Spanish people in other isolated villages. No matter what the hardships, they managed to maintain a strong sense of community, in part fostered by their strong kinship ties and religious beliefs (Swadesh 1974:3–4).

A Brief History of LA 105710

LA 105710 fits comfortably into the above picture of Hispanic life in northern New Mexico. Over the past 100+ years several structures were built on this site: a Penitente morada, a small store, corrals, animal pens, and a shed. Several other structures directly related to those at LA 105710 were built on adjacent or nearby land. Only small sections of the adobe morada walls remain standing; otherwise all of these structures have been abandoned, dismantled, and the materials reused. A former wagon road has also been abandoned, as has a trail (LA 118549) which ran along or near the edge of the ridgetop east of LA 105710. The following sketchy history of this land leaves many gaps, some of which may be filled by additional research in the future.

The earliest written information concerning LA 105710 and surrounding land may be found on an 1877 plat of the Ojo Caliente Land Grant, surveyed by Griffin and McMullen (Fig. 25.1). This appears to be the first official survey of the Ojo Caliente Grant, which was created in 1793. LA 105710 was part of this grant, which at that time included 33,590 acres and extended roughly 7 mi (11.3 km) east of the Ojo Caliente River. The surveyors' notes stated that the land on the eastern part of the grant was rolling and heavily timbered with piñon and cedar. The central area afforded good pasture, and the area just east of the river included cultivated lands extending about 5 mi (8.1 km) north to south and about 5 to 10 chains in width. LA 105710 was directly east of the cultivated land shown on this map. Most likely the land on the ridge top to the east, just above LA 105710, was the main area of the ejido. Noted on the 1877 map as "prairie lands" and "grama grass lands," this large area was crisscrossed by roads and trails to Cieneguilla, Taos, Abiquiu, and Conejos, and also showed a "wood road." Local resident Flora Trujillo stated that she had never heard the term *ejido*, but when she was young, people grazed their livestock and went for firewood on the ridge east of the Ojo Caliente River Valley and beyond. Each summer, people grazed their cattle up on top and moved them north to the areas around Taos Junction and Cerro Azul. In the winter, the livestock returned to the farms in and around Ojo Caliente, where their owners cut hay for them and installed little pumps and water tanks on their property or opened gates so the animals could go down to the river for water.

On the 1877 map, three small communities are shown in the Ojo Caliente River drainage on the east side of the river. From north to south they were the Plaza de Ojo Caliente, with a church; Plaza de los Gallegos; and Gavilan. According to the accompanying field notes (Griffin and McMullen 1878), the total population was about 250. The land between the river and the road to the east, and between Los Gallegos on the north and Gavilan on the south, is noted as "under cultivation." Only the Ojo Caliente Springs are shown on the west side of the river, at the base of a ridge rising behind them

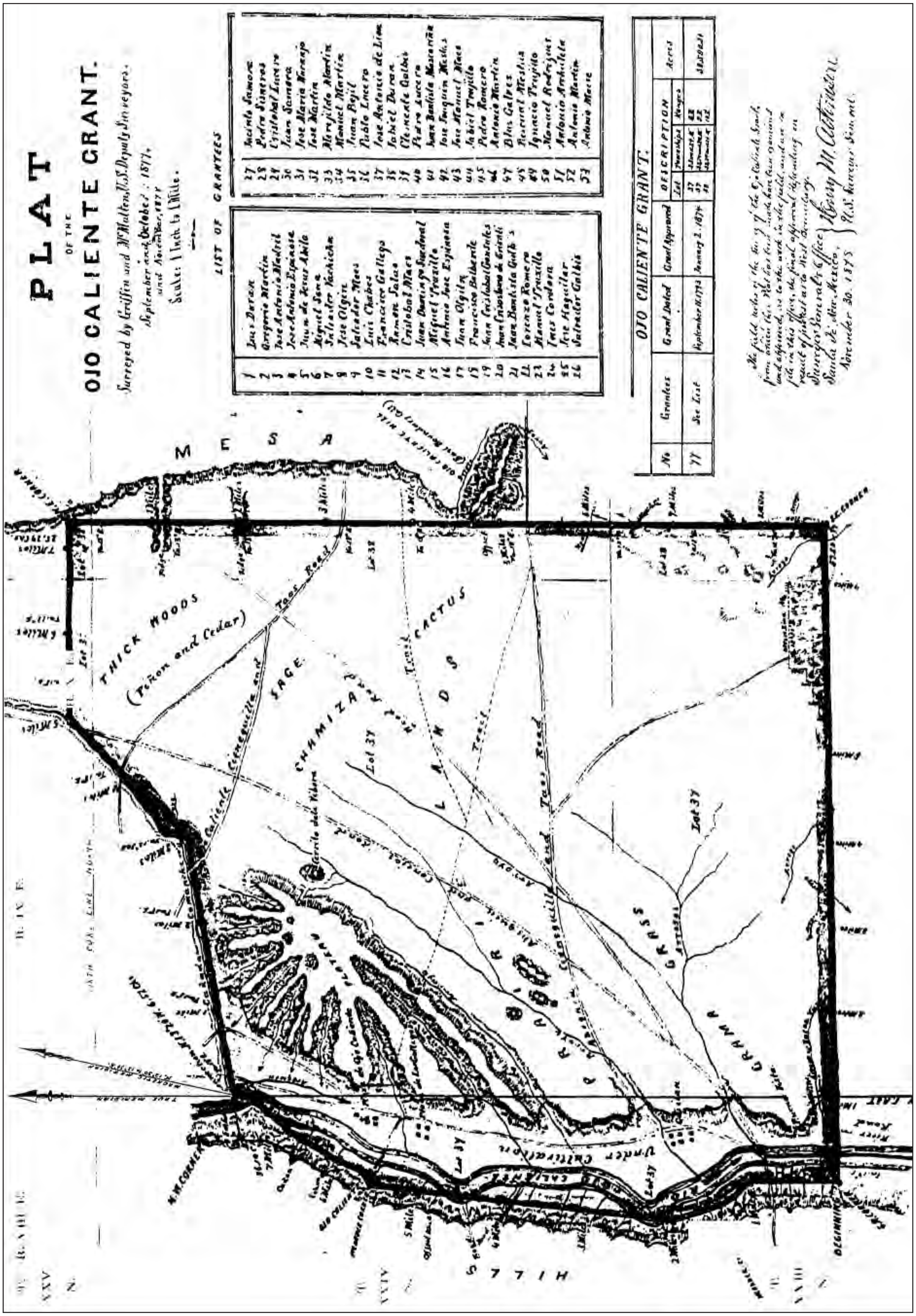


Figure 25.1. Plat of the Ojo Caliente Grant in 1877 by Griffin and McMullen.

to the west. No other significant cultural information is presented on the map aside from the location of the Ojo Caliente church and a list of names of the 1793 grantees (Fig. 25.1).

By the time of an 1882 survey by Curry and Jones, the grant boundaries had shrunk significantly, from 33,590 acres to 2,854.64 acres. The entire ridge area east of the road appears to have been excluded from the grant and was divided by the surveyors into sections, as shown on a 1919 BLM survey map (Fig. 25.2) created by surveyor William B. Douglass, which was based on the 1882 subdivisions created by Curry and Jones (Douglass 1922). Ownership of the ejido in 1882 is unknown, but it is possible that this land might have become part of the public domain by that time. In his field notes accompanying the boundary survey of the Ojo Caliente Grant, Douglass (1922) mentions the location of the Ojo Caliente cemetery, several cross-cutting roads, log corrals, the Church of the Penitentes, the village of Gavilan, the stable and house of C. M. García, the house of Juan C. García, and the house of Juan Archuleta. It is clear from his descriptions that the cemetery was in its current location as was the morada and the houses of the Garcías and Archuletas. These two families were relatives of Flora Archuleta Trujillo (Fig. 25.3), an elder and lifelong resident of Gavilan/Ojo Caliente with an excellent memory and extensive knowledge of local history. Much of her information will be presented later in this report.[1]

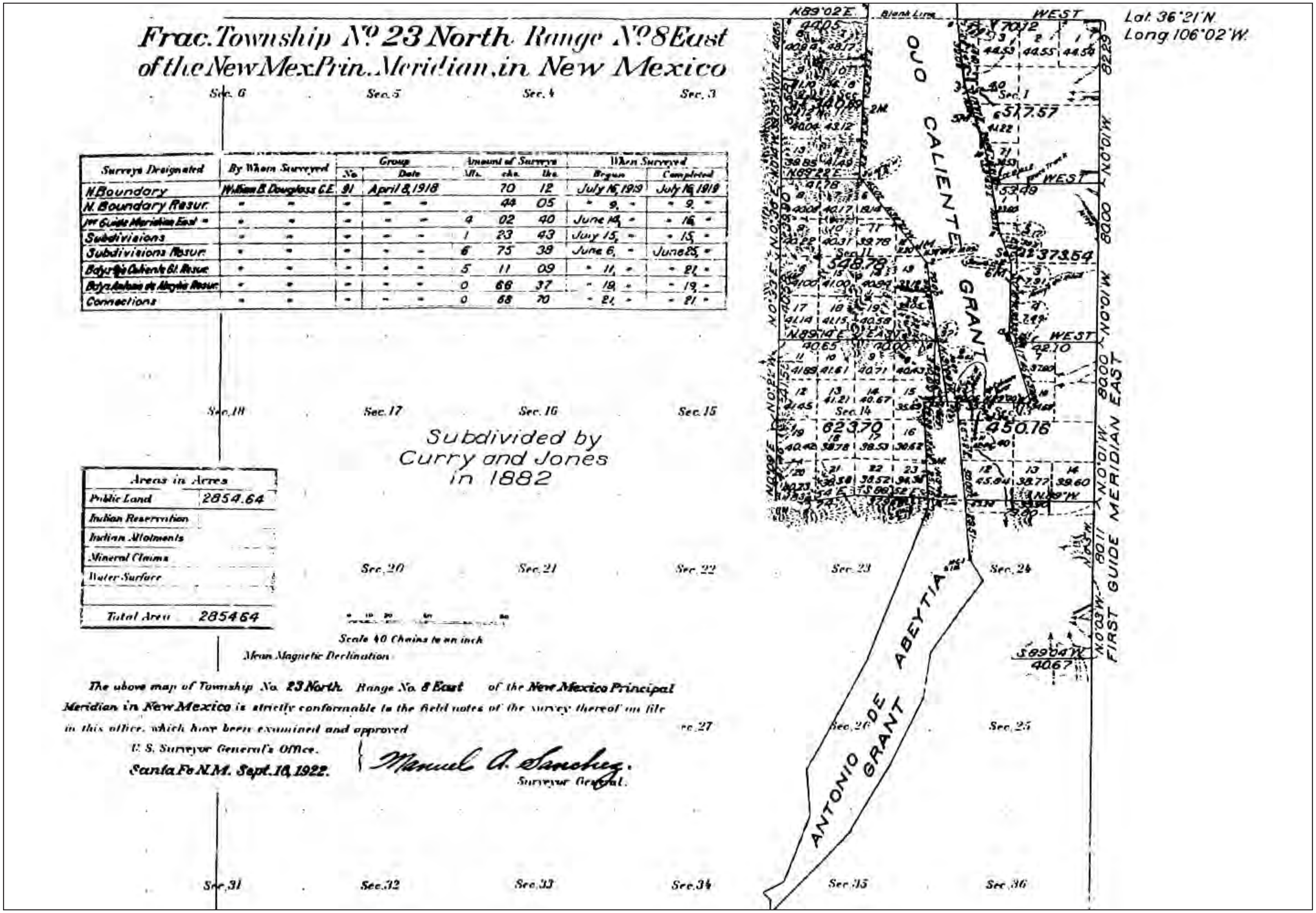
An 1895 plat of the Ojo Caliente Grant, surveyed by Sherrard Coleman (1894), also shows the grant as a long narrow strip paralleling the river and extending to the east and west only as far as the ridges on either side of the river (Fig. 25.4). The area of the grant has shrunk even further, to 2,244.99 acres. On his map, Coleman indicates the Ojo Caliente spring west of the river, the village of Ojo Caliente east of the river, Gallegos south of Ojo Caliente, and Gavilan south of Gallegos. Interestingly, neither of the early maps (1877 and 1895) shows a community called Duranes between Gallegos and Gavilan. Perhaps settled more recently, Duranes is present on the 1953 USGS Ojo Caliente Quadrangle topographic map. Flora Trujillo knew that this area had been called Duranes but said that it was also known as South Ojo Caliente. Even though Gallegos is shown on all of the above maps, Flora stated that she never heard this name applied to the area.

Little is currently known concerning the land-ownership history of LA 105710. According to Flora Archuleta Trujillo, part of LA 105710 and the surrounding land formerly belonged to her paternal grandfather, Juan Antonio Archuleta, and part belonged to Juan Antonio García, her maternal granduncle. She did not know who owned the portion where the morada was situated. Some of Juan A. García's land was later transferred to his sons Candido and Manuel García.

A 1939 New Mexico Department of Transportation map (NMSHTD 1939) shows ownership of much of the land adjacent to the highway at that time (Fig. 25.5). A portion of LA 105710 east of the road belonged to Josephine García, a daughter of Candido García. As can be seen on this map, several structures existed on Josephine's property. Near the south end was a tiny adobe house (later discovered, through interviews with Gavilan elders, to be her father Candido García's store). A few hundred feet north was a log corral, and just north of it, a log pig pen and sheep pen. All were inside the 1939 right-of-way and were to be removed by WPA forces. Descriptions of these structures by Flora Trujillo are presented later in this report. The land east of these structures, which also belonged to Josephine García, was noted on the 1939 map as "sandy pasture" and "sandy flat." The morada, north and east of the corrals on LA 105710, was on land of unknown ownership, as were the remnants of an old dirt road. Neither are shown on the 1939 map.

Josephine García also owned a smaller parcel of land on the west side of the road, directly across from her father's store. It was described on the 1939 map as "Farm Yard." Her uncle Manuel García's land, also designated as "Farm Yard," was on the west side of the road, just south of Josephine's. Directly north of her land was a small area called "Church Land" (Fig. 25.5). According to Flora Trujillo and her nephew, Fred Archuleta Jr. (another resident of Gavilan), the Penitente oratorio, which does not appear on this map, was outside the right-of-way on this "Church Land." Flora stated that it had been donated for this purpose by Ascencionita García Sisneros, her maternal grandmother.

Candido García's name did not appear as owner of any of the land along either side of the



Surveys Designated	By Whom Surveyed	Group No.	Group Date	Amount of Surveys Mls.	chs.	lks.	When Surveyed Begun	Completed
N. Boundary	William B. Douglass C.E.	91	April 8, 1918		70	12	July 16, 1919	July 16, 1919
N. Boundary Resur.	"	"	"		44	05	" 9, "	" 9, "
1st Guide Meridian East "	"	"	"	4	02	40	June 14, "	" 16, "
Subdivisions	"	"	"	1	23	43	July 15, "	" 15, "
Subdivisions Resur.	"	"	"	6	75	38	June 6, "	June 25, "
Bdys. Ojo Caliente Gt. Resur.	"	"	"	5	11	09	" 11, "	" 21, "
Bdys. Antonio de Abeytia Resur.	"	"	"	0	66	37	" 19, "	" 19, "
Connections	"	"	"	0	68	70	" 21, "	" 21, "

Figure 25.2. Plat of the Ojo Caliente Grant in 1919 by Douglas, based on 1882 survey by Curry and Jones.

Figure 25.3. Flora Archuleta Trujillo, a retired teacher, in front of her Gavilan house, with her dog, Brandy.

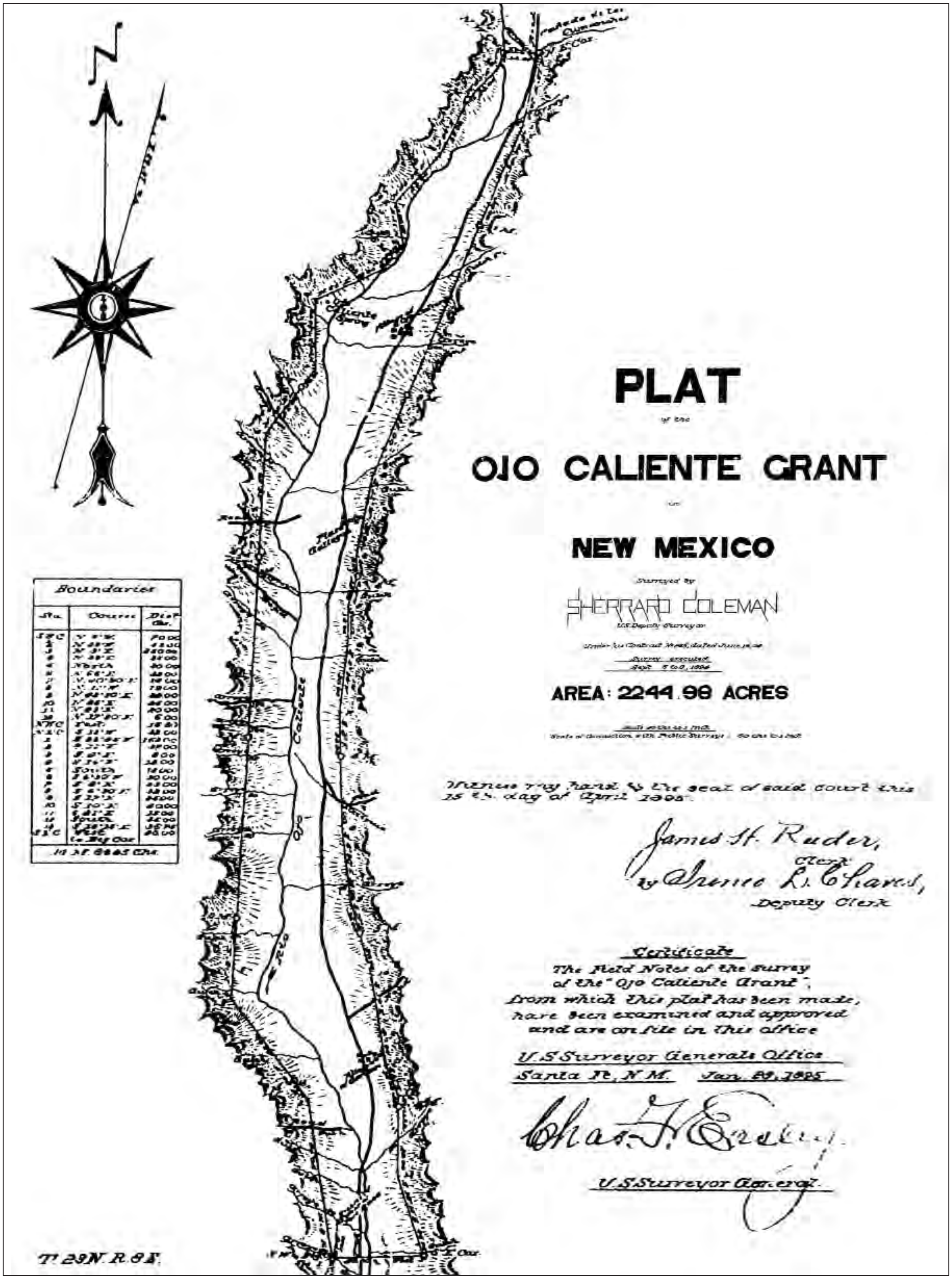


Figure 25.4. Plat of the Ojo Caliente Grant in 1894 by Coleman.

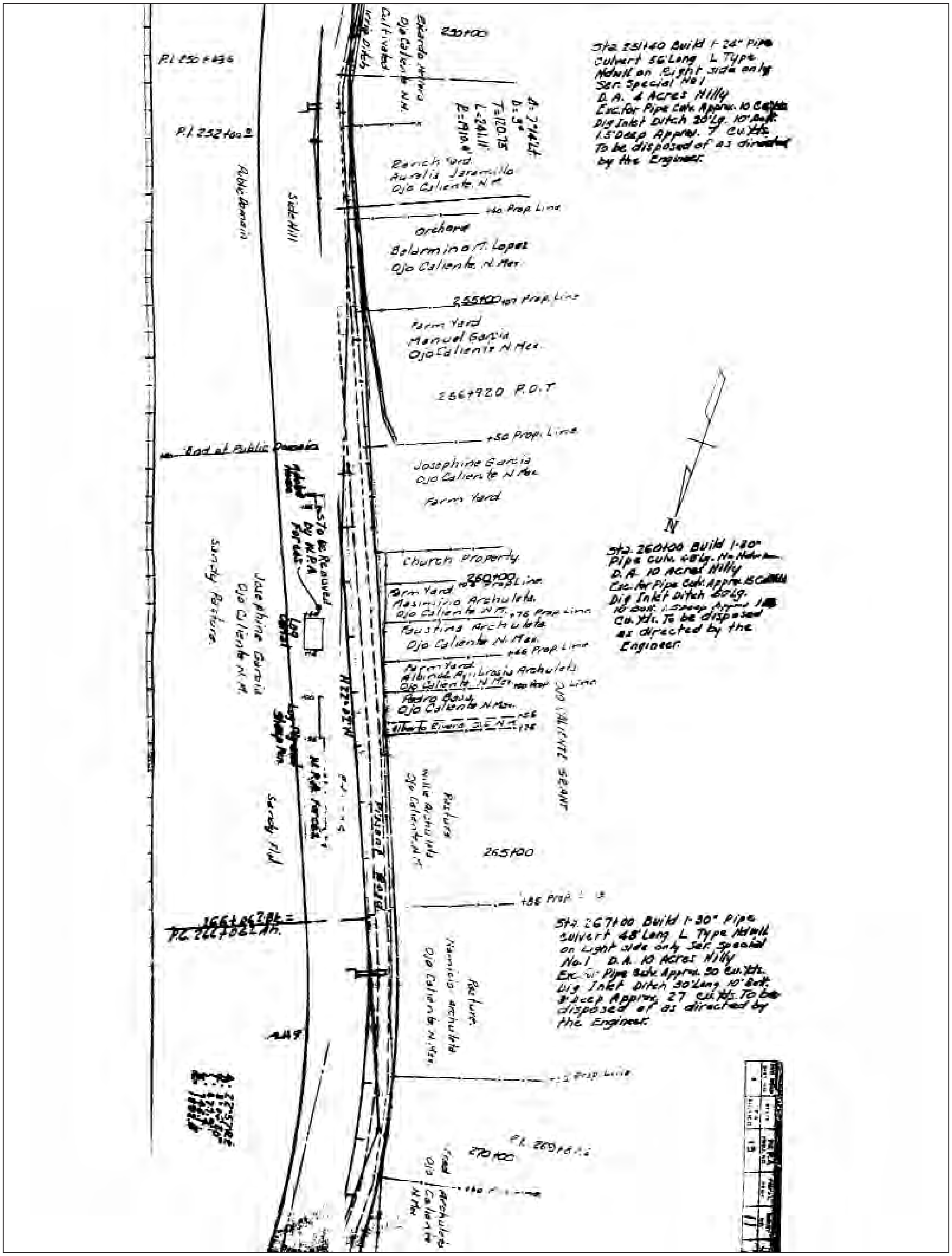


Figure 25.5. Sheet 11 from 1939 construction plans for U.S. 285 (NMSHTD 1939), showing ownership of land adjacent to the highway near LA 105710.

road in 1939, even though Flora Trujillo knew that his little store east of the road and his large house west of it had been built on land that he owned. Flora stated that Candido may have deeded this land to his daughter for financial reasons.

Flora Trujillo recalled that Candido had a homestead in Gavilan for a number of years, although she did not know exactly where it was or what happened to it. BLM records show a homestead application for this land (which appears to have included a portion of LA 105710) filed in the name of Candido M. García on July 16, 1930 (BLM Serial No. and Homestead Patent Number SF 062055). The original homestead, dated December 29, 1916, was also noted on the document, but without the name of the individual who filed it at that time. No other information was recorded concerning this homestead, except that on April 2, 1935, Candido M. García's homestead patent was canceled by relinquishment. The reasons are unknown, but finances may once again have been the issue. Perhaps his daughter, Josephine, acquired it after her father relinquished it. It is also possible that this land reverted to the public domain after Josephine's ownership lapsed. According to Flora Trujillo, Josephine and her husband moved away from Gavilan about the time of World War II and never returned. She died over 30 years ago. It is clear, however, that after 1939 this land came under BLM control when that agency gained jurisdiction over all U.S. public land not managed by the USDA Forest Service.

Structures, Features, and Use-Areas along U.S. 285 at or near LA 105710

The Small Stores

In the 1930s Candido García built and ran a small store east of U.S. 285 on LA 105710, within project boundaries, 0.15 mi (0.24 km) south of the morada. Candido's brother, Manuel García, built and ran a very similar little store directly across the road on the west side of U.S. 285, also in the right-of-way. Neither store had a name. Local residents simply called them the García Brothers' *tienditas* (small stores). During the few years these tienditas were in operation, the brothers were always in competition with each other. Unless noted otherwise, information concerning the brothers and their stores, as well as other features on or near this site, was related by Flora Trujillo, a cousin of the García brothers.

Never very profitable, these small stores were only open for a few years, from approximately 1931 to 1937, according to Flora Trujillo and her nephew Fred Archuleta Jr. When the García brothers closed their businesses, each dismantled his store, took the adobes and beams, and reused them elsewhere. Only the foundations were left.

The mud and rock foundation of Manuel's store, just a few feet west of the roadway, was eliminated in 1939 when the road was first paved. The concrete foundation of Candido's store was left intact at that time. It remained on the east side of the highway, back from the roadbed but within the right-of-way, until additional road work was undertaken in 1998.

Each of these one-room structures was built to be a store, and neither was used for any other purpose. Both were made of adobe and had at least one window. Candido's store had a cement and rock foundation upon which the adobe block walls were built. The roof was corrugated metal, basically flat, but with a slight pitch so water would run off. It had a "lumber" floor and a door that faced the road to the west. Flora recalled one small window but couldn't remember whether it was on the north or west wall. Manuel's store had a mud and rock foundation upon which the adobe block walls were built. The door of Manuel's store faced the road to the east.

The interior of each store was plain and functional. In Candido's store, aside from the small window in the north or west wall, a wooden counter stood near the east wall, and a scale sat on the counter (Fig. 25.6). Wooden shelves lining the north wall held canned and other dried goods. FSs of dry food were piled on the floor along the south wall. No chairs or benches were present. A wood-burning stove was near the west wall, close to the south corner, with a wood box next to it. There was no electricity. A single kerosene lantern provided artificial light.

The interior of Manuel's store was similar, but the store was oriented differently due to its placement in relation to the road (Fig. 25.7). The counter was near the north wall, and a window

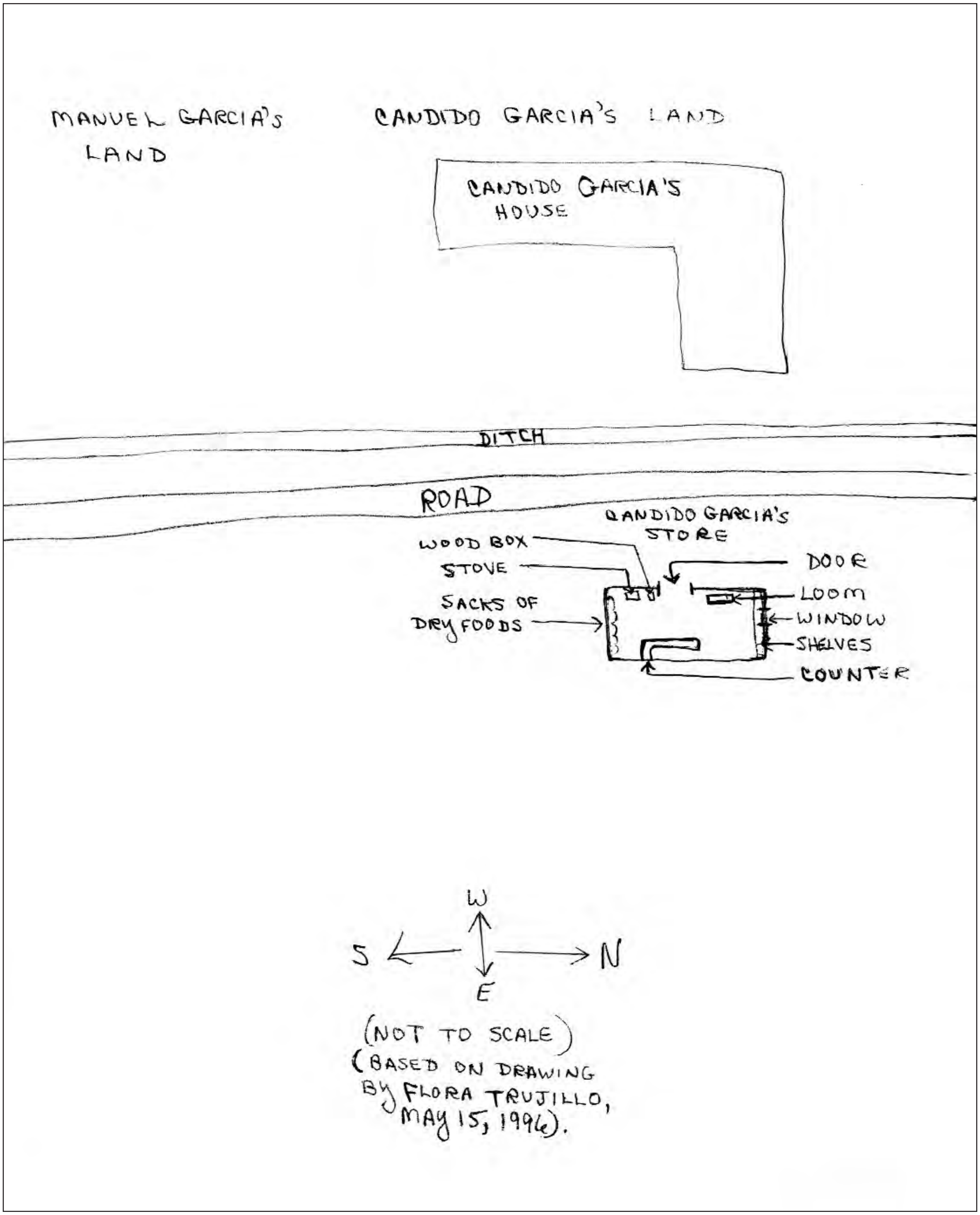


Figure 25.6. Adaptation of Flora Trujillo's 1996 sketch plan of Candido García's store and house at Gavilan.

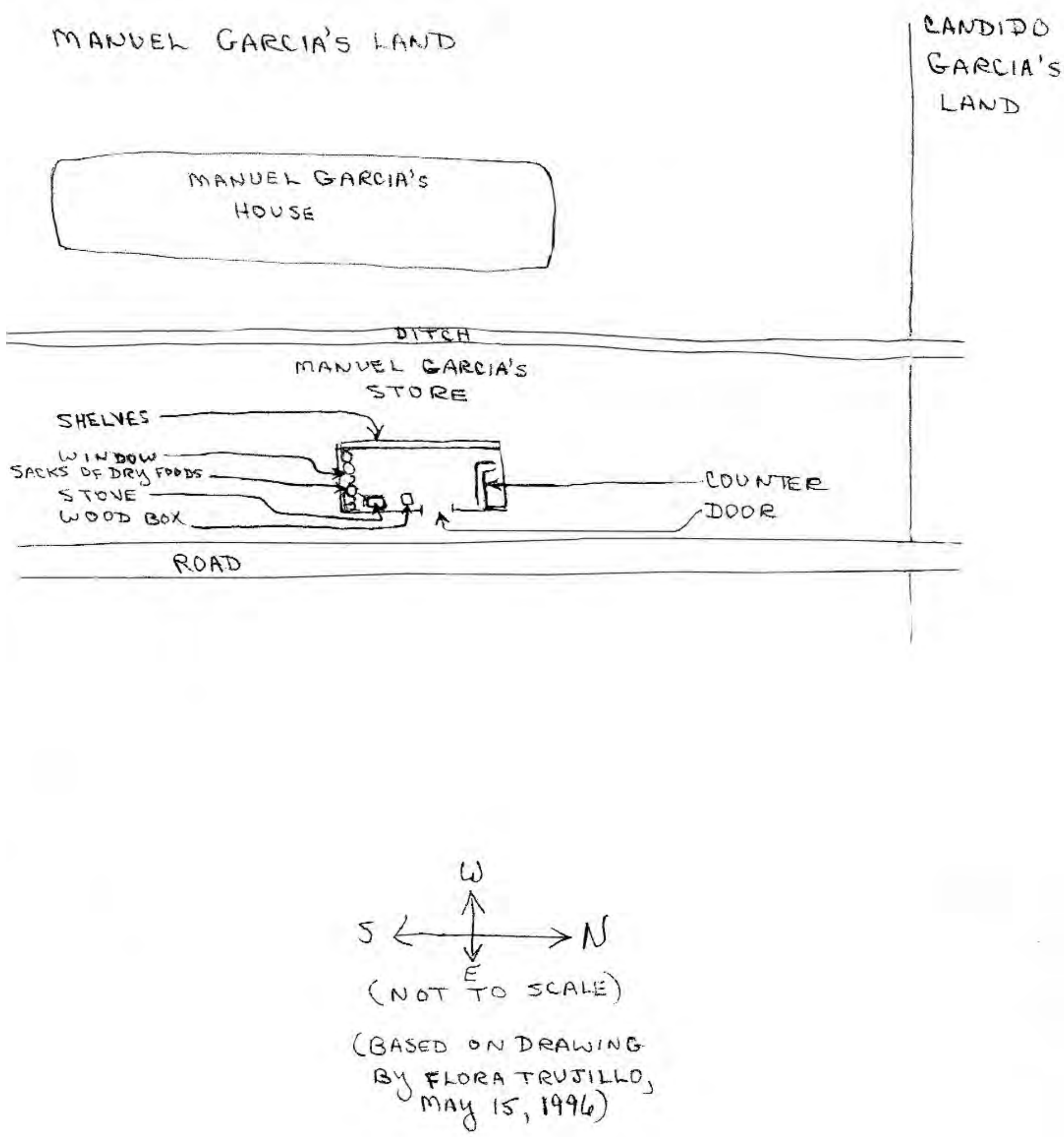


Figure 25.7. Adaptation of Flora Trujillo's 1996 sketch plan of Manuel García's store and house at Gavilan.

was on the south. Sacks of dried goods were beneath the window. Shelves along the west wall held the canned goods. A stove was placed near the east wall, close to the south corner, and a wood box was next to it.

Flora Trujillo recalled a special time when she worked in Candido's store. She had learned how to weave in school one year, and the following summer, Candido, who always wanted to learn to weave, built a loom and invited her to spend a month weaving inside his store. He never could spend enough time to really learn how to weave, but Flora's loom was set up in the northwest corner of the room, and she worked there every day. Her mother helped her card, spin, and dye the wool. She enjoyed talking to people when they came in to see what she was doing. The store was open continuously during that month. She only did the weaving demonstration for this short period of time, however, because her interests soon led her back to school, where she trained to become a teacher.

The García stores were not open on a regular basis since each brother supported his family primarily by farming and raising livestock. Candido also worked part time as a carpenter and built many of the houses in the Gavilan area. The stores were a secondary undertaking and remained closed and locked much of the time. Often, persons in need of an item had to seek out the owner or his wife and ask them to unlock the store so they could purchase the goods they needed.

In their stores, the brothers did not buy or sell produce and livestock raised by local families. They primarily sold canned goods and canned meats as well as dry foods such as flour, pinto beans, piñon nuts, potatoes, sugar, coffee, salt, baking powder, baking soda, and candy. Nonfood items included soap, lamp oil, matches, and balloons for the children. According to Flora Trujillo they did not sell shoes or clothes, nor did they have a gasoline pump. However, Ben Maestas, a nephew of Manuel García, did recall a gas pump at his uncle's store and a big sign which said, "Polarin," the name of the gas company. Ben's uncle also sold pop and had barrels of candy. Few cars traveled the dirt road at that time and, according to Ben, his Uncle Manuel didn't do very well financially.

Flora Trujillo stated that the García brothers did not extend credit. They were poor people and needed the cash to purchase more goods. When they were financially unable to stock the shelves, their little stores might be closed for months or even a year at a time. These were very small businesses, always on the financial edge. According to Flora, "Neither had very much trade at their little stores and they didn't charge high prices. They did their best to buy canned goods and other products cheap so they could charge a reasonable price and make a little profit" (Goodman Field Notes, 1998). Flora recalled that they went to a special place to buy things more cheaply, but she could not remember where.

Both families survived largely by farming, growing fruit, and raising livestock on their land. They had orchards in some of their fields near the river and annually harvested plums, peaches, apricots, cherries, and apples. They also grew chile. As the fruit ripened they picked it and then traveled to Monte Vista, Pagosa Springs, and other towns in Colorado, where they sold it. The Garcías strung and sold chile *ristras* and sometimes exchanged their produce for items they didn't grow, such as potatoes. They also gathered piñon nuts in good years and sold them in Colorado. Neither brother sold fruit, chile, or piñons in his little store. Every summer and fall Candido and Manuel hired people to pick apples and other fruit for them from their orchards, pick chile from their fields, and string ristras. They didn't take advantage of people who worked for them; they treated them well.

Concerning social and familial patterns, the García brothers were related to everyone in Gavilan and as a result were closely tied to the community (Fig. 25.8). Aunts, uncles, and other relatives lived all around them. Candido and Manuel (first cousins of Flora Trujillo's mother) lived only a few houses away from Flora's grandparents, for example. The brothers were respected, were considered to be honest and hardworking, and were no wealthier than anyone else in the local area. Both were well liked and responsible, and they participated in a variety of communal activities such as ditch cleaning, planting, harvesting, and so forth.

Flora recalled that each brother lived in a large house on adjacent land (Figs. 25.6 and 25.7). Manuel's house was directly south of Candido's. Each owned about 10–12 acres (4.1–4.9 ha) stretching from the Gavilan ditch on the east in a long lot to the river on the west. Ditch water was used to irrigate their crops and the fruit trees in their large orchards. Each house was just west of the ditch. Each brother also had a well on his property that supplied drinking water.

Candido's house for his wife and nine children was on the west side of the road, while his store was on the east side. Manuel's seven-room house for his wife and nine children was down the hill behind his store; house and store were both on the west side of the road. After he closed and dismantled his store beside the road, Manuel turned one of those seven rooms into a new store. He and his wife operated this store in their home for many years. One of his specialties was ground chile. As an old man, he moved to Santa Fe to live with one of his daughters.

Flora Trujillo felt there were two main reasons why the brothers closed their little stores. First, there was a great deal of jealousy between them; they were in stiff competition all the time. Second, neither store showed a profit, and it was a financial strain to keep them open.

When Candido closed and dismantled his store, he never opened another. He sold his large house and with his family moved to the west coast during World War II to be near one of his sons, who was ill. None of them ever returned to the Ojo Caliente area. Flora Trujillo stated that Bob Smith and his family bought Candido's house and land, while Ben Maestas, who had always loved this area since he was a small boy, later purchased his uncle Manuel García's house and land.

The Archuleta Corrals, Animal Pens, and Shed

Approximately 0.04 mi (.06 km) north of Candido García's little store, on land formerly belonging to Flora Trujillo's paternal grandparents, Juan Antonio and Faustina Archuleta, were the Archuleta cattle corrals, sheep corrals, chicken pens, a pig pen, a large wood pile, and a shed where the wagons were housed and harnesses and saddles hung (Fig. 25.9). When she was young, Flora was told that her grandfather owned all this land. Later, she was told that it belonged to the government. Flora thought that probably her family never had a deed to this land, and since all the land was inherited in this area, there was probably no need for a deed. Built on a portion of LA 105710 on the east side of U.S. 285, these Archuleta structures took up a significant amount of space, as did adjacent areas for storing hay and other feed. Flora recalled their presence as late as 1934, when she went to gather wood from the woodpile there, following a *velorio* (vigil) held for her granduncle Albino Archuleta's deceased baby. Some of these structures were shown on a 1939 New Mexico Department of Transportation map (NMSHTD 1939), which also indicates that they were slated for removal by WPA forces (Fig. 25.5). They were most likely dismantled shortly after this time, and no trace of them remains. The land where they formerly stood, currently unused, is across the highway from the large, two-story house that belonged to Flora's paternal grandparents, Juan Antonio and Faustina Archuleta. This structure now stands abandoned, back away from the west side of the road. Several other houses have been built beside and in front of it.

Flora stated that the land to the east of her grandparents' corrals on the ridge above LA 105710 was open, free land where people let their cattle and horses graze. She remembered that the hills to the east were beautiful—formerly they were covered with grasses that provided plenty of forage for the livestock. Now those hills are barren, and anyone who keeps livestock there must buy feed for them. No one had to buy feed when she was young. Local families raised large quantities of corn and wheat for human consumption and as feed for chickens and hogs.

Roads Directly North of the Morada

According to several elders, an abandoned dirt road on LA 105710 that runs up the mesa to the east just north of the morada had several uses. It served mainly as a wagon road for the men of Gavilan when they went to gather firewood on the ridge east of the village. Since it has been out of use for many years, current residents were unsure whether or not this road had, at one time, also connected Gavilan with the Rio Grande villages to the east. According to several elders, it was also the principal road used when the Penitentes walked in procession up to the Calvario. Over time this road has become an arroyo, and only the dim outline of a two-track

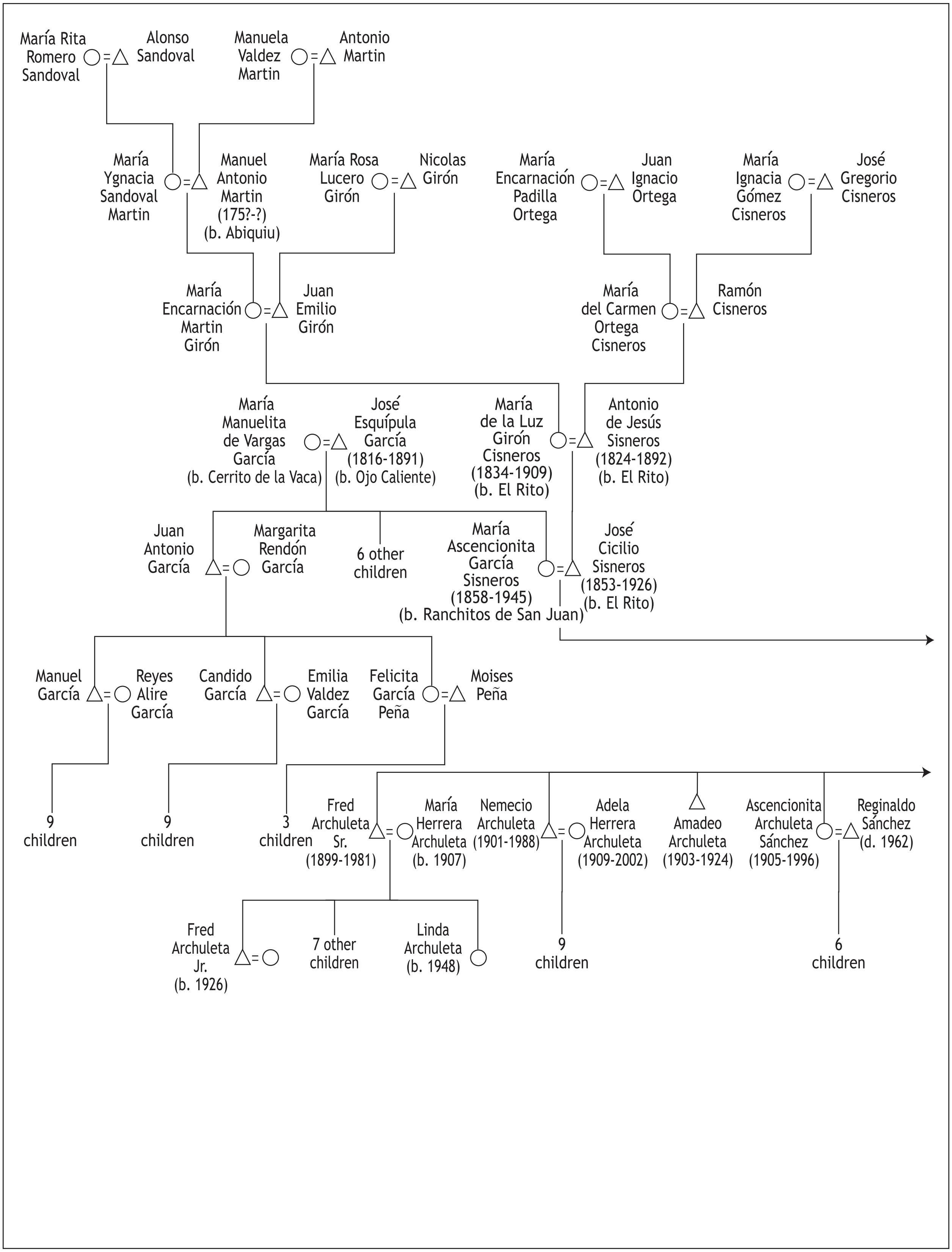
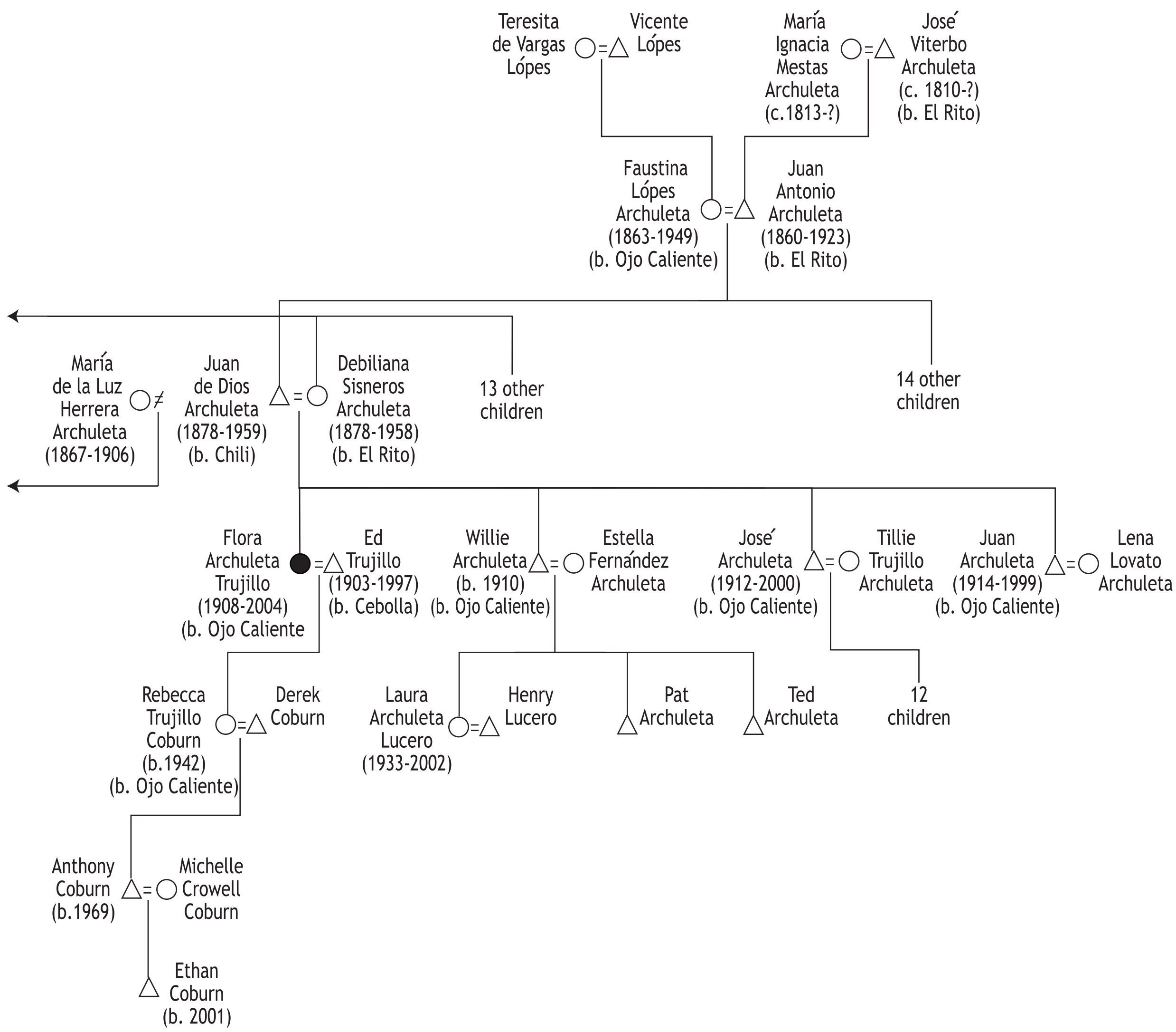


Figure 25.8. Genealogical chart of García-Sisneros-Archuleta family. Compiled from information supplied by Flora Archuleta Trujillo and Anthony Coburn.


Teresita
de Vargas
Lópes
Vicente
Lópes
María
Ignacia
Mestas
Archuleta
(c.1813-?)
José
Viterbo
Archuleta
(c. 1810-?)
(b. El Rito)
Faustina
Lópes
Archuleta
(1863-1949)
(b. Ojo Caliente)
Juan
Antonio
Archuleta
(1860-1923)
(b. El Rito)
María
de la Luz
Herrera
Archuleta
(1867-1906)
Juan
de Dios
Archuleta
(1878-1959)
(b. Chili)
Debiliana
Sisneros
Archuleta
(1878-1958)
(b. El Rito)
13 other
children
14 other
children
Flora
Archuleta
Trujillo
(1908-2004)
(b. Ojo Caliente
Ed
Trujillo
(1903-1997)
(b. Cebolla)
Willie
Archuleta
(b. 1910)
(b. Ojo Caliente)
Estella
Fernández
Archuleta
José
Archuleta
(1912-2000)
(b. Ojo Caliente)
Tillie
Trujillo
Archuleta
Juan
Archuleta
(1914-1999)
(b. Ojo Caliente)
Lena
Lovato
Archuleta
Rebecca
Trujillo
Coburn
(b.1942)
(b. Ojo Caliente)
Derek
Coburn
Laura
Archuleta
Lucero
(1933-2002)
Henry
Lucero
Pat
Archuleta
Ted
Archuleta
12
children
Anthony
Coburn
(b.1969)
Michelle
Crowell
Coburn
Ethan
Coburn
(b. 2001)

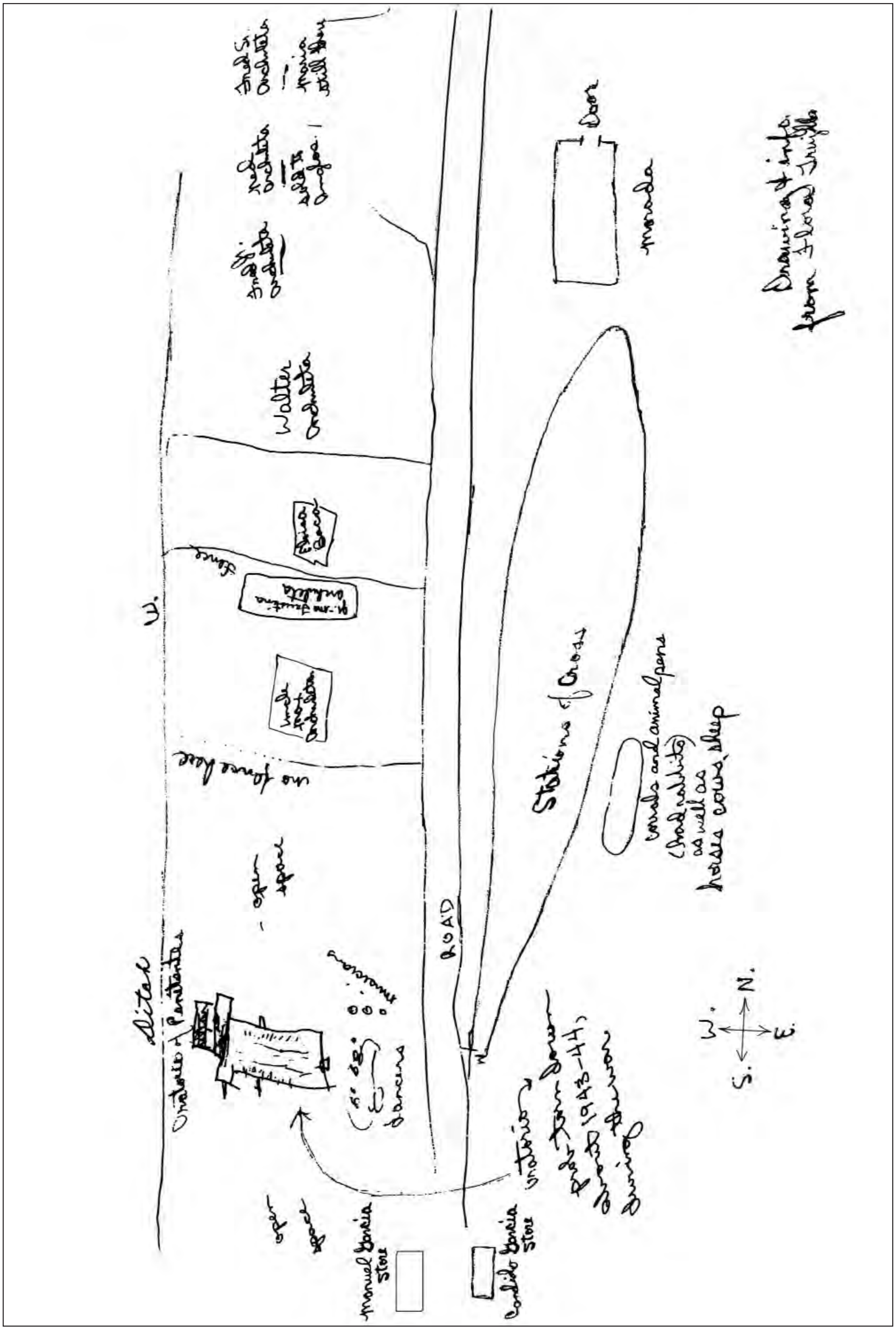


Figure 25.9. Adaptation of Flora Trujillo's 1998 sketch plan showing the location of the Penitente oratorio, morada, and other features and structures along U.S. 285 at Gavilan.

can be seen just to the north and west of the morada.

Another more usable dirt wagon road was visible winding up the south end of a rather steep cliff face approximately 0.20 mile (0.32 km) north of the first road on the east side of U.S. 285. This road was also used by the men when they went to gather wood. According to Flora Trujillo, when she was young there were a great many trees over the ridge to the east, and it was easy to gather large quantities of wood there. At that time firewood was free, and people just took what they needed. Flora recalled that her grandfather, Juan Antonio Archuleta, used to hitch up his wagon, leave the house at 3:00 AM, and travel up either of these two roads to gather wood. When his wagon was full, he would return to the house, usually about 10:00 AM, and continue with his daily tasks. According to Fred Archuleta Jr., the road farther to the north was the one that Ojo Caliente and Gavilan families always took when they went to visit the Rio Grande villages to the east, when he was a young boy in the 1930s. This second and perhaps newer road is no longer used today.

The Gavilan Morada

The remains of the Gavilan morada are on LA 105710, about 0.15 mile (0.24 km) north of Candido García's little store, on a slope on the east side of U.S. 285 and adjacent to but just outside the right-of-way fence. The morada was known as La Morada de Nuestro Padre Jesus (Fig. 25.9). According to interviewees, no other morada ever existed in this area. North of the land that belonged to Juan Antonio and Faustina Archuleta, this morada was originally built by the Penitentes of Ojo Caliente and Gavilan, perhaps between the 1850s and 1870s, and was used principally for religious purposes. Flora Trujillo's mother, Debiliana Sisneros Archuleta, had said it was built before she was born in 1878.

The interior of the morada was described somewhat differently by two interviewees who attended services in it between 1930 and 1960. About 1948–52, it underwent some modification, and this may be responsible for the differences. No other elders were able to remember much about the interior or the exterior. Flora Trujillo attended services in this morada in the 1930s, while Ben Gallegos remembered the morada from his visits in the 1940s and 1950s. They both agreed that the morada's only door was made of wood, had no window in it, and faced north. The windows of this adobe structure were on the west wall. Flora Trujillo recalled one window made up of a number of small panes of glass, while Ben Gallegos remembered three separate windows in the west wall. Flora stated that there was only one large room inside; Ben, however, was certain that there were two rooms: a large one, where most ceremonies and activities were held, and a small one at the south end of the building, where the altar and a number of saints were kept.

Flora, in describing the interior of the large room, stated that it was very dark inside. A large adobe fireplace (*fogón*) was in the northwest corner, and a big bucket of water often sat beside it. This water was heated, then sagebrush was dipped into it and used to wash the wounds of Penitentes after they completed their penance through flagellation. Yucca leaves were used as whips for penance, which Flora thought took place inside the morada. A pile of wood for the fire was placed just outside the door, to the northeast. Wooden benches lined the east wall of the morada, and cots were set up along the west wall, beneath the window (Fig. 25.10). Oil lamps hung on the walls, as did some candle holders. When no oil was available, candles were burned. For some ceremonies, the people lit candles and set them in a row on the floor. Along the north wall were benches and a very large wooden table where food was placed when it was brought in from the outside. At the opposite end of this long room was an altar that consisted of a plain wooden table upon which stood candles and a few hand-carved santos. A large crucifix hung on the wall above. Flora could only recall statues of St. Anthony, the Blessed Virgin Mary, and the Sacred Heart of Jesus, although she knew others had been placed there as well.

According to Flora, at first the Stations of the Cross were not inside the morada; they were in the Penitente oratorio, across the road. Later, however, as the walls of the oratorio started to crack and it was dismantled, the wooden Stations of the Cross were placed in the morada, and the local community used them there. When certain ceremonial activities were to take place in the

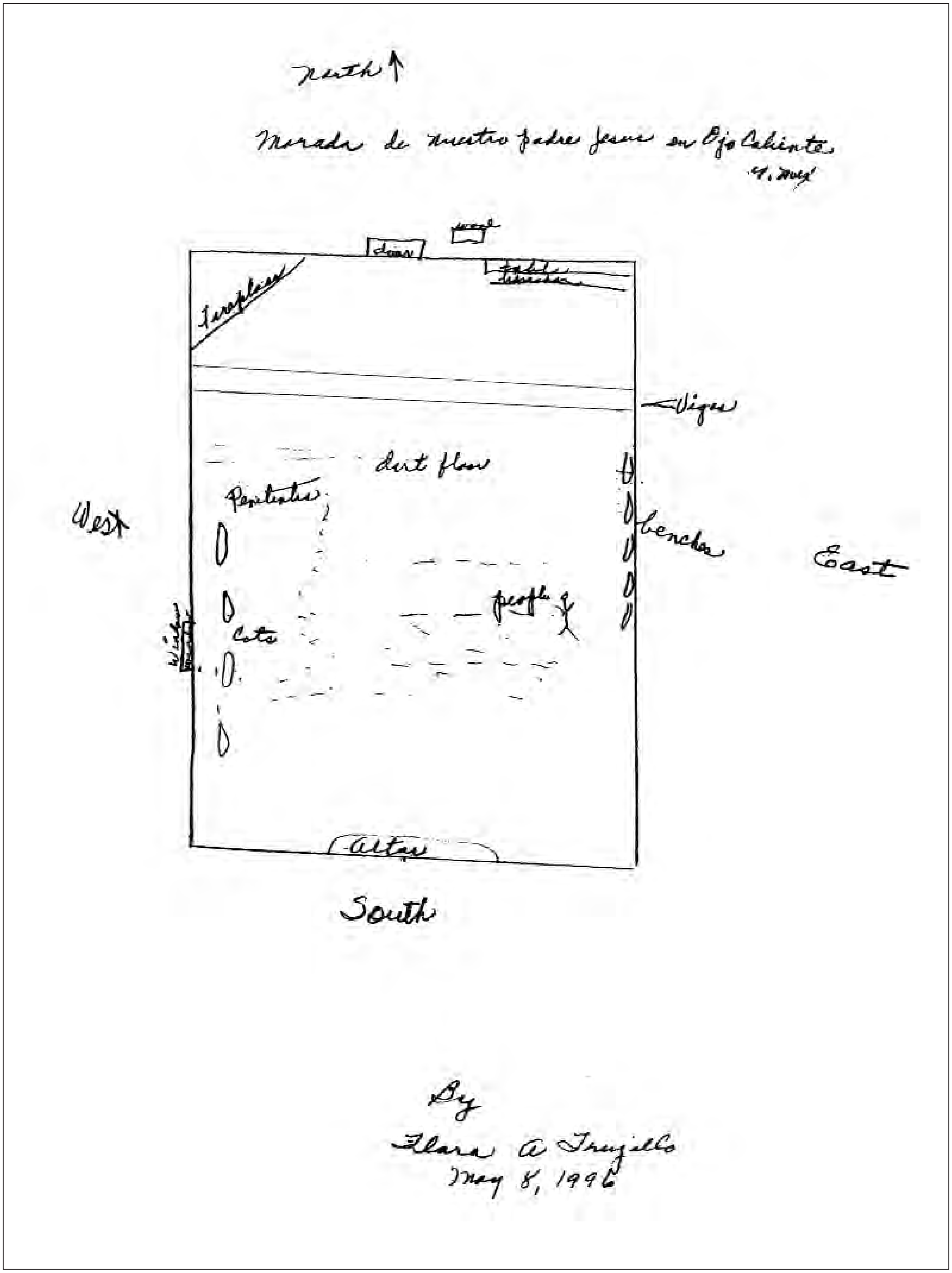


Figure 25.10. Adaptation of Flora Trujillo's 1996 sketch plan of the Penitente morada at Gavilan.

morada, some of the men moved the benches and placed a few in front of the altar so people could sit there. Non-Penitentes sat on these benches on the east side of the middle aisle in the morada. The Penitentes stood (but never sat) on the west side of the center aisle.

The floor of the morada was dirt. Large, wooden, hand-hewn vigas were visible in the ceiling, laid across the narrowest dimension of the room from east to west. The room could only be as wide as the length of the beams, which came from trees cut in the mountains around El Rito. Flora recalled that dried blood was clearly visible on them. The exterior roof, she said, was flat and had dirt on top of it.

Ben Gallegos stated that as long as he could remember (since the mid to late 1940s), the morada had two rooms: a large room with a fireplace, benches, and two windows in the west wall; and a small room beyond it that held the altar with its many saints. This small room had one window in the west wall. Most ceremonies and activities took place in the large room, at the north end of the building. After the Penitente oratorio across the road collapsed in about 1942, he recalled that people used the small room of the morada for an oratorio. Here they prayed and lit their candles. He also stated that the Stations of the Cross were always inside (though he did not say in which room) when he was young. They never put them outside during his lifetime. Flora Trujillo was enough older to have seen and participated in praying the Stations of the Cross when they were placed outside and southwest of the morada (Figs. 25.9 and 25.11).

According to Flora, Penitente men or sometimes their wives were responsible for cleaning the morada. Women auxiliaries (wives, sisters, mothers, and daughters of Penitentes) brought food when asked to do so. Food donations were frequently requested and always given. Different families provided meals at different times, so no one had to bear an excessive burden. Two guards were stationed outside the door at the north end of the morada so that nonmembers could not enter when Penitente activities were in progress. (Ben Gallegos stated that people went up the hill when they needed a bathroom. He did not know of an outhouse anywhere nearby.)

None of the interviewees recalled precisely when the morada was dismantled. Both Ben Maestas and Flora Trujillo knew that it had been in use in 1942 and 1943, but they didn't know how much later than this it was still operational. Fred Archuleta Jr. stated that it was still standing when he returned from California in 1972, after an absence of more than twenty years. Eloisa Baca, another lifelong resident, recalled that the morada was falling apart in 1974, when her husband Pedro, who had been a Penitente, passed away. She said that the remaining Penitentes began taking it apart that year. Some took adobes, while others took vigas, the roof, doors, and windows.

Ben Gallegos had some specific information about the morada structure, since his father had been a Penitente. Ben stated that the morada was made only of adobe; no rocks were used in its construction. When he was a teenager, roughly between 1948 and 1952, some remodeling took place, and a pitched tin roof was put on. It wasn't too long, however, before a tremendous windstorm blew it off. So the Penitentes divided up and used the tin and lumber. However, they repaired the morada again and continued to use it a bit longer. Ben recalled that the morada was falling down and was dismantled before his father passed away in 1972. He thought that it had been taken apart in the late 1960s or early 1970s. At that time, the few remaining Penitentes took the vigas and adobes to be reused elsewhere. The information given by the two people whose father and husband had been Penitentes suggests the building was dismantled in the 1970s. If so, the Gavilan morada was in use for approximately 100 years before being abandoned.

The Via Crucis and the Exterior Stations of the Cross

The Stations of the Cross (*estaciones*) were placed in a roughly oval pattern in a specific outdoor location along the Via Crucis in Gavilan at the beginning of Holy Week each year (Figs. 25.9 and 25.11). According to Flora Trujillo, the term Via Crucis means "Stations of the Cross," and the two terms were used interchangeably by local residents. The exterior Stations of the Cross, which included fourteen parts of the story of the crucifixion and death of Jesus, was a temporary feature erected annually by the Penitentes on

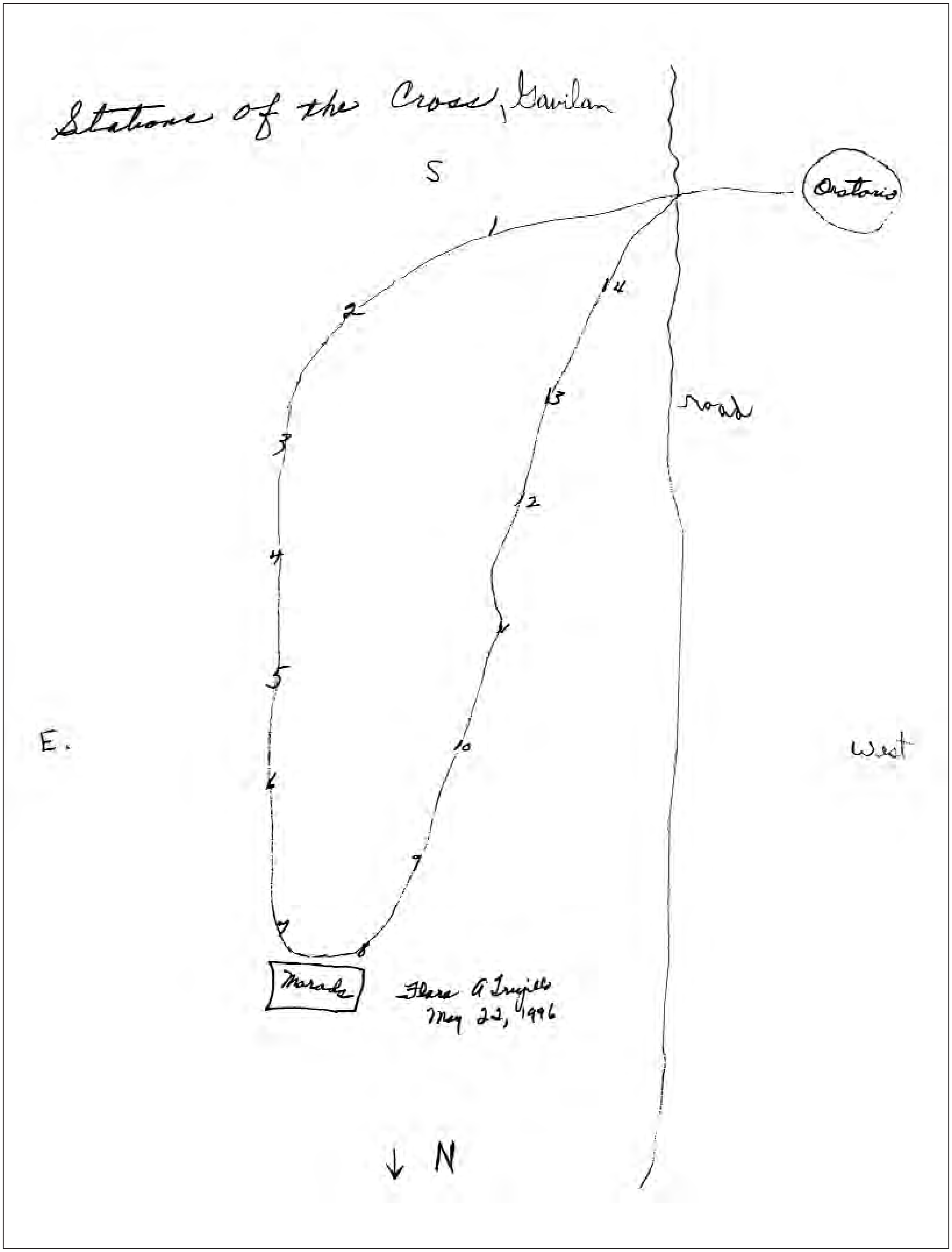


Figure 25.11. Adaptation of Flora Trujillo's 1996 sketch plan of the outside Stations of the Cross at Gavilan.

land south and slightly west of the morada and west of the Archuleta animal pens and corrals on LA 105710, within the project area. The first of the fourteen Stations of the Cross was placed directly east, across the highway from the Penitente oratorio in a large open space. The next six Stations of the Cross were then placed along one half of an oval shape, moving counterclockwise in a northerly direction toward the Morada. The last seven Stations of the Cross were along the other half of the oval, moving in a southerly direction back toward the oratorio (Fig. 25.11). Penitente members evenly spaced small wooden crosses outdoors in this location whenever they planned to pray the Stations of the Cross, which might be on any Friday during Lent, but always on Wednesday, Thursday, and Friday of Holy Week before Easter. This outdoor activity did not occur at any other time of the year. According to Flora, by the time she was older they had dispensed with the small wooden crosses altogether. Instead, members of the procession sang as they moved to one of the former stations. At this spot, one of their number made a recitation relevant to that particular Station of the Cross.

Flora recalled that when she was young, Penitentes and non-Penitentes alike would begin praying the Stations of the Cross in this outdoor setting about 3:00 PM on Wednesday, Thursday, and Friday afternoons of Holy Week. Penitentes led the procession; non-Penitentes followed behind them. All moved in a counterclockwise circuit from Station 1 through Station 14, singing, kneeling, praying, and listening to the recitations. A flute, drum, and matraca (noise-maker) often accompanied them. Upon completion of all the stations (about 4:30 PM), the participants reentered the oratorio, where they said a short prayer before departing. Penitentes then returned to the morada and non-Penitentes to their homes. This outdoor religious activity probably ended in the late 1930s or early 1940s.

The Calvario

The Calvario (the symbolic place where Christ was crucified) was most likely on a hill above and northeast of the morada. The last Penitentes in Gavilan died between 1992 and 1995, and their relatives could not recall specifically which hill the Calvario had stood on. The general consensus was that it was the hill northeast of the morada, where Hilltop Ruin (LA 66288) is located. Ben Gallegos, the son of a Gavilan Penitente, stated that the Calvario had been on the top of the hill where the ruins are. A few people thought it might have been on the hill just to the south, but they were not sure. The Penitentes climbed to the Calvario on the dirt wagon road just north of the morada. This road has since become an arroyo. According to Flora, there was no name for the path the Penitentes took up to the Calvario from the morada.

No permanent structures were ever built as part of the Calvario, and no construction was involved in creating it. Activities of the participants included dragging or carrying huge wooden crosses to the designated spot during Holy Week every year. This was done in procession while they prayed, sang, and whipped themselves. Usually three large, wooden crosses were placed on the Calvario at this time. Other Penitente activities held there were private, and non-Penitentes were not allowed to witness the proceedings. Processions going to and activities occurring on the Calvario ended 50 to 60 years ago.

The Old Trail (LA 118549)

An old foot path, LA 118549, ran up and down the hillsides along the ridge directly east of the highway (see Chapter 17). None of the residents of Gavilan knew anything about it. Some remembered playing on this path as children, but they had never been told anything about it by parents or grandparents. Flora Trujillo did mention that there was a path that the Penitentes took during Lent and Holy Week, when they moved in procession along the ridge top east of the highway. She saw them do this when she was very young but did not know whether they used LA 118549 or a different route. She also mentioned that starting from the Calvario, some of the Penitentes went in procession to Alcalde, El Rito, Abiquiu, and Hernandez during Holy Week each year—journeys that involved the use of several different paths. However, she could not recall any of her elders ever talking about the path that constitutes LA 118549. Neither she nor Fred Archuleta Jr. knew anything specific about it, nor did her grandson, Anthony Coburn, who recalled play-

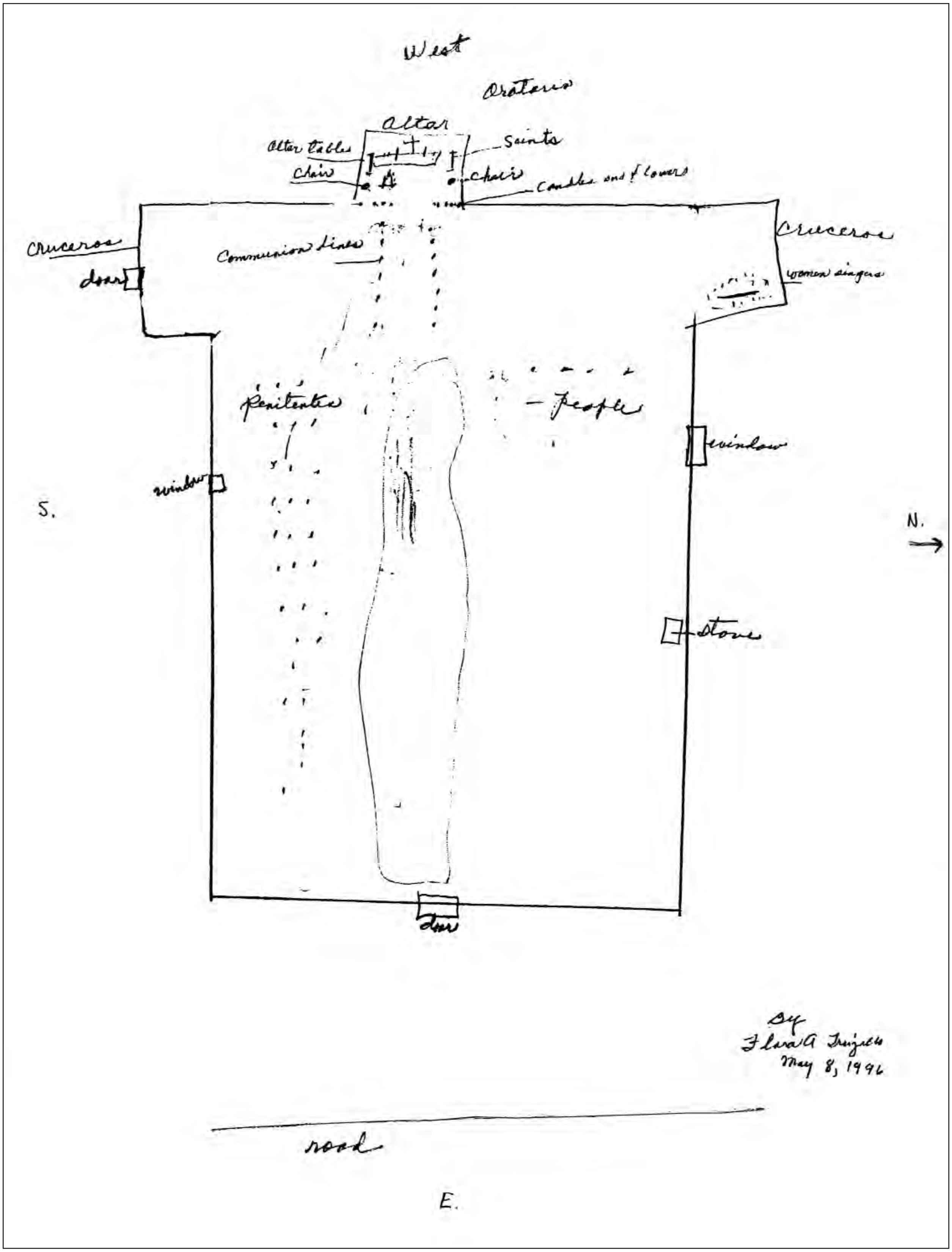


Figure 25.12. Adaptation of Flora Trujillo's 1996 sketch plan of the interior of the Penitente oratorio at Gavilan.

ing on it as a child.

LA 118549 was probably a prehistoric Indian trail, generally unknown to the Spanish settlers in the area. There is no conclusive evidence on whether or not the Penitentes occasionally used it, and no other ethnohistoric material is currently available concerning it.

The Cattle Guard

The "cattle guard" that Marshall (1995) mentioned in his survey report (near U.S. 285, just north of the morada) was unknown to the people interviewed. Upon further investigation, project personnel discovered that it had been part of a drainage feature, a concrete culvert box, which funneled water from the arroyo channel above it under the highway and down toward the Ojo Caliente River to the west. It was probably constructed in about 1939, when the highway was first paved. Ben Gallegos stated that this culvert was put in because water used to run down the dirt road just north of the morada. Another identical feature was found at the mouth of the arroyo channel near the former location of Candido García's store. Neither of these drainage features had any connection with the Hispanic use of LA 105710.

The Penitente Oratorio

The Penitente oratorio, on the west side of U.S. 285 about 0.10 mile (0.16 km) south of the Gavilan morada and approximately 60 ft (18.3 m) outside the right-of-way, stood on land donated by Flora Trujillo's maternal grandmother, Ascencionita García Sisneros. It is unclear when this oratorio was built. On three different occasions Flora Trujillo provided three different scenarios, but she could not say which was the most accurate: (1) The Penitente oratorio, dedicated to our Padre Jesús, was built shortly before or at the time the García-Sisneros oratorio was being torn down in 1923–24. (2) The Penitente oratorio was originally built as a small structure around 1900 and enlarged about 1915. Flora remembered receiving her first Holy Communion in the Penitente oratorio about 1920 or 1921, when she was 12 or 13 years old, which would indicate a construction date before 1923. (3) The Penitente oratorio had been built by the Penitentes in the late 1800s and was in existence before Flora was born in 1908. Thus far, no corroborating information has been found for any of these dates, and no other interviewees knew for sure when the Penitente oratorio had been built. An educated guess might place the construction of this oratorio between 1890 and 1924.

Flora felt that the Penitentes built their own oratorio because the older García-Sisneros oratorio was attached to a family's house (on private land), and the brotherhood probably felt uncomfortable using it in the middle of the night, when they might disturb the family. Once they built their own oratorio on their own land, they were free to use it whenever they needed to do so.

The Penitente oratorio was an adobe structure built in the shape of a cross. The main entrance opened to the east and faced the road (Figs. 25.9 and 25.12). Another, smaller door, used only by the Penitentes and only during Holy Week, was on the south side, on the arm of the cross, or *crucero*). One small window on each long side wall (north and south walls) let a small amount of light into the whitewashed interior. A wood-burning stove sat roughly at the midpoint on the north wall with a wood box next to it. Constructed of wood and adobe, this oratorio had an earthen floor and a ceiling of vigas and latillas. It was covered by a flat roof. The vigas had been peeled with special knives but were not finely finished.

The altar, at the west end of the building in what could be called the top of the cross, consisted of a wooden table covered with a crocheted white cloth on which stood hand-carved, painted statues of St. Joseph and the Blessed Virgin Mary, the priest's chalice, pictures of saints, candles, and vases of flowers. On the altar stood St. Joseph, who was dressed in yellow, and Our Father Jesus, who was tall, dressed in purple, and had long, stringy, black human hair, and a strange, ugly mouth. Flora said it was unpleasant to behold. She didn't know the meaning of this unusual carved figure nor what had happened to these santos or others in the oratorio, nor to the large crucifix that hung on the wall above and to the right of the altar. As a child, she had first seen these objects inside the García-Sisneros oratorio. After it was torn down, she saw them again when they were safely ensconced in the Penitente oratorio. When the latter fell apart, the objects were removed to unknown locations.

In front of the altar table, at each end, was placed a wooden chair. The priest sat in one of these chairs when he came to offer mass, and an altar boy or assistant sat in the other. A triangular candelabra, which stood to the left of the altar in front of the communion rail, held candles that were placed there by people praying that a certain petition would be answered. (A petition was made to request help for a problem such as illness or drought.) If more candles were needed than the candelabra could accommodate, they would be lit and placed in holes in a wooden board on the dirt floor behind the communion rail. Other candles in holders on the walls were used to light the interior of the oratorio, usually for velorios held there at night. The Stations of the Cross, consisting of 14 small, painted wooden retablos, were also placed on the interior walls—seven on each side. These too, came from the older García-Sisneros oratorio after it was torn down.

Most people sat and knelt on the earth floor during mass. Flora could not recall any benches or chairs. Women brought blankets, spread them on the floor, sat and knelt on them, and put their babies to sleep on them. Non-Penitentes sat on the north (right) side of the oratorio; Penitentes sat and knelt on the south (left) side. A central aisle separated the two groups. When a group of women (wives of the Penitentes) were requested to sing for the mass, they stood in the crucero on the north or right side of the oratorio. The priest came to conduct mass in the oratorio only once or twice a year during Lent, always very early in the morning, according to Flora.

The oratorio also functioned as a chapel where services were held for Penitentes and others in the community. It was used constantly during Holy Week each year, and at other times as well. In May, local families prayed the rosary every day in the oratorio, had processions for the Blessed Virgin Mary, and held velorios. St. Joseph's Day was celebrated inside and in front of this structure every November 19. Easter processions commenced at the oratorio, passed through the outdoor stations of the cross, then returned to the oratorio. Velorios for deceased Penitentes and others were held in the oratorio or the individual's home the night before the funeral. The next day, the priest from El Rito came and conducted a funeral mass in the old church in Ojo Caliente before the burial in the Ojo Caliente cemetery.

No one could recall exactly when the Penitente oratorio was abandoned, fell into disrepair, and was dismantled. Flora Trujillo thought that it fell apart some time in the 1940s and was torn down then or in the early 1950s. Afterwards, the big room of the morada was used as an oratorio, where rosaries and the Stations of the Cross were prayed and velorios were held.

An unfinished three-sided cinderblock structure with no roof or east wall now stands on the site of the former Penitente oratorio, on the west side of U.S. 285, outside the right-of-way. For many years the two people living on either side of it claimed ownership: Flora's uncle, Max Archuleta, to the north; and Bob Smith, on the south. The former passed away, and the latter moved away. It is unclear whether ownership of the building was ever determined. Houses currently stand all around the location of the old Penitente oratorio.

Other Structures in the Vicinity of Gavilan and LA 105710

LA 105710 and the surrounding area constitute a region of cultural significance. For approximately 100 years it has been at the heart of many religious and social activities as well as some of the economic activities of residents of Gavilan and Ojo Caliente. Most religious and related social activity in Gavilan centered on the area that included the Penitente morada, near the north end of LA 105710, and the oratorio, adjacent to LA 105710 but across the road and a little to the south (Fig. 25.9). The Via Crucis and outdoor Stations of the Cross provided a connecting link between these two structures when they were most intensively used—during Lent and Holy Week each year. However, these were only a few of the significant structures that provided various kinds of support for this small, isolated, Hispanic community over the years. Flora Trujillo was kind enough to describe, and in some cases illustrate, several of these other structures and discuss their importance to the local community.

The García-Sisneros Oratorio

The García-Sisneros oratorio was approximately 0.34 mile (0.55 km) south of the Penitente oratorio in Gavilan, on the west side of U.S. 285 at the base of a steep dropoff outside project limits. According to Flora Trujillo, it was built before the Penitente oratorio, which replaced it. Even though the García-Sisneros Oratorio was a private, family oratorio, the Penitentes and others in the community always had permission to use it whenever they wanted to do so. Probably built after 1850 by Flora Trujillos's maternal great grandparents, Esquipula García and Manuelita de Vargas García, it was already in existence when Flora's mother, Debiliana, was born in 1878. Debiliana used to say that, as a young child, she had watched the Penitentes come with whips from the morada to her parents' oratorio to make visits during Holy Week each year.

This family oratorio was attached to the south end of Manuelita and Esquipula García's house on land they owned. It shared a common wall with their dining room; however, there was no entrance to the oratorio from their house. At the south end of the structure were several adobe steps which led up to the oratorio entrance. The wooden door was beautifully carved, possibly by Esquipula García. This long, rectangular, flat-roofed adobe building had a dirt floor and vigas and latillas for the ceiling. The vigas were huge, much larger than those later used to construct the ceiling in the Penitente oratorio. Also, the adobes in the García-Sisneros oratorio were about three times the size of those used today. According to Flora, adobes of unusual shape were made to fit into specific spaces. Some were thick on one end and thin on the other.

The García-Sisneros oratorio (Fig. 25.13) was not built in the shape of a cross like the later Penitente oratorio; rather, it consisted of just one long room, approximately 14 by 35 feet (4.3 by 10.7 m). Four windows, two on the east wall and two on the west, were covered with white curtains, which allowed the sun to flood the space with natural light. Flora stated that the interior, with its whitewashed walls, was pretty and clean, and she liked going there. Fourteen small retablos representing the Stations of the Cross were hung on the walls—seven on one long wall, and seven on the opposite wall. Number one was at the northwest end of the oratorio, closest to the altar. Number seven was at the southwest end, nearest the door, as was number eight, which was placed at the southeast end. Finally, number 14 was at the northeast corner, back near the altar. People made a counterclockwise circuit whenever they prayed the Stations of the Cross.

The altar was at the north end of this long room against the common wall. On the floor in front of it was a long board with regularly spaced holes. When people made petitions, they lit candles and placed them in this holder. The altar itself consisted of a wooden table covered with a lace-edged, embroidered altar cloth, upon which candles and a crucifix were placed. A large crucifix hung above. Also present were the two *bultos* mentioned earlier: St. Joseph, dressed in yellow, with a round face, a crown on his head, and a book in his hands; and Our Father Jesus, dressed in purple, with long, stringy, black human hair, and a deformed mouth. On either side of the altar stood a long, wooden table upon which stood St. Joseph, St. Jude, St. Anthony, and many other santos. When it was decided that the García-Sisneros oratorio would be torn down, the crucifixes, saints, and stations of the cross were removed and placed in the Penitente oratorio. Also, on each side of the altar stood a large triangular candelabra. In front of the altar was a communion rail with a gate in the center, so the priest could exit to give communion to those who could not walk. Usually, however, attendees knelt in a long line that formed against the communion rail, extending from both ends of the gate.

Flora could not recall whether or not there were benches inside this oratorio. If so, there were not very many—perhaps only four. Those who did not sit on a bench prayed and knelt on the cold dirt floor. Flora's family carried blankets and sat on the floor. When not filled with people, the oratorio interior was a large, open, empty space.

During Lent, the Stations of the Cross were prayed every Friday in the García-Sisneros oratorio. Velorios were held there every night during Holy Week. Usually the priest came from El Rito and held mass in this space once during the long Lenten period. Each year during May, the month of the Blessed Virgin Mary, the oratorio saw continual use—mostly by women, who said a rosary in Her honor every afternoon and every evening

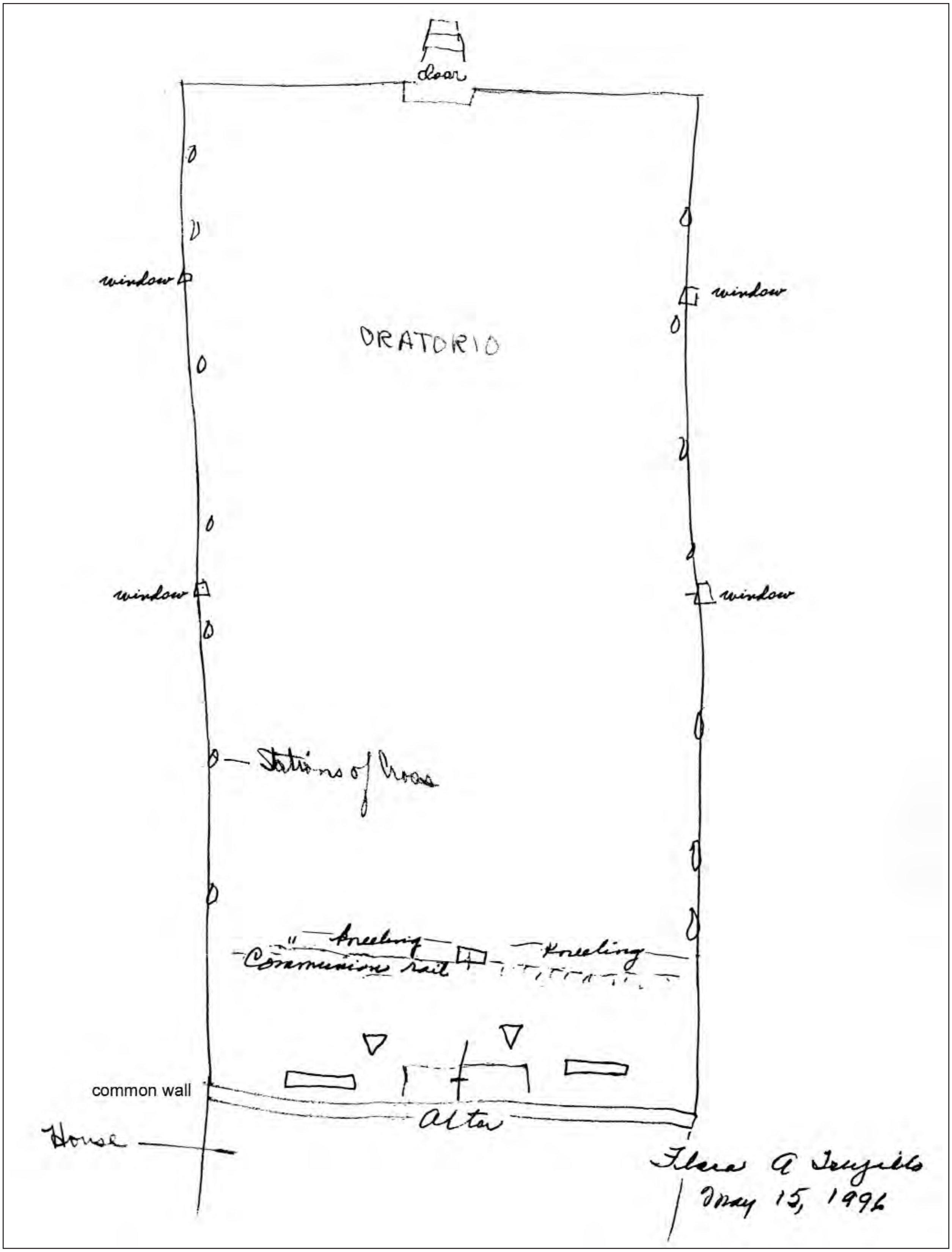


Figure 25.13. Adaptation of Flora Trujillo's 1996 sketch plan of the interior of the García-Sisneros oratorio at Gavilan.

after supper. The young girls kept the altar supplied with fresh flowers.

This García-Sisneros oratorio was also used when local residents passed away. The deceased was laid out and cared for in its large open space, and sung and prayed over all night during a velorio before the funeral the next day. According to Flora Trujillo, in about 1913 or 1914, a baby, the son of Juan and Simonita Trujillo, passed away in this oratorio and was buried inside the structure, under the floor. Flora, only five or six at the time, was not aware of this incident, but her mother told her about it later. Flora did not know which part of the floor the infant had been buried under.

The Penitentes were not responsible for the upkeep of this family oratorio. Rather, Flora's aunts and cousins used to do all the cleaning, painting, and the washing, starching, and ironing of the altar cloth, curtains, and so forth.

After the death of great-grandfather Esquipula García, Flora's great-grandmother, Manuelita, asked her daughter, Ascencionita, and the latter's husband, Cicilio Sisneros (Flora's grandparents) to come from El Rito to Gavilan and live with her. All she asked was that they bury her inside the old Ojo Caliente church, which they later did. In return she gave them all her property—her fields, the house, the oratorio—everything. This occurred in approximately 1891. All these structures had been built long before this time, but the exact date is unknown.

Flora thought that the family oratorio was torn down around 1924. She had discussed this with her younger brother, Juan Archuleta, before he passed away in 1998, and also with her brother, Willie. Both told Flora that they had stayed with Grandpa Sisneros in 1923 and 1924, and that the oratorio was "knocked down" during that time. Flora recalled that it was always in perfect condition and was a place she loved. However, over time, its upkeep became too much for the family to manage. More and more people wanted to use it for funerals and other occasions, and when they came for services, they parked their horses and buggies on the south side of the building, leaving a large quantity of horse droppings for the family to clean up the next day. Babies were often put to sleep in the family's beds, and since there were no diapers, the sheets often needed to be changed and washed, making extra work for the women. Flora's mother, Debiliana, and other family members did not enjoy these jobs, which became more and more frequent and unpleasant over time. Therefore, a decision was finally made to close and dismantle the oratorio. Many of the vigas and adobes were reused to build a house for her uncle, Anselmo, approximately 0.6 mile (1 km) to the north. The land where the oratorio formerly stood was leveled, according to Juan Archuleta, and a new house was later built there.

The García-Sisneros House

The García-Sisneros house was probably the first structure built on the family property, perhaps even before the mid-1800s. It first belonged to Esquipula and Manuelita García, later to their daughter Ascencionita and her husband, Cicilio Sisneros. Consisting of a series of long, narrow, connected rooms, it housed several parts of the extended family at various times in its history. Later, the oratorio was added and attached to one end of the house. In 1996, when discussing this combined structure, Flora showed it as L-shaped and oriented along an east-west axis. In 1998, when checking some of this information, she indicated that she had oriented it incorrectly in 1996 and redrew the structure, orienting it on a north-south axis, changing the positions of most of the rooms. Since the house and oratorio were torn down more than 60 years ago, it is hard to know which orientation was the correct one. Therefore descriptions and drawings of both are included.

In her 1996 drawing (Fig. 25.14), Flora Trujillo sketched the connected oratorio and house in a large L shape. The door to the oratorio was at the far west end. This long room stretched from west to east. Next came a common wall separating the oratorio from the house. The house included two rooms: a combination sleeping and living room east of the oratorio, and a kitchen to the east of the living room. At a common wall at the north end of the kitchen, the house turned into an L shape. This wall separated Ascencionita's house from the three-room home of her brother, Victor García. His portion of the house was oriented north-south. Victor's house included a large room used as a social hall, north of Ascencionita's kitchen. Next came his kitchen,

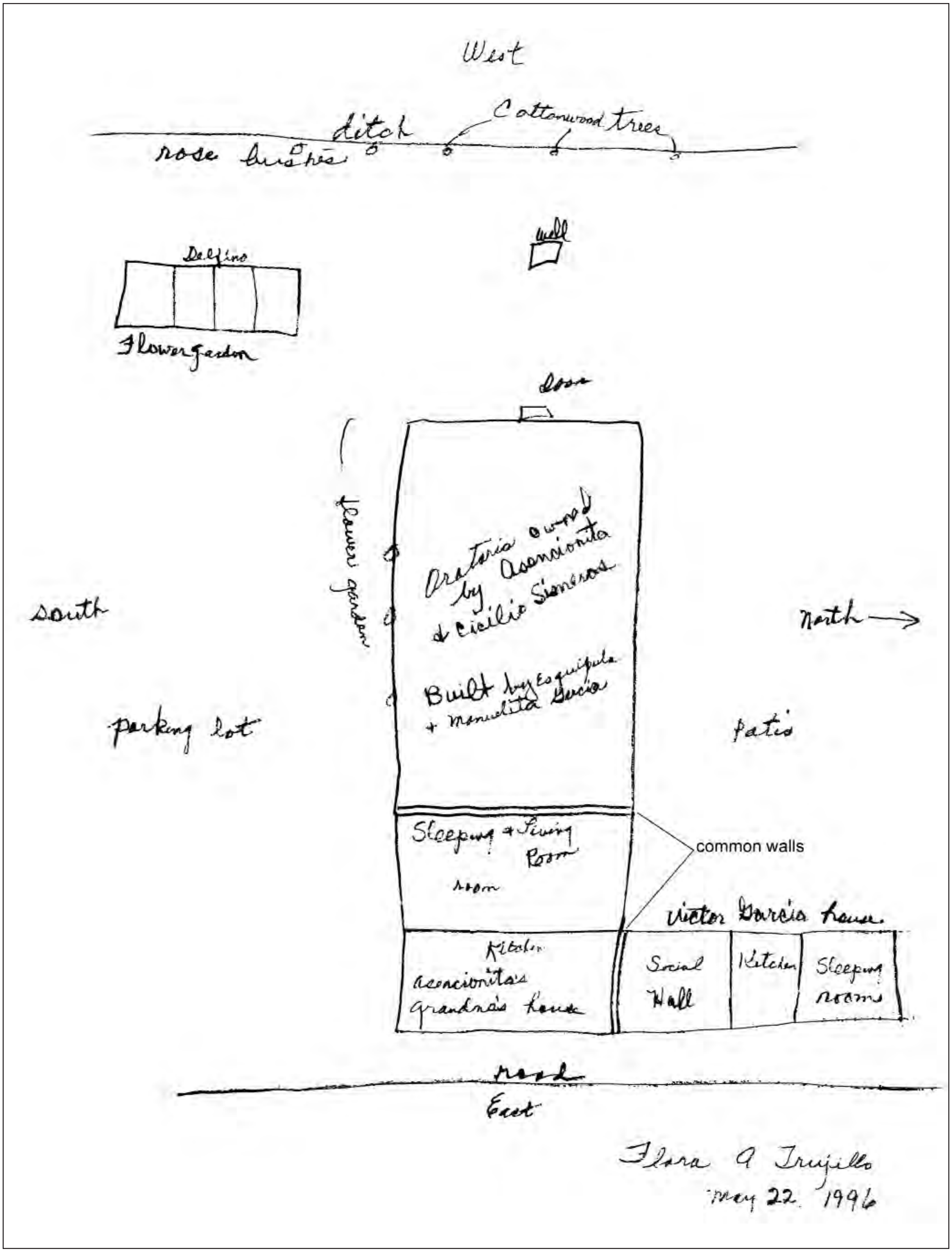


Figure 25.14. Adaptation of Flora Trujillo's 1996 sketch plan of the García-Sisneros house and oratorio at Gavilan.

and beyond it to the north was a sleeping room.

According to Flora's 1996 drawing, the road was just east of Victor's part of the house, and the parking area for people attending functions at the oratorio was south of that part of the structure. A patio was on the north side of Ascencionita's house, a well was to the west, just beyond the door of the oratorio, and a little further west was the acequia, lined with rosebushes and cottonwood trees. Southwest of the oratorio was a detached structure consisting of a group of four sleeping rooms, where a number of the unmarried sons slept.

In her 1998 drawing (Fig. 25.15), Flora changed the orientation of the García-Sisneros oratorio, house, and surrounding use-areas. The house was now oriented north-south and paralleled the road, which at that time was just to the east. The oratorio was the room farthest south, and its entrance was on the south. A common wall on the north separated the oratorio from Ascencionita's dining room. The rest of Ascencionita's five-room house formed an L in the center of the structure. Her kitchen was west of the dining room, with one sleeping room to the west of the kitchen. Two other sleeping rooms were built north of the first sleeping room, completing the L shape. Victor García's house extended north from a common wall with Ascencionita's dining room. So Ascencionita's dining room was sandwiched in between Victor's home on the north and the oratorio on the south. There were no interior doors connecting these three separate spaces. At the south end of Victor's house was a hall used for social dances, usually associated with weddings. Next to this room was a kitchen, and beyond it to the north was a sleeping room. The parking area was southeast of the oratorio, and the well was southwest. The patio was north of Victor's hall, and the ditch was south and west of the oratorio and house.

The oratorio was dismantled in 1923 or 1924. In 1945 the family tore down Victor's and Ascencionita's attached houses, leveled the land, and built a rectangular house with four rooms. The two rooms on the north side belonged to Flora's uncle, Antonio Sisneros, who later added two more rooms on the north end of his house. At the south end, two rooms were given to his daughter, Viola Sisneros. At some point she bought the rest of this house from other family members. It currently stands unoccupied, west of her own house and north of Flora Trujillo's house in Gavilan.

The Churches in Ojo Caliente

The old adobe church in Ojo Caliente, La Iglesia de Santa Cruz, dates officially from 1793. However, according to written accounts, it was in existence considerably earlier than this. As early as 1744, Father Miguel de Menchero mentioned the presence of 46 families and occasional visits from the priest at the Taos mission, which implies the presence of a church or chapel (Hackett 1937:399). A document dated 1751 states that the church and houses at Ojo Caliente were tumbled down (SANM 1753), so obviously a church had been built there before this date. Governor Mendinueta, after inspecting Ojo Caliente in 1769, ordered the chapel, houses, and plaza to be boarded up and abandoned (SANM 1769). Deliberately built into the side walls of this church were a number of small loopholes through which firearms could be discharged when defending against Indian attacks. Flora Trujillo's grandmother recalled running to the church for protection whenever an alarm was raised. It is not known if the chapel or church mentioned by these early writers is the same structure known in 1793 as the Ojo Caliente church. The 1793 church was refurbished in 1994 by a combination of local and nonlocal groups (Fig. 25.16). It is on the south side of NM 414, approximately 0.10 mile (0.16 km) west of its junction with U.S. 285.

According to Flora Trujillo, in 1945 a new church called St. Mary's was built directly west of the old 1793 church. While digging the new foundation, construction workers found coffins of people buried long ago. Apparently this land was part of a former cemetery in front of the old church. All the unearthed coffins were reburied, but Flora was not sure where. She thought that they were reburied near the old church or in the *camposanto* (cemetery) on the east side of U.S. 285, across from the new post office.

The Ojo Caliente Cemeteries

According to elderly interviewees, Ojo Caliente

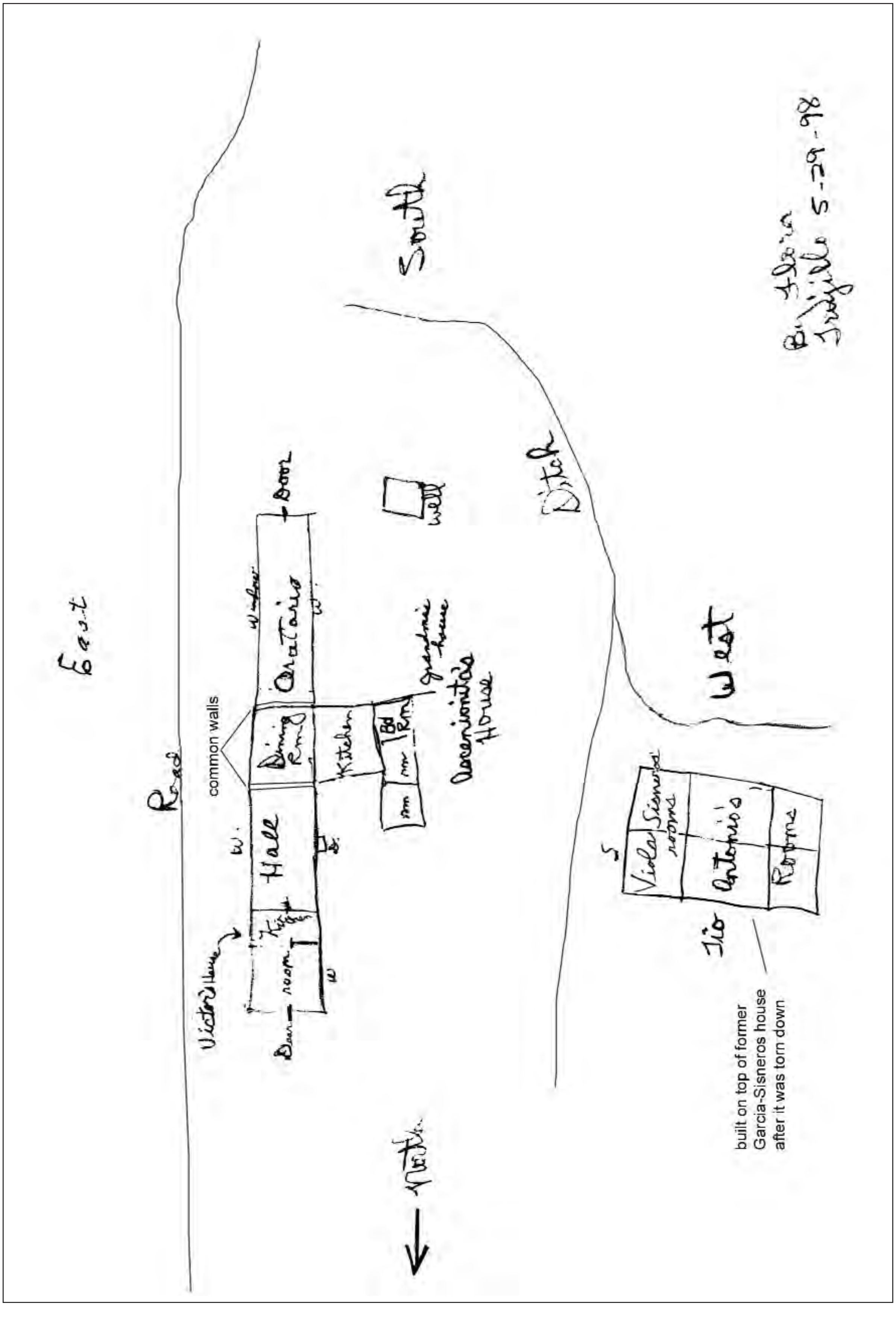


Figure 25.15. Adaptation of Flora Trujillo's 1998 sketch plan of the García-Sisneros house and oratorio at Gavilan.

Figure 25.16. The Church of Santa Cruz, Ojo Caliente, originally built in 1793, refurbished in 1994, and photographed in 1998. Note the loop (gun) holes in the church wall just below the shadow. Photo by Linda J. Goodman.

has had only two cemeteries since it was first settled. Early settlers were buried inside the old Ojo Caliente church or on land directly west of the church entrance. Flora Trujillo stated that long ago people were buried in and around the old church first, then when this space was filled, a new cemetery (which is still in use) was created farther away. Her great grandmother, Manuelita García, was probably one of the last to be buried inside the church, at a cost of $50 to the family (considered to be a large sum of money). Manuelita was the only one buried in the church at that time, because this practice had mostly ended by then. According to Flora, the burial ground in front of the old Ojo Caliente church was still being used as late as 1908, when a baby brother of Flora's mother, Debiliana, died and was buried there. This baby died the same year that Flora was born. Flora stated that all her relatives from her great-grandparents' time and earlier were buried in the church or the church yard.

Approximately 0.10 mile (0.16 km) south of the junction of NM 414 and U.S. 285, outside the right-of-way on the east side of U.S. 285, the current Ojo Caliente cemetery was placed a moderate distance away from established living areas. The exact date of its creation is not known; however, in his 1919 boundary survey of the Ojo Caliente Grant, Douglass (1922) noted its existence. Therefore, this cemetery was most likely established between 1908 and 1919. Flora recalled that her grandparents and all later relatives were buried in the newer cemetery. Currently it is the only one in use in the area.

Stores in the Ojo Caliente Region

The García brothers were not the only ones who owned stores in the area. There were quite a few other stores within roughly a 5 mi (8 km) radius. Some were quite small, others larger. Following is a brief description of several of these stores. Most of this information was provided by Flora Trujillo and supplemented by Fred Archuleta Jr.

and Ben Maestas.

The Lucero family, originally from Antonito, Colorado, set up, owned, and ran a large, well-stocked store in Ojo Caliente. They were good business people and did well financially. Since they had moved to Ojo Caliente many years earlier (before 1900) and had established large sheep farms in the area, they were considered a local family. In approximately 1900, Jesús Lucero built his first store on the west side of U.S. 285, about 1 mi (1.6 km) south of the junction with NM 414 on the outskirts of Ojo Caliente (in the area perhaps known as Gallegos). His livestock corrals were on the east side of the road. Sometime after 1930 he built a new store where his corrals had formerly stood, and later added a dance hall at the south end (Fig. 25.17). For an unknown period of time the dance hall also served as a meeting house for the SPMDTU (Sociedad Protetiva Mutual de Trabajadores Unidos). Flora Trujillo recalled that for many years community social dances were often held in the Lucero dance hall, also known as La Sala Grande. Jesús Lucero later added a small bar at the south end of the dance hall. Both the dance hall and bar have long been closed, though the structures still stand and are now part of the Oliver Vigil store, just north of LA 105713. The Lucero store carried a variety of dry goods as well as lamp oil, soap, canned goods, other foodstuffs, medicines, and hardware. This was a much larger store than either of the García brothers' stores, and the Luceros were able to extend credit to their customers.

After Jesús Lucero died in 1957, his son, Pete, ran the store for a few years, then sold it to Oliver Vigil's family in about 1965. Now called Oliver's store, it continues to be a viable business and is still owned by the Oliver Vigil family. According to daughter-in-law Helen Vigil, the family of Oliver Vigil Sr. bought this store and named it in honor of Oliver Vigil Jr., who had passed away a few years before its purchase. The Vigils, who are from El Rito, where they have extensive land and cattle holdings, are not considered local in the same way that the Luceros or the García brothers were. According to Flora Trujillo, they owned no land and had no family in the Ojo Caliente area. Their store, which today contains all types of

Figure 25.17. The former Lucero store (left), the dance hall (center), and the bar (right end of structure). All are now part of the Oliver Vigil store. Photo by Linda J. Goodman, 2000.

foodstuffs as well as a few dry goods and hardware items, continues to serve the local community. Gasoline can also be purchased there.

Another of the large, older stores in Ojo Caliente, the Carlos Hernández store, was located across the road from the old Ojo Caliente church. The Hernández store was also a general store built before 1908. The Hernández family moved to Ojo Caliente from Taos, and since they had neither land nor family in the area, they were not considered local. Flora did not know whether the Hernández or Lucero store was older, but she knew that both allowed people to buy on credit and that both families became wealthy. The Hernández store carried a variety of goods comparable to the Lucero's, and local residents used to frequent both for a variety of necessities. The Hernández store was eventually sold to the Wilson family, and in the recent past it was sold again. Now called the Mercantile at Ojo Caliente, it is still across from the church on the north side of NM 414 and sells an assortment of upscale clothing and art objects.

Another of the large, older stores was owned and run by Flora's paternal granduncle, Santana López—a local man who owned a great deal of land in the area and raised many cattle. López built a house with an attached general store, grocery store, and liquor store on a piece of land south of the present Church of Saint Mary in Ojo Caliente. This store, too, was probably in existence before 1908. Santana was a good man who always worked hard for what he had. In 1913, however, he died in a tragic accident when hauling barrels of liquor to his store in a wagon. He left a wife and five children. His widow remarried a few years later. Her second husband sold the store as well as all the land and cattle shortly thereafter, which eventually left the family in poverty. Currently, neither the store nor the house exists.

Two other small stores, comparable to those of Candido and Manuel García, were owned and run by another pair of local brothers—Rosinaldo and Vicente Archuleta, first cousins of Flora Trujillo (their fathers were brothers—Elías Archuleta and Juan Antonio Archuleta, respectively). The Archuleta stores were built in front of their parents' house in an area known by the locals as South Ojo Caliente. This small community, called Duranes on the Ojo Caliente topographic quadrangle, is approximately 1 mile (1.6 km) north of Gavilan. The stores were on opposite sides of a narrow dirt road which begins 0.2 mi (0.32 km) south of Milepost 351 on U.S. 285 and runs west and then south, roughly parallel with U.S. 285, approximately 0.1 mi (0.16 km) west of it. On the west side of this dirt road Rosinaldo sold groceries and liquor in his small store, while Vicente, on the east side, sold groceries, gasoline, and candy to the school children. The small South Ojo Caliente Post Office, which was housed inside Vicente's store, served Duranes and Gavilan from approximately 1962 through 1969. Its window and awning overhang were still visible on the exterior west wall at the north end of the store in 1998.

According to Flora Trujillo, the Archuleta brothers were in fierce competition with each other and had little contact. It is thought that they opened their stores around 1940, a few years after the García brothers closed their stores in Gavilan. Rosinaldo closed his store about 1950 and moved to Los Gatos, California, where he remained until he passed away in 1991. His store has been torn down. Vicente moved his store across to the west side of the dirt road sometime after 1969, and a faded sign above it still reads, "V. Archuleta." He ran this small store (without the post office) until just a few years before his death in 1993 or 1994. Both of Vicente's stores, whitewashed and with pitched metal roofs, are still standing very near the dirt road, but they are deserted and deteriorating (Figs. 25.18 and 25.19).

Another small local store existed on the west side of the Ojo Caliente River, in the southwest corner of the building that formerly housed the hotel at the Ojo Caliente Mineral Springs Resort. This was the second hotel built on this spot. The first was destroyed by fire in the 1890s. The Fareses family ran this operation when Flora was young, and she recalled that people used to cross the river on a little wooden bridge to pick up their mail there. This store no longer exists, and Flora did not know when it closed.

Yet another small store, originally built by José Vargas later than the store at the mineral springs hotel, still exists on the west side of U.S. 285 about 0.9 mi (1.5 km) south of the junction of N.M. 414 and U.S. 285. Gasoline as well as a variety of foodstuffs are sold in this store, which is now owned by Marcellina Herrera.

Figure 25.18. The two stores formerly owned by Vicente Archuleta, beside the dirt road in South Ojo Caliente, looking south. Photo by Linda J. Goodman, 1998.

Figure 25.19. Vicente Archuleta's store, on the west side of the dirt road in South Ojo Caliente. Photo by Linda J. Goodman, 2000.

Certain goods were not carried at any of the stores in the Ojo Caliente area, and local people traveled to the big store at San Juan Pueblo (run by Parker Wells's father, according to Flora) or the large Bond store in Española. Both of these establishments were much larger and carried more interesting and unusual items than the stores around Ojo Caliente. Children enjoyed occasional family trips to these more distant stores.

It is clear from this brief examination of stores in the Ojo Caliente area that many families hoped to supplement their incomes by this means. The owners of the larger stores carried many types of goods and extended credit to their customers. All of these families prospered. The owners of the numerous small stores did not fare as well. Because it was difficult to keep the doors open and the shelves stocked, these stores were often quite short-lived, or were run on the proverbial shoestring. Today, only three stores continue to coexist: Oliver's, the Herrera store, and the Mercantile at Ojo Caliente. The others have all closed.

Dance Halls

Dances were the high point of social life in Ojo Caliente and Gavilan for many years and were well attended by the local and sometimes regional communities. On these occasions people visited, ate piñons, danced, flirted, and enjoyed themselves. Often the public programs held on July 4 or Shrove Tuesday also took place in one of the local dance halls because no other space was large enough to hold a crowd.

Dances were held frequently because many religious holidays and celebrations ended with this pleasant social activity. As a result, several dance halls sprang up in the area. Although dates and exact locations are not available, Flora Trujillo spoke briefly about the dance halls she recalled. The first belonged to Felix Archuleta and was known as Felix's Dance Hall. It was near the present Herrera store (close to Flora's mother's former house) on the north side of Ojo Caliente, west of U.S. 285. Dances were often held here for weddings, on New Year's, Holy Saturday before Easter, and July 4 celebrations. Eventually this hall was sold to Jesús González, and he remodeled it into a house with a number of rooms for his large family. By this time Jesús Lucero had built a dance hall behind his store (probably in the early 1940s), and it became the main dance hall in the area (Fig. 25.17).

Victor García's little hall, adjacent to the García-Sisneros oratorio, was often used for dances specifically associated with weddings. It generally was not used for other types of social dances. Another dance hall, south of Flora's land on the west side of U.S. 285 (adjacent to Arthur Rodarte's land), was used for social dances connected with St. Joseph's Day on November 19 each year. St. Joseph's Day activities and the associated social dance ended after this dance hall unexpectedly collapsed (date unknown). These four halls were the only ones Flora recalled. All have been closed for many years, and the only one still standing is the former Lucero dance hall.

Religious Activities and Annual Holidays Occurring at or near LA 105710

LA 105710 and nearby sites to the south and west of it were all part of one large culture use-area and provided space for activities that were essential for the psychological and religious well-being of the families living in the vicinity. When the Gavilan morada and oratorios were in use, the Penitente Brotherhood governed essentially all of the religious life in the area. Some activities took place indoors; others occurred outdoors. Certain events were open to the entire community, while others, for Penitente members only, were held in secret.

New Year's Celebrations

New Year's celebrations had no religious overtones. According to Flora Trujillo, on December 31 a big dance was held at the Lucero dance hall. A much-loved social event, it was attended by almost everyone in the community, including entire families, old ladies, and babies. It began about 8:00 or 9:00 PM on December 31 and ended sometime after midnight on January 1. A group of local musicians provided lively guitar and fiddle music for the dancers.

When the dance ended, the women and children returned to their homes. The men, however, gathered as a group and went from house to house in the village, serenading, and in return receiving food and drink at each stop. The women made empanaditas, biscochitos, candy, and lots of other good food. They served pots of steaming posole, fresh sopaipillas, and chile. The men usually did not eat too much since they brought their own whiskey and proceeded to get more and more drunk as they moved from house to house. They were "singing in the New Year," performing songs called Versos de Nuevo Año, which were sung to every member of the house. In their repertoire were songs such as "Esta Mañana," always sung to the accompaniment of guitar and fiddle. (Tio Polito Alire played violin; Abel Ribera played guitar. One of the best singers was Alejandrino Velásquez.) According to Flora Trujillo, "In those days everyone had time to enjoy life together" (Goodman Field Notes, 1996).

Shrove Tuesday, Ash Wednesday, and Lent

A series of secular celebrations were held on Shrove Tuesday each year. In the morning, flag-carrying members of the SPMDTU led a parade in which musicians played the national anthem. They rode in a buggy and played guitar and violin. After lunch, people arrived at the designated dance hall, where a public program for the community was held. This might include several speakers and/or a previously prepared program put on by one of the school classes. Following the afternoon program, visitors from other communities were invited to houses of local families for dinner. At night a dance, which lasted from 8 PM to midnight, was held at one of the dance halls. People came from all the surrounding communities—Española, La Madera, El Rito, Taos, and others—for this enjoyable social occasion.

By the following morning (Ash Wednesday), however, the entire tone had changed. There were no more celebrations. Lent was a quiet, contemplative time. Some people began a period of fasting on Ash Wednesday and also prayed the Stations of the Cross. Some fasted throughout this period, others only for the last several days of Holy Week. No one ate meat on Fridays. In this case, fasting meant no food or drink in the morning. There was plenty of food at noon, however, and a small amount at night. Therefore, fasting in this manner was not a hard penance.

During the 46 days of Lent each year, processions and visitations by the Penitentes occurred frequently, many of them in private. The Brotherhood held velorios in their oratorio every Friday night. Generally this was a serious time when people were supposed to remember Jesus and how he died on the cross.

Flora Trujillo recalled a Lenten service she and her mother attended inside the morada when she was young:

> At three in the afternoon they rang a little bell to let people know that it was time to come in to pray. So we went in and we knelt wherever we wanted. And after all the people were in, the Penitentes started coming in, in a line. The singers would be the first ones to come in—they would come in singing. Everyone stood up until the hymn was finished. And afterwards they knelt down and started praying the usual prayers for such an occasion. The praying and the singing of alabados would last for about an hour and a half. . . . Then, after they were finished, the Penitentes would thank the people for coming to pray with them. The people would leave and the Penitentes would remain in the morada. (Goodman Field Notes, 1996).

Holy Week and Easter

A number of sacred activities took place during Holy Week, preceding Easter. During this time the Gavilan Penitentes traveled to other villages for visitas, and members from other villages came to Gavilan for the same purpose. On Wednesday, Thursday, and Friday of Easter week the Gavilan Penitentes held a number of processions, some of which involved whipping and other penitential activities undertaken by designated members. Flora Trujillo remembered that when she was small, she and her family used to go to her half-brother Ned Archuleta's house, near the Penitente oratorio, to watch these processions (Fig. 25.9). Most local people who were not participating gathered at appropriate times and places to watch. During processions where whipping occurred, the Penitentes wore black cloths over their heads and faces so they could not be recognized as their blood flowed freely. At times the processions involved men carrying large crosses, a man who played a pito, several who sang, and another who played the matraca. These processions might go from the morada to the oratorio, from the oratorio to the morada, or sometimes to the Calvario. After the processions were over for that day, the Penitentes returned to and remained inside the morada, where their wives or other non-Penitente members of the community brought them hot food for supper.

Flora stated that everyone worked on Monday and Tuesday of Holy Week to be ready for the events of Wednesday, Thursday, and Friday. The women cleaned house and cooked large quantities of food. The men chopped wood and did other necessary tasks. No one worked on Wednesday, Thursday, and Friday; rather, they were expected to spend their time praying. Everyone over the age of 13 was also supposed to fast on those three days; they were not to eat or drink in the morning. Flora and her family fasted as required (they did not eat breakfast) and waited in great anticipation for the big noon meal. All kinds of special foods were prepared for this occasion: calabacitas, torte de huevo, chile colorado, beans, posole, panoche, pumpkin pies, apple pies, and many other dishes.

The entire community participated in praying the outdoor Stations of the Cross on Wednesday, Thursday, and Friday afternoons of Holy Week. Beginning about 3:00 PM, the Penitente men led the procession and sang the first verse of an alabado as they walked to the first Station of the Cross. Here they knelt and prayed and had a recitation. Then they began singing the next verse of the alabado as they walked to the next station. (Two outstanding local singers frequently in attendance were Polito Alire and Arturo Pacheco.) Participants sang a different verse as they walked to each station, often accompanied by flute, drum, and matraca. Non-Penitentes followed behind them. After completing the fourteenth Station of the Cross, the group returned to the oratorio, where they finished their prayers and sang more alabados. The Penitentes then departed for the morada, and everyone else returned to their respective homes.

After dinner every Friday night during Lent and on Wednesday, Thursday, and Friday nights of Holy Week, a velorio was held at the Penitente oratorio. The community gathered from about 7 to 10 PM to pray and sing, sometimes in the presence of Penitentes who whipped themselves or did other penance in fulfillment of personal vows. These vows, prayers, and penitent acts were performed for a variety of reasons, for example, to aid relatives, to improve or maintain health, to bring good weather, to bring rain, or to help find a job.

According to Flora Trujillo, the Tinieblas ceremony, organized and run by the Penitentes, took place in the Penitente oratorio late on Friday night of Holy Week after the conclusion of the velorio. Members of the Brotherhood were the first to enter the oratorio at the appointed time, followed by men and women of the community who had been given permission to attend. When she was a teenager, Flora and several of her girlfriends attended the Tinieblas ceremony just once. She first noted that many candles were lit in three places: in the tall triangular candle holder at the front of the oratorio, in a long row across the floor in front of the altar, and in each of the wall candle holders along the sides of the oratorio. Alabados were sung, and at the proper time one of the Penitentes began extinguishing the candles, one by one. All the while, the singing continued. Finally, when all the candles were out, the oratorio was enveloped in total darkness. More Penitentes entered. Flora's description bears strong resemblance to that of Marta Weigle (1976). Weird noises and screams began. Big drums were beaten, matracas were sounded, whistles blew, noise and commotion swirled around everyone in the dark. Someone might try to pull a person's coat off, something might pull on a person's leg or their foot, sometimes the women's' hair was pulled—all in complete darkness. It was unnerving. After a certain period of time passed, the appointed person began lighting the candles again, slowly, one by one. As light returned to the oratorio, all the noise and abnormal happenings stopped, and things returned to a more normal state. Flora said that she and her friends left before the Tinieblas was completed because they did not like being there—it was very uncomfortable. They told the doorkeeper that one of their friends was fainting and felt sick, so the doorkeeper let them out. They never attended another of these ceremonies (Goodman Field Notes, 1998).

The only event that occurred on Holy Saturday was the Blessing of the Water. Flora's three youngest brothers filled large buckets with water and placed them in the church in El Rito, beside all the other water troughs and containers to be blessed by the priest. Afterwards, the brothers brought their buckets home, used some of this special water to bless the house, then gave some to neighbors so they could bless their houses as well. On Saturday night, upon conclusion of the religious activities connected with Holy Week, a big social dance was held at the large Lucero dance hall.

On Easter Sunday everything was quiet. Penitente activities were concluded for another year. Some families went to El Rito to attend mass at the church, others stayed home. There were no services in the Ojo Caliente church. Easter itself was anticlimactic following the preceding Holy Week activities.

May—Month of the Blessed Virgin Mary

Every evening during May after the day's work was done, the women and children gathered in the García-Sisneros oratorio, lit candles, and placed flowers on the altar, then prayed the rosary and sang hymns in honor of the Blessed Virgin Mary. Attractive white flowers called *flores de mayo* grew everywhere in abundance at this time of year. Young girls delighted in picking these flowers and placing them on the altar along with fresh lilacs and apple blossoms. After the García-Sisneros oratorio was torn down, the women held this service in the Penitente oratorio each May. According to Flora Trujillo, her aunt, Elena Sánchez García, and the latter's daughter each had wonderful voices and did much of the singing. They alternated performing the solo parts on different evenings, while the group of women responded as a chorus.

After the rosary was completed each evening, the children in attendance went to their mothers and aunts to receive blessings from them. These blessings came from the Blessed Virgin Mary through the adult women to strengthen the children. This ceremony probably ended in the 1930s.

May 31—Women's Velorio

On May 31 of each year the women of the area gathered at the Penitente oratorio for a service held about 1:00 PM. First they prayed and sang in honor of the Blessed Virgin Mary. Then every woman took one of the many santos housed there and carried it in a procession from the oratorio to Arroyo de los Valdezes on the north, then down by the Ojo Caliente River as far south as Arroyo Pula. From there, the women made their way back to the road and north to the Penitente oratorio. After returning the santos to their proper places in this chapel, the women went home for dinner. In the evening they returned to the Penitente oratorio and held a velorio that continued for a number of hours. During this time the women offered prayers to the saints, prayed the rosary, and sang hymns until they ended their "watch" at midnight.

Other Velorios

A velorio (from *velar*, to watch or keep vigil over) involves the offering of prayers for a specific situation: for someone who is ill or has died, for the saints during the month of the Blessed Virgin Mary, for a particular saint at certain times of the year, for someone who has a special request or need, and so forth. For example, one year when Flora was a young woman, there had been a terrible drought, and all the crops were drying up and dying. The women felt they had to do something, so in June they held a velorio. First, during the day, they had a procession in which they carried the saints to the arroyo, the river, and back. At night they held a velorio in the Penitente oratorio. They prayed and sang until midnight. About 10:00 PM it began to rain. It rained all night, and the drought was ended. In those days everyone believed in the power of the velorio—it was like a miracle. Now, according to Flora, no one would hold a velorio for this purpose, and no one would believe that it could work.

A velorio was almost always held when someone died. In the past, these "watches" continued for many hours—sometimes all night. People prayed, kept watch, and at times sang alabados for the deceased. Now, at least in the vicinity of Ojo Caliente and Gavilan, this is no longer the case. Such occasions are not even called *velorios* anymore. Presently, a regular service lasting one or two hours in the evening is held at the mortuary for the deceased person.

First Communion

First communion was the culmination of a period of religious education for children in the community. Flora Trujillo recalled her own. Before she and several other children her age (about 12 or 13) could receive their first communion, much preparation, study, and memorizing were necessary. The priest from El Rito, Father José Pajol, came on the appointed evening to the Penitente house of Julian Rivera. There he conducted examinations of the students who wished to receive their first communion. He quizzed them relentlessly. Those who knew their prayers and gave correct answers to his questions passed his exam and were allowed to take communion the next day. A few others were not so lucky.

The morning following the examination everyone went to the service—Sunday Mass—which was held in the Penitente oratorio and was conducted by the priest. The girls wore new white dresses and carried white candles. All the children who passed their exams took their first communion. The singing was done only by the Penitente men. There were blessings from both sets of grandparents, and afterwards, each family held a feast at home to honor the child who had received his or her first communion. Often, friends, neighbors, and relatives were invited. Flora said that she expected something unusual or wonderful to happen when she took her first communion, but nothing ever did.

July 4 Celebrations

The Fourth of July was a much loved secular holiday celebrated every year in Ojo Caliente and Gavilan. In the morning, people arrived from the surrounding region in buggies and wagons, ready for a big parade with flags, music, and firecrackers. The parade started at the Lucero dance hall and went to the Ojo Caliente springs, then turned and went as far as the arroyo on the south, then turned again and proceeded north, back to the dance hall. (A procession also took this path on Shrove Tuesday.) About 1:00 PM an hour-long program featured special speakers and was most often held in the SPMDTU hall. SPMDTU members organized the July 4 celebrations. The audience sat on benches in the hall while the men who were members of this organization made a circle in the middle and sang hymns. After the speeches, those in attendance proceeded to the Lucero dance hall, where dancing lasted until about 8:00 PM. Participants then went home for dinner, changed into good clothes, and returned to the hall, where they danced all night. Violins, guitars, and sometimes an accordion provided the music. People came from many of the surrounding villages to attend this enjoyable social occasion.

August 15—Day of the Blessed Virgin Mary

The Day of the Blessed Virgin Mary is a relatively new celebration in Ojo Caliente. It began during World War II, when the community built the Church of St. Mary (ca. 1942). Upon completion of the new structure, a feast was prepared on August 15 to celebrate the grand opening—a celebration that has been repeated every year since. First, a low mass without a choir was held about 6:00 PM. Afterwards the women of the community brought large quantities of home-cooked food, which they placed on a series of long tables either outside or inside the old high school gym. Everyone came to eat, visit, listen to the music (guitar and fiddle), and have a good time. Money acquired from the food purchases was used to maintain the church. Over the last few years, however, the priest from El Rito has shown little interest in continuing this celebration, and it has lapsed.

All Soul's Day—November 1

All Soul's Day was not a major holiday. There were no dances or major feasts. A mass was celebrated in the morning at the Penitente oratorio or in the church. Local people who attended wrote down the names of their deceased relatives so the priest could pray for them. Confession and Holy Communion also took place on this day, and people made donations in honor of their deceased relatives. In the afternoon people stayed home from work and prayed, or else visited friends. This was a quiet, contemplative day.

St. Joseph's Day—November 19

On the calendar of saint's days, St. Joseph's Day occurred on March 19 each year; however, since this day often comes during Lent, the holiday was moved to November 19 so it could be celebrated properly. Far in advance, people began to prepare for this holiday. In the summer they cleaned their yards, planted flowers and vegetables, cleaned their houses, replastered, and painted. Some worked in the Colorado beet, bean, and vegetable fields to have enough money to participate (Goodman Field Notes, 1996).

Friends and relatives who were invited often came a day early, on November 18, to participate in various activities and spend the night. They usually arrived around noon and ate lunch with their host family. Late in the afternoon, the priest from El Rito conducted vespers in the Penitente oratorio. Afterwards, in front of the oratorio, the Matachines danced to music played by local musicians. Following this performance, visitors from surrounding villages were invited to the homes of local residents for dinner. That night, a big dance was held at the little dance hall in Gavilan, about 1/4 mi south of Flora Trujillo's present house, beside the highway, near the land that today belongs to Arthur Rodarte's family. There was no official name for this dance hall.

On the morning of November 19, the Penitente oratorio was packed with people attending mass. Afterwards, the Matachines appeared again and danced for about an hour in front of the oratorio. Spanish musicians came from the area around San Juan Pueblo to play for the Matachines; however, the violin player, Torivio López, was from Ojo Caliente. All of the Matachines dancers were from the local area, and the adult men were members of the Society of St. Joseph. Some were Penitentes as well, but this was not a requirement. The Monarca (king), the principal figure, wore an elaborate headdress and costume, and carried a three-pronged trident in his right hand. The man selected was usually a fine dancer. The Malinche was a little girl from the community who was willing to learn to dance this role. She wore a long white dress and had a wreath around her long hair. The Torito (little bull) was played by a small boy wearing an animal skin and horns. An older man, roughly dressed, who wore an ugly mask and carried a whip, was the Abuelo (grandfather), much feared because he used his whip on anyone who misbehaved. At the end of the dance, he killed and castrated the bull (Champe 1983:7–16; Goodman Field Notes, 1996, 2000).

When the Matachines concluded their dance, lunch was in order. All the houses were open, and guests were welcome anywhere they wished to go. Afterwards, everyone rushed off to the dance hall, where they had danced and socialized the previous night. At the end of the day, community members and their visitors retired to their respective houses for supper, changed into more festive clothes, and returned to the dance, which lasted until about 1:00 AM.

In communities such as Gavilan, dances were the preferred form of social entertainment. Almost everyone loved to dance, and residents and visitors alike especially relished the dances connected with St. Joseph's Day. There was always live music, often performed by local musicians who played guitar and fiddle. Included were many square dances, polkas, and waltzes, as well as other types of dances. Girls usually made new dresses for this greatly anticipated social occasion. Young men who came from the surrounding communities, anxious to see which girls would attend. This was a time for courting. Some romances deepened over time, and a number of marriages resulted from the St. Joseph's Day activities.

Even though St. Joseph's Day was a mixture of religious and social activities, it was not an old holiday. When Flora was a child, there had been no celebration at all on this day in Ojo Caliente and Gavilan. The celebration started in the early 1920s, but it is not known who started it or why. Unfortunately, the St. Joseph's Day celebration was short-lived. It disappeared about 1940, when, according to Flora Trujillo, the dance hall collapsed.

Christmas

Christmas in Ojo Caliente and Gavilan was a very quiet day. There were no church services or other special activities. Since most of the local population was poor, there was little to be given in the way of gifts. If possible, parents tried to give one practical gift to each of their children. Sometimes they would give a shirt, a pair of shoes, or even a little money. There was no elaborate gift giving.

Instead of staying home to celebrate Christmas, some families, Flora Trujillo's included, went to San Juan Pueblo to spend time with Indian friends. The Spanish family usually arrived at the pueblo on Christmas Eve and went to the house of friends, where they stayed until almost midnight. Then the families attended a series of three masses together: Midnight Mass; the Mass at Dawn; and Christmas Morning Mass, held about 9:00 AM. Between these masses they found a little time to eat and sleep. On Christmas day they watched Indian dances at the pueblo, shared a large midday meal with their friends, and made the return trip home to Ojo Caliente or Gavilan in the late afternoon. This was an enjoyable time for both the Spanish settlers in the region and the Pueblo Indians because it offered all of them an opportunity to visit, renew acquaintances and friendships, and catch up on the past year's events and news.

Answers to Questions Originally Posed in the Data Recovery Plan

A series of questions relating to the historic structures on LA 105710 were posed as part of the original data recovery plan (Wiseman and Ware 1996:62–64). Though most of these questions have been answered in the body of this report, each is summarized here. Research Issues 1–6 concern prehistoric sites and are addressed elsewhere.

Research Issue 7: Construction Details and Dating of the Morada

According to interviewees the morada was constructed of adobes and hand-hewn wooden beams. It had a flat earthen roof, an earthen floor, windows with small glass panes, and a large corner fireplace. Between 1948 and 1952 some repair and remodeling work occurred. At this time the one large interior room may have been remodeled into two rooms, and instead of just one window, three separate windows may have been placed in the west wall. A pitched metal roof was put on, but a severe wind and thunderstorm soon followed, which blew the new roof off. The metal was divided up and used by various Penitente families, and a flat roof was put on once again. According to Flora Trujillo, corner buttresses were most likely part of the later repair work, not an original feature of the morada,.

A specific date for construction of the Penitente morada in Gavilan is not available, and no written records have been found. Elderly residents did not know when it was built. The only substantive information was provided by Flora Trujillo, who stated that her mother, Debiliana Sisneros Archuleta, knew that the morada had been built before she (Debiliana) was born in 1878. As a young girl, Debiliana recalled watching the Penitentes go from the morada to the García-Sisneros oratorio and was told by her elders that both the morada and oratorio were built before she was born. The Penitentes established themselves in northern New Mexico sometime between 1797 and 1833 (Steele and Rivera 1985:3); however, it is not known when the Ojo Caliente/Gavilan chapter was founded. Based on Debiliana Archuleta's information, however, it appears that La Morada de Nuestro Padre Jesús in Gavilan existed in 1878, and it may have been built between 1850 and 1870.

Research Issue 8: Internal Organization of the Morada

Two lifelong residents of Gavilan remember different interior features of this morada. It is possible that Flora Trujillo, who is 26 years older than Ben Gallegos, recalled the morada from the time before it was remodeled, when it had only one room, and that he remembered it from the time after it was remodeled, when it had two rooms. This could explain the discrepancies in their recollections. (Refer to their descriptions, presented earlier, and Fig. 25.10).

Research Issue 9: Location and Construction Details of the Calvario

No active Penitentes remain in Gavilan. The elders living there in the late 1990s discussed among themselves the location of the Calvario. They knew it was on one of two hills—the hill to the east and slightly south of the morada or, more likely, the hill to the northeast of the morada, where Hilltop Pueblo sits. Most people were fairly certain that the latter was correct. They also stated that an old wagon road once crossed the land north of the morada and went to the top of the ridge to the east, and that the Penitentes formerly walked up this road to the Calvario. Long ago, however, this road became a deep arroyo. No permanent structures were ever built as part of the Calvario, and no construction was involved in creating it.

Research Issue 10: Location and Organization of the Via Crucis

The Via Crucis (and exterior Stations of the Cross) were on LA 105710, on land south and slightly west of the morada, west of the Archuleta animal pens and corrals, and east of the highway. This sacred area was reestablished temporarily during Holy Week each year, when small wooden crosses representing the Stations of the Cross were placed in a particular pattern between the Penitente oratorio and morada (see Figs. 25.9 and 25.11).

Research Issue 11: Oratorios

Two oratorios formerly existed in Gavilan. The first, a family oratorio, was built by Flora Trujillo's great-grandparents, Esquipula García and his wife, Manuelita de Vargas García, sometime before 1878, perhaps ca. 1850–70. This oratorio was attached to the existing family house, which was approximately 1/3 mi (0.55 km) south of LA 105710 on the west side of the road. The Penitente oratorio was probably built later on a piece of land donated by Flora Trujillo's maternal grandmother, Ascencionita García Sisneros. It was directly west of LA 105710, across the highway. Flora Trujillo could not remember when this oratorio was built and gave three possible dates: before 1900; in the early 1900s: or in 1924, when the García-Sisneros oratorio was torn down. No precise date exists since no one else in the community knew when it was constructed, and there are no written records. It is possible that this oratorio was built between 1890 and 1924, and that it was dismantled in the late 1940s or early 1950s (see Figs. 25.12 and 25.13).

Research Issue 12: Construction Details and Interior Organization of the Store

Flora Trujillo said that there had been two small stores across the road from each other, operated by the García brothers, who were her cousins. In about 1931 Candido García built and began operating his small one-room store at the south end of LA 105710, on the east side of U.S. 285. On the west side of the highway just across from Candido's store, his brother, Manuel García, also built and operated a small one-room store at about the same time. The brothers were in fierce competition with each other. Neither store was very successful, and both closed in about 1937 (see Figs. 25.6 and 25.7).

Research Issue 13: Specific Types of Goods Sold and Their Points of Origin

The García brothers sold basic staples, canned goods, and sacks of dry foods such as flour, sugar, pinto beans, potatoes, and coffee at their stores. They did not sell specialty items, clothing, or hardware. Manuel had a gas pump and sold gasoline; Candido did not. The elders of Gavilan had no idea where the brothers bought the items they sold, nor did they know any of their business arrangements. In general, the Garcías did not sell local produce in their stores; the foodstuffs they carried were acquired elsewhere. These stores had little impact on the surrounding community. Local people were largely self-sufficient, raising their own livestock, fruits, and vegetables. When necessary, families did the majority of their shopping at the larger stores in Ojo Caliente, San Juan Pueblo, or Española. Later, after both Garcías had closed their little stores along the highway, Manuel turned one room of his house into a small store and for many years sold his own ground chile there as well as a few other foodstuffs and necessities.

Research Issue 14: Social Dynamics of the García Store

According to Gavilan elders, the García brothers did not take unfair advantage of their customers. They were related to everyone in Gavilan and were well liked in the community. Their little stores never made them rich; they always remained at the same economic level as most of the residents of Gavilan. The families of both brothers survived principally by farming and raising livestock, not by being store owners. These stores were never large enough and never turned enough profit to be of much financial benefit to the families. Therefore they do not fit into the exploitation and usury pattern suggested by Kutsche and Van Ness (1981:18, 137). However, there were a number of other stores in the Ojo Caliente area that were larger and quite profitable for their families. These stores extended credit to their customers, and the owners sometimes acquired parcels of land as payment for debts. Concepts relating to merchants, their practices, and acquisition of wealth (Kutsche and Van Ness 1981; Swadesh 1974:26–27, 59) are relevant to some of the larger stores in the area.

LA 105710 and Its Relation to Sociocultural Events in the Ojo Caliente/Gavilan Area

For 100 to 150 years (early to mid-1800s to 1970s), the Hispanic community of Gavilan/Ojo Caliente used a number of structures on and surrounding LA 105710 for a variety of economic and religious purposes. This area can be called a local Hispanic region of cultural significance. Religious activities were important to many members of this strongly Catholic community, and since there was no resident priest to sponsor and support religious undertakings, Gavilan, and especially LA 105710, became the center of ceremonial activity for the area. The land was donated by members of the García and Archuleta families. About 4 mi (6.4 km) south of Ojo Caliente, this locale became a focal point for Penitente and non-Penitente religious activities conducted by local residents. In days past, Gavilan, a fairly isolated area, was ideal for Penitentes, who shunned public exposure of their rituals and ceremonies. Thus, the Penitente morada, the external Stations of the Cross and the Via Crucis, the Calvario, the Penitente oratorio, and the García-Sisneros oratorio were built or placed on LA 105710 and the surrounding land. No other place in Ojo Caliente or Gavilan contained such a cluster of religious structures and activity areas, which drew together most of the local, and part of the regional. population a number of times each year.

Many other northern New Mexican Hispanic villages built similar types of structures for essentially the same reasons. Without a resident priest, the local population found it necessary to develop their own institutions and activities to meet their immediate religious and social needs. Thus, the Penitente Brotherhood and a variety of moradas, the Via Crucis, the Stations of the Cross, Calvarios, and oratorios sprang up in or near small villages throughout the region. Most were placed at a distance from the official Catholic church. According to Pratt and Snow (1988:259), "after 1850, when penitent rites became a spectacle for the curious, moradas began to be located in more remote areas in order to avoid observation." Chapels were generally placed to the west of the church (Pratt and Snow 1988:259). This was true in the case of both the García-Sisneros oratorio and the Penitente oratorio in Gavilan—both were south and west of the morada. Pratt and Snow (1988:259) indicated that in the smaller moradas, most functions were performed in one room. This fits with Flora Trujillo's statement that there was only one large room in the Penitente morada, where she attended various services. Ben Gallegos, 26 years younger, stated that he recalled two rooms, and that the oratorio was a small room at the south end of the structure. This would be a variation on the more traditional pattern, but certainly possible, especially since the morada was remodeled. Although undocumented in the published literature, it is clear from oral interviews that the residents of Gavilan and Ojo Caliente built, maintained, and used a complete Penitente religious complex, all of which was at or near LA 105710.

Secular activities which fit the typical northern New Mexican subsistence pattern—essentially an agricultural and pastoral way of life—were also reflected by structures on LA 105710. Several sheets from the 1939 highway construction plans showed that many (though not all) families in this area placed their animal pens and corrals on the east side of the highway at the edge of the ejido (NMSHTD 1939). These families built their houses and acequias on the west side of the road, with agricultural fields and orchards between the house and the Ojo Caliente River, farther to the west. This pattern was evident at LA 105710 in the presence of a shed, wood piles, animal pens, and corrals. All were placed on the east side of the road at the edge of the ejido. Residences of the García and Archuleta families, who owned a portion of LA 105710 and much of the land south and west of it, were on the west side of the road, as were their fields, orchards, ditches, and wells. An organizational plan such as this could not work successfully until the danger of Indian raids in the area had subsided. So, even though there are no exact dates, this type of land use and placement of structures and activity areas undoubtedly developed after the threat from nomadic tribes had largely abated. Once the threat of outside attacks was eliminated, it made good sense to separate livestock from the agricultural fields and living areas, and it allowed for ease of movement of livestock to different ranges as necessitated by the changing seasons and climatic conditions each year. Thus the pattern here, as elsewhere, was a practical one: to keep the animals as close as possible to good pasture land and maximize the use of irrigated land for agricultural purposes.

Considering the location of agricultural land, it is reasonable to ask why both oratorios were on the west side of the highway, while the morada, Via Crucis, and Calvario were on the east side. One would think that placing the oratorios on the east side of the highway would free more land for agricultural use. In this case, however, specific circumstances probably determined otherwise. The earlier García-Sisneros oratorio was built as an attachment to a previously existing house on the west side of the road. It was a fairly common practice for a family home to have its own chapel. Therefore, the addition of this chapel to the García house made sense, since one existing wall could be used in the new construction. The men of the family then had to build only three additional walls and a roof to create another functional room.

According to Flora Trujillo, the Penitente oratorio, probably constructed later than the García-Sisneros oratorio, was built on land donated for this purpose by her maternal grandmother, Ascencionita García Sisneros. It is not known why she donated this particular piece of land, but her gift certainly explains the presence of this oratorio on the west side of the highway.

The presence of the Penitente morada, Via Crucis, and Calvario on the east side of the road might be explained by the fact that they were placed on land considered to be ejido—land which belonged to everybody and nobody—which was not part of the valuable agricultural acreage. Since the Penitentes kept most of their activities separate and often secret, it was ideal to locate these special areas away from normal living spaces. Flora Trujillo stated that the morada was on land north of that which belonged to her paternal grandparents, Juan Antonio and Faustina Archuleta. She did not know whether they or anyone else had ever legally owned this land. The Via Crucis and external Stations of the Cross appeared on a temporary basis on Juan Antonio and Faustina Archuleta's land during Holy Week each year, to the west of their animal pens and corrals on the east side of the road. Spaced between the Penitente oratorio and morada, the Archuleta land was ideally situated for the placement of the Via Crucis and Stations of the Cross. The Calvario, involving no construction at all, was most likely on top of the hill northeast of the morada near the ruins of Hilltop Pueblo, because it was isolated from daily activities and habitation areas, yet fairly close to the Penitente morada.

Evidence of another type of economic endeavor was also identified at LA 105710. The presence of a small, single-room store near the south end of the site was an indicator of one type of mercantile activity that occurred in northern New Mexico. Two small, short-lived stores belonging to Candido García on the east side of the road and Manuel García on the west side of the road fit into a larger pattern of local stores scattered throughout the region. Owners of numerous small stores hoped to supplement their meager agricultural incomes and provide better lives for their families. Owners of larger stores, often with more economic resources at hand, were more focused on turning their establishments into successful business ventures. In reality, the larger stores, with more stock and the ability to extend credit to customers, tended to survive, while most (but not all) of the little stores struggled valiantly for a few years, then ceased to exist.

Thus, LA 105710 and the surrounding area supported essential religious and economic activities in the community. The location was convenient and practical for residents of Gavilan. However, as economic and also religious circumstances changed over time, so did the use of the various structures and activity areas. People moved away to seek better jobs or join the war effort. Livestock and agriculture became less desirable pursuits, and eventually there was no need for corrals, pens, and sheds. On the religious front, as the Catholic Church became stronger in the region and the priest from El Rito came many Sundays to hold mass in St. Mary's Church in Ojo Caliente, most of the Penitente activities that had taken place at LA 105710 and in the surrounding area fell out of favor and gradually disappeared. There is no longer an active Penitente brotherhood in the Ojo Caliente and Gavilan region. Today this community, with its unique Hispanic culture, is losing its sense of history and strong religious ties and is slowly becoming gentrified as Anglo outsiders move into the area. Formerly a vital and central part of the community, LA 105710 is now entirely devoid of structures and activities. Some houses still exist on parcels of land surrounding this site, but the Penitente activities, the associated social occasions, and the agricultural, pastoral, and mercantile way of life are largely gone. A casual glance as one drives by this area would never reveal all that has transpired on this land in the past.

Note

1. C. M. García was Candido M. García, Flora Archuleta Trujillo's cousin; "Juan C. García" was probably Juan A. García, Flora's maternal uncle. There was no other Juan García who owned land in the area at that time. Juan Archuleta was undoubtedly Juan Antonio Archuleta, Flora's paternal grandfather, who also owned land in the area at this time.

Now closed and empty, this structure served as the first post office (date unknown) in Ojo Caliente. Photo by Linda J. Goodman, 2000.

Individuals Interviewed and Consulted about Gavilan and LA 105710

Fred Archuleta Jr. (1926–). Nephew of Flora Trujillo, mayordomo of the Gavilan acequia. Fred lives across the highway from the Gavilan morada. He grew up in Gavilan and moved to California as a young man but returned to Gavilan over 20 years ago. As a young person he acquired considerable knowledge of the area.

Eloisa Baca (1911–99). Lifelong resident of Gavilan, she was a first cousin of Flora Trujillo and wife of Pedro Baca, a Gavilan Penitente. Eloisa had knowledge of various aspects of Penitente life and activities.

Benjamin Gallegos (1934–). Son of a Gavilan Penitente, Ben became an assistant who aided the Penitentes in the years before the Gavilan chapter closed. He is knowledgeable about some aspects of Penitente activities as well as the morada, Calvario, and Penitente oratorio.

Ben Maestas (1928–). Nephew of Manuel García. Born in Salida, Colorado, from the age of four he spent summers in Gavilan with his uncle and aunt. He is knowledgeable about his uncle's little store, some aspects of life in Gavilan, and the history of New Mexico.

Felipe Ortega (1953–). A lifelong resident of La Madera, New Mexico, and friend of several people in Gavilan. Some members of his family are Penitentes, and he is knowledgeable about some aspects of the Gavilan morada.

Flora Trujillo (1908–2004). Former schoolteacher and lifelong resident of Gavilan and Ojo Caliente. She has extensive knowledge of the area, the people, and the religious structures as well as excellent recall of past history, events, and activities.

Helen Vigil (age unknown, approximately mid to late forties). Married into the Oliver Vigil family. Lives in El Rito, works at Oliver's store in Ojo Caliente. She has knowledge and background information concerning the Oliver Vigil store.

Chapter 26. LA 105710 in the Gavilan Community: Synthesis of Ethnohistoric and Archaeological Information

Jeffrey L. Boyer

In the data recovery plan for this project (Wiseman and Ware 1996), a series of eight research issues were posed regarding the historic components of LA 105710. Issues 7 through 11 focused on the Penitente morada and associated structures and features, while Issues 12 through 14 focused on the Candido García store and its role in the Gavilan community. The research issues recognize two important aspects of data recovery at LA 105710:

1. The historic structures and other features at LA 105710 are not isolated features in the Rio Ojo Caliente Valley. Rather, they are integral features of the Gavilan community. Their presence and locations help identify the community (see Steele 1983), and they should be considered in that light. Goodman's research (Chapter 25) supports this perspective by showing not only the interrelationships of the structures and features at and surrounding LA 105710, but also their roles in the Gavilan community.

2. Data from LA 105710 and its constituent features was recovered largely through ethnohistorical rather than archaeological means, primarily because most of the features were outside project limits and so were not subjected to excavations. Only the Candido García store was actually available for excavation, and, as discussed in Chapter 14, the data recovery plan assumed that excavations would not reveal significant information. Chapters 14 and 21 show that such was not the case. Although the remains of the morada building were not excavated, archaeological observations were made that can be used to expand or clarify ethnohistorical data.

This chapter examines both the archaeological information presented in Chapters 14 and 21 and the ethnohistorical information presented in Chapter 25, in light of the research issues defined for LA 105710.

The Gavilan Morada

Research Issue 7: Dating the Morada

Initial construction. No archaeological data is available concerning initial construction of the morada building. No documentary evidence was found that would date its construction, and informants were not sure of its construction date. However, there is ethnohistorical evidence that the morada was built before 1878, and Goodman (Chapter 25) speculates that construction took place between 1850 and 1870.

Structural remodeling. Archaeological evidence of remodeling consists of cement plaster on the exterior of the building's walls, buttresses at each corner of the building, and ceramic flue pipe fragments at and near the building's northwest corner. In Chapter 14, we suggested that these factors point to remodeling after World War II. Goodman's informants stated that the morada was repaired and remodeled between about 1948 and 1952. Specifically, one informant stated that the buttresses dated to this period. Although she did not mention the cement plaster, it certainly postdates the buttresses, which were built with adobe mortar but covered with cement plaster.

There was no observable evidence of the pitched metal roof or the extra windows that, according to informants, were installed in the late 1940s or early 1950s. Goodman's informants stated that the original window and the new windows were in the building's west wall. Demolition of the west wall to remove the windows, as described by the informants, may explain why the building's west wall was reduced to a low mound, while portions of the east wall remained at the time of our investigations. It is possible that installation of the ceramic flue pipe coincided with construction of the new roof.

Characteristics of the morada generally fit architectural criteria proposed by Bunting et al.

(1983), who identified three periods of morada construction. The informant described the building as originally having a flat roof supported by hand-hewn beams, an earthen floor, a single window with small panes, and a f*ogón* (corner fireplace), matching the description by Bunting et al. (1983:43–46) of "early period" (pre-1900) moradas. Likewise, the ca.-1950 renovations described by informants largely match the description of "middle" (1900–1940) and "late" (post-1940) moradas. Particularly, Bunting et al. (1983:45–46) state that corrugated metal roofing dated after 1920 in most cases, and that windows installed between the two world wars were wooden, factory-made, multipane windows. After World War II, metal casement windows were available; because renovation of the Gavilan morada took place not long after World War II, wooden multipane windows may have been more readily available than metal casement windows, particularly in this relatively remote area.

Bunting et al. (1983:40) also state, "The only source of heat in early times, of course, was the fireplace (*fogón*). Later, when iron stoves became available, they were preferred because of their greater efficiency, and in some instances the old *fogón* was removed." Iron stoves were, apparently, most common during the "middle" (1900–1940) period. While the fogón in the Gavilan morada was not removed in the ca.-1950 renovations, it was probably remodeled, including installation of ceramic flue pipe.

Research Issue 8: Internal Organization of the Morada

Two informants identified the large fogón in the northwest corner of the building, matching the location of the ceramic flue pipe fragments observed at the structure. The older informant remembered one large room, while the younger remembered two rooms. The large room, according to the younger informant, may have been divided into two rooms in the early to mid 1940s so that the smaller, southern room could be used as an oratorio. Given that the renovations identified by both informants occurred around 1950, division of the building into two rooms probably also took place at that time. There was no observable evidence for division of the single large room into two rooms, suggesting that the dividing wall was not built of adobe bricks. If it was, in fact, built in the 1940s, it may have been made of milled lumber. Bunting et al. (1983:38–39) state that single-room morada buildings are the exception; they apparently occur only when the oratorio is a separate building.

There was no observable evidence of the locations of other features within the morada building as described by informants. However, those features were impermanent and portable (see Research Issue 11, below), so their presence might not be evident, even had excavation taken place.

Research Issue 9: Location and Construction Details of the Calvario

Informants stated that the Calvario—the location of the large cross or crosses at the end of a short pilgrimage route used during Holy Week and sometimes associated with the Via Crucis (Way of the Cross)—was on a hilltop above (to the east of) the morada building. They could not concur on which hilltop, but most agreed that the Calvario was on the hill near (or at) Hilltop Pueblo (LA 66288). Apparently, no structure or other construction was associated with the Calvario (Chapter 25); there was no observable evidence of the Calvario on either hill (Chapters 6 and 14).

Goodman's informants also stated that an "old wagon road" climbed the hill north of the morada and was used for access to the Calvario. According to the informants, erosion turned the road into an arroyo. Figure 6.1 shows an abandoned two-track road climbing the slope of the hill south and west of Hilltop Pueblo. There was no indication that the dredged arroyo immediately north of the morada was originally a road, although that possibility cannot be ruled out. Still, it seems possible that the abandoned road shown in Figure 6.1 was the one used for access to the Calvario, and that informants confused it with the arroyo. If so, then the road may have been abandoned when the morada was abandoned and dismantled in the late 1960s or early 1970s.

Research Issue 10: Location and Organization of the Via Crucis

Informants placed the Via Crucis in the area south and west of the morada (Chapter 25). Although the Via Crucis often connects the morada to the Calvario (Bunting et al. [1983:37] state this is always the case), this pattern seems to have characterized situations in which the morada meeting house also contained the oratorio. At Gavilan, two oratorios were located southwest of the morada building, and the Via Crucis was placed between the morada and the oratorios. There was no archaeological evidence of the Via Crucis, because, as Goodman's informants stated, there were no permanent features or markers of the Via Crucis, and the 14 Stations of the Cross were temporarily reestablished each year during Holy Week.

Research Issue 11: Oratorios

Informants identified the locations of two oratorios in Gavilan; both were southwest of the morada on the west side of the highway (Chapter 25). The older oratorio was built by the García family at the family house before 1878; apparently, its construction was approximately contemporaneous with that of the morada. The younger oratorio, known locally as the Penitente oratorio, was apparently built later, after about 1890 and perhaps as recently as 1924, when the older García-Sisneros oratorio was to be torn down. According to informants, the Penitente oratorio was probably torn down in the late 1940s or early 1950s; that date would make its dismantling approximately contemporaneous with renovations to the morada that included division of the original single-room building into two rooms, one of which was then used as an oratorio. After the renovations to the morada building, the Stations of the Cross were apparently kept in the morada rather than being set up outside for the Via Crucis. This may have been because the access route up the hill to the Calvario was not conducive to use as the Via Crucis, since it had not been designed for that purpose originally.

Regarding the oratorio, which they also call the oratory or the chapel, Bunting et al. (1983:39) state,

> The most important room in a morada, the oratorio, is subject to the greatest architectural variation. If several types of building materials have been used in the construction of a particular morada, the one considered the finest will be used for the chapel . . . where a difference exists, the chapel is the more finished or better constructed.

Examination of the descriptions in Chapter 25 of the morada building and the two oratorios, provided by Goodman's informants, supports this observation. The description of the morada building is relatively simple. before the ca.-1950 renovations, it was a single large room with an earthen floor, a flat roof supported by vigas, one plain wooden door, one small window, and a fogón in the northwest corner. All other interior features were portable: oil lamps or candles, benches, wooden tables for food and an altar, santos, and retablos. During renovation, a pitched roof was constructed of milled lumber and corrugated metal, three windows were installed in the west wall, the fogón was remodeled, and the single room was divided, probably by a milled-lumber wall. With the dismantling of the second oratorio, there were, apparently, more santos, retablos, and other ceremonial items in the morada, including the Stations of the Cross; all of these were, however, still impermanently installed and portable.

The simplicity of the morada building contrasts with descriptions of the García-Sisneros and Penitente oratorios (Chapter 25). The García-Sisneros oratorio was attached to the García house but had its own entrance (see Steele 9183:39). The single wooden door was elaborately carved. The flat roof was supported by "huge" vigas, and the walls were built of oversized adobe bricks. The structure's east and west walls each had two windows that were covered with white curtains. The interior walls were whitewashed, and the 14 retablos portraying the Stations of the Cross were hung on the two long walls. The altar consisted of a wooden table covered with a lace-edged, embroidered cloth. One wooden candelabra was on either side of the altar; in front of the altar were a wooden-board candle-holder and a communion rail. Numerous santos, bultos, and retablos were present.

The Penitente oratorio, built and maintained by members of the morada (unlike the privately owned but community-used García-Sisneros oratorio), was built in the shape of a cross. It had two doors, one used only by the Penitentes during Holy Week, and vigas that had been "peeled with a special knife." Most of the portable features that had been in the García-Sisneros oratorio were moved to or replicated in the Penitente oratorio when the former was closed—the altar table and cloth, the santos, bultos, and retablos, candelabra, communion rail, and the 14 Stations of the Cross.

Descriptions of the morada and the oratorios in Gavilan support the distinctions made by Bunting et al. (1983) and the observation that the structures and associated nonstructural features were integrated parts of the Gavilan community. None of them can be understood individually.

Discussion

Steele (1983:295) makes the following observation about Spanish settlement on the New Mexican frontier:

> Because the Spanish came into New Mexico with their religion already formed and because they were not as space-oriented as [the region's Native inhabitants], they found it impossible to employ the same means of integrating the locales in which they now lived into their scheme of things. They had come into the middle of a world of things unknown. First of all, there was no continuity with the former world they had known in Mexico, for the new foundation of 1598 was separated by hundreds of miles from the former extent of European control. Second, the various portions of the colony were separated from one another by the topographical divisions of the terrain.

In order to accommodate this frontier situation, and with a need to identify themselves in space and in time and to connect themselves with other Spanish Europeans, Spanish New Mexicans utilized two means of assigning place-names: intrinsic and extrinsic denomination (Steele 1983:299). The former assigns a place-name based on descriptive, historic, or ethnographic characteristics of the location. Two examples relevant to this project are Gavilan and Ojo Caliente. Steele (1983:299) argues that "intrinsic denominations would give the group bestowing and using the name a sense of comprehension of the place they inhabit." As discussed in Chapter 14, we do not know whether the community name "Gavilan" was adapted by Spanish settlers from a Tewa name for the area.

Extrinsic denomination assigns place-names after other places, such as a city in Mexico or Spain, or for a Catholic saint. In so doing, a connection is made between settlers living in an unfamiliar land and a land with which they are familiar: "If the new settlers of an area do not reach for the intrinsic intelligibility of a place and encapsulate it in a name, they can at least import some intelligibility from outside and bring it to bear on the place in question" (Steele 1983:299). This point is particularly important for Spanish Catholic settlers in isolated frontier circumstances because "in New Mexico the villages, one by one, were centered and inserted in the sacred calendar by naming the chapel and in many cases the village itself with the name of a sacred personage" (Steele 1983:300; see also Van Ness 1979:26). Steele (1983:300) goes on to assert that

> the name of the chapel served as a designation of identity; the space of the village received its most profound and universal validation in the name of the saint. Since . . . the Spanish attribute primacy to time rather than to space, the main function of the name of the saint is to tie the chapel and the village and the people into the liturgical cycle of the Roman Catholic church.

In turn, the liturgical cycle links people who are co-participants in "the wider Spanish and Catholic world" (Steele 1983:300) but are isolated from each other, in the same "universal" time-frame calendar, to maintain unity and continuity among widely separated groups of Spanish Catholics.

The factor of isolation presented a problem. Annual fiestas in honor of patron saints provided each community with ritual participation in the liturgical calendar. But as Steele (1983:301) pointed out,

> The lunar-solar cycle that brings Lent, Holy Week, and Easter each year keys the central

> common Christian feast, and on these holiest of days, only the parish centers would have enjoyed the full priestly rituals. For this special time of the year, each village without a priest would have had to manufacture a ceremony of its own.

It is in that context, Steele (1983:301) contends, that "the *Hermanos penitentes* kept New Mexico in the Christian-European orbit of religion and culture." That is, along with their social functions in their isolated communities (Chapter 25; Weigle 1976; Kutsche and Gallegos 1979), the Penitentes provided their communities with a critical ritual connection to the rest of the Spanish Catholic world during the common holy season of Lent, Holy Week, and Easter, and, in so doing, provided continuity of Spanish Catholic identity, spatially and temporally. This was important both in the face of frontier conditions of population separation from other groups and from critical church functions, and during events and periods of social change: "Perhaps of greater significance was the fact that La Fraternidad remained a fortress of cultural identity when the Hispanic settlers and natives were faced with Indian incursions and later with the more culturally destructive forces of the dominant Anglo-American society" (Bunting et al. 1983:32).

Bunting et al. (1983:32) state, "Brothers' religious views were not necessarily espoused but certainly acknowledged by all members of Hispano village society as part of their cultural heritage." Although not all members of the Gavilan community participated in or even supported the local Penitente organization and its activities, social and ritual (Linda Goodman, personal communication, 2003), the prominence of the Penitentes and their structural and nonstructural features is not disputed. Examination of the Gavilan morada reinforces this perspective (Chapter 25).

The Candido García Store

Research Issue 12: Construction Details and Internal Organization of the Store

Descriptions of the Candido García store obtained from Goodman's informant (Chapter 25) and from archaeological excavations (Chapter 14) are essentially similar, although each provides details not supplied by the other. The informant remembered that Candido's store was a small, one-room structure with a cement-and-rock foundation, in contrast to his brother Manuel's store, also a small, one-room structure, but with a foundation of mud and rock. Excavation of Candido's store revealed a small, one-room structure represented by a rectangular foundation, three sides of which were made of concrete poured on a footer of large cobbles. The fourth, western, foundation was simply a footer of large cobbles. Although excavations showed that the northern and southern walls extended past the western wall, perhaps supporting a portal along the building's western side, Goodman's informant did not mention such a feature.

Goodman's informant did recall that the building's walls were constructed of adobe bricks. Although no bricks were found on the wall foundations during excavation—an observation explained by the informant's statement that the structure was dismantled after its abandonment—brick fragments were encountered in the fill. The interior wall surfaces had been covered with adobe plaster and a single coat of whitewash plaster; the single layer of whitewash supports informant statements that the store was in use for only a few years.

Goodman's informant also stated that the store had a "lumber" floor. Excavation revealed no evidence of a wooden floor and suggested that the structure's floor was packed earth, based on artifacts on what appeared to be a hard, earthen surface. Of course, if a wooden floor had been removed during structural dismantling, any items left in the building at that time or deposited there later would be found on the dirt below the former floor. However, Williamson's analysis (Chapter 21) shows that of 98 nails and nail fragments that could be identified by type, only 1 is a flooring nail, and only 13 others are box or common nails that could have been used to construct a wooden floor.

Likewise, no archaeological evidence of a corrugated metal roof was found, as described by the informant. However, numerous small and large fragments of "tar paper" roofing felt were found, inside and outside the structure. Within the structure, tar paper fragments were found on the "floor" and in all three fill strata but were least common in Stratum 1, the melted adobe plaster and brick material found immediately above the "floor," and most common in Strata 2 and 3, the colluvial and eolian sediments. Outside the structure, tar paper fragments were found in all excavation levels below the modern ground surface. The ubiquitous presence of tar paper fragments suggests that the structure's roof was covered with tar paper, which was torn and scattered when the structure was dismantled. Williamson's analysis (Chapter 21) also shows that, of the 98 identifiable nails, 73 (74.5 percent) are roofing nails. Under these circumstances, it seems likely that the 13 box and common nails, and perhaps many of the indeterminate nail fragments, were used in construction of the roof, rather than a wooden floor. The scarcity of asphalt roofing tar adhering to tar paper fragments (only seven pieces of tar were recovered) shows that the roof was not coated with roofing tar, which may support the informant's memory of a corrugated metal roof.

Excavation confirmed the informant's recollection that the structure had a door in its western wall. The informant also remembered a single window but was not sure whether it was in the northern or eastern wall. Window-glass fragments were most common within the structure on the "floor" near the southern wall, suggesting that the window was in the southern wall (Chapter 14). However, since the structure was completely dismantled, it is quite possible that the pane or panes in the window were broken and discarded, and that their archaeological locations did not reflect their location in a structure wall.

Excavations revealed no clear evidence of the internal features described by Goodman's informant: a counter along the east wall, shelves along the north wall, and a wood-burning stove and wood box in the southeast corner. Still, as Williamson (Chapter 21) points out, the fire bricks and other bricks and brick fragments could have been associated with the stove or the shelves, and several thin mica fragments may have come from the stove.

An interesting and enigmatic issue is raised by the light bulb base, possible bulb glass fragments, connector base, and copper wire fragments recovered during excavation (Chapter 21). They suggest that the building was wired for electricity, but Goodman's informant denied this, stating that the store was lit by a single kerosene lamp. Although we were not able to determine with certainty when electricity came to Ojo Caliente, it was probably not available before World War II, since the Kit Carson Electric Cooperative, which serves Taos County and parts of Rio Arriba County, was formed in 1944, and the Jemez Mountains Electric Cooperative, which serves most of Rio Arriba County, was formed in 1948, the year that electricity came to the La Madera area, north of Ojo Caliente (Pringle 1993:77). Since the store had been abandoned for about a decade by that time, it is unlikely that it had electricity, and the electrical artifacts were probably introduced at a later date.

Research Issue 13: Specific Types of Goods Sold and Their Points of Origin

Goodman (Chapter 25) summarizes informant information about items and goods sold by Candido García and his brother Manuel as follows:

> The Garcia brothers sold basic staples, canned goods, and sacks of dry goods such as flour, sugar, pinto beans, potatoes, and coffee at their stores. They did not sell specialty items, clothing, or hardware. Manuel had a gas pump and sold gasoline; Candido did not. The elders of Gavilan had no idea where the brothers bought the items they sold nor did they know any of their business arrangements. In general, the Garcias did not sell local produce in their stores; the foodstuffs they carried were acquired elsewhere.

Of 1,623 Euroamerican artifacts recovered from the Candido García store, 349 (21.5 percent) could not be identified by function (Chapter 21). Most of them (n = 322; 92.3 percent) are can and bottle fragments, and many of the latter represent modern road trash. The remaining 1,274 artifacts can be assigned to eight function categories. Of those, most (n = 1,157; 91.1 percent) are in the construction/maintenance category and would not be related to items for sale at the store. Of the remaining 117 artifacts, 27 (23.1 percent) are probably or certainly older than the store. They include a (possible) ink bottle base, an amethyst glass bottle finish, a sardine can fragment, a meat can fragment, a Ford automobile circuit breaker, a ceramic button, three shell buttons, three bullet slugs, and 15 bullet cases. Twelve items (10.8 percent), a tobacco tin and eleven artifacts in the indulgences category (see Chapter 21), are younger than the store. Thirteen items (11.1 percent) are unlike those described by informants as available at the store; they include two automobile parts, a saddle concho, a harness ring, two fragments of a pressed-glass vessel, a white ware sherd, two children's shoes and an infant shoe, a clothing snap, a stocking supporter, and a brooch. The two children's shoes are worn and had been repaired. Williamson (Chapter 21) notes that the other personal effects items were also worn. In addition, a few glass artifacts could not be identified but may have been fragments from an internally lit glass sign. There is no indication from informant data that the store had a sign, and the absence of electricity probably precludes that possibility (Chapter 21).

Besides artifacts unlikely to represent items for sale in Candido García's store, we are left with 27 artifacts that could have been associated with the commercial aspect of the store. They include 20 canning jar lids and sealer bands, one pint-jar lid, five candy wrapper fragments, and a 1935 New Mexico tax token. Williamson (Chapter 21) suggests that the presence of so many canning jar sealer lids and bands, combined with the absence of canning jars and identifiable jar sherds, may indicate that the store sold supplies to local people who canned their own foodstuffs. That might also account for the pint-jar lid. Goodman's informant (Chapter 25) included candy among items sold by García, which could account for the candy wrapper fragments recovered during excavation. Williamson (Chapter 21) does note that some fragments were burned.

The 1935 tax token is the only artifact that clearly dates to the years of the store's use. As Williamson (Chapter 21) notes, while the token is classified as a personal effects artifact, it properly reflects the common use of those tokens as money. This probably confirms the association of the token with the store, making it the only artifact recovered during excavations that can be securely associated with the store as a commercial establishment.

It is also important to note Williamson's observation that, of the artifacts for which condition was recorded, 47.4 percent showed evidence of burning. Since so few artifacts can be potentially associated with items sold at the store, while almost half the artifacts were apparently burned, it seems likely that the artifact assemblage represents three depositional situations:

1. The construction/maintenance artifacts, which comprise over 70 percent of the assemblage, largely reflect items used in construction of the building and were deposited in and around the building when it was dismantled. The probable exceptions are the electrical artifacts.

2. Most of the other artifacts were deposited during episodes of trash disposal after the building was dismantled. This would account for the frequency of burned artifacts and the worn conditions of other artifacts, as well as artifacts that are older or younger than the store and items not likely to have been available at the store, given ethnographic information.

3. Only the tax token can probably be associated with the store. The canning jar sealer lids and bands, the pint-jar lid, and the candy wrappers could represent items for sale at the store.

Research Issue 14: Social Dynamics of the García Store

The research design for this project focuses Research Issue 14 on an observation by Kutsche and Van Ness (1981:18, 137) that "entrepreneurial activities in rural northern New Mexican villages could cause social disruptions" (Wiseman and Ware 1996:64). Succinctly, these disruptions stem from

> a general belief among rural northern New Mexicans that store owners take advantage of their customers through various means such as high prices [for store merchandise] and low prices for local produce. In small communities, where families must cooperate for ditch cleaning, harvesting, and other activities, suspicions of taking advantage of people can create serious rifts that manifest through-

out village life. (Wiseman and Ware 1996:64)

In addition to perceptions of price-gouging, merchants have sometimes sold goods in usury and taken payment in land and other property when their customers could not finally settle their accounts with cash. Swadesh (1974:26–27, 59) links this situation to the advent of American merchants during the Mexican period (1821–47), while González (1969) and Weber (1979) see it becoming significant after the 1870s. Certainly, it attests to increasing participation by rural New Mexicans who for generations had pursued a local/regional, agricultural-pastoral, subsistence economy in an increasingly cash-based United States national economy.

Weber (1979:81) summarized the differences between subsistence and cash economies:

> The orientation of a cash economy is in direct opposition to that of a subsistence economy. While the latter stresses local independence in production and consumption, a cash economy requires regional (and often national or international) inter-dependence. Basic to a cash economy is a market system where goods and labor may be readily converted to cash which in turn can be readily exchanged for an almost unlimited number of goods and services. This convertibility factor leads to the utilization and development of specific rather than generalized resources. Another critical distinction between subsistence and cash economies is production for local *vs.* extra-local consumption. [Note: it may be a recognition of this point that leads Swadesh to link social issues associated with merchants with ties between New Mexico and the United States beginning in the Mexican period.] The lifestyle within a subsistence economy is limited by one's ability to derive his total livelihood from that area. The more complex cash economy implies specialization in production and labor, sale of the product, and purchase of goods from other similarly specialized producers.

Further, Weber (1979:81, 80) points out that in northern New Mexico, "While the family formed the basic biological and sociological unit, families combined into villages to form self-sufficient economic units. . . . As with families, each subsistence settlement shared a generally similar environment and produced most of the same goods." Weber (1979:82–84) identifies five factors that increased rural New Mexican villagers' involvement in the United States' national economy. Prior to the Great Depression of the 1930s, northern New Mexicans were introduced to and became increasingly dependent on the growing national cash economy through taxes, itinerant employment, decreasing land bases needed for agricultural and pastoral pursuits, and growing population numbers. He contends, "The extent of the reliance on external sources became apparent during the Great Depression. It closed off outside sources of income, and previously employed itinerants were forced to return or to remain at home" (Weber 1979:83).

In this position, Weber follows González (1969:118–120), who argues that the advent of the railroad in the 1870s and 1880s brought greater participation on the part of all New Mexicans in the national economy.

> Jobs were available for all who cared to labor—part-time or full-time. Many Hispanos used this means of supplementing their small income from farming [this statement reveals changes from truly subsistence farming to income-producing farming], thus making it possible to continue life in the rural villages in spite of decreasing productivity there. In time wage labor became the mainstay, supplemented by homegrown produce. (González 1969:120)

Gonzáles (1969:123) goes on to argue,

> The opportunities for wage labor outside the home village and the income derived from it succeeded in covering up the real situation until the early 1930's, when the widespread depression decreased and almost cut off completely the available jobs.
>
> When this situation occurred, the men tried to fall back upon the more traditional sources of income—farming and sheepherding—and then discovered that changes in the ecological balance, new laws, and competition with modern techniques made it impossible for farming and sheepherding to support the

existing population.

Amelioration of these circumstances—to which rural New Mexicans responded by depending on federal relief programs; by becoming increasingly and more widely seasonally migratory; and by moving to cities in California, Arizona, and Colorado—did not really begin until World War II (Weber 1979:83).

It is in this context that we can examine the observations made by Kutsche and Van Ness (1981) in regard to the García brothers' stores. Her ethnographic information leads Goodman (Chapter 25) to conclude that the stores owned by Candido and Manuel García did not fit the pattern of usury and exploitation ascribed by Kutsche and Van Ness to some stores operated in small Hispanic communities. Since the brothers were related to all their customers and neighbors in Gavilan, and since their stores were small, were not open consistently, did not traffic in local produce, did not offer credit, and did not make much profit for their owners, Candido and Manuel García were not perceived as taking advantage of their customers. Apparently, as Goodman (Chapter 25) points out, "These stores had little impact on the surrounding community."

Certainly, the stores represented shifting economic orientations in the Rio Ojo Caliente Valley, from subsistence-based, agricultural, and pastoral economics to cash-based, labor-specific economics. However, the goods sold by the García brothers largely mirrored the foodstuffs produced by families in the local communities. The stores did not offer a range of specialized or limited-availability items that may have been needed by but were not produced in local communities. According to Goodman's informants (Chapter 25), when families in Gavilan needed such items, they tended to buy them from larger stores in Ojo Caliente, San Juan, or Española. If the 20 canning jar sealer lids and bands recovered during excavations do indeed reflect some of the items sold by Candido Garcia, they suggest that he did stock items that could have been useful to local subsistence activities.

The García brothers established their stores during the Great Depression period of the 1930s, when the national cash economy was unstable and that of the valleys of northern New Mexico more so (González 1969; Weber 1979). As we noted earlier, northern New Mexicans responded to the Great Depression by, among other things, attempting to fall back on farming and herding, with varying degrees of success. Consequently, by opening small stores that were dependent on cash because they sold goods that had to be purchased with cash, largely sold the kinds of goods that could be produced by local families, but did not sell or trade local produce during the Great Depression, when northern New Mexicans were attempting to refocus economic pursuits away from cash bases, the García brothers probably doomed their stores to failure. Goodman (Chapter 25) observed that the stores were often closed for months at a time because the brothers themselves did not have the cash needed to buy items to sell.

Discussion

An interesting contrast to the Garcia brothers' stores is found in the tienditas of Rosinaldo and Vicente Archuleta, brothers living in the Duranes area south of Ojo Caliente (Chapter 25). Both Archuleta stores opened about 1940, after the García stores closed, and apparently sold similar goods (although we do not have information on products in the Archuleta stores in the same detail as we have for the García stores). Rosinaldo closed his store in about 1950, when he moved to California. Vicente kept a store open until around 1990; his store also housed the South Ojo Caliente Post Office in the 1960s. Although we can't know with any certainty, we can speculate that the Archuleta brothers' tienditas continued to operate because they opened in the 1940s and because federal relief programs and the economic changes associated with World War II provided cash needed by such small stores to survive.

As Goodman (Chapter 25) points out, several larger stores were established in Ojo Caliente. One informant stated that the Lucero and Hernández stores extended credit to customers, and that the owners grew wealthy. One family, the Vigils, who bought the Lucero store, was from El Rito, where it already had extensive holdings. The Vigils were not considered "locals." This situation reflects the observations made by Kutsche and Van Ness. Valdez (1979) provides an interesting discussion of the sociocultural context of the animosity that can be directed towards the owners of large stores in his paper on *vergüenza* (literally, shame; more appropriately, modesty). Valdez (1979:104) states succinctly that "some professions are traditionally regarded as necessarily *sin vergüenza*," (without shame or modesty) because "the essence of *sin vergüenza* is using one's knowledge, customs and traditions, possessions or personal characteristics to put oneself ahead of others. The sense of 'at the expense of others' is always involved in the male *sin vergüenza*." The point is that a person sin vergüenza does not operate in the best interests of the community in which he lives; he increases himself at others' expense.

Among those professions that are, by definition, sin vergüenza are those having to do with lending and capitalist business. Valdez (1979:104) states,

> Usury has been *sin vergüenza* since medieval Spain, and of course *leyes* were enacted to limit the type of people who could get involved in these activities. One takes advantage of others by having money when they need it. . . . The businessman is another example of one trying to get ahead for himself and his immediate family. The very nature of all business activities, of buying low and selling high, of showing a profit, is *sin vergüenza*. And, those who need the businessman's service never hesitate to consider him such a man. It is assumed that he is sly.

In this context, we can see why their neighbors and customers in Gavilan were not suspicious of the García brothers. Although the brothers operated cash-based businesses, those businesses were very small, did not operate on credit, did not make much profit, and, although they did not necessarily aid others, they also did not impede others' participation in their subsistence-based activities. So, the García brothers were not sin vergüenza. The same was probably true of the Archuleta brothers and their stores, unlike the owners of the larger stores, who did extend credit, did (and do) make profit from the efforts of their neighbors, and were (and are) participants in the economic and sociocultural transformations of Hispanic village life. We would not want to say, in this context, that the owners of larger stores in the area were or are sin vergüenza, since that would be a judgment of social values that is not ours to make. Further, Goodman's research did not focus on gathering detailed information about goods or services provided by those stores or about their positions in the social dynamics of the Ojo Caliente area. However, her information does provide descriptions that suggest distinctions between those stores and the ones operated by the García brothers, both in terms of goods and services and in terms of local and regional social and economic contexts.

Conclusions

Comparative examination of the results of ethnohistorical and archaeological research about and at LA 105710 reveals that the two methods of data recovery have provided complementary information relevant to the eight research issues identified for the historic components of the site. Ethnohistorical research has provided a critical view of the site in the context of the whole community of Gavilan. It shows that the site figured importantly in the community and that the site's features can and must be understood as integrated aspects of the whole community. This is a fascinating result of the research, because the site, from an archaeological perspective, does not present a particularly imposing picture (although we did not conduct excavations of the morada, so we do not actually know what might be revealed there). Nonetheless, archaeologically the site consisted of the morada, the remains of the Candido García store, and the Archuleta corrals, represented primarily by stands of wolfberry bushes. Without the ethnohistorical research, we might not have known the extent to which LA 105710 represents religious, economic, and integrative aspects of the Gavilan community. On the other hand, without the archaeological research, we might not have known the degree to which the site represents changes in the religious, economic, and integrative aspects of the Gavilan community. Clearly, the focus in the project research design on ethnohistorical research was warranted. Just as clearly, the research design underestimated the potential for contributions that were made by archaeological investigations. This chapter demonstrates that ethnohistorical (Chapter 25) and archaeological (Chapters 14 and 21) investigations can profitably be combined to recover comparable and complementary information about a site that may appear to be of relatively minor significance but may, in fact, be of central importance in understanding local and regional community dynamics.

Chapter 27. Summary and Conclusions

James L. Moore

The Nature of Frontiers

Though this project examined in detail only a fairly narrow corridor through the middle of the Ojo Caliente Valley, the data that it generated provide a detailed look at several aspects of prehistoric and historic life in the region. The Ojo Caliente Valley has truly been on the frontier through most of the time that it was occupied by farmers and herders. However, the form taken by those frontiers varied in the prehistoric and historic periods. Though none of the sites examined by this study date to the initial periods of prehistoric or historic occupation, those earlier forms helped determine the trajectory that later settlements took.

Casagrande et al. (1964:284) define two major types of colonization, or movement onto a frontier. The first type is *external colonization*, in which a population expands into a distant or noncontiguous geographic region. This is the type of colonization represented by western European movement to the New World. The second type is *internal colonization*, in which population movement is into parts of a group's own territory that are not currently occupied, or into adjacent territory that is controlled by a different nation or group. In both the prehistoric and historic periods of occupation in the Ojo Caliente Valley, movement into that area represented internal colonization—the Ojo Caliente Valley was either within the territory controlled by the colonizing group or adjacent to their territory and considered to be open for settlement. At this rather gross level, both periods of settlement are similar in nature, but they differed considerably in specifics.

Frontiers can take many different forms and mean different things to different cultures. Billington (1963:25) defines a frontier as "a geographic region adjacent to the unsettled portions of the continent in which a low man-land ratio and unusually abundant, unexploited, natural resources provide an exceptional opportunity for social and economic betterment to the small-propertied individual." By this definition, movement onto a frontier is an economic process, where individuals who lack wealth seek a chance to improve their economic situation. A frontier is also "the process through which the socioeconomic-political experiences and standards of individuals were altered by an environment where a low man-land ratio and the presence of untapped natural resources provided an unusual opportunity for individual self-advancement" (Billington 1963:25). Steffen (1980) distinguishes between farming and expeditionary (mining and ranching) frontiers. While movement onto a farming frontier results in value transformations, this does not occur with movement onto expeditionary frontiers because they remain closely linked to the mainstream culture (Steffen 1980).

These views of frontiers can be applied to the Spanish colonization of New Mexico and the subsequent expansion of their settlements into areas that were not previously occupied, but they make little sense when the prehistoric occupation of the region is considered. Most discussions of frontiers are historical rather than anthropological in focus and tend to stress processes that can be observed in Western colonizing groups and rarely look at the effects of colonization on the indigenous, usually nonliterate population. But colonization affects both the settlers and the indigenous population, and frontier studies rarely detail both sides of the story (Waselkov and Paul 1981). Frontiers also occur among groups who left no written records that can be used to interpret how those frontiers formed and were used, and how that use affected their sociocultural and economic systems.

Thus, while there was usually an economic aspect to frontiers, as Billington's (1963) definition suggests, the form and meaning of frontiers can vary greatly. The simplest definition of a frontier is the zone that separates two disparate populations. When those populations are at the same economic, technological, and sociocultural level, the frontier between them might be very formal and carefully controlled. Thus, the frontiers between most modern nations tend to be distinctly defined borders that present obstacles to unrestricted population movement and economic transactions. This is also the form taken, historically, by the frontier between the United States and New Spain, in which the latter carefully limited emigration and trade to restrict foreign influences and protect trade monopolies. The frontiers between these nations and neighboring Indian tribes took a more traditional form that were attractive for the economic opportunities they represented, which could be exploited because of the "cultural superiority" of the Western nations who "owned" those lands but did not yet occupy them.

Frontiers between tribally organized groups can be very different from those that separate centrally organized nations from one another or from less centrally organized groups. For instance, the frontier between two pueblos may take the form of a "no-man's land." Under normal circumstances, this type of frontier might be available to both groups to use for temporary economic exploitation but remain free from settlement to prevent conflict between the groups, or simply because settling that zone would be too difficult or expensive. At other times, frontiers might simply have been areas that were not currently amenable to farming and so were left unsettled but were used to exploit other resources that they contained.

The Prehistoric Pueblo Frontier

There is no evidence of occupation of the Chama–Ojo Caliente Valleys by sedentary farmers before the Coalition period. The region was sporadically used by hunter-gatherers before that time, but there were no full-time residents. Movement into the region may have begun as early as the thirteenth century in the Rio del Oso (Anschuetz 1998). This date is based on the presence of large amounts of Santa Fe Black-on-white at Maestas Pueblo (LA 90844) and AR-03-10-06-1230 (Anschuetz 1998). However, farmers probably did not spread throughout the region until the early 1300s, as demonstrated by tree-ring dates from Palisade and Riana Ruins (Peckham 1981; Stallings 1937a). The few villages known from the Coalition period are medium-sized to fairly large, ranging from 24 rooms at Riana Ruin to between 100 and 200 rooms at Leafwater Pueblo, Maestas Pueblo, and AR-03-10-06-1230 in the Chama Valley and Rio del Oso (Anschuetz 1998; Hibben 1937; Luebben 1953). Though dwarfed by the much larger villages of the Classic period, these Coalition period villages argue for the presence of a fairly sizable fourteenth-century population. No single-component Coalition period villages have as yet been identified in the Ojo Caliente Valley, but many of the large Classic period villages in the region are underlain by late Coalition period remains including (at least) Te'ewi, Tsama, and Sapawe in the Rio Chama drainage, and Ponsipa'akeri and Hupobi in the Ojo Caliente Valley.

Thus, Pueblo occupation of the Ojo Caliente Valley probably began in the Coalition period. The lack of Coalition period pottery in our sample from Hilltop Pueblo may indicate that it was not built until the Early Classic period. Similarly, the atypical location of the nearby village of Nute could also indicate a strictly Classic period occupation, but this conclusion remains tentative because of the lack of investigations there.

The Chama–Ojo Caliente Valleys as an Internal Frontier

The Chama–Ojo Caliente Valleys may have acted as a safety valve for the population of the Northern Rio Grande during the late Coalition and Classic periods. Crown et al. (1996:195) note that there was a population explosion on the Pajarito Plateau during the late Coalition period that may have been the result of emigration. This influx probably reflects the general exodus from the San Juan region in the late 1200s and early 1300s, and movement of that population into adjacent regions. As new people emigrated into the Northern Rio Grande, they came into conflict with the indigenous inhabitants. On the Pajarito Plateau this eventually culminated in a dividing line between the Keres and Tewas—by tradition at Frijoles Canyon—the former to the south and the latter to the north. Crown et al. (1996) note that Coalition period population increase and aggregation were more marked in the northern Pajarito Plateau. During the Early Classic period there was a decrease in the population of the northern Pajarito Plateau, while population aggregation reached a peak in the southern Pajarito Plateau during that period (Crown et al. 1996:196).

Though Crown et al. (1996:196) attribute these trends to a partial population shift from the northern to the southern Pajarito Plateau, this makes little sense when the potential for ethnic conflict is considered. Why would Tewas from the northern plateau move in with Keres on the southern plateau, especially when there is plenty of evidence for competition, perhaps violent, between these groups? The continuing population buildup on the southern Pajarito Plateau is probably more attributable to the persistent movement of San Juan peoples into the region. Population loss on the northern Pajarito Plateau undoubtedly resulted from movement into the Ojo Caliente–Chama Valleys, accounting for both the population decline in the former and the appearance of numerous large villages in the latter.

Northern Rio Grande peoples began moving onto the Pajarito Plateau by at least the early Coalition period. This represented movement of a sedentary population into an unoccupied frontier zone, probably for economic reasons. Refugees from the San Juan seem to have been drawn to the Pajarito Plateau for similar reasons, but they were moving onto a different type of frontier—an area that was already sparsely occupied by an unrelated population that may not have been as well organized as they were. Initially, the region seems to have been shared with a minimum of strife. Conflicts over available resources eventually occurred as San Juan peoples continued to move into the region, culminating in the development of a boundary between the Keres and Tewas—a zone that separated the competing groups and probably limited access to the resource zones controlled by each.

During much of the Pueblo period, the Ojo Caliente–Chama Valleys were a convenient frontier for the Tewas. However, this region was not a traditional frontier like the one that separated the Keres from the Tewas on the Pajarito Plateau. Instead, it was an internal frontier, similar to those identified in parts of Africa. The African internal frontier "consists of politically open areas nestling between organized societies but 'internal' to the larger regions in which they are found" (Kopytoff 1987:9). Schlegel (1992:377) feels that this concept may be applicable to the prehistoric and early historic Pueblo inhabitants of the northern Southwest, and she tests this possibility by applying it to the Hopis of northeast Arizona. Africa and the prehistoric Southwest shared an attribute that predisposed them to similar social adaptations: large unsettled expanses of land between and adjacent to occupied zones were open to settlement and within colonizing distance of those occupied zones (Schlegel 1992:378). Internal frontiers are dynamic, especially those defined in Africa, and occur between organized societies rather than at their edges (Kopytoff 1987:9). New settlements in these zones are usually formed by groups of people rather than individuals. Fissioning can be for political, social, or economic reasons, and frontier settlements that survive without being reabsorbed or conquered may develop into a new nation or village. While the Hopi and African examples share several characteristics, they are also quite different, suggesting that this is a complex process that can assume many forms.

Schlegel (1992) discusses several features common to groups moving onto internal frontiers in Africa and Hopi, based on Kopytoff's (1987) model: (1) movement in groups; (2) social integration through kinship; (3) ranking according to the order of arrival; (4) shared backgrounds; and (5) the weak hold of authority (Schlegel 1992:388). In both areas, movement into internal frontiers appears to have been in groups who were integrated with other immigrants through kinship. Ranking was done in order of arrival in the origin stories, though groups may not have actually arrived in that specific order. Rather, this was a way to legitimize the ranking of groups with little real social differentiation. Most immigrants probably had shared backgrounds, having come from neighboring populations. Finally, the political heirarchy that developed under these conditions was weak, with little or no coersive power.

As noted above, movement into an internal frontier may take many different forms and probably varied from one area or group to another, sometimes radically. Not all of the features that Schlegel (1992) defined as common to groups moving into an internal frontier in Africa and Hopi can be evaluated for the prehistoric occupation of the Ojo Caliente Valley. For example, we cannot evaluate the prehistoric ranking of groups in villages, nor can we estimate the strength of the prehistoric political heirarchy from currently available data. However, we can look for some of these features in oral tradition and archaeological data.

Oral traditions can be used to suggest how different groups were integrated in a single village by the Tewas. Hopi oral traditions recognize the disparate origins of their various clans and clan groupings, essentially linking them to nearly all other parts of the Southwest. This is not the case with the Tewas, whose oral traditions see them as originating as a single group, splitting for the journey south, and then once again rejoining to form the modern Tewa population. Like that of the Hopis, the Tewa origin story suggests that different groups were integrated through the kinship system when they joined to form larger villages. In this case, that integration becomes the joining of the Summer and Winter people, and the assigning of various roles in the ritual and political heirarchy to each.

Archaeological information also sheds some light on this process. Using Palisade Ruin as a likely example of how frontier movement worked, new villages seem to have been founded by small groups of people living in shallow pit structures. They were soon joined by other people, and together they built a small planned village that continued to grow by accretion as more people continued to move into the village after the initial construction episode (Beal 1987). Some of these early, small Coalition period villages—Palisade and Riana in particular—failed fairly quickly, and their surviving residents either left the area or, as is more likely, joined another community. Some of the more successful villages attained a fairly large size, but eventually they also failed and were abandoned—for example, Leafwater, Maestas Pueblo, and Tsiping. A few villages were more successful, eventually growing into the large Classic period villages that are considered ancestral by the modern Tewas. This follows the models of movement onto internal frontiers discussed above. Some of the new villages founded in the frontier zone failed and were abandoned, while others survived. The populations of the failed villages may have been reabsorbed by the populations they were originally derived from, though they more likely simply joined another, more successful frontier village. The surviving villages grew into large, probably independent population centers.

Thus, several of the features discussed by Schlegel (1992) are visible in the admittedly insufficient archaeological record of the Chama–Ojo Caliente Valleys. Movement into the region appears to have been in groups rather than by individuals. Integration of those groups was undoubtedly accomplished through kinship ties. Culturally, the immigrants all appear to have had a common origin; indeed, in this case nearly all were probably members of the same linguistic and sociocultural community. How group ranking was accomplished is uncertain, though aspects of the origin story suggest that some differentiation was made between the people that were already in place and those who joined them. This suggests that movement into the study area was mostly consistent with models of emigration into an internal frontier.

But why do we define the Chama–Ojo Caliente Valleys as an internal frontier rather than another type of frontier? The distribution of tool types on Archaic sites documented in the Chama Valley suggests a differential pattern of seasonal use and exploitation from one end of the valley to the other (Anschuetz et al. 1985). This type of use appears to have continued through the Developmental period and into the early Coalition period (Anschuetz et al. 1985). Whether this indicates that the Chama–Ojo Caliente Valleys contained hunter-gatherers marginal to the Pueblo population living further to the south, or represented a zone exploited for its wild plant and animal resources by those Pueblos is unclear. Since the presence of late hunter-gatherers in the region remains undemonstrated, the latter possibility is more plausible at this time. Thus, we feel that the Chama–Ojo Caliente Valleys represented a zone that was exploited by the Pueblo occupants of the Northern Rio Grande but remained unsettled until necessitated by population pressure and/or allowed by climatic amelioration or advancements in farming technology. Since they were already part of the region used for subsistence by the Northern Rio Grande Pueblos, the Chama–Ojo Caliente Valleys represented an internal frontier.

A Model of Pueblo Movement into the Chama–Ojo Caliente Valleys

Three factors—population pressure, climatic amelioration, and advances in farming technology—may have led to the spread of Pueblo farmers into the Chama–Ojo Caliente Valleys. As discussed in Chapter 2, climatic reconstructions of this region suggest that precipitation levels were generally good for farming through much of the fourteenth century. In particular, all three climatic reconstructions discussed in that chapter indicate that the fourteenth century opened with fairly good precipitation levels, and that average or above-average precipitation prevailed into the mid to late 1330s (Maxwell 2000; Orcutt 1999a; Rose et al. 1981). Though precipitation levels during the rest of the fourteenth century varied quite a bit around the mean, the stage was set for population movement into the region.

As noted earlier, the Coalition period was marked by the movement of San Juan peoples into the Northern Rio Grande. This process is especially apparent on the Pajarito Plateau. Though there is no clear demarcation between competing populations in that area until the Classic period, by the late Coalition period there was a large-scale influx of population, which eventually culminated in an ethnic dividing line around Frijoles Canyon that was remembered by the historic Pueblos long after the Pajarito Plateau was abandoned. As people moved in from the south and west, the earlier occupants of the southern Pajarito Plateau were absorbed or, more likely, displaced. Needing a new place to live, many of these people probably emigrated into the Chama–Ojo Caliente Valleys, which were not densely populated at that time. At the same time, there appears to have been a new development in agricultural technology that expanded the range of acceptable farmlands. The earliest documented gravel-mulched fields are currently in the Rio del Oso Valley, where the Coalition period population first seems to have used this technological advance. Thus, by the early 1300s, the Pueblo occupants of the Northern Rio Grande were in need of new lands on which to live and farm. Most of the Chama–Ojo Caliente Valleys were previously unoccupied by sedentary farmers, but they were known to the occupants of the Northern Rio Grande, who sporadically exploited them for resources. Population pressure on the Pajarito Plateau provided the impetus for moving into this region, and that movement was facilitated by favorable precipitation levels and improvements in farming technology that allowed more efficient use of dry-farmed fields.

Numerous small- to medium-sized Coalition period villages probably acted as magnets for other occupants of the Northern Rio Grande during the Early Classic period, providing an outlet for excess population from the northern Pajarito Plateau as well as other areas that were now in conflict with San Juan peoples moving into the region. Since all of the large Classic period villages in the Chama–Ojo Caliente Valleys are considered ancestral by the Tewas, and their ceramic assemblages are dominated by biscuit wares, San Juan peoples never seem to have gained a foothold in that region.

The Transition of an Internal Frontier into Part of the Core

The Chama–Ojo Caliente Valleys seem to have made the transition from a frontier settlement area to part of the population core fairly rapidly. However, the speed of its development as a locus of ritual importance remains uncertain. This process may have been similarly rapid, or it could have taken somewhat more time. At least 14 large villages were occupied in the Chama–Ojo Caliente Valleys during the Classic period, most of which seem to have grown out of smaller Coalition period settlements. Some of these villages were quite sizable—for example, the village of Sapawe in the El Rito Valley (a tributary of the Rio Chama) is the largest known adobe village in New Mexico (Cordell 1978:52).

The Chama–Ojo Caliente Valleys seem to have rapidly become a center of Tewa settlement during the Classic period, perhaps containing a larger population than either the Pajarito Plateau or the Tewa Basin. While settlement of this region can be viewed as movement into an internal frontier, it also represents an expansion of the population and economic core. There is no evidence of attenuated contact between the Chama–Ojo Caliente region and the original core in the Tewa Basin, as might be expected on a classic farming frontier (Steffen 1980). Nor is there any evidence of a loss of sociocultural complexity due to a reduction in contact between frontier and core, as often occurs in the classic examples of this process (Doolittle 1973; Lewis 1973, 1977). Thus, this internal frontier seems to have made a fairly rapid transition into part of the core without suffering some of the sociocultural losses that are common in frontier settings.

The Ojo Caliente Valley also assumed quite a bit of ritual significance during its Pueblo occupation. The hot springs that give the valley its name are in the valley bottom on the west side of the Rio Ojo Caliente. Today they are the centerpiece of a resort, but to the Tewas they are a shrine of great importance, with significant connections to Poseyemu, the Tewa culture hero (Harrington 1916:164; Hewett and Dutton 1945:40). Morley (1910a:18–19) was told by residents of San Juan Pueblo that Poseyemu was born at the village of Howiri in the Ojo Caliente Valley, and people from Santa Clara, San Ildefonso, and Nambe agreed that Poseyemu lived in the vicinity of the historic village of Ojo Caliente. As noted in Chapter 24, Poseyemu is said to have occasionally entered the hot springs when he lived in the Ojo Caliente area. The spring is thought to be the home of his grandmother, and Poseyemu comes to visit her once a year (Harrington 1916:164). People at San Juan Pueblo told Harrington (1916:164) that the Tewas still drank water from the hot springs in the early twentieth century and, presumably, had done so in the past. Clearly the association of a major supernatural figure with the Ojo Caliente Valley is indicative of the ritual importance of this area to the modern Tewas, and to the Classic period Tewas as well.

Indeed, the Tewa name for the Ojo Caliente area refers to the sacred hot springs "from which the Tewa claim that they originally came" (Harrington 1916:165). Thus, even though there is no evidence of a sedentary Pueblo population in the Chama–Ojo Caliente Valleys before the Coalition period, that area is considered to be where the Tewas ended their southward journey after their emergence into this world.

This brings us to the prehistoric sites investigated during this project, and in particular the trail (LA 118549) and apparently related features adjacent to it but included as parts of farming sites. In our discussion of this site in Chapter 24, we noted that LA 118549 seems to have served two purposes: a pedestrian corridor and a ritual corridor. Evidence of use of the trail as a pedestrian corridor takes two forms: its articulation with large Classic period villages, and its connection to farming sites. LA 118549 passes two large Classic period villages on the east edge of the Ojo Caliente Valley: Ponsipa'akeri and Nute/Hilltop Pueblo. The trail passes Ponsipa'akeri on the terrace slope below that village and is connected to the village by two smaller paths that were documented by Bugé (1978). It may be significant that the trail does not ascend to the terrace top at Ponsipa'akeri. Had the trail passed through Ponsipa'akeri, the village might have been able to exert some control over traffic along that segment. The significance of the trail bypassing the village may have been in its common ownership and access. The trail belonged to everybody and nobody at the same time, and the access it provided to villages, fields, and ritually significant areas remained unobstructed.

LA 118549 also passes Nute and Hilltop Pueblo and does not directly articulate with either, instead passing between them. Rather than passing directly below Hilltop Pueblo on the terrace slope, the trail descended to the valley floor before it got to that village. Unfortunately, the route of the trail is lost between the point at which it reached the valley floor and where it next ascended the terrace slope on the north side of Arroyo de Gavilan, beyond Nute/Hilltop Pueblo. In bypassing both villages, this segment of the trail belonged to neither. The atypical descent onto the valley floor may have been meant to route the trail at an equal distance from the two villages, thereby ascribing no greater level of importance to either. If so, then by extension, both villages were occupied when the trail was initially built.

A second aspect of the route taken by LA 118549 probably related to land tenure patterns. No evidence of farming features has been found on the terrace slope traversed by the trail. Thus, that slope probably represented common lands that were not amenable to farming and were open to all for use. The valley bottom and terrace top on either side of the trail were probably held by various corporate groups belonging to local villages, and to route a trail through either of those zones would have meant traversing farmlands, both areas that were used as fields and areas that were not currently being used but could potentially be brought under cultivation. In either case, someone would most likely have objected. Routing the trail along the terrace slope was probably a good compromise—that area was unowned common land and unlikely to ever be used for farming. Bypassing occupied villages along the route taken by the trail kept outsiders from intruding on the private lives of those villages as well as preventing villagers from exerting control over traffic along the trail.

The trail did not directly articulate with the farming sites above it on the gravel terrace that forms the east edge of the Ojo Caliente Valley. Only four locations were noted where the trail ascended the slope to the top of the terrace—at LA 105705, LA 105707, LA 105708, and LA 105709. However, the configuration of the trail in those areas suggested that its main function was not to provide access to fields. Indeed, more ephemeral paths leading up to LA 105705 and LA 118547 from the trail may be examples of how foot traffic more commonly accessed fields. In all four locations where LA 118549 ascended to the top of the terrace, the downslope edge of the trail was bermed. Shrines were identified in two of these locations—an earth navel at LA 105709 and an elaborate borrow pit at LA 105708 that appears to have been modified into a ritually significant feature, unlike any others seen in the project area. No definite shrine was identified near the trail at LA 105705, though a possible ritually significant feature was noted there. This was Feature 12, which could have been a materials stockpile or a cobble pavement. If the latter is correct, then shrines were found at three of the locations where LA 118549 ascended to the terrace top. No shrine or other ritually significant feature was found adjacent to the trail at LA 105707, but this is not surprising because most Pueblo shrines are understated and inconspicuous (Swentzell 1997). In addition, the area directly adjacent to the section of trail that crosses the terrace top at LA 105707 was removed during an earlier highway construction episode, undoubtedly erasing any ritually significant feature that may have originally been there.

In two cases where the trail ascends to the terrace top adjacent to ritual features (LA 105708 and LA 105709), the berm along the outside edge of the path is to the south of those features. Berms may have been built through these areas as visual clues to inform travelers that they were approaching a location of ritual importance. If so, this suggests that the proper direction for pilgrims to travel along the path was south-to-north. As was the case with the villages noted earlier, the trail did not directly access these features, maintaining a degree of separation between the shrines and the pedestrian corridor. This was probably due to the dual nature of the trail, allowing it to function as a travel corridor for those who were not visiting the shrines and may not have been highly initiated enough to know their true significance, yet permit ready access to those who were.

The berm was configured somewhat differently at LA 105705, beginning as the trail approached the terrace top from the south, continuing across the terrace top, and extending downslope for a short distance as the trail began to descend the slope. However, the berm was much taller and more conspicuous on the southern approach at LA 105705, and the trail was wider through that area. This again suggests that the approach to the terrace top from the south may have been marked to indicate the proximity of a ritually important location. The segment of trail at LA 105707 seems to have originally been configured similarly to the segments at the other three sites, but damage from earlier construction episodes along U.S. 285 obscured the southern approach in that area. In this case, the section of trail that ascended the terrace slope from the south was gone, and the trail began near the terrace top, directly adjacent to the existing roadcut. A berm remained along the downslope side of the segment of trail that crossed the terrace top, disappearing as it began to descend the slope. Again, this suggests that the berm was built as a visual clue to northbound traffic that they were approaching a ritually important location.

Unfortunately, historic activities in and around the village of Ojo Caliente have eradicated any evidence of the trail north of LA 105713. Did it continue farther up the valley, or did it cross over the river to the hot springs below Posi'ouinge? The answer may never be known, though Bandelier (Lange et al. 1975:86) noted the presence of an "old trail" leading to a Pueblo village that was probably Posi'ouinge. Since LA

118549 seems to have served as a pedestrian corridor in addition to its ritual use, it probably continued up-canyon at least as far north as Howiri, joining all the villages on the east side of the Ojo Caliente Valley together. Most likely, a spur of the trail crossed the river and led to the hot springs, and perhaps Posi'ouinge, but this, too, must remain supposition. However, the ethnographic evidence presented earlier in this section on the sacred nature and use of the hot springs suggest that this is likely. Pilgrims from villages in the Tewa Basin may have stopped at several ritually significant locations on their journey to the sacred hot springs, including the two probable shrines identified along the trail as well as others that remain undefined.

If these suppositions are correct, then locations in the Ojo Caliente Valley could have assumed ritual importance at a fairly early date in the occupation of that area. Indeed, places like the hot springs may have been considered sacred even before farmers settled the valley, since there is evidence of sporadic Pueblo use of the region before the Coalition period (summarized in Maxwell 2000). Coalition period remains have been found in the lowest excavated levels at Ponsipa'akeri (Bugé 1978), so that village was founded during the earliest period of Pueblo occupation in the Ojo Caliente Valley. Fallon (1987:12) notes that Stallings (1937b) collected tree-ring samples from Hupobi dating between A.D. 1271 and 1367, though sample quality was poor. These dates suggest that Hupobi was also founded during the Coalition period. While it is likely that the other large villages in the valley (Posi'ouinge, Nute, and Howiri) were initially founded at about the same time, this has not yet been demonstrated.

Providing an initial date for the trail might give us an idea of when ritual features in the Ojo Caliente Valley assumed a general and widespread importance, drawing pilgrims from other population centers. It may also provide an idea of when the region became part of the core rather than an internal frontier. Did these events happen at a fairly early date in the farming occupation of the region, or did they develop over time? Did both occur at the same time, or were they sequential?

Good temporal control over the founding dates for villages adjacent to the trail might help determine just how early that corridor could have become formalized. Unfortunately, those dates are not available. As we noted earlier, Bugé (1978) encountered evidence of a Coalition period occupation at Ponsipa'akeri, and Beal (1987) suggests a similarly early founding date for Hupobi. Thus, we assume that Pueblo people began settling the Ojo Caliente Valley in the Coalition period, perhaps as early as the late 1200s, and certainly by the early 1300s. By extension, we can hypothesize that most of the large Classic period villages in the valley began as small Coalition period villages. Unfortunately, we cannot prove this point, and knowing when these villages were first settled is critical to our discussion.

If all of the large villages on the east side of the Ojo Caliente Valley developed out of a Coalition period occupation, then we might be able to argue a greater antiquity for the trail. However, if some of these villages instead reflect a Classic period inception, then the trail may have been built at a later date. The only temporal information generated by this study for the large villages in the region came from Hilltop Pueblo, but we unfortunately remain uncertain about the occupational dates for that village. In Chapter 6, Boyer suggests that radiocarbon dates recovered by this study indicate that Hilltop Pueblo was occupied in the Early Classic period and abandoned by ca. A.D. 1420. In Chapter 19, Wilson suggests a *late* Classic period affinity for the ceramic assemblage recovered from Hilltop Pueblo, though noting a possible range between ca. A.D. 1400 and 1550–1600. Without further excavation, this potential conflict cannot be resolved.

No sherds that predate the Classic period were recovered from Hilltop Pueblo, though it must be remembered that our pottery sample was not large. Thus, there currently is no reason to suppose that Hilltop Pueblo was initially founded during the Coalition period. As discussed earlier, Nute is the only large village in the Ojo Caliente Valley that is in the valley bottom, not on a mesa or terrace top. Could this indicate a wholly Classic period occupation? Because Nute is so poorly documented, we don't know.

Unfortunately, there is no way to accurately date a trail except by its association with residential sites and other features found along it. We have made several suppositions concerning the temporal relationship between the trail and the villages and features found along it. The fact that the trail primarily traverses the slope between the top of a gravel terrace and the valley bottom suggests that the land tenure system had already parceled out all of the arable land in the valley by the time the trail was built, restricting the potential routes that could be taken by a pedestrian corridor. This suggests that the villages and fields were present, in some form, when the trail developed. To summarize our discussion of the villages to this point, Ponsipa'akeri was initially founded during the Coalition period, Nute may have been founded at a similarly early date, though this is questionable, and Hilltop Pueblo was probably founded sometime during the Classic period.

The fields examined during this study all seem to have been built and used during the Classic period. In Chapter 19, Wilson concludes that the distribution of pottery types at the farming sites indicates they were used during the late part of this period, ca. A.D. 1450–1550. This was supported by excavational data from four sites, which also suggest that these fields were built and used during the Late Classic period (see Chapter 23). The beginning of this period coincided with a 30+ year interval of drought in the Northern Rio Grande (Maxwell 2000; Orcutt 1999a; Rose et al. 1981). Many, if not all, of these fields may have been built in response to the low precipitation levels that prevailed during that time. If these suppositions are correct, the top of the terrace that forms the east edge of the Ojo Caliente Valley may not have been extensively used for farming until the mid-1400s. Presumably, fields were built along the terrace edge to supplement those that already existed in the valley bottom. Most of the terrace top may have been considered common land before this time, except for locations amenable to dry farming within and along intermittent streams.

Taken together, these data suggest that formalization of the pedestrian corridor along the east edge of the Ojo Caliente Valley may not have occurred until the middle or late Classic period. All three villages that the trail bypasses were in existence by that time, as were the fields that rim the terrace edge. Though we can provide no date for the earth navel shrine at LA 105709, the elaborate borrow pit at LA 105708 that may have functioned as a shrine probably did not exist before construction of the adjacent fields. Currently available data suggest that this is the best time frame for construction of the trail, and some effort was certainly put into building and maintaining this corridor, considering that the trail was cleared of rocks and berms were built along approaches to ritual locations on top of the terrace.

This analysis indicates that development of the Chama–Ojo Caliente Valleys as part of the population core probably occurred before the area became a location of general ritual significance. If LA 118549 was used as a formal route for pilgrimages to ritually significant locations in the Ojo Caliente Valley, it probably wasn't built until fairly late in the Pueblo occupation. Thus, the Chama–Ojo Caliente Valleys first represented an internal frontier that was exploited for resources but remained unsettled. Population pressure caused by the movement of San Juan peoples into the Northern Rio Grande may have created the first impetus toward settlement of the Chama–Ojo Caliente Valleys, and that settlement may have been made possible by climatic amelioration and advances in farming technology that permitted sedentary farming villages to form in the region. Some of the villages founded during the early settlement period failed, while others succeeded. Continuing population movement off the northern Pajarito Plateau and, at least in part, into the Chama–Ojo Caliente Valleys caused the successful villages to continue growing until they became some of the largest pueblos in the Northern Rio Grande. This process transformed the region from a frontier into part of the population core and seems to have occurred fairly rapidly, with no apparent loss of sociocultural complexity. Eventually, the hot springs assumed a pan-Tewa importance, perhaps becoming the terminus of formal pilgrimages.

Ethnographic studies and Pueblo stories show that the Ojo Caliente hot springs were accorded this level of importance. Harrington (1916:164) refers to the hot springs as "one of the most sacred places known to the Tewa," as do Hewett and Dutton (1945:40). Ortiz (1969:16) notes that the Tewa origin story says that Posi'ouinge was founded when the two groups of Tewas, who had split soon after their emergence, rejoined there to form a new village. Thus, Posi'ouinge is (at least now) considered to be the first complete Tewa village. Poseyemu is associated with Posi'ouinge as well as the nearby villages of Hupobi and Howiri, and various Tewa stories associate him with other locations in the Ojo Caliente Valley as well. Grant (1925:123–126) presents a previously unpublished version of the Poseyemu story by Adolph Bandelier that was collected from the principal ritual leaders at San Juan Pueblo. This version stresses the importance of Posi'ouinge, which is attributed to its control over the sacred hot springs. In this account Poseyemu was born at Posi'ouinge and became its ritual leader. After bringing great prosperity to the village, he eventually left, at which point Posi'ouinge fell into decline and was abandoned.

Ponds and lakes, sacred in the Tewa religion, represent openings between this world and the underworld (Harrington 1916:164). Indeed, all waters are considered to be connected in Pueblo religion (Parsons 1939; Stevenson 1906). Though the Tewa place of emergence is considered to be a small lake in southeast Colorado, Harrington (1916:165) notes that the name "Posi'i'i" refers to the whole region around the Ojo Caliente hot springs, "from which the Tewa claim that they originally came." Hewett and Dutton (1945:39) state that the Tewas considered the area around Ojo Caliente to have been "the cradleland of their people." These statements can be interpreted in two ways. The Tewa origin story says that the village where the Summer and Winter people rejoined after their long journey south was Posi'ouinge (Ortiz 1969). Thus, Harrington's informant may simply have been referring to the area where the Tewas feel they originated as a complete group.

However, there is another, more esoteric interpretation of this statement that takes into account the principle of substitution, an important aspect of Pueblo religion (Parsons 1939). Substitutes will be found to replace an important religious society when it dies out, and for ritual materials when they are not available, and locations near villages may be substituted for distant shrines to preclude having to make a pilgrimage to the actual shrine location. As Parsons (1939:1148) notes, "The place of emergence in Zuni tradition was too far away for pilgrimage, so Kachina town was established within easy distance, for men and kachina. Similarly, to preclude having to make a trip to a distant shrine, Hopi will call a shrine near town by the name of the far shrine."

Ellis (1994:104) suggests, from conversations with Pueblo elders, that such a substitution only occurs when the group has moved a long distance from its former home. Thus, distance is an important principle in shrine substitution, with nearby ritual locales acting as proxies for the faraway originals. This type of substitution may be visible in Ortiz's (1969:140–141) discussion of the Tewas' sacred mountain of the north. Currently, this is Canjilon Peak, but earlier studies (Harrington 1916; Hewett 1930) recognized San Antonio Peak, 80 km farther north, as the sacred mountain of that direction. Canjilon Peak probably represents a twentieth-century substitute for San Antonio Peak, necessitated by distance and difficulty of access.

In many cases, substitution may not be the best way to refer to this principle. The substitution of Canjilon Peak for San Antonio Peak may be an actual replacement of one location of ritual significance for another. If so, then memory of San Antonio Peak as the original (or earlier) mountain of the north will disappear. Rather than a substitution, this would be a replacement that was perhaps occasioned by a shrinking of the Tewa world. Though the sacred mountain of the north is important in Tewa religion, it is also a boundary marker that may have been movable depending on distance, access, and danger or hardship involved in traveling there. In other cases where an actual replacement is not occasioned, *surrogate* may be a better term than *substitution*. For example, Kachina Town may have acted as a surrogate for the Zuni place of emergence, rather than replacing it. The important principal here is that the surrogate does not replace the original location of ritual importance, it simply acts in its place, and in doing so essentially becomes that original location when necessary.

This discussion of the principle of surrogacy in Pueblo religion combined with the extreme importance of the hot springs at Ojo Caliente in Tewa stories and religion suggest a possible reason for that importance. A pilgrimage to the Tewa lake of emergence in southeast Colorado would have been long and arduous, and probably was not undertaken very often. The Ojo Caliente hot springs may have been a convenient surrogate, and that surrogacy could be responsible for the statements mentioned above that consider the hot springs to be the place where the Tewas originated. Formal pilgrimages could be made more easily to a location in the Tewa core, and such a surrogacy represented a valid religious principle.

An interesting adjunct to the idea of surrogacy is the proper direction of pilgrimage along the trail. As discussed earlier, berms occurred along the southern approaches to ritually significant locales where the trail ascended to the top of the terrace, suggesting that the proper direction of ritual travel was south to north. A pilgrimage to the lake of emergence would also have been from south to north, so it is feasible that the direction of travel along the trail was part of the surrogacy, acting as a proxy for the actual long, arduous journey.

Surrogate ritual locations may be very important in Tewa ritual life. Swentzell (1988:15) indicates that Tewa plazas contain *nansipu*, or symbolic emergence holes that connect the underworld with the sky and all that lies in between. The plaza itself is "at the intersection of the horizontal and vertical regions of the physical and symbolic Pueblo universe" (Swentzell 1988:15). The creative energy of the universe flows out of the nansipu into the plaza, giving life to the physical, social, and religious community (Swentzell 1988:15–16). At a symbolic level, the hot springs at Ojo Caliente may have represented the ultimate nansipu, the center of the Tewa world rather than simply a single village, acting as a surrogate for the place of emergence directly adjacent to the first complete Tewa village. As such, it would have symbolically become where the Tewas originated.

The use of the hot springs as a surrogate for the actual lake of emergence would account for the highly sacred nature of the springs and the Ojo Caliente area in general. It would also account for the close association of a major Tewa deity with villages in the Ojo Caliente Valley, and the hot springs in particular. In any case, the formal nature of the trail (LA 118549), especially when it approaches the terrace top near probable shrines, and the fact that it does not directly articulate with any of the Classic period villages or fields that it passes, argue for a dual function as both a pedestrian and a ritual corridor. With the admittedly hazy date that can be assigned to this landscape feature, we can suggest that the Ojo Caliente Valley attained ritual importance in the Classic period, after the area had ceased being on the Tewa frontier and had become part of the population and sociocultural core.

The Historic Spanish Frontier

A Theoretical Perspective

Most frontier studies focus on post-medieval western European nations and their colonies throughout the world. This provides us with a somewhat firmer and better established theoretical platform for dealing with the historic period in New Mexico. But to simply focus on New Mexico would be to ignore the critical relationship between frontier and core, because the form taken by a frontier is based on its relationship with the core. Different levels of communication and different expectations result in different types of frontiers.

Two main types of frontiers have been defined and are relevant to this discussion: *cosmopolitan frontiers* and *insular frontiers*. Cosmopolitan frontiers "are economically specialized and often short term with their success based largely on the colonial policy of the parent state. As a result of direct manipulation in the colony's activities, there is a low degree of insularity and no opportunity for indigenous development. Consequently, no fundamental alteration in economic, political, and social institutions and behavior patterns are likely to arise on cosmopolitan frontiers" (Lewis 1984:16). In contrast, insular frontiers "are economically diverse and long term in nature. Their success requires a more extensive adaptation to local conditions, causing links with the socioeconomic system of the homeland to become fewer and more indirect" (Lewis 1984:16–17).

Contrary to the term used to describe them, cosmopolitan frontiers do not connote high population levels or industrial development. Rather, cosmopolitan frontiers represent areas of limited resource-extractive activities that remain almost completely economically dependent on the core.

Types of cosmopolitan frontiers that have been defined and discussed in the literature include military, industrial, exploitative plantation, ranching, trading, and transportation (Lewis 1984). Insular frontiers represent areas of permanent settlement with limited or attenuated contact with the core that are not completely economically dependent on the core. For the most part, insular frontiers are agricultural or farming frontiers.

The two main differences between cosmopolitan and insular frontiers are their duration and level of contact with the core. Insular frontiers tend to last much longer than do cosmopolitan frontiers, but they also have a much lower level of political, economic, and social contact with the core. Where fundamental social, economic, and political change is possible on an insular frontier, much closer ties to the core tend to prevent these types of changes from occurring on cosmopolitan frontiers (Lewis 1985:253).

Cosmopolitan frontiers are often, but not always, replaced by insular frontiers. In some instances, especially in areas lying beyond the zone of effective agricultural production, cosmopolitan frontiers may be long-term and remain unreplaced by insular frontiers (Lewis 1984:270). Frontiers also tend not to be static but undergo change as the economic focus and strength of interaction with the core vary. For example, Steffen (1980) defines the colonial Appalachian frontier as an insular frontier as long as the focus of agriculture was family-oriented self-sufficiency. As communication improved between the core and the Appalachian frontier, agricultural production became market-driven, and the form of the frontier was transformed (Steffen 1980:23–25). But transformed into what?

Using the concept of a world economy, as defined by Wallerstein (1974, 1980), Lewis (1984:14) notes,

> A world economy is composed of two basic parts based on the division of labor associated with production. The functional distinction is expressed geographically in the separation of the world economy into the core states of Europe at its center and peripheral areas at its boundaries. . . . The latter are distinguished as comprising “that geographic sector of (a world economy) wherein production is primarily of lower-ranking goods (that is goods whose labor is less well rewarded) but which is an integral part of the overall system of the division of labor, because the commodities involved are essential for daily use” (Wallerstein 1974:302). Exchange between peripheral areas and core states is characterized by a “vertical specialization” involving the movement of raw materials from the former to the latter and the movement of manufactures and services in the opposite direction.

Frontiers are a type of peripheral area, but all peripheral areas do not remain frontiers (Lewis 1984:297). Once a level of stable economic development is reached, a peripheral area is no longer a frontier, though not all frontiers reach this level (Lewis 1984:298). Insular frontier colonization begins the process of permanent occupation in a region and can ultimately lead to the achievement of core status in the world economy (Lewis 1984:298).

Another concept of relevance to this discussion, not as clearly presented, is that of *subfrontiers*. As Steffen (1980:232) notes,

> Whether early American development is viewed politically, economically, or socially, there are grounds for viewing it in terms of the frontier process, a process in which the pressures for change exerted by the New World environment are juxtaposed to the number of interacting links in existence between America and its Western European reference base. The interaction of the two forces constitutes a large and complex frontier process, a process which contains many subfrontiers represented by the themes just reviewed.

Thus, Steffen (1980:24) views the Appalachian frontier as a subfrontier of the more general American frontier.

To summarize the concepts examined in this discussion, the colonization of areas peripheral to economic cores results in two generalized types of frontiers: cosmopolitan and insular. Though cosmopolitan frontiers can be transformed into insular frontiers, this transformation does not necessarily always occur. Frontiers can eventually become an integral part of the peripheral area as a level of stable economic development is reached. Eventually, a peripheral area can become part of the economic core, though this does not always occur.

We now turn to a discussion of the New Mexican frontier in light of these ideas. However, it should be kept in mind that most of the preceding discussion developed out of examinations of the American frontier. Processes can certainly be different on the Spanish frontier, and in many instances were quite different because of different political policies.

The New Mexican Frontier

New Mexico was on various frontiers throughout its history. During the early Spanish Colonial period (1598–1680), the function of New Mexico as a frontier was mixed. Initially, settlers came to the province seeking economic opportunities, but those expectations were not satisfactorily fulfilled by what they found there. Rather than rich mines and wealthy Indian villages that could be easily exploited, they found a lack of mineral wealth that could be accessed at the level of technology available to them, and the Pueblo villages were certainly not wealthy in the Spanish sense of the term. Oñate's colony at San Gabriel was nearly destroyed by discontent and dissent, and for a time the Spanish government considered abandoning it (Espinosa 1988:8–9). The colony was saved when mass baptisms of Pueblo Indians and reports that many others were ready for baptism were used to argue for an alternative to economic colonization (Espinosa 1988:9). Thus, New Mexico became a missionizing frontier upon which the conversion of the indigenous population to Christianity was considered to be the main focus of Spanish settlement (Gutiérrez 1991:146).

In terms of our theoretical discussion, early Spanish Colonial period New Mexico was a cosmopolitan frontier primarily dependent on Mexico for nearly everything except basic food supplies to keep the colony going. The maintenance of New Mexico as a cosmopolitan frontier was political in nature, as was the maintenance of Mexico as a peripheral area to the economic core in Spain. Though Mexico was developing in the direction of the economic core, key industries were retained as monopolies by the Crown, most notably the production of steel. Thus, even though several industries developed in Mexico to fulfill local needs, for the most part that kingdom remained a locus of low-level production fulfilling the needs of the economic core. Political policy also kept New Mexico from developing into an insular frontier during this period by maintaining close economic, social, and political ties with the core.

In the official government and church view, the focus of settlement in New Mexico was the conversion of the Pueblos to Christianity. Since this type of frontier does not appear to have occurred elsewhere in North America, it has not previously been discussed as a type of cosmopolitan frontier and should be added to that list. Though the defense of New Mexico was entrusted to a group of upper-class citizens, New Mexico was not a true military frontier during this period. This is because of the way in which the defenders of New Mexico were funded. Rather than stationing a permanent professional military unit in New Mexico, 35 upper-class citizens were responsible for defending the province, and in return they received the right to economically exploit the Pueblos. This was the encomienda system, which represents an aspect of an exploitative plantation frontier. Thus, officially, New Mexico was a mixture of cosmopolitan frontier types: missionization and exploitative plantation.

However, these functions do not account for the ordinary settlers who had also moved to New Mexico. There was little economic, religious, or military support for these settlers. These factors, in addition to others, tended to set the settlers against the missionaries. Exacerbating this civil unrest was the economic exploitation of the Pueblo Indians by both the missionaries and the encomenderos. Slave raids against the surrounding Apaches (usually for economic gain by the governor) riled the non-Pueblo populations as well. Thus, there appears to have been momentum toward the development of an insular frontier in New Mexico, but this was stifled by official governmental policy, which effectively supported the church and its missionizing efforts but tended to ignore the secular population.

Conditions reached a boil in 1680 when the

Pueblo Indians and their Apachean allies forced the Spaniards out of New Mexico for 13 years. This event, in combination with the changing world scene, led to a major alteration in the focus of the New Mexican colony when it was reestablished in the final years of the seventeenth century. By the early 1700s New Mexico had metamorphosed from a missionizing and exploitative plantation frontier to an insular frontier with a dual focus. In addition to an agricultural function, New Mexico also became a defensive frontier (Bannon 1963; Gutiérrez 1991:146). Though a small, permanent professional military garrison was stationed at Santa Fe, it was insufficient for the defensive needs of the province and was supplemented by local militias and Pueblo and Genízaro auxiliaries. This, in addition to the development of agricultural self-sufficiency in the province, suggests that it was an insular frontier during the late Spanish Colonial period, and not a cosmopolitan military frontier.

Again, there is a disparity between the official function of the New Mexican frontier and the view of the settlers on that frontier. The Spanish government saw New Mexico's role as primarily a defensive buffer, protecting the inner silver-producing provinces from Indian attacks. However, the settlers themselves were there for the economic opportunities that existed on the Mexican periphery. Thus, New Mexico developed as an insular frontier even as it acted in its defensive role. New Mexico remained in this role throughout the late Spanish Colonial period and into the Mexican period, though the enemies it defended against changed several times. Areas on the local New Mexican frontier also metamorphosed from economic frontiers to defensive frontiers as the relationship between Spaniards and the surrounding nomadic Indians changed through time.

During the first half of the eighteenth century, the Spaniards were mainly concerned with the spreading influence of other European nations on their northern and northeastern flanks. In the case of New Mexico, the Spanish government was worried about the French along the Mississippi and on the Great Plains. By the 1760s the French were no longer much of a threat, but the nomadic Indians that ringed New Mexico had become an even bigger problem than they had been over the past one and a half centuries (Bannon 1963:169–171). In order to deal with this defensive problem, the northern provinces were reorganized in the 1770s and transformed into a unified command separate from that of the viceroy in Mexico City (Bannon 1963:182; Simmons 1968).

Peace was concluded between the Spaniards and the Comanches by 1786, and the Apaches were essentially neutralized by 1790 (Bannon 1963; Noyes 1993; Thomas 1932). For a short time after that date, New Mexico did not need to serve as a defensive line against the European and indigenous enemies of Spain. During this period of relative peace, New Mexicans began to expand the frontier of the province, occupying new lands as well as resettling lands that had been abandoned because of hostilities (Frank 2000:119). This time of relative peace also seems to have kicked off a period of economic expansion, which lasted through the rest of the Spanish Colonial period and into the Mexican period (Frank 2000). Migration into New Mexico from other parts of New Spain seems to have begun by the 1790s (Gutiérrez 1991:174). This was perhaps indicative of a perception that the northern frontier had become safer and once again represented a place of economic opportunity. Indeed, Spain began making an effort to more closely integrate New Mexico into the economy of New Spain during this period (Gutiérrez 1991:305–306). These factors combined to cause intense land pressure, relieved by grants of unoccupied lands (Gutiérrez 1991:306). Thus, New Mexico became part of the periphery of Mexico, which by this time was developing into an economic core. The frontier nature of New Mexico was beginning to fade, and New Mexico was beginning to be more closely tied to the core economically, socially, and politically.

Though the period of relative economic prosperity and movement onto the New Mexican frontier continued, New Mexico was soon forced back into its role as a defensive frontier (Bannon 1963). European politics had transferred the Louisiana Territory from French control to the Spaniards and back again. Spain lost and regained Florida. During the same time, the United States had begun turning covetous eyes toward the holdings of other nations on its borders. This ambition intensified after the Louisiana Purchase was completed in 1803, especially because no clear boundary existed between the Louisiana territory and the holdings of Spain in North America (Bannon 1963). This especially caused trouble in Texas and western Florida. Thus, New Mexico again became a defensive frontier, this time against the expansionist designs of the United States.

After Mexico won its independence from Spain in 1821, trade relations were opened with the United States across the Santa Fe Trail. During this period New Mexico served as a port-of-entry through which traders from the United States passed, initially to do business almost exclusively in Santa Fe, and later on their way to conduct their main business further south in the more prosperous Mexican provinces. The Santa Fe trade actually increased communication between New Mexico and New Spain and better defined New Mexico as part of the periphery to the Mexican core, continuing its transformation from frontier status. Though welcoming of the American merchants, the Mexican government remained suspicious of American settlers. Their fears were justified when the United States seized the northern provinces of Mexico during the Mexican War of 1846–1848.

When New Mexico became part of the United States it again became a frontier. The relationship of the United States with surrounding nomadic tribes was different from that of Spain and Mexico. Once again, raids from Plains tribes threatened the region, and New Mexico was a defensive frontier, a role it fulfilled until nearly the end of the nineteenth century.

The Historic Chama–Ojo Caliente Frontier

The historic Chama–Ojo Caliente frontier is much better known and documented than its prehistoric counterpart. As discussed in Chapters 4 and 25, the Chama–Ojo Caliente Valleys remained an unsettled frontier on the edge of Spanish New Mexico until the 1730s. There was probably some sporadic use of the area before that time, both by Spaniards and Pueblos, but there were no documented permanent settlements in the region between its abandonment at the end of the Classic period and the establishment of Spanish settlements in the Ojo Caliente and Chama Valleys in the mid-1730s. The only known exception was a temporary settlement of Tewas that was built during the Pueblo Revolt period, but that village did not last.

The Chama–Ojo Caliente Valleys were settled by people seeking economic opportunities and represent a subfrontier of the New Mexican frontier. Though the region may have been used as a cosmopolitan frontier before the first permanent settlements were founded, this type of use is not well documented and so remains questionable. By founding permanent settlements in the region, the Spaniards created an insular agricultural subfrontier. Like the New Mexican frontier in general, the Chama–Ojo Caliente subfrontier quickly assumed a defensive function in addition to its agricultural function.

The defensive nature of this subfrontier is typified by the number of times settlements in the Chama–Ojo Caliente Valleys were abandoned in response to raids by hostile nomadic Indians and then resettled by order of the government. The lands granted to settlers in the Chama–Ojo Caliente Valleys in the mid-1730s were abandoned in 1748 in response to massive raids by the Comanches (Adams and Chávez 1956; Carrillo 2004; Ebright 1994; Quintana and Snow 1980; Swadesh 1974). The Chama Valley was resettled by Spanish families in 1750 and augmented by a Genízaro settlement in 1754 (Carrillo 2004). That area was again experiencing a gradual abandonment by 1770, but the settlers were ordered to return and build a fortified plaza for defense (Carrillo 2004). Otherwise, the Chama Valley was not again abandoned for defensive reasons.

This was not the case with the Ojo Caliente Valley. Receiving the same order to resettle in 1750 as the Chama Valley settlers, few people returned to the Ojo Caliente Valley. By 1766 most of that area had not yet been resettled, and the land grants reverted to the Crown (Simmons 1968). New land grants were issued, and the Ojo Caliente Valley was resettled in 1768–69 (Adams and Chávez 1956:78; Frank 2000:43). By 1770 the settlers were again being attacked by Comanches and abandoned the region rather than comply with the governor's order to build a defensive plaza instead of living scattered through the valley (Frank 2000; Noyes 1993). It wasn't until after the defeat of the great Comanche war chief Cuerno Verde by Governor Anza and the peace treaty that he negotiated with the Comanches in

1786 that the Ojo Caliente Valley was finally settled by Spaniards on a permanent basis. There were almost certainly settlers at Ojo Caliente before 1790, though formal grants had apparently not been made. A land grant petition in 1790 was not acted upon, because the settlers did not want to leave the homes they had already established and move to an even more exposed location (see Chapter 25). In 1793 the settlers were successful in their efforts to establish a community grant. However, the region remained vulnerable to attack, and from time to time its protection was augmented by a detachment of troops (Simmons 1968:125).

Both valleys were on the Spanish Colonial frontier, and both were initially settled by the same type of people—families looking for new homes that would provide economic security. In both cases, the settlers preferred to live in small homesteads scattered throughout these valleys. They repeatedly failed to form defensive plazas because they preferred to remain near their own lands and livestock. So why were their histories of settlement so different? The main cause was the use of the Ojo Caliente Valley by nomadic Indians as a route for raids against Spanish and Pueblo settlements (Frank 2000:43). Both the Comanches and Kiowas used this route, and it was in their best interests not to allow successful settlement of the valley so that their entrances into and disappearances from Spanish New Mexico would remain unimpeded (Frank 2000:43; Swadesh 1974:40).

Settlements in the Chama and Ojo Caliente Valleys were initially formed because that region represented a chance for the settlers to improve their economic status. This changed after the Comanche attacks of 1747, and the Chama–Ojo Caliente Valley settlements were blatantly used as a defensive frontier, protecting the larger and more important villages in the territorial core (see Chapter 25). This replicated the official function of the New Mexican frontier on a subfrontier. The Chama–Ojo Caliente subfrontier remained defensive in nature until nearly 1790. It is probably no coincidence that permanent settlements again began to be founded in the Ojo Caliente Valley soon after peace was negotiated with the Comanches. The study area probably benefitted from the period of prosperity that accompanied this peace, and the government reforms that occurred at the same time helped expand the economy and attract migrants from elsewhere in New Spain. Reoccupation of the Ojo Caliente Valley was part of the process of expansion out from the core, which resulted in the opening of new frontiers as well as the resettlement of areas abandoned because of hostilities. Though this new frontier continued to have a defensive function, it was mainly economic in nature, providing opportunities for economic improvement to families from the population core.

By the mid-nineteenth century the Ojo Caliente Valley had been transformed from a frontier to a peripheral area, and it remained in that relationship to the core until well into the twentieth century, as can be seen from Goodman's discussion in Chapter 25. While this area no longer formed a defensive bulwark for the more important settlements of the inner province, it remained outside the population and commercial core. This provided some economic alternatives for locals wishing to supplement their income from agricultural pursuits. Thus, small mercantile establishments like the García store sprang up, usually offering a meager return for the effort and going out of business in a few years. A lack of economic choices led many residents to leave the area, some to return after retirement. This type of movement seems to have begun after World War II and has continued to the present day. These processes have led to the demise of the tightly knit Hispanic community of Ojo Caliente. New people are moving in and gentrifying these communities, finally bringing the area into the modern population and economic core.

Comparing the Prehistoric and Historic Frontiers

The Ojo Caliente area began as a frontier during both its prehistoric and historic occupations, but through time it underwent transformation from that function to another during both periods of occupation. The processes involved in each transformation and the trajectories followed during both periods were different and can be compared and contrasted. During both periods of occupation, the Ojo Caliente Valley initially represented an area of economic opportunity. Groups of

Pueblos established small farming communities during the Coalition period. The more successful of those communities continued to grow through the rest of the Coalition period and into the Classic period, which saw a large-scale population influx that quickly brought the region into the economic and population core.

The historic occupation began in a similar fashion—small groups of people looking for economic advantage. However, in this case the region soon metamorphosed into a defensive subfrontier, a line of communities considered more expendable than those in the provincial core. The defensive nature of the historic Chama–Ojo Caliente subfrontier is revealed in the establishment of Genízaro settlements in both valleys (Gutiérrez 1991:305; Quintana and Snow 1980). Traditionally, Genízaros (Christianized, detribalized Indians) were settled to provide a first line of defense against nomadic Indian raids. Thus, the presence of Genízaro settlements in addition to records of numerous nomadic Indian raiders passing through the study area attest to its defensive nature.

Though some of the early Pueblo settlements in the Chama Valley may have been placed in defensive locations, the defensive frontier during that period was on the Pajarito Plateau and in the Rio Grande Valley, as San Juan peoples who had abandoned their homelands moved into the Northern Rio Grande. There is no evidence for movement of these peoples into the Chama–Ojo Caliente region, so a defensive posture was mostly unnecessary in that area. The Chama–Ojo Caliente Valleys were an undisputed internal frontier to the Pueblo peoples who moved into that region. The population, economic, and ritual core was in adjacent areas to the south and southwest. This was completely unlike the historic situation, where settlement on the Chama–Ojo Caliente subfrontier was disputed, and the true population, economic, and ritual core was far distant in Mexico and ultimately Spain. A local core may have developed in the Santa Fe area in the late Spanish Colonial period but could provide little economic or military aid to settlements on its own frontier. During the prehistoric occupation, the Chama–Ojo Caliente area became a refuge for people abandoning the defensive frontier or simply seeking a location with better economic opportunities than their former homes. During the historic period, the core communities of New Mexico provided refuges against the onslaught of nomadic Indians along the Chama–Ojo Caliente frontier. Thus, the direction of population movement was mostly reversed. Prehistoric movement was from a former core into a newly developing core that had until recently been an internal frontier. Historic movement was from a defensive frontier back to the core in response to relentless raiding, then back to the frontier as the raiding tapered off.

Thus, in a 300-year period the prehistoric Chama–Ojo Caliente region went from a sparsely settled internal frontier to a population and ritual core, and was finally abandoned at about the time the Spaniards were establishing their first colony in New Mexico. The region remained empty of permanent settlements for nearly 150 years before Spanish settlers began moving in. However, rather than moving into an internal frontier, as had the prehistoric Pueblo settlers, the Spaniards were moving into a region that was used by nomadic Indians and soon came into conflict with them. In 250 years of historic settlement, the Chama–Ojo Caliente region still remains on the fringe of the population and economic core of New Mexico.

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1999 Rockin' Gardens. *Dragonfly*, May/June, 26–27. National Science Teachers Association, Washington D.C.

Appendix 1. Pollen Analysis of a Sedimentary Column from LA 105710 and Intensive Scan Microscopy Analysis of Five Agricultural Sites

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A total of 13 pollen samples were submitted for full count microscopy from LA 105710. This column was taken from a profile through dunal deposits. LA 105710 dated to the Classic period (A.D. 1325–1500), and all deposits are thought to postdate the occupation. At this time, no radiocarbon dates are available from this deposit.

Also, 45 samples were taken from gravel mulch agricultural fields associated with five other sites. All sites date to the Classic period (A.D. 1325–1500). All 45 samples were analyzed using intensive scan microscopy (ISM), and counting was continued until target taxa were present in levels below 1 grains/g. Multiple fields were sampled from each site.

LA 105703, the northernmost site, is a large farming site dating to the Classic period. Eight gravel-mulched fields were identified, and five of them were sampled.

LA 105704 is a small farming site. Four features were recorded, including two gravel-mulched fields and two cobble alignments. Both gravel-mulched fields were sampled.

LA 105708 is a large farming site. Two systems of gravel-mulched fields were sampled in addition to four borrow pits, which were not submitted for analysis.

LA 105709 is a large farming site in Rio Arriba County. Two gravel-mulched fields were sampled from this site. Also present was a possible temporary shelter, a hearth, and a collection of farming features, which were not submitted for analysis.

LA 118547 is a large farming site at the south end of the project area. Nine gravel-mulched fields, 16 terrace-edge borrow pits, two terrace-interior borrow pits, and a possible historic grave were identified. Samples were submitted from one mulched field and two terrace-edge borrow pits.

The sites are between 6,150 and 6,250 feet in elevation. The modern vegetation consists of a piñon-juniper community with a typical associated understory. Higher elevations support a more heavily forested environment including additional conifer species such as *Picea* and *Abies*.

Methods and Materials

Chemical extraction of pollen samples was conducted at the Palynology Laboratory at Texas A&M University, using a procedure designed for semiarid Southwestern sediments. The method detailed below specifically avoids use of such reagents as nitric acid and bleach, which are destructive to pollen grains (Holloway 1981).

From each pollen sample submitted, 25 g of soil were subsampled. Prior to chemical extraction, three tablets of concentrated *Lycopodium* spores (Batch 307862, Department of Quaternary Geology, Lund, Sweden; 13,500 ± 500 marker grains per tablet) were added to each subsample. The addition of marker grains permits calculation of pollen concentration values and provides an indicator for accidental destruction of pollen during the laboratory procedure.

The samples were treated with 35-percent hydrochloric acid (HCl) overnight to remove carbonates and release the *Lycopodium* spores from their matrix. After neutralizing the acid with distilled water, the samples were allowed to settle for at least three hours before the supernatant liquid was removed. Additional distilled water was added to the supernatant, and the mixture was swirled and then allowed to settle for five seconds. The suspended fine fraction was decanted through 150μ mesh screen into a second beaker. This procedure, repeated at least three times, removed lighter materials, including pollen grains, from the heavier fractions. The fine material was concentrated by centrifugation at 2,000 rpm.

The fine fraction was treated with concentrated hydrofluoric acid (HF) overnight to remove silicates. After the acid was completely neutralized with distilled water, the samples were treated with a solution of darvan and sonicated in a Delta D-9 Sonicator for 30 seconds. The darvan solution was removed by repeated washing with distilled water and centrifuged (2,000 rpm) until the supernatant liquid was clear and neutral. This procedure removed fine charcoal and other associated organic matter and effectively deflocculated the sample.

The samples were dehydrated in glacial acetic acid in preparation for acetolyis. Following Erdtman (1960), acetolysis solution (acetic anhydride, concentrated sulfuric acid in 9:1 ratio) was added to each sample. Centrifuge tubes containing the solution were heated in a boiling water bath for approximately eight minutes and then cooled for an additional eight minutes before centrifugation and removal of the acetolysis solution with glacial acetic acid, followed by distilled water. Centrifugation at 2,000 rpm for 90 seconds dramatically reduced the size of the sample but did not remove fossil palynomorphs.

Heavy-density separation ensued using zinc bromide ($ZnBr_2$), with a specific gravity of 2.00, to remove much of the remaining detritus from the pollen. The light fraction was diluted with distilled water (10:1) and concentrated by centrifugation. The samples were washed repeatedly in distilled water until neutral. The residues were rinsed in a 1-percent solution of potassium hydroxide (KOH) for less than one minute, which was effective in removing the majority of the unwanted alkaline soluble humates.

The material was rinsed in ethanol (ETOH) stained with safranin-O, rinsed twice with ETOH, and transferred to 1-dram vials with tertiary butyl alcohol (TBA). The samples were mixed with a small quantity of glycerine and allowed to stand overnight for evaporation of the TBA. The storage vials were capped and returned to the Office of Archaeological Studies at the completion of the project. Because of the nature of the analyses conducted, all microscope slides used in this project were also returned.

A drop of the polliniferous residue was mounted on a microscope slide for examination under an 18 by 18 mm cover slip sealed with fingernail polish. The slide was examined using 200x or 100x magnification under an aus-Jena Laboval 4 compound microscope. Occasionally, pollen grains were examined using 400x or 1,000x oil immersion to obtain a positive identification to the family or genus level.

Abbreviated microscopy was performed on each sample in which either 20 percent of the slide (approximately four transects at 200x magnification) or a minimum of 50 marker grains were counted. If warranted, full counts were conducted by counting to a minimum of 200 fossil grains. Regardless of which method was used, the uncounted portion of each slide was completely scanned at a magnification of 100x for larger grains of cultivated plants such as *Zea mays* and *Cucurbita*, two types of cactus (*Platyopuntia* and *Cylindropuntia*), and other large pollen types such as members of the Malvaceae or Nyctaginaceae families. Because corn pollen was very common in many of these samples, corn grains were tabulated during the scans only if an unequal distribution of this taxon on the microscope slide was observed.

For those samples warranting full microscopy, a minimum of 200 pollen grains per sample were counted as suggested by Barkley (1934), which allows the analyst to inventory the most common taxa in the sample. All transects were counted completely, resulting in various numbers of grains counted beyond 200. Pollen taxa encountered on the uncounted portion of the slide during the low-magnification scan are tabulated separately.

Total pollen concentration values were computed for all taxa. In addition, the percentage of indeterminate pollen was also computed. Statistically, pollen concentration values provide a more reliable estimate of species composition within the assemblage. Traditionally, results have been presented by relative frequencies (percentages), where the abundance of each taxon is expressed in relation to the total pollen sum (200+ grains) per sample. With this method, rare pollen types tend to constitute less than 1 percent of the total assemblage. Pollen concentration values provide a more precise measurement of the abundance of even these rare types. The pollen data are reported here as pollen concentration values using the following formula:

$$PC = \frac{K^{*}\Sigma_p}{\Sigma_L{}^{*}S}$$

where: PC = pollen concentration
K = *Lycopodium* spores added
Σ_p = fossil pollen counted
Σ_L = *Lycopodium* spores counted
S = sediment weight

The following example should clarify this approach. Taxon X may be represented by a total of 10 grains (1 percent) in a sample consisting of 1,000 grains, and by 100 grains (1 percent) in a second sample consisting of 10,000 grains. Taxon X is 1 percent of each sample, but the difference in actual occurrence of the taxon is obscured when pollen frequencies are used. Pollen concentration values are preferred because they accentuate the variability between samples in the occurrence of the taxon. The variability, therefore, is more readily interpretable when comparing cultural activity to noncultural distribution of the pollen rain.

Variability in pollen concentration values can also be attributed to deterioration of the grains through natural processes. In his study of sediment samples collected from a rockshelter, Hall (1981) developed the "1,000 grains/g" rule to assess the degree of pollen destruction. This approach has been used by many palynologists working in other contexts as a guide to determine the degree of preservation of a pollen assemblage and, ultimately, to aid in the selection of samples to be examined in greater detail. According to Hall, a pollen concentration value below 1000 grains/g indicates that forces of degradation may have severely altered the original assemblage. However, a pollen concentration value of fewer than 1,000 grains/g can indicate the restriction of the natural pollen rain. Samples from pit structures or floors within enclosed rooms, for example, often yield pollen concentration values below 1,000 grains/g.

Pollen degradation also modifies the pollen assemblage because pollen grains of different taxa degrade at variable rates (Holloway 1981, 1989). Some taxa are more resistant to deterioration than others and remain in assemblages after other types have deteriorated completely. Many commonly occurring taxa degrade beyond recognition in only a short time. For example, most (ca. 70 percent) angiosperm pollen has tricolpate (three furrows) or tricolporate (three furrows each with pores) morphology. Because surfaces erode rather easily, once deteriorated, these grains tend to resemble each other and are not readily distinguishable. Other pollen types (e.g., cheno-am) are so distinctive that they remain identifiable even when almost completely degraded.

Pollen grains were identified to the lowest taxonomic level whenever possible. The majority of these identifications conformed to existing levels of taxonomy with a few exceptions. For example, cheno-am is an artificial, pollen-morphological category including pollen of the family Chenopodiaceae (goosefoot) and the genus *Amaranthus* (pigweed), which are indistinguishable from each other (Martin 1963). All members are wind pollinated (anemophilous) and produce very large quantities of pollen. In many sediment samples from the American Southwest, this taxon often dominates the assemblage.

Pollen of the Asteraceae (sunflower) family was divided into four groups. The high-spine and low-spine groups were identified on the basis of spine length. High-spine Asteraceae contain grains with spine length greater than or equal to 2.5µ, while the low-spine group have spines less than 2.5µ long (Bryant 1969; Martin 1963). *Artemisia* pollen is identifiable to the genus level because of its unique morphology, a double tectum in the mesocopial (between furrows) region of the pollen grain. Pollen grains of the Liguliflorae are also distinguished by their fenestrate morphology. Grains of this type are restricted to the tribe Cichoreae, which include such genera as *Taraxacum* (dandelion) and *Lactuca* (lettuce).

Pollen of the Poaceae (grass) family are generally indistinguishable below the family level, with the single exception of *Zea mays*, identifiable by its large size (ca. 80µ), relatively large pore annulus, and the internal morphology of the exine. All members of the family contain a single pore, are spherical, and have simple wall architecture. Identification of noncorn pollen depends on the presence of the single pore. Only complete or fragmented grains containing this pore were tabulated as Poaceae.

Clumps of four or more pollen grains (anther fragments) were tabulated as single grains to avoid skewing the counts. Clumps of pollen grains (anther fragments) from archaeological contexts are interpreted as evidence of flowers at the sampling locale (Bohrer 1981). This enables the analyst to infer human behavior.

Pollen grains in the final stages of disintegration but retaining identifiable features, such as furrows, pores, complex wall architecture, or a combination of these attributes, were assigned to the indeterminate category. The potential exists to miss counting pollen grains without identifiable characteristics. For example, a grain that is so severely deteriorated that no distinguishing features exist closely resembles many spores. Pollen grains and spores are similar in size and are composed of the same material (sporopollenin). So that spores are not counted as deteriorated pollen, only those grains containing identifiable pollen characteristics are assigned to the indeterminate category. Thus, the indeterminate category contains a minimum estimate of degradation for any assemblage. If the percentage of indeterminate pollen is between 10 and 20 percent, relatively poor preservation of the assemblage is indicated, whereas indeterminate pollen in excess of 20 percent indicates severe deterioration to the assemblage.

In samples where the total pollen concentration values are at or below 1,000 grains/g and the percentage of indeterminate pollen is 20 percent or greater, counting was terminated at the completion of the abbreviated microscopy phase. In some cases, the assemblage was so deteriorated that only a small number of taxa remained. Statistically, the concentration values may have exceeded 1,000 grains/g. If the species diversity was low (generally these samples contained only pine, cheno-am, members of the Asteraceae (sunflower) family, and pollen of the indeterminate category), counting was also terminated after abbreviated microscopy, even if the pollen concentration values slightly exceeded 1,000 grains/g.

ISM (Dean 1998) was requested for all 45 samples from the agricultural fields. This technique allows the analyst to examine sufficient pollen residue to reach a predetermined pollen concentration value. For the purposes of this study, it was determined that analysis would cease once the estimated maximum potential concentration value was 1 grain/g or less. Based on the pollen concentration formula above, and using 1.0 for the pollen concentration value, the equation was solved for the number of marker grains counted, which was 1,620. After the initial slide, additional slides were examined until an estimated 1,620 marker grains had been counted. The counts upon which the pollen concentration values are based were conducted only on the initial slide. The remainder of that slide was examined using low-power magnification, and the estimated number of marker grains present on that slide was computed using the average number of marker grains per transect counted and multiplying this by the total number of transects present on that slide. On each subsequent slide, a minimum of four transects were examined and counted for marker grains. These provided the baseline data for estimating the number of marker grains on that slide. This was repeated until the level of 1,620 marker grains had been attained. For this study, a maximum of three slides was necessary to obtain less than 1.0 grains/g estimated potential concentration values. In most samples, however, only two slides were necessary. Entire slides were examined during this process, which is why in numerous samples the estimated potential concentration values fall to significantly below 1 grain/g. Once this level had been attained, microscopy was terminated.

Results

For ease of comparison, Table A1.1 contains a list of scientific and common names of the plant taxa used in this report. Table A1.2 contains the raw pollen counts and calculated pollen concentration values from LA 105710. Tables A1.3 and A1.4 contain the raw pollen counts and calculated pollen concentration values, respectively, from the gravel-mulched agricultural fields, including the results of ISM. The samples from LA 105710 were counted using full counts with a pollen sum in excess of 200 grains. The remaining samples were analyzed using ISM to obtain an estimated

Table A1.1. Scientific and common names

Family	Scientific Name	Common Name
Amaranthaceae	*Amaranthus*	pigweed
Asteraceae		composite family
	Artemisia	sagebrush
	Helianthus	sunflower
	Lactuca	lettuce
	Taraxacum	dandelion
	Chichoreae	tribe of Asteraceae, heads comprised entirely of ligulate flowers
	Liguliflorae	pollen morphological group, fenestrate pollen
	low-spine	pollen morphological group, spines <2.5μ height
	high-spine	pollen morphological group, spines >2.5μ height
Cactaceae		cactus family
	Opuntia	prickly pear or cholla cactus
	Cylindropuntia	subgenus of *Opuntia* , cholla cactus
	Platyopuntia	subgenus of *Opuntia* , prickly pear cactus
Capparidaceae	*Cleome*	spider flower
Chenopodiaceae		goosefoot family
	Atriplex canescens	saltbush
	Chenopodium	goosefoot, lamb's-quarters
	Sarcobatus	greasewood
	cheno-am	pollen morphological group, members of the family Chenopodiaceae and the genus *Amaranthus*
Cucurbitaceae		gourd family
	Cucurbita sp.	gourd, pumpkin
Cupressaceae	*Juniperus*	juniper
Ephedraceae	*Ephedra*	Mormon tea
Fabaceae		bean family
	Acacia greggii	cat's-claw acacia
	Phaseolus sp.	domesticated bean
	Prosopis	mesquite
Fagaceae	*Quercus*	oak
Juglandaceae	*Carya*	hickory, pecan
Malvaceae		cotton family
	Gossypium	cotton
	Sphaeralcea	globemallow
Nyctaginaceae		desert four o'clock family
Onagraceae		evening primrose family
Pinaceae		pine family
	Abies sp.	fir
	Picea sp.	spruce
	Pinus	pine
	Pinus edulis	piñon pine
	Pinus ponderosa	ponderosa pine
Poaceae		grass family
	Zea mays	corn
Polygonaceae		buckwheat family
	Eriogonum	wild buckwheat
	Polygonum	knotweed, smartweed
Rosaceae		rose family
	Shepherdia sp.	
Salicaceae		willow family
	Salix	willow
Typhaceae		cattail family
	Typha angustifolia	cattail

Table A1.2a. Raw pollen counts and concentration values, LA 105710

Site	FS No.	Provenience	Stratum	*Pinus* undifferentiated	*Pinus ponderosa*	*Pinus edulis*	*Juniperus*	*Picea*	*Abies*	*Salix*	*Acacia*
Raw Counts											
LA 105710	108	BT-1	0	103	29	30	2	1	-	1	-
LA 105710	109	BT-1	1	77	10	2	5	2	1	-	-
LA 105710	110	BT-1	3	42	2	-	4	-	-	-	-
LA 105710	111	BT-1	6	34	1	-	3	-	-	-	-
LA 105710	112	BT-1	25	38	2	3	4	-	-	-	-
LA 105710	113	BT-1	17	32	1	-	1	-	-	-	-
LA 105710	114	BT-1	18	8	-	-	1	-	-	-	-
LA 105710	115	BT-1	19	11	1	-	-	-	-	-	-
LA 105710	116	BT-1	22	19	3	-	1	-	-	-	1
LA 105710	117	BT-1	21	21	-	-	-	-	-	-	1
LA 105710	118	BT-1	33	26	4	5	-	-	-	-	-
LA 105710	119	BT-1	36	27	1	3	-	-	-	-	-
LA 105710	120	BT-1	38	37	7	7	-	-	-	-	-
Concentration Values											
LA 105710	108	BT-1	0	2196	618	639	43	21	0	21	0
LA 105710	109	BT-1	0	630	82	16	41	16	8	0	0
LA 105710	110	BT-1	3	126	6	0	12	0	0	0	0
LA 105710	111	BT-1	6	111	3	0	10	0	0	0	0
LA 105710	112	BT-1	25	112	6	9	12	0	0	0	0
LA 105710	113	BT-1	17	257	8	0	8	0	0	0	0
LA 105710	114	BT-1	18	62	0	0	8	0	0	0	0
LA 105710	115	BT-1	19	66	6	0	0	0	0	0	0
LA 105710	116	BT-1	22	49	8	0	3	0	0	0	3
LA 105710	117	BT-1	21	118	0	0	0	0	0	0	6
LA 105710	118	BT-1	33	63	10	12	0	0	0	0	0
LA 105710	119	BT-1	36	144	5	16	0	0	0	0	0
LA 105710	120	BT-1	38	108	20	20	0	0	0	0	0

Table A1.2b. Raw pollen counts and concentration values, LA 105710

Site	FS No.	*Shepherdia*	*Eriogonum*	*Sarcobatus*	Poaceae	Cheno-am	Cheno-am af.	High-spine Asteraceae	Low-spine Asteraceae
Raw Counts									
LA 105710	108	1	13	1	1	176	-	32	37
LA 105710	109	-	-	-	-	153	1	9	22
LA 105710	110	-	-	-	3	125	-	3	34
LA 105710	111	-	1	-	19	103	-	29	12
LA 105710	112	-	-	2	2	134	2	25	10
LA 105710	113	-	1	-	6	333	-	43	9
LA 105710	114	-	-	-	5	160	1	36	7
LA 105710	115	-	-	-	2	233	-	9	6
LA 105710	116	-	-	-	7	168	1	23	4
LA 105710	117	-	-	-	5	84	-	65	2
LA 105710	118	-	-	-	5	104	-	55	8
LA 105710	119	-	-	-	9	130	-	30	9
LA 105710	120	-	-	-	2	130	-	28	3
Concentration Values									
LA 105710	108	21	277	21	21	3752	0	682	789
LA 105710	109	0	0	0	0	1252	8	74	180
LA 105710	110	0	0	0	9	376	0	9	102
LA 105710	111	0	3	0	62	336	0	95	39
LA 105710	112	0	0	6	6	395	6	74	29
LA 105710	113	0	8	0	48	2671	0	345	72
LA 105710	114	0	0	0	39	1234	8	278	54
LA 105710	115	0	0	0	12	1388	0	54	36
LA 105710	116	0	0	0	18	435	3	60	10
LA 105710	117	0	0	0	28	473	0	366	11
LA 105710	118	0	0	0	12	253	0	134	19
LA 105710	119	0	0	0	48	693	0	160	48
LA 105710	120	0	0	0	6	380	0	82	9

Table A1.2c. Raw pollen counts and concentration values, LA 105710

Site	FS No.	*Artemisia*	Cactaceae	*Cylindropuntia*	*Platyopuntia*	*Ephedra*	Nyctagninaceae	Indeterminate	Unknown Triporate
Raw Counts									
LA 105710	108	6	1	-	-	2	-	5	-
LA 105710	109	-	-	1	-	1	-	-	-
LA 105710	110	-	-	-	-	1	-	7	-
LA 105710	111	-	-	1	-	1	1	7	-
LA 105710	112	-	-	-	-	1	-	13	-
LA 105710	113	1	-	-	-	1	-	14	-
LA 105710	114	-	-	-	-	-	-	6	1
LA 105710	115	-	-	-	-	1	-	3	-
LA 105710	116	-	-	-	-	2	-	13	-
LA 105710	117	-	9	2	-	1	-	14	-
LA 105710	118	-	-	-	-	1	-	10	-
LA 105710	119	-	-	2	-	-	-	11	-
LA 105710	120	-	-	-	-	-	-	4	-
Concentration Values									
LA 105710	108	128	21	0	0	43	0	107	0
LA 105710	109	0	0	8	0	8	0	0	0
LA 105710	110	0	0	0	0	3	0	21	0
LA 105710	111	0	0	3	0	3	3	23	0
LA 105710	112	0	0	0	0	3	0	38	0
LA 105710	113	8	0	0	0	8	0	112	0
LA 105710	114	0	0	0	0	0	0	46	8
LA 105710	115	0	0	0	0	6	0	18	0
LA 105710	116	0	0	0	0	5	0	34	0
LA 105710	117	0	51	11	0	6	0	79	0
LA 105710	118	0	0	0	0	2	0	24	0
LA 105710	119	0	0	11	0	0	0	59	0
LA 105710	120	0	0	0	0	0	0	12	0

Table A1.2d. Raw pollen counts and concentration values, LA 105710

Site	FS No.	*Zea mays*	Sum	Total	Marker	Percent Indeterminate	Transects	Total Transects	Markers / Slide	*Lycopodium* Added	Weight / Area
Raw Counts											
LA 105710	108	2	443	9443	76	1.13	2	26	988	40500	25
LA 105710	109	2	286	2340	198	0	6	26	858	40500	25
LA 105710	110	1	222	668	538	3.15	10	24	1291	40500	25
LA 105710	111	-	212	691	497	3.3	6	25	2071	40500	25
LA 105710	112	1	237	698	550	5.49	8	24	1650	40500	25
LA 105710	113	-	442	3545	202	3.17	4	23	1162	40500	25
LA 105710	114	-	225	1736	210	2.67	4	24	1260	40500	25
LA 105710	115	-	266	1584	272	1.13	4	24	1632	40500	25
LA 105710	116	-	242	627	625	5.37	8	23	1797	40500	25
LA 105710	117	1	205	1153	288	6.83	4	24	1728	40500	25
LA 105710	118	-	218	530	666	4.59	11	24	1453	40500	25
LA 105710	119	1	223	1188	304	4.93	6	24	1216	40500	25
LA 105710	120	-	218	637	554	1.83	5	25	2770	40500	25
Concentration Values											
LA 105710	108	43	443	9443	76	1.13	2	26	988	40500	25
LA 105710	109	16	286	2340	198	0	6	26	858	40500	25
LA 105710	110	3	222	668	538	3.15	10	24	1291	40500	25
LA 105710	111	0	212	691	497	3.3	6	25	2071	40500	25
LA 105710	112	3	237	698	550	5.49	8	24	1650	40500	25
LA 105710	113	0	442	3545	202	3.17	4	23	1162	40500	25
LA 105710	114	0	225	1736	210	2.67	4	24	1260	40500	25
LA 105710	115	0	266	1584	272	1.13	4	24	1632	40500	25
LA 105710	116	0	242	627	625	5.37	8	23	1797	40500	25
LA 105710	117	6	205	1153	288	6.83	4	24	1728	40500	25
LA 105710	118	0	218	530	666	4.59	11	24	1453	40500	25
LA 105710	119	5	223	1188	304	4.93	6	24	1216	40500	25
LA 105710	120	0	218	637	554	1.83	5	25	2770	40500	25

Table A1.2e. Numbers including counts and low-magnification scan of the slides, LA 105710

Site	FS No.	*Abies*	*Zea mays*	Cactaceae	*Cylindropuntia*	*Platyopuntia*	Onagraceae	*Acacia*	Cheno-am af
Raw Counts									
LA 105710	108	3	11	-	-	-	1	-	-
LA 105710	109	-	9	-	-	-	-	-	-
LA 105710	110	-	4	-	-	-	-	-	-
LA 105710	111	-	-	-	1	-	-	-	-
LA 105710	112	-	1	-	2	-	-	-	-
LA 105710	113	-	-	1	1	-	-	-	-
LA 105710	114	-	-	-	-	-	-	-	1
LA 105710	115	-	-	-	-	-	-	-	-
LA 105710	116	-	-	-	3	-	-	-	-
LA 105710	117	-	1	10	7	-	-	2	-
LA 105710	118	-	-	-	-	-	-	-	-
LA 105710	119	-	1	-	3	-	-	-	-
LA 105710	120	-	1	-	-	1	-	-	-
Concentration Values									
LA 105710	108	5	18	0	0	0	2	0	0
LA 105710	109	0	17	0	0	0	0	0	0
LA 105710	110	0	5	0	0	0	0	0	0
LA 105710	111	0	0	0	1	0	0	0	0
LA 105710	112	0	1	0	2	0	0	0	0
LA 105710	113	0	0	1	1	0	0	0	0
LA 105710	114	0	0	0	0	0	0	0	1
LA 105710	115	0	0	0	0	0	0	0	0
LA 105710	116	0	0	0	3	0	0	0	0
LA 105710	117	0	1	9	7	0	0	2	0
LA 105710	118	0	0	0	0	0	0	0	0
LA 105710	119	0	1	0	4	0	0	0	0
LA 105710	120	0	1	0	0	1	0	0	0

Table A1.3a. Raw pollen counts, LA 105703, LA 105704, LA 105708, LA 105709, and LA 118547

Site	FS No.	EU	Grid	Stratum	Level	Elevation (ft)	Feature	Type
LA 105703	24	A	2	2	2	6150	8	gravel mulch
LA 105703	25	B	3	2	2	6150	2	gravel mulch
LA 105703	18	C	3	2	2	6150	2	gravel mulch
LA 105703	5	D	4	2	2	6150	2	gravel mulch
LA 105703	31	E	1	2	2	6150	18	gravel mulch
LA 105703	56	E	3	4	3	6150	18	cobble-mulch field
LA 105703	33	F	1	2	2	6150	18	gravel mulch
LA 105703	51	F	3-4	4	4	6150	18	cobble-mulch field
LA 105703	35	G	2	2	2	6150	18	gravel mulch
LA 105703	44	H	3	2	2	6150	18	gravel mulch
LA 105703	45	H	1	4	3	6150	18	cobble-mulch field
LA 105703	65	I	1	4	3	6150	18	cobble-mulch field
LA 105703	83	J	3	2	2	6150	22	gravel mulch
LA 105703	88	J	2	4	3	6150	22	cobble-mulch field
LA 105703	79	K	2	2	2	6150	22	gravel mulch
LA 105703	84	K	2	4	4	6150	22	cobble-mulch field
LA 105703	71	M	3	2	2	6150	21	gravel mulch
LA 105703	91	N	2	2	2	6150	18	gravel mulch
LA 105703	90	O	3	2	2	6150	18	gravel mulch
LA 105704	3	A	2	2	1	6250	1	gravel mulch
LA 105704	8	B	1	2	1	6250	1	gravel mulch
LA 105704	1	C	3	2	1	6250	2	gravel mulch
LA 105708	22	A	3	3	3	6200	9	gravel mulch
LA 105708	8	B	3	2	2	6200	9	gravel mulch
LA 105708	11	C	3	2	2	6200	9	gravel mulch
LA 105708	26	D	4	2	2	6200	3	gravel mulch
LA 105708	21	E	2	2	2	6200	3	gravel mulch
LA 105708	29	F	4	2	2	6200	3	gravel mulch
LA 105709	433	A	2	2	1	6150	1	gravel mulch
LA 105709	430	C	3	2	1	6150	4	gravel mulch
LA 118547	473	A	2	2	2	6165	15	gravel mulch
LA 118547	459	B	1	2	2	6165	15	gravel mulch
LA 118547	456	C	2	2	2	6165	15	gravel mulch
LA 118547	465	D	2	2	2	6165	15	gravel mulch
LA 118547	461	E	3	2	2	6165	15	gravel mulch
LA 118547	497	F	1-4	2	2	6165	15	gravel mulch
LA 118547	472	G	1	2	2	6165	15	gravel mulch
LA 118547	470	H	2	3	3	6165	15	gravel mulch
LA 118547	487	I	1	2	2	6165	15	gravel mulch
LA 118547	492	J	4	2	2	6165	15	gravel mulch
LA 118547	494	K	3	2	2	6165	15	gravel mulch
LA 118547	499	L	4	2	2	6165	15	gravel mulch
LA 118547	482	BT-1	-	-	-	6165	1	borrow pit
LA 118547	483	BT-2	-	-	-	6165	2	borrow pit

Table A1.3b. Raw pollen counts, LA 105703, LA 105704, LA 105708, LA 105709, and LA 118547

LA 105703	24	64	Classic	1325-1500	172	3	-	-	-
LA 105703	25	3479	Classic	1325-1500	108	2	-	-	-
LA 105703	18	3479	Classic	1325-1500	170	1	2	1	-
LA 105703	5	3479	Classic	1325-1500	202	3	2	-	1
LA 105703	31	2715	Classic	1325-1500	55	-	-	-	-
LA 105703	56	2715	Classic	1325-1500	60	1	-	-	-
LA 105703	33	2715	Classic	1325-1500	214	2	3	2	-
LA 105703	51	2715	Classic	1325-1500	77	-	2	-	-
LA 105703	35	2715	Classic	1325-1500	159	5	1	1	-
LA 105703	44	2715	Classic	1325-1500	63	3	1	-	-
LA 105703	45	2715	Classic	1325-1500	28	-	-	-	-
LA 105703	65	2715	Classic	1325-1500	28	1	-	-	-
LA 105703	83	936	Classic	1325-1500	44	2	-	-	-
LA 105703	88	936	Classic	1325-1500	142	-	-	-	-
LA 105703	79	936	Classic	1325-1500	193	2	2	1	
LA 105703	84	936	Classic	1325-1500	33	1	-	-	1
LA 105703	73	2715	Classic	1325-1500	18	-	-	-	-
LA 105703	71	820	Classic	1325-1500	104	1	1	-	2
LA 105703	91	2715	Classic	1325-1500	101	-	-	-	-
LA 105703	90	2715	Classic	1325-1500	54	1	-	-	-
LA 105704	3	180	Classic	1325-1500	319	4	2	-	-
LA 105704	8	180	Classic	1325-1500	145	2	-	-	-
LA 105704	1	48	Classic	1325-1500	123	2	-	-	-
LA 105708	22	971	Classic	1325-1500	82	-	-	-	-
LA 105708	8	971	Classic	1325-1500	180	1	2	-	-
LA 105708	11	971	Classic	1325-1500	80	3	-	-	-
LA 105708	26	225	Classic	1325-1500	121	-	1	-	1
LA 105708	21	225	Classic	1325-1500	187	9	4	-	1
LA 105708	29	225	Classic	1325-1500	220	-	2	1	-
LA 105709	433	444	Classic	1325-1500	210	2	3	-	1
LA 105709	430	47	Classic	1325-1500	229	1	1	1	-
LA 118547	473	3911	Classic	1325-1500	217	5	2	-	1
LA 118547	459	3911	Classic	1325-1500	162	1	-	-	-
LA 118547	456	3911	Classic	1325-1500	202	-	2	-	-
LA 118547	465	3911	Classic	1325-1500	92	1	-	-	-
LA 118547	461	3911	Classic	1325-1500	125	2	-	1	-
LA 118547	497	3911	Classic	1325-1500	135	4	-	1	-
LA 118547	472	3911	Classic	1325-1500	66	1	-	-	-
LA 118547	470	3911	Classic	1325-1500	156	2	-	-	-
LA 118547	487	3911	Classic	1325-1500	24	-	-	-	-
LA 118547	492	3911	Classic	1325-1500	32	-	-	-	-
LA 118547	494	3911	Classic	1325-1500	86	2	-	-	-
LA 118547	499	3911	Classic	1325-1500	103	1	-	-	-
LA 118547	482	125	Classic	1325-1500	129	1	-	-	-
LA 118547	483	184	Classic	1325-1500	110	-	-	-	-

Table A1.3c. Raw pollen counts, LA 105703, LA 105704, LA 105708, LA 105709, and LA 118547

Site	FS No.	Onagraceae	Fabaceae	*Polygonum*	*Eriogonum*	*Sarcobatus*	Poaceae	Cheno-am
LA 105703	24	-	-	-	-	-	-	34
LA 105703	25	-	-	1	-	-	5	63
LA 105703	18	-	-	-	-	3	7	37
LA 105703	5	-	-	2	-	1	-	76
LA 105703	31	-	-	-	-	-	-	29
LA 105703	56	-	-	-	-	1	1	35
LA 105703	33	-	-	-	-	3	3	51
LA 105703	51	-	-	1	-	2	-	19
LA 105703	35	-	-	-	-	1	4	16
LA 105703	44	1	-	-	-	2	3	44
LA 105703	45	-	-	-	-	-	1	55
LA 105703	65	-	-	-	-	1	2	19
LA 105703	83	-	-	-	-	2	-	27
LA 105703	88	-	-	-	-	-	1	35
LA 105703	79	-	-	-	-	2	6	51
LA 105703	84	-	-	-	-	3	1	43
LA 105703	73	-	-	1	-	-	1	14
LA 105703	71	-	-	-	-	4	2	53
LA 105703	91	-	-	-	-	-	1	27
LA 105703	90	-	-	-	-	-	-	26
LA 105704	3	1	-	-	-	2	1	44
LA 105704	8	-	-	-	1	1	2	28
LA 105704	1	-	-	-	-	-	4	22
LA 105708	22	-	-	-	-	-	1	36
LA 105708	8	-	-	-	1	-	4	35
LA 105708	11	-	-	-	-	-	-	46
LA 105708	26	-	-	-	-	-	1	42
LA 105708	21	-	-	-	-	2	2	62
LA 105708	29	-	-	-	-	-	1	51
LA 105709	433	-	-	-	-	-	6	70
LA 105709	430	-	-	-	-	1	1	42
LA 118547	473	-	-	-	-	-	-	75
LA 118547	459	-	-	-	-	2	8	96
LA 118547	456	-	-	-	-	2	4	102
LA 118547	465	-	-	-	-	-	-	50
LA 118547	461	-	-	-	-	-	3	84
LA 118547	497	-	-	-	-	1	4	47
LA 118547	472	-	-	-	-	-	2	40
LA 118547	470	-	-	-	-	1	6	53
LA 118547	487	-	-	-	-	-	1	23
LA 118547	492	-	-	-	-	-	3	25
LA 118547	494	-	1	-	-	-	1	43
LA 118547	499	-	-	-	-	-	1	27
LA 118547	482	-	-	-	-	-	-	51
LA 118547	483	-	-	-	-	-	5	46

Table A1.3d. Raw pollen counts, LA 105703, LA 105704, LA 105708, LA 105709, and LA 118547

Site	FS No.	Cheno-am af	Asteraceae High-Spine	Asteraceae Low-Spine	Liguliflorae	*Artemisia*	Cactaceae
LA 105703	24	-	6	8	-	-	-
LA 105703	25	-	5	4	-	-	-
LA 105703	18	-	6	11	-	-	1
LA 105703	5	-	3	9	-	5	-
LA 105703	31	-	1	1	-	1	-
LA 105703	56	-	3	2	-	2	1
LA 105703	33	-	2	5	-	5	-
LA 105703	51	-	5	5	-	2	-
LA 105703	35	-	1	3	-	3	-
LA 105703	44	-	3	21	-	1	-
LA 105703	45	-	3	1	-	1	-
LA 105703	65	-	1	1	-	-	-
LA 105703	83	-	1	2	-	-	-
LA 105703	88	-	7	3	-	1	-
LA 105703	79	-	6	7	-	1	-
LA 105703	84	-	-	4	-	-	-
LA 105703	73	-	1	1	-	-	-
LA 105703	71	1	2	2	-	-	-
LA 105703	91	-	3	3	-	-	-
LA 105703	90	-	2	1	-	1	-
LA 105704	3	-	4	8	-	-	-
LA 105704	8	-	1	2	1	1	-
LA 105704	1	-	-	5	-	-	-
LA 105708	22	-	4	2	-	-	-
LA 105708	8	1	3	3	-	6	-
LA 105708	11	-	2	1	-	1	-
LA 105708	26	-	2	4	-	2	-
LA 105708	21	1	7	5	-	4	-
LA 105708	29	-	2	4	-	1	-
LA 105709	433	-	6	10	-	11	1
LA 105709	430	-	4	9	-	2	-
LA 118547	473	2	7	8	-	3	-
LA 118547	459	1	9	18	-	2	-
LA 118547	456	1	21	23	-	6	-
LA 118547	465	1	1	9	-	3	-
LA 118547	461	-	10	10	-	1	-
LA 118547	497	-	4	27	-	2	-
LA 118547	472	-	6	4	-	1	-
LA 118547	470	1	9	16	-	1	1
LA 118547	487	-	1	1	-	-	-
LA 118547	492	-	3	1	-	-	-
LA 118547	494	1	6	6	1	1	-
LA 118547	499	-	1	-	-	1	-
LA 118547	482	1	2	8	-	-	-
LA 118547	483	1	5	6	-	-	-

Table A1.3e. Raw pollen counts, LA 105703, LA 105704, LA 105708, LA 105709, and LA 118547

Site	FS No.	*Cylindropuntia*	*Ephedra*	Nyctagninaceae	Indeterminate	*Typha angustifolia*
LA 105703	24	-	-	-	8	-
LA 105703	25	-	1	-	1	-
LA 105703	18	1	4	-	5	-
LA 105703	5	-	1	-	3	-
LA 105703	31	-	-	-	3	-
LA 105703	56	1	-	-		-
LA 105703	33	1	1	-	5	-
LA 105703	51	-	1	-	1	-
LA 105703	35	-	1	-	2	-
LA 105703	44	1	4	-	9	-
LA 105703	45	1	-	2	3	-
LA 105703	65	-	2	-	1	-
LA 105703	83	-	-	-	3	-
LA 105703	88	-	-	-	2	-
LA 105703	79	-	2	-	3	-
LA 105703	84	1	-	-	2	-
LA 105703	73	-	1	-	1	-
LA 105703	71	-	-	-	3	-
LA 105703	91	-	-	-	2	-
LA 105703	90	2	-	-	1	-
LA 105704	3	-	4	-	12	-
LA 105704	8	-	-	-	-	-
LA 105704	1	-	1	-	1	-
LA 105708	22	2	-	-	1	-
LA 105708	8	-	1	-	1	-
LA 105708	11	-	2	-	3	-
LA 105708	26	1	-	-	5	-
LA 105708	21	-	2	-	3	-
LA 105708	29	78	2	-	2	-
LA 105709	433	-	4	-	9	-
LA 105709	430	1	1	-	4	-
LA 118547	473	1	3	-	9	-
LA 118547	459	1	7	-	6	-
LA 118547	456	-	4	-	8	-
LA 118547	465	1	2	-	4	-
LA 118547	461	-	1	-	2	-
LA 118547	497	2	4	-	5	-
LA 118547	472	-	2	-	4	-
LA 118547	470	2	-	-	4	-
LA 118547	487	-	-	-	1	-
LA 118547	492	-	-	-	1	1
LA 118547	494	-	-	-	7	-
LA 118547	499	1	-	-	-	-
LA 118547	482	1	3	-	2	-
LA 118547	483	-	-	1	3	-

Table A1.3f. Raw pollen counts, LA 105703, LA 105704, LA 105708, LA 105709, and LA 118547

Site	FS No.	Unknown Triporate	Malvaceae	*Sphaeralcea*	*Zea mays*	Sum	Percent Indeterminate
LA 105703	24	-	-	-	4	235	3.4
LA 105703	25	-	1	-	2	193	0.52
LA 105703	18	-	1	-	6	256	1.95
LA 105703	5	-	-	-	-	308	0.97
LA 105703	31	-	-	-	2	92	3.26
LA 105703	56	-	1	-	1	109	0
LA 105703	33	-	-	-	3	300	1.67
LA 105703	51	-	-	-	1	116	0.86
LA 105703	35	-	-	-	1	198	1.01
LA 105703	44	1	-	-	1	158	5.7
LA 105703	45	-	-	-	-	95	3.16
LA 105703	65	-	-	-	2	58	1.72
LA 105703	83	-	-	-	-	81	3.7
LA 105703	88	-	-	-	2	193	1.04
LA 105703	79	-	-	-	6	282	1.06
LA 105703	84	-	-	-	1	90	2.22
LA 105703	73	-	-	-	-	38	2.63
LA 105703	71	-	-	-	2	177	1.69
LA 105703	91	-	-	-	1	138	1.45
LA 105703	90	-	-	-	-	88	1.14
LA 105704	3	-	-	-	1	402	2.99
LA 105704	8	-	-	-	2	186	0
LA 105704	1	-	-	-	2	160	0.63
LA 105708	22	-	-	-	-	128	0.78
LA 105708	8	-	-	1	3	242	0.41
LA 105708	11	-	-	-	2	140	2.14
LA 105708	26	-	-	-	3	183	2.73
LA 105708	21	-	-	-	2	291	1.03
LA 105708	29	-	-	-	-	364	0.55
LA 105709	433	-	-	-	2	335	2.69
LA 105709	430	-	-	-	7	304	1.32
LA 118547	473	-	-	-	1	334	2.69
LA 118547	459	-	1	-	4	318	1.89
LA 118547	456	-	-	-	3	378	2.12
LA 118547	465	-	-	-	2	166	2.41
LA 118547	461	-	1	-	6	246	0.81
LA 118547	497	-	-	-	1	237	2.11
LA 118547	472	-	-	-	-	126	3.17
LA 118547	470	-	-	1	2	255	1.57
LA 118547	487	-	1	-	2	54	1.85
LA 118547	492	-	-	-	1	67	1.49
LA 118547	494	-	-	-	1	156	4.49
LA 118547	499	-	-	-	3	138	0
LA 118547	482	-	-	-	4	202	0.99
LA 118547	483	-	-	-	2	179	1.68

Table A1.3g. Numbers including counts and low-magnification scan of slides, LA 105703, LA 105704, LA 105708, LA 105709, and LA 118547

Site	FS No.	*Abies*	*Zea mays*	*Sphaeralcea*	Cactaceae	*Cylindropuntia*	*Platyopuntia*
LA 105703	24	1	41	-	3	-	-
LA 105703	25	-	16	-	2	-	-
LA 105703	18	-	49	-	1	3	-
LA 105703	5	1	31	-	2	6	-
LA 105703	31	-	11	-	-	2	3
LA 105703	56	-	5	-	1	2	-
LA 105703	33	4	34	-	2	4	-
LA 105703	51	-	14	-	-	2	-
LA 105703	35	7	37	-	1	5	-
LA 105703	44	-	19	-	5	2	-
LA 105703	45	-	8	-	1	7	-
LA 105703	65	-	8	-	1	2	-
LA 105703	83	-	11	-	-	3	-
LA 105703	88	-	20	-	-	4	-
LA 105703	79	6	51	-	-	18	-
LA 105703	84	-	21	-	1	31	1
LA 105703	73	-	2	-	-	2	-
LA 105703	71	-	26	-	-	3	-
LA 105703	91	-	18	-	1	2	-
LA 105703	90	-	2	-	2	4	-
LA 105704	3	6	37	-	2	2	-
LA 105704	8	1	15	-	-	1	-
LA 105704	1	2	15	-	-	8	-
LA 105708	22	-	13	-	-	8	-
LA 105708	8	-	26	-	-	3	-
LA 105708	11	-	21	-	-	4	-
LA 105708	26	-	26	-	2	6	-
LA 105708	21	16	65	-	3	8	-
LA 105708	29	-	33	-	-	963	-
LA 105709	433	3	44	-	-	7	-
LA 105709	430	-	66	-	-	12	-
LA 118547	473	6	71	2	3	13	-
LA 118547	459	-	43	-	2	3	-
LA 118547	456	1	89	-	-	7	-
LA 118547	465	2	10	-	-	7	-
LA 118547	461	1	17	-	-	-	-
LA 118547	497	2	24	-	-	10	-
LA 118547	472	-	10	-	-	3	-
LA 118547	470	1	26	2	4	7	-
LA 118547	487	-	5	-	-	1	-
LA 118547	492	-	6	-	1	1	-
LA 118547	494	5	34	-	1	10	-
LA 118547	499	-	24	-	-	4	-
LA 118547	482	-	27	-	-	7	-
LA 118547	483	-	28	-	-	9	-

Table A1.3h. Numbers including counts and low-magnification scan of LA 105703, LA 105704, LA 105708, LA 105709, and LA 118547

Site	FS No.	Onagraceae	*Prosopis*	*Carya*	Nyctaginaceae	Malvaceae	Cucurbitaceae
LA 105703	24	-	-	-	-	-	-
LA 105703	25	-	-	-	-	-	-
LA 105703	18	-	-	-	-	2	1
LA 105703	5	1	-	-	-	1	-
LA 105703	31	1	-	-	-	2	-
LA 105703	56	-	-	-	-	-	-
LA 105703	33	1	-	-	1	13	-
LA 105703	51	-	-	-	-	-	-
LA 105703	35	-	1	1	-	1	-
LA 105703	44	-	-	-	-	-	-
LA 105703	45	1	-	-	5	5	-
LA 105703	65	1	-	-	3	3	-
LA 105703	83	-	-	-	1	-	-
LA 105703	88	-	-	-	2	-	1
LA 105703	79	1	-	-	4	-	-
LA 105703	84	-	-	-	-	9	-
LA 105703	73	-	-	-	-	2	-
LA 105703	71	-	-	-	-	-	-
LA 105703	91	1	-	-	-	1	-
LA 105703	90	-	-	-	1	-	-
LA 105704	3	1	-	-	1	1	-
LA 105704	8	1	-	-	1	5	-
LA 105704	1	-	-	-	-	-	-
LA 105708	22	1	-	-	2	-	-
LA 105708	8	-	-	-	1	-	-
LA 105708	11	1	-	-	-	-	-
LA 105708	26	-	-	-	-	5	-
LA 105708	21	1	-	1	-	-	-
LA 105708	29	1	-	-	1	-	1
LA 105709	433	-	-	-	1	-	-
LA 105709	430	2	-	-	-	-	-
LA 118547	473	1	-	-	-	1	-
LA 118547	459	2	-	-	-	3	-
LA 118547	456	2	-	-	2	3	-
LA 118547	465	-	-	1	-	14	-
LA 118547	461	1	-	-	-	2	-
LA 118547	497	2	-	-	-	14	-
LA 118547	472	-	-	-	-	1	-
LA 118547	470	1	-	-	-	2	-
LA 118547	487	-	-	-	-	1	1
LA 118547	492	-	-	-	-	2	-
LA 118547	494	-	-	-	-	-	-
LA 118547	499	-	-	-	-	2	-
LA 118547	482	1	-	-	2	1	-
LA 118547	483	1	-	-	1	-	-

Table A1.3i. Numbers including counts and low-magnification scan of LA 105703, LA 105704, LA 105708, LA 105709, and LA 118547

Site	FS No.	Cheno-am af	Unknown	*Picea*	*Shepherdia*
LA 105703	24	-	-	-	-
LA 105703	25	-	-	8	-
LA 105703	18	-	-	3	-
LA 105703	5	-	-	25	-
LA 105703	31	-	1	12	-
LA 105703	56	-	-	2	-
LA 105703	33	-	-	-	-
LA 105703	51	-	-	15	-
LA 105703	35	-	-	6	-
LA 105703	44	-	-	28	1
LA 105703	45	-	-	4	-
LA 105703	65	-	-	1	-
LA 105703	83	-	-	-	-
LA 105703	88	-	-	3	-
LA 105703	79	1	-	17	-
LA 105703	84	-	-	37	-
LA 105703	73	-	-	-	-
LA 105703	71	-	-	-	-
LA 105703	91	-	-	6	1
LA 105703	90	-	-	8	-
LA 105704	3	-	-	4	-
LA 105704	8	-	-	35	-
LA 105704	1	-	-	13	-
LA 105708	22	-	-	19	-
LA 105708	8	-	-	3	-
LA 105708	11	-	-	22	-
LA 105708	26	-	-	24	-
LA 105708	21	-	-	28	-
LA 105708	29	-	-	117	-
LA 105709	433	-	-	25	-
LA 105709	430	-	-	98	-
LA 118547	473	-	-	42	-
LA 118547	459	-	-	77	-
LA 118547	456	-	-	11	1
LA 118547	465	-	-	17	-
LA 118547	461	-	-	2	-
LA 118547	497	-	-	3	-
LA 118547	472	-	-	7	-
LA 118547	470	-	-	6	-
LA 118547	487	-	-	21	-
LA 118547	492	-	-	3	-
LA 118547	494	-	-	4	-
LA 118547	499	-	-	16	-
LA 118547	482	-	-	9	-
LA 118547	483	-	-	6	-

Table A1.4a. Pollen concentration values, LA 105703, LA 105704, LA 105708, LA 105709, and LA 118547

Site	FS No.	EU	Grid	Stratum	Level	Elevation (ft)	Feature	Type
LA 105703	24	A	2	2	2	6150	8	gravel-mulch field
LA 105703	25	B	3	2	2	6150	2	gravel-mulch field
LA 105703	18	C	3	2	2	6150	2	gravel-mulch field
LA 105703	5	D	4	2	2	6150	2	gravel-mulch field
LA 105703	31	E	1	2	2	6150	18	gravel-mulch field
LA 105703	56	E	3	4	3	6150	18	cobble-mulch field
LA 105703	33	F	1	2	2	6150	18	gravel-mulch field
LA 105703	51	F	3-4	4	4	6150	18	cobble-mulch field
LA 105703	35	G	2	2	2	6150	18	gravel-mulch field
LA 105703	44	H	3	2	2	6150	18	gravel-mulch field
LA 105703	45	H	1	4	3	6150	18	cobble-mulch field
LA 105703	65	I	1	4	3	6150	18	gravel-mulch field
LA 105703	83	J	3	2	2	6150	22	gravel-mulch field
LA 105703	88	J	2	4	3	6150	22	cobble-mulch field
LA 105703	79	K	2	2	2	6150	22	gravel-mulch field
LA 105703	84	K	2	4	4	6150	22	cobble-mulch field
LA 105703	73	L	1	4	3	6150	18	gravel-mulch field
LA 105703	71	M	3	2	2	6150	21	gravel-mulch field
LA 105703	91	N	2	2	2	6150	18	gravel-mulch field
LA 105703	90	O	3	2	2	6150	18	gravel-mulch field
LA 105704	3	A	2	2	1	6250	1	gravel-mulch field
LA 105704	8	B	1	2	1	6250	1	gravel-mulch field
LA 105704	1	C	3	2	1	6250	2	gravel-mulch field
LA 105708	22	A	3	3	3	6200	9	gravel-mulch field
LA 105708	8	B	3	2	2	6200	9	gravel-mulch field
LA 105708	11	C	3	2	2	6200	9	gravel-mulch field
LA 105708	26	D	4	2	2	6200	3	gravel-mulch field
LA 105708	21	E	2	2	2	6200	3	gravel-mulch field
LA 105708	29	F	4	2	2	6200	3	gravel-mulch field
LA 105709	433	A	2	2	1	6150	1	gravel-mulch field
LA 105709	430	C	3	2	1	6150	4	gravel-mulch field
LA 118547	473	A	2	2	2	6165	15	gravel-mulch field
LA 118547	459	B	1	2	2	6165	15	gravel-mulch field
LA 118547	456	C	2	2	2	6165	15	gravel-mulch field
LA 118547	465	D	2	2	2	6165	15	gravel-mulch field
LA 118547	461	E	3	2	2	6165	15	gravel-mulch field
LA 118547	497	F	1-4	2	2	6165	15	gravel-mulch field
LA 118547	472	G	1	2	2	6165	15	gravel-mulch field
LA 118547	470	H	2	3	3	6165	15	gravel-mulch field
LA 118547	487	I	1	2	2	6165	15	gravel-mulch field
LA 118547	492	J	4	2	2	6165	15	gravel-mulch field
LA 118547	494	K	3	2	2	6165	15	gravel-mulch field
LA 118547	499	L	4	2	2	6165	15	gravel-mulch field
LA 118547	482	BT-1	0	0	0	6165	1	borrow pit
LA 118547	483	BT-2	0	0	0	6165	2	borrow pit

Table A1.4b. Pollen concentration values, LA 105703, LA 105704, LA 105708, LA 105709, and LA 118547

Site	FS No.	Size	Period	Age (A.D.)	*Pinus*	*Juniperus*	*Picea*	*Abies*	*Quercus*
LA 105703	24	64	Classic	1325-1500	2964	52	0	0	0
LA 105703	25	3479	Classic	1325-1500	2108	39	0	0	0
LA 105703	18	3479	Classic	1325-1500	5508	32	65	32	0
LA 105703	5	3479	Classic	1325-1500	3177	47	31	0	16
LA 105703	31	2715	Classic	1325-1500	707	0	0	0	0
LA 105703	56	2715	Classic	1325-1500	661	11	0	0	0
LA 105703	33	2715	Classic	1325-1500	3041	28	43	28	0
LA 105703	51	2715	Classic	1325-1500	1327	0	34	0	0
LA 105703	35	2715	Classic	1325-1500	11708	368	74	74	0
LA 105703	44	2715	Classic	1325-1500	1398	67	22	0	0
LA 105703	45	2715	Classic	1325-1500	540	0	0	0	0
LA 105703	65	2715	Classic	1325-1500	331	12	0	0	0
LA 105703	83	936	Classic	1325-1500	1584	72	0	0	0
LA 105703	88	936	Classic	1325-1500	2474	0	0	0	0
LA 105703	79	936	Classic	1325-1500	4810	50	50	25	0
LA 105703	84	936	Classic	1325-1500	563	17	0	0	17
LA 105703	73	2715	Classic	1325-1500	213	0	0	0	0
LA 105703	71	820	Classic	1325-1500	1652	16	16	0	32
LA 105703	91	2715	Classic	1325-1500	2773	0	0	0	0
LA 105703	90	2715	Classic	1325-1500	587	11	0	0	0
LA 105704	3	180	Classic	1325-1500	4741	59	30	0	0
LA 105704	8	180	Classic	1325-1500	1515	21	0	0	0
LA 105704	1	48	Classic	1325-1500	2657	43	0	0	0
LA 105708	22	971	Classic	1325-1500	999	0	0	0	0
LA 105708	8	971	Classic	1325-1500	2976	17	33	0	0
LA 105708	11	971	Classic	1325-1500	1878	70	0	0	0
LA 105708	26	225	Classic	1325-1500	2253	0	19	0	19
LA 105708	21	225	Classic	1325-1500	8188	394	175	0	44
LA 105708	29	225	Classic	1325-1500	2640	0	24	12	0
LA 105709	433	444	Classic	1325-1500	3910	37	56	0	19
LA 105709	430	47	Classic	1325-1500	3500	15	15	15	0
LA 118547	473	3911	Classic	1325-1500	5763	133	53	0	27
LA 118547	459	3911	Classic	1325-1500	1715	11	0	0	0
LA 118547	456	3911	Classic	1325-1500	4040	0	40	0	0
LA 118547	465	3911	Classic	1325-1500	618	7	0	0	0
LA 118547	461	3911	Classic	1325-1500	854	14	0	7	0
LA 118547	497	3911	Classic	1325-1500	2514	74	0	19	0
LA 118547	472	3911	Classic	1325-1500	708	11	0	0	0
LA 118547	470	3911	Classic	1325-1500	3663	47	0	0	0
LA 118547	487	3911	Classic	1325-1500	185	0	0	0	0
LA 118547	492	3911	Classic	1325-1500	305	0	0	0	0
LA 118547	494	3911	Classic	1325-1500	3317	77	0	0	0
LA 118547	499	3911	Classic	1325-1500	1236	12	0	0	0
LA 118547	482	125	Classic	1325-1500	2750	21	0	0	0
LA 118547	483	184	Classic	1325-1500	1856	0	0	0	0

Table A1.4c. Pollen concentration values, LA 105703, LA 105704, LA 105708, LA 105709, and LA 118547

Site	FS No.	Onagraceae	Fabaceae	*Polygonum*	*Eriogonum*	*Sarcobatus*	Poaceae	Cheno-am
LA 105703	24	0	0	0	0	0	0	586
LA 105703	25	0	0	20	0	0	98	1230
LA 105703	18	0	0	0	0	97	227	1199
LA 105703	5	0	0	31	0	16	0	1195
LA 105703	31	0	0	0	0	0	0	373
LA 105703	56	0	0	0	0	11	11	386
LA 105703	33	0	0	0	0	43	43	725
LA 105703	51	0	0	17	0	34	0	327
LA 105703	35	0	0	0	0	74	295	1178
LA 105703	44	22	0	0	0	44	67	976
LA 105703	45	0	0	0	0	0	19	1061
LA 105703	65	0	0	0	0	12	24	225
LA 105703	83	0	0	0	0	72	0	972
LA 105703	88	0	0	0	0	0	17	610
LA 105703	79	0	0	0	0	50	150	1271
LA 105703	84	0	0	0	0	51	17	733
LA 105703	73	0	0	12	0	0	12	166
LA 105703	71	0	0	0	0	64	32	842
LA 105703	91	0	0	0	0	0	27	741
LA 105703	90	0	0	0	0	0	0	283
LA 105704	3	15	0	0	0	30	15	654
LA 105704	8	0	0	0	10	10	21	293
LA 105704	1	0	0	0	0	0	86	475
LA 105708	22	0	0	0	0	0	12	438
LA 105708	8	0	0	0	17	0	66	579
LA 105708	11	0	0	0	0	0	0	1080
LA 105708	26	0	0	0	0	0	19	782
LA 105708	21	0	0	0	0	88	88	2715
LA 105708	29	0	0	0	0	0	12	612
LA 105709	433	0	0	0	0	0	112	1303
LA 105709	430	0	0	0	0	15	15	642
LA 118547	473	0	0	0	0	0	0	1992
LA 118547	459	0	0	0	0	21	85	1016
LA 118547	456	0	0	0	0	40	80	2040
LA 118547	465	0	0	0	0	0	0	336
LA 118547	461	0	0	0	0	0	21	574
LA 118547	497	0	0	0	0	19	74	875
LA 118547	472	0	0	0	0	0	21	429
LA 118547	470	0	0	0	0	23	141	1244
LA 118547	487	0	0	0	0	0	8	177
LA 118547	492	0	0	0	0	0	29	238
LA 118547	494	0	39	0	0	0	39	1659
LA 118547	499	0	0	0	0	0	12	324
LA 118547	482	0	0	0	0	0	0	1087
LA 118547	483	0	0	0	0	0	84	776

Table A1.4d. Pollen concentration values, LA 105703, LA 105704, LA 105708, LA 105709, and LA 118547

Site	FS No.	Cheno-am af	High-Spine Asteraceae	Low-Spine Asteraceae	Liguliflorae	*Artemisia*	Cactaceae
LA 105703	24	0	103	138	0	0	0
LA 105703	25	0	98	78	0	0	0
LA 105703	18	0	194	356	0	0	32
LA 105703	5	0	47	142	0	79	0
LA 105703	31	0	13	13	0	13	0
LA 105703	56	0	33	22	0	22	11
LA 105703	33	0	28	71	0	71	0
LA 105703	51	0	86	86	0	34	0
LA 105703	35	0	74	221	0	221	0
LA 105703	44	0	67	466	0	22	0
LA 105703	45	0	58	19	0	19	0
LA 105703	65	0	12	12	0	0	0
LA 105703	83	0	36	72	0	0	0
LA 105703	88	0	122	52	0	17	0
LA 105703	79	0	150	174	0	25	0
LA 105703	84	0	0	68	0	0	0
LA 105703	73	0	12	12	0	0	0
LA 105703	71	16	32	32	0	0	0
LA 105703	91	0	82	82	0	0	0
LA 105703	90	0	22	11	0	11	0
LA 105704	3	0	59	119	0	0	0
LA 105704	8	0	10	21	10	10	0
LA 105704	1	0	0	108	0	0	0
LA 105708	22	0	49	24	0	0	0
LA 105708	8	17	50	50	0	99	0
LA 105708	11	0	47	23	0	23	0
LA 105708	26	0	37	74	0	37	0
LA 105708	21	44	306	219	0	175	0
LA 105708	29	0	24	48	0	12	0
LA 105709	433	0	112	186	0	205	19
LA 105709	430	0	61	138	0	31	0
LA 118547	473	53	186	212	0	80	0
LA 118547	459	11	95	191	0	21	0
LA 118547	456	20	420	460	0	120	0
LA 118547	465	7	7	60	0	20	0
LA 118547	461	0	68	68	0	7	0
LA 118547	497	0	74	503	0	37	0
LA 118547	472	0	64	43	0	11	0
LA 118547	470	23	211	376	0	23	23
LA 118547	487	0	8	8	0	0	0
LA 118547	492	0	29	10	0	0	0
LA 118547	494	39	231	231	39	39	0
LA 118547	499	0	12	0	0	12	0
LA 118547	482	21	43	171	0	0	0
LA 118547	483	17	84	101	0	0	0

Table A1.4e. Pollen concentration values, LA 105703, LA 105704, LA 105708, LA 105709, and LA 118547

Site	FS No.	*Cylindropuntia*	*Ephedra*	Nyctagninaceae	Indeterminate	*Typha angustifolia*
LA 105703	24	0	0	0	138	0
LA 105703	25	0	20	0	20	0
LA 105703	18	32	130	0	162	0
LA 105703	5	0	16	0	47	0
LA 105703	31	0	0	0	39	0
LA 105703	56	11	0	0	0	0
LA 105703	33	14	14	0	71	0
LA 105703	51	0	17	0	17	0
LA 105703	35	0	74	0	147	0
LA 105703	44	22	89	0	200	0
LA 105703	45	19	0	39	58	0
LA 105703	65	0	24	0	12	0
LA 105703	83	0	0	0	108	0
LA 105703	88	0	0	0	35	0
LA 105703	79	0	50	0	75	0
LA 105703	84	17	0	0	34	0
LA 105703	73	0	12	0	12	0
LA 105703	71	0	0	0	48	0
LA 105703	91	0	0	0	55	0
LA 105703	90	22	0	0	11	0
LA 105704	3	0	59	0	178	0
LA 105704	8	0	0	0	0	0
LA 105704	1	0	22	0	22	0
LA 105708	22	24	0	0	12	0
LA 105708	8	0	17	0	17	0
LA 105708	11	0	47	0	70	0
LA 105708	26	19	0	0	93	0
LA 105708	21	0	88	0	131	0
LA 105708	29	936	24	0	24	0
LA 105709	433	0	74	0	168	0
LA 105709	430	15	15	0	61	0
LA 118547	473	27	80	0	239	0
LA 118547	459	11	74	0	64	0
LA 118547	456	0	80	0	160	0
LA 118547	465	7	13	0	27	0
LA 118547	461	0	7	0	14	0
LA 118547	497	37	74	0	93	0
LA 118547	472	0	21	0	43	0
LA 118547	470	47	0	0	94	0
LA 118547	487	0	0	0	8	0
LA 118547	492	0	0	0	10	10
LA 118547	494	0	0	0	270	0
LA 118547	499	12	0	0	0	0
LA 118547	482	21	64	0	43	0
LA 118547	483	0	0	17	51	0

Table A1.4f. Pollen concentration values, LA 105703, LA 105704, LA 105708, LA 105709, and LA 118547

Site	FS No.	Unknown Triporate	Malvaceae	*Sphaeralcea*	*Zea mays*	Sum	Total Concentration
LA 105703	24	0	0	0	69	235	4050
LA 105703	25	0	20	0	39	193	3767
LA 105703	18	0	32	0	194	256	8294
LA 105703	5	0	0	0	0	308	4844
LA 105703	31	0	0	0	26	92	1183
LA 105703	56	0	11	0	11	109	1201
LA 105703	33	0	0	0	43	300	4263
LA 105703	51	0	0	0	17	116	1999
LA 105703	35	0	0	0	74	198	14580
LA 105703	44	22	0	0	22	158	3506
LA 105703	45	0	0	0	0	95	1832
LA 105703	65	0	0	0	24	58	686
LA 105703	83	0	0	0	0	81	2916
LA 105703	88	0	0	0	35	193	3362
LA 105703	79	0	0	0	150	282	7028
LA 105703	84	0	0	0	17	90	1535
LA 105703	73	0	0	0	0	38	449
LA 105703	71	0	0	0	32	177	2811
LA 105703	91	0	0	0	27	138	3789
LA 105703	90	0	0	0	0	88	957
LA 105704	3	0	0	0	15	402	5975
LA 105704	8	0	0	0	21	186	1944
LA 105704	1	0	0	0	43	160	3456
LA 105708	22	0	0	0	0	128	1559
LA 105708	8	0	0	17	50	242	4000
LA 105708	11	0	0	0	47	140	3287
LA 105708	26	0	0	0	56	183	3408
LA 105708	21	0	0	0	88	291	12741
LA 105708	29	0	0	0	0	364	4368
LA 105709	433	0	0	0	37	335	6238
LA 105709	430	0	0	0	107	304	4646
LA 118547	473	0	0	0	27	334	8870
LA 118547	459	0	11	0	42	318	3367
LA 118547	456	0	0	0	60	378	7560
LA 118547	465	0	0	0	13	166	1116
LA 118547	461	0	7	0	41	246	1682
LA 118547	497	0	0	0	19	237	4413
LA 118547	472	0	0	0	0	126	1352
LA 118547	470	0	0	23	47	255	5987
LA 118547	487	0	8	0	15	54	417
LA 118547	492	0	0	0	10	67	638
LA 118547	494	0	0	0	39	156	6017
LA 118547	499	0	0	0	36	138	1656
LA 118547	482	0	0	0	85	202	4306
LA 118547	483	0	0	0	34	179	3021

Table A1.4g. Pollen concentration values, LA 105703, LA 105704, LA 105708, LA 105709, and LA 118547

Site	FS No.	Marker	Transects	Total Transects	Markers / Slide	Markers / Slides 1-2	Markers / Slides 1-3	Total Markers	*Lycopodium* Added
LA 105703	24	94	4	26	611	793	937.5	2341.5	40500
LA 105703	25	83	4	24	498	1209	-	1707	40500
LA 105703	18	50	4	24	300	1075	737.5	2112.5	40500
LA 105703	5	103	3	25	858.3	1755	-	2613.3	40500
LA 105703	31	126	4	24	756	1365	-	2121	40500
LA 105703	56	147	6	27	661.5	1610	-	2271.5	40500
LA 105703	33	114	4	24	684	1196	-	1880	40500
LA 105703	51	94	4	23	540.5	1118	-	1658.5	40500
LA 105703	35	22	1	22	484	864	871	2219	40500
LA 105703	44	73	4	26	474.5	871	845	2190.5	40500
LA 105703	45	84	4	24	504	1066	292.5	1862.5	40500
LA 105703	65	137	4	24	822	2093	-	2915	40500
LA 105703	83	45	4	26	292.5	1078	342	1712.5	40500
LA 105703	88	93	4	24	558	1330	-	1888	40500
LA 105703	79	65	4	24	390	1162	385	1937	40500
LA 105703	84	95	6	26	411.7	784	612	1807.7	40500
LA 105703	73	137	4	24	822	1768	-	2590	40500
LA 105703	71	102	4	25	637.5	1358	-	1995.5	40500
LA 105703	91	59	4	28	413	1087.5	162.5	1663	40500
LA 105703	90	149	4	28	1043	1344	-	2387	40500
LA 105704	3	109	4	28	763	1092	-	1855	40500
LA 105704	8	155	4	26	1007.5	952	-	1959.5	40500
LA 105704	1	75	4	27	506.2	1204	-	1710.3	40500
LA 105708	22	133	4	24	798	840	-	1638	40500
LA 105708	8	98	4	28	686	1134	-	1820	40500
LA 105708	11	69	4	24	414	560	767	1741	40500
LA 105708	26	87	4	26	565.5	754	1296	2615.5	40500
LA 105708	21	37	2	24	444	754	1012.5	2210.5	40500
LA 105708	29	135	4	24	810	1274	-	2084	40500
LA 105709	433	87	2	24	1044	1174.5	-	2218.5	40500
LA 105709	430	106	4	25	662.5	1246	-	1908.5	40500
LA 118547	473	61	2	26	793	1605	-	2398	40500
LA 118547	459	153	4	22	841.5	2079	-	2920.5	40500
LA 118547	456	81	2	24	972	1417.5	-	2389.5	40500
LA 118547	465	241	4	28	1687	-	-	1687	40500
LA 118547	461	237	4	28	1659	-	-	1659	40500
LA 118547	497	87	4	26	565.5	1323	-	1888.5	40500
LA 118547	472	151	4	26	981.5	2038.5	-	3020	40500
LA 118547	470	69	2	24	828	1050	-	1878	40500
LA 118547	487	210	4	26	1365	2856	-	4221	40500
LA 118547	492	170	4	25	1062.5	1890	-	2952.5	40500
LA 118547	494	42	4	28	294	1120.5	585	1999.5	40500
LA 118547	499	135	2	24	1620	-	-	1620	40500
LA 118547	482	76	2	26	988	1386	-	2374	40500
LA 118547	483	96	2	25	1200	1391	-	2591	40500

Table A1.4h. Numbers including counts and low-magnification scan of slides, LA 105703, LA 105704, LA 105708, LA 105709, and LA 118547

Site	FS No.	Weight / Area	*Abies*	*Zea mays*	*Sphaeralcea*	Cactaceae	*Cylindropuntia*	*Platyopuntia*
LA 105703	24	25	0.7	28.4	0	2.1	0	0
LA 105703	25	25	0	15.2	0	1.9	0	0
LA 105703	18	25	0	37.6	0	0.8	2.3	0
LA 105703	5	25	0.6	19.2	0	1.2	3.7	0
LA 105703	31	25	0	8.4	0	0	1.5	2.3
LA 105703	56	25	0	3.6	0	0.7	1.4	0
LA 105703	33	25	3.4	29.3	0	1.7	3.4	0
LA 105703	51	25	0	13.7	0	0	2	0
LA 105703	35	25	5.1	27	0	0.7	3.7	0
LA 105703	44	25	0	14.1	0	3.7	1.5	0
LA 105703	45	25	0	7	0	0.9	6.1	0
LA 105703	65	25	0	4.4	0	0.6	1.1	0
LA 105703	83	25	0	10.4	0	0	2.8	0
LA 105703	88	25	0	17.2	0	0	3.4	0
LA 105703	79	25	5	42.7	0	0	15.1	0
LA 105703	84	25	0	18.8	0	0.9	27.8	0.9
LA 105703	73	25	0	1.3	0	0	1.3	0
LA 105703	71	25	0	21.1	0	0	2.4	0
LA 105703	91	25	0	17.5	0	1	1.9	0
LA 105703	90	25	0	1.4	0	1.4	2.7	0
LA 105704	3	25	5.2	32.3	0	1.7	1.7	0
LA 105704	8	25	0.8	12.4	0	0	0.8	0
LA 105704	1	25	1.9	14.2	0	0	7.6	0
LA 105708	22	25	0	12.9	0	0	7.9	0
LA 105708	8	25	0	23.1	0	0	2.7	0
LA 105708	11	25	0	19.5	0	0	3.7	0
LA 105708	26	25	0	16.1	0	1.2	3.7	0
LA 105708	21	25	11.7	47.6	0	2.2	5.9	0
LA 105708	29	25	0	25.7	0	0	748.6	0
LA 105709	433	25	2.2	32.1	0	0	5.1	0
LA 105709	430	25	0	56	0	0	10.2	0
LA 118547	473	25	4.1	48	1.4	2	8.8	0
LA 118547	459	25	0	23.9	0	1.1	1.7	0
LA 118547	456	25	0.7	60.3	0	0	4.7	0
LA 118547	465	25	1.9	9.6	0	0	6.7	0
LA 118547	461	25	1	16.6	0	0	0	0
LA 118547	497	25	1.7	20.6	0	0	8.6	0
LA 118547	472	25	0	5.4	0	0	1.6	0
LA 118547	470	25	0.9	22.4	1.7	3.5	6	0
LA 118547	487	25	0	1.9	0	0	0.4	0
LA 118547	492	25	0	3.3	0	0.5	0.5	0
LA 118547	494	25	4.1	27.5	0	0.8	8.1	0
LA 118547	499	25	0	24	0	0	4	0
LA 118547	482	25	0	18.4	0	0	4.8	0
LA 118547	483	25	0	17.5	0	0	5.6	0

Table A1.4i. Numbers including counts and low-magnification scan of LA 105703, LA 105704, LA 105708, LA 105709, and LA 118547

Site	FS No.	Onagraceae	*Prosopis*	*Carya*	Nyctaginaceae	Malvaceae	Cucurbitaceae	Unknown
LA 105703	24	0	0	0	0	0	0	0
LA 105703	25	0	0	0	0	1.9	0.9	0
LA 105703	18	0	0	0	0	0.8	0	0
LA 105703	5	0.6	0	0	0	1.2	0	0.6
LA 105703	31	0.8	0	0	0	0	0	0
LA 105703	56	0	0	0	0	9.3	0	0
LA 105703	33	0.9	0	0	0.9	0	0	0
LA 105703	51	0	0	0	0	1	0	0
LA 105703	35	0	0.7	0.7	0	0	0	0
LA 105703	44	0	0	0	0	3.7	0	0
LA 105703	45	0.9	0	0	4.3	2.6	0	0
LA 105703	65	0.6	0	0	1.7	0	0	0
LA 105703	83	0	0	0	0.9	0	0.9	0
LA 105703	88	0	0	0	1.7	0	0	0
LA 105703	79	0.8	0	0	3.3	7.5	0	0
LA 105703	84	0	0	0	0	1.8	0	0
LA 105703	73	0	0	0	0	0	0	0
LA 105703	71	0	0	0	0	0.8	0	0
LA 105703	91	1	0	0	0	0	0	0
LA 105703	90	0	0	0	0.7	0.7	0	0
LA 105704	3	0.9	0	0	0.9	4.4	0	0
LA 105704	8	0.8	0	0	0.8	0	0	0
LA 105704	1	0	0	0	0	0	0	0
LA 105708	22	1	0	0	2	0	0	0
LA 105708	8	0	0	0	0.9	0	0	0
LA 105708	11	0.9	0	0	0	4.7	0	0
LA 105708	26	0	0	0	0	0	0	0
LA 105708	21	0.7	0	0.7	0	0	0.7	0
LA 105708	29	0.8	0	0	0.8	0	0	0
LA 105709	433	0	0	0	0.7	0	0	0
LA 105709	430	1.7	0	0	0	0.8	0	0
LA 118547	473	0.7	0	0	0	2	0	0
LA 118547	459	1.1	0	0	0	1.7	0	0
LA 118547	456	1.4	0	0	1.4	9.5	0	0
LA 118547	465	0	0	1	0	1.9	0	0
LA 118547	461	1	0	0	0	13.7	0	0
LA 118547	497	1.7	0	0	0	0.9	0	0
LA 118547	472	0	0	0	0	1.1	0	0
LA 118547	470	0.9	0	0	0	0.9	0.9	0
LA 118547	487	0	0	0	0	0.8	0	0
LA 118547	492	0	0	0	0	0	0	0
LA 118547	494	0	0	0	0	1.6	0	0
LA 118547	499	0	0	0	0	1	0	0
LA 118547	482	0.7	0	0	1.4	0	0	0
LA 118547	483	0.6	0	0	0.6	0	0	0

Table A1.4j. Numbers including counts and low-magnification scan of slides, LA 105703, LA 105704, LA 105708, LA 105709, and LA 118547

Site	FS No.	Cheno-am af	*Picea*	*Shepherdia*	Maximum Estimated Potential Concentration
LA 105703	24	0	5.5	0	0.692
LA 105703	25	0	2.8	0	0.949
LA 105703	18	0	19.2	0	0.767
LA 105703	5	0	7.4	0	0.620
LA 105703	31	0	1.5	0	0.764
LA 105703	56	0	0	0	0.713
LA 105703	33	0	12.9	0	0.862
LA 105703	51	0	5.9	0	0.977
LA 105703	35	0	20.4	0.7	0.730
LA 105703	44	0	3	0	0.740
LA 105703	45	0	0.9	0	0.870
LA 105703	65	0	0	0	0.556
LA 105703	83	0	2.8	0	0.946
LA 105703	88	0.9	14.6	0	0.858
LA 105703	79	0	30.9	0	0.836
LA 105703	84	0	0	0	0.896
LA 105703	73	0	0	0	0.625
LA 105703	71	0	4.9	0.8	0.812
LA 105703	91	0	7.8	0	0.974
LA 105703	90	0	2.7	0	0.679
LA 105704	3	0	30.6	0	0.873
LA 105704	8	0	10.7	0	0.827
LA 105704	1	0	18	0	0.947
LA 105708	22	0	3	0	0.989
LA 105708	8	0	19.6	0	0.890
LA 105708	11	0	22.3	0	0.930
LA 105708	26	0	17.3	0	0.619
LA 105708	21	0	85.7	0	0.733
LA 105708	29	0	19.4	0	0.777
LA 105709	433	0	71.6	0	0.730
LA 105709	430	0	35.7	0	0.849
LA 118547	473	0	52	0	0.676
LA 118547	459	0	6.1	0.6	0.555
LA 118547	456	0	11.5	0	0.678
LA 118547	465	0	1.9	0	0.960
LA 118547	461	0	2.9	0	0.976
LA 118547	497	0	6	0	0.858
LA 118547	472	0	3.2	0	0.536
LA 118547	470	0	18.1	0	0.863
LA 118547	487	0	1.2	0	0.384
LA 118547	492	0	2.2	0	0.549
LA 118547	494	0	13	0	0.810
LA 118547	499	0	9	0	1.000
LA 118547	482	0	4.1	0	0.682
LA 118547	483	0	4.4	0	0.625

maximum potential-concentration value of 1 grain/g or less to maximize the number of potential economic taxa recovered. Since the objectives of both investigations are different, the results are reported separately. The samples from LA 105710 were all collected from Backhoe Trench 1 and provide a stratigraphic sequence. The individual results from this site are presented by stratum in descending order.

LA 105710

Stratum 0. FS 108 contained 9,443 grains/g total pollen concentration values with 1.14 percent indeterminate pollen. *Pinus* undifferentiated (2,196 grains/g), *Pinus ponderosa* (618 grains/g), and *Pinus edulis* (639 grains/g) clearly dominated the assemblage. *Juniperus, Picea*, and *Salix* were present in small amounts. Cheno-am (3,752 grains/g) pollen was high, with low to moderate amounts of both Poaceae and *Sarcobatus* (21 grains/g each). High-spine (682 grains/g) and low-spine (789 grains/g) Asteraceae were both high, with high amounts of *Artemisia* (238 grains/g). *Shepherdia*, Cactaceae (21 grains/g each), *Eriogonum* (277 grains/g), and *Zea mays* (43 grains/g) were also present. *Abies* (5 grains/g) and Onagraceae (2 grains/g) were observed only in the low-magnification scan of the slide.

Strata 1–2. FS 109 contained 2,340 grains/g total pollen concentration values. *Pinus* undifferentiated decreased to 630 grains/g. *Pinus ponderosa* (82 grains/g) and *Pinus edulis* (16 grains/g) also decreased. *Juniperus*, *Picea*, and *Abies* were also present in trace amounts. Cheno-am (1,252 grains/g) pollen was moderate, with high amounts of both high-spine (74 grains/g) and low-spine (180 grains/g) Asteraceae pollen. A small number of cheno-am clumps (8/g) were also present. *Cylindropuntia* and *Ephedra* (8 grains/g each) were present in addition to *Zea mays* (16 grains/g).
An unknown species (2 grains/g) was observed only in the low-magnification scan of the slide.

Stratum 3. FS 110 contained 668 grains/g total pollen concentration values with 3.15 percent indeterminate pollen. *Pinus* (126 grains/g) was very low, with only a trace (6 grains/g) of *Pinus ponderosa* and *Juniperus* (12 grains/g) pollen. Cheno-am (376 grains/g), Poaceae (9 grains/g), and high-spine Asteraceae (9 grains/g) were present in very low amounts, with higher amounts of low-spine Asteraceae (109 grains/g). *Zea mays* (3 grains/g) was present in very low amounts.

Stratum 6. FS 111 contained 691 grains/g total pollen concentration values with 3.3 percent indeterminate pollen. *Pinus* undifferentiated (111 grains/g) and *Pinus ponderosa* (3 grains/g) were present in trace amounts along with *Juniperus* (10 grains/g) pollen. Cheno-am (336 grains/g) and Poaceae (62 grains/g) were present in low and moderate amounts, with moderate to high amounts of low-spine (39 grains/g) and high-spine (95 grains/g) Asteraceae. *Eriogonum* and *Cylindropuntia* were present in trace amounts (3 grains/g each). A single grain of *Picea* was observed only in the low-magnification scan of the slide.

Stratum 25. FS 112 contained 698 grains/g total pollen concentration values with 5.49 percent indeterminate pollen. *Pinus* undifferentiated (112 grains/g), *Pinus ponderosa* (6 grains/g), and *Pinus edulis* (9 grains/g) were present in trace amounts along with *Juniperus* (12 grains/g). Traces of *Sarcobatus*, Poaceae, and cheno-am clumps (6 grains/g each) were present along with low amounts of cheno-am (395 grains/g) and low-spine Asteraceae (29 grains/g). High-spine Asteraceae (74 grains/g) were present in moderate to high amounts. *Zea mays* (3 grains/g) was present in low to trace amounts. *Cylindropuntia* (2 grains/g) was observed only in the low-magnification scan of the slide.

Stratum 17. FS 113 contained 3,545 grains/g total pollen concentration values with 3.17 percent indeterminate pollen. *Pinus* undifferentiated (257 grains/g) and *Pinus ponderosa* (8 grains/g) were present in trace amounts along with *Juniperus* (8 grains/g) pollen. Cheno-am (2,671 grains/g) dominated the assemblage, with moderate amounts of Poaceae (48 grains/g) and high amounts of high-spine (345 grains/g) and low-spine (72 grains/g) Asteraceae. A trace of *Artemisia* and *Ephedra* (8 grains/g each) were present. Cactaceae and *Cylindropuntia* (1 grain/g each) were observed only in the low-magnification scan of the slide.

Stratum 18. FS 114 contained 1,736 grains/g total pollen concentration values with 2.67 percent indeterminate pollen. *Pinus* undifferentiated (62 grains/g) was present in trace amounts, with only a trace of *Juniperus* (8 grains/g). Cheno-am (1,234 grains/g) and Poaceae (39 grains/g) were moderate, with high amounts of high-spine (278 grains/g) and low-spine (54 grains/g) Asteraceae. A small number of cheno-am clumps (8/g) were also present.

Stratum 19. FS 115 contained 1,584 grains/g total pollen concentration values with 1.13 percent indeterminate pollen. *Pinus* undifferentiated (66 grains/g) and *Pinus ponderosa* (6 grains/g) were present in trace amounts only, along with a small amount of Poaceae (12 grains/g). High-spine (54 grains/g) and low-spine (36 grains/g) Asteraceae were moderate.

Stratum 22. FS 116 contained 627 grains/g total pollen concentration values with 5.37 percent indeterminate pollen. *Pinus* undifferentiated (49 grains/g), *Pinus ponderosa* (8 grains/g), *Juniperus*, and *Acacia* (3 grains/g each) were present in trace amounts only. Cheno-am (435 grains/g) and Poaceae (18 grains/g) were very low, with moderate amounts of high-spine Asteraceae (60 grains/g) and low amounts (10 grains/g) of low-spine Asteraceae. *Cylindropuntia* was observed only in the low-magnification scan of the slide.

Stratum 21. FS 117 contained 1,153 grains/g total pollen concentration values with 6.83 percent indeterminate pollen. *Pinus* undifferentiated (118 grains/g) was very low, as was *Acacia* (6 grains/g). Cheno-am (473 grains/g) and Poaceae (28 grains/g) were both low, as were high-spine (366 grains/g) and low-spine (11 grains/g) Asteraceae. Cactaceae (51 grains/g) was high, and *Cylindropuntia* (11 grains/g) contained moderate concentration values. A small amount (6 grains/g) of *Zea mays* was also present.

Stratum 33. FS 118 contained 530 grains/g total pollen concentration values with 4.59 percent indeterminate pollen. *Pinus* undifferentiated (63 grains/g), *Pinus ponderosa* (10 grains/g), and *Pinus edulis* (12 grains/g) were present in trace amounts. Cheno-am (253 grains/g) and Poaceae (12 grains/g) were both low. High-spine Asteraceae (134 grains/g) was high, and low-spine (19 grains/g) Asteraceae was low.

Stratum 36. FS 119 contained 1,188 grains/g total pollen concentration values with 4.93 percent indeterminate pollen. *Pinus* undifferentiated (144 grains/g), *Pinus ponderosa* (5 grains/g), and *Pinus edulis* (16 grains/g) were present in trace amounts. Cheno-am (693 grains/g) was low, and Poaceae (48 grains/g) was moderate. High-spine (168 grains/g) and low-spine (48 grains/g) Asteraceae were high to moderate. *Cylindropuntia* (11 grains/g) was moderate, with a small amount of *Zea mays* (5 grains/g).

Stratum 38. FS 120 contained 637 grains/g total pollen concentration values with 1.83 percent indeterminate pollen. *Pinus* undifferentiated (108 grains/g), *Pinus ponderosa* (20 grains/g), and *Pinus edulis* (20 grains/g) were present in trace amounts. Cheno-am (380 grains/g) and Poaceae (6 grains/g) were both present in very small to trace amounts. Small amounts of both high-spine (82 grains/g) and low-spine (9 grains/g) Asteraceae pollen were present. *Zea mays* and *Platyopuntia* (1 grain/g each) were observed only in the low-magnification scan of the slide.

LA 105703

LA 105703 was at an elevation of 6,150 ft. Five features were sampled in 14 excavation units.

Feature 2. FS 25 was taken from EU-B and contained 3,767 grains/g total pollen concentration values with 0.52 percent indeterminate pollen. This field covered 3,479 sq m. *Pinus* (2,108 grains/g) pollen was high, with moderate amounts of *Juniperus* (39 grains/g). Cheno-am (1,230 grains/g) was moderate with high amounts of Poaceae (98 grains/g), high-spine Asteraceae (98 grains/g), and low-spine Asteraceae (78 grains/g). *Polygonum*, Malvaceae (20 grains/g each) and *Zea mays* (39 grains/g) were also present.

FS 18 was taken from EU-C and contained 8,294 grains/g total pollen concentration values with 1.95 percent indeterminate pollen. *Pinus* (5,508 grains/g) dominated the assemblage, with small amounts of *Juniperus, Abies* (32 grains/g), and *Picea* (65 grains/g). Cheno-am (1,199 grains/g) was moderate, with high amounts of *Sarcobatus* (97 grains/g) and Poaceae (227 grains/g). High-spine (194 grains/g) and low-spine (356 grains/g) Asteraceae were high, along with high amounts of *Ephedra* (130 grains/g). Cactaceae, *Cylindropuntia*, Malvaceae (32 grains/g each), and *Zea mays* (194 grains/g) were all present in high amounts.

FS 5 was taken from EU-D and contained 4,844 grains/g total pollen concentration values with 0.97 percent indeterminate pollen. *Pinus* (3,177 grains/g) was very high, with small to moderate amounts of *Juniperus* (47 grains/g), *Picea* (31 grains/g), and *Quercus* (16 grains/g). Cheno-am (1,195 grains/g) was moderate, with low amounts of *Sarcobatus* (16 grains/g). High-spine Asteraceae (47 grains/g) was moderate, with high amounts of low-spine Asteraceae (142 grains/g) and *Artemisia* (79 grains/g). *Polygonum* (31 grains/g) was moderate to high.

Feature 8. FS 24 was taken from EU-A and contained 4,050 grains/g total pollen concentration values with 3.4 percent indeterminate pollen. This field covered 64 sq m. *Pinus* (2,964 grains/g) was high, with moderate to high amounts of *Juniperus* (54 grains/g). Cheno-am (586 grains/g) was very low, with high amounts of high-spine (103 grains/g) and low-spine (138 grains/g) Asteraceae. *Zea mays* pollen (69 grains/g) was also high.

Feature 18. FS 31 was taken from EU-E and contained 1,183 grains/g total pollen concentration values with 3.26 percent indeterminate pollen. This field covered 2,715 sq m. This sample, like the majority of samples, was taken from the gravel-mulch layer (Stratum 2). *Pinus* (707 grains/g) was very low, with low amounts of cheno-am (373 grains/g). Both high-spine and low-spine Asteraceae and *Artemisia* (13 grains/g each) were very low. *Zea mays* (26 grains/g) was also present but in moderate to low amounts.

FS 56 was taken from EU-E and contained 1,201 grains/g total pollen concentration values with no indeterminate pollen. This sample was taken from the cobble mulch layer (Stratum 4). *Pinus* (661 grains/g) was very low, with low amounts of *Juniperus* (11 grains/g). Cheno-am (386 grains/g) was low, with small amounts of *Sarcobatus* and Poaceae (11 grains/g each). High-spine (33 grains/g) and low-spine Asteraceae and *Artemisia* (22 grains/g each) were also very low. Cactaceae, Malvaceae, and *Zea mays* (11 grains/g each) were also present.

FS 33 was taken from EU-F and contained 4,263 grains/g total pollen concentration values with 1.67 percent indeterminate pollen. *Pinus* (3041 grains/g) dominated the assemblage, with smaller amounts of *Juniperus, Abies* (28 grains/g each), and *Picea* (43 grains/g). Cheno-am (725 grains/g) was low, with moderate amounts of Poaceae and *Sarcobatus* (43 grains/g each). High-spine Asteraceae (28 grains/g) was low, with high amounts of low-spine Asteraceae and *Artemisia* (71 grains/g each). *Cylindropuntia* (11 grains/g) and *Zea mays* (43 grains/g) were also present.

FS 51 was taken from EU-F and contained 1,999 grains/g total pollen concentration values with 0.86 percent indeterminate pollen. This sample was taken from the cobble mulch layer (Stratum 4). *Pinus* (1327 grains/g) was low to moderate, with a small amount of *Picea* (34 grains/g). Cheno-am (327 grains/g) was very low, with moderate amounts of *Sarcobatus* (34 grains/g). High- and low-spine Asteraceae (86 grains/g each) were high, with moderate to low amounts of *Artemisia* (34 grains/g). *Polygonum* and *Zea mays* (17 grains/g each) were also present.

FS 35 was taken from EU-G and contained 14,580 grains/g total pollen concentration values with 1.01 percent indeterminate pollen. *Pinus* (11,708 grains/g) clearly dominated the assemblage with high amounts of *Juniperus* (368 grains/g), *Picea*, and *Abies* (74 grains/g each). Cheno-am (1,178 grains/g) was moderate, with high amounts of Poaceae (295 grains/g), *Sarcobatus* (74 grains/g), high-spine Asteraceae (74 grains/g), and low-spine Asteraceae and *Artemisia* (221 grains/g each). *Zea mays* (74 grains/g) was also high.

FS 44 was taken from EU-H and contained 3,506 grains/g total pollen concentration values with 5.70 percent indeterminate pollen. *Pinus* (1398 grains/g) was moderate, with *Juniperus* (67 grains/g) and *Picea* (22 grains/g) present. Cheno-am (976 grains/g) was low, with moderate amounts of Poaceae (67 grains/g) and *Sarcobatus* (44 grains/g). Low-spine Asteraceae was very high (466 grains/g), with moderate amounts of high-spine Asteraceae (67 grains/g) and *Artemisia* (22 grains/g). *Cylindropuntia*, Onagraceae, an unknown triporate, and *Zea mays* (22 grains/g each) were also present.

FS 45 was taken from EU-H and contained 1,832 grains/g total pollen concentration values with 3.16 percent indeterminate pollen. This sample was taken from the cobble mulch layer (Stratum 4). *Pinus* (540 grains/g) was very low, with low to moderate amounts of cheno-am (1,061 grains/g) and Poaceae (19 grains/g). High-spine Asteraceae (58 grains/g) was moderate, with low amounts of low-spine Asteraceae and *Artemisia* (19 grains/g). *Cylindropuntia* (19 grains/g) and Nyctaginaceae (39 grains/g) pollen were also present.

FS 65 was taken from EU-I and contained 686 grains/g total pollen concentration values with 1.72 percent indeterminate pollen. *Pinus, Juniperus, Sarcobatus*, Poaceae, cheno-am, high-spine and low-spine Asteraceae, *Ephedra*, and *Zea mays* were present in small amounts.

FS 73 was taken from EU-L and contained 449 grains/g total pollen concentration values with 2.63 percent indeterminate pollen. *Pinus, Polygonum*, Poaceae, cheno-am, high-spine and low-spine Asteraceae, and *Ephedra* were present in low amounts.

FS 91 was taken from EU-N and contained 3,789 grains/g total pollen concentration values with 1.45 percent indeterminate pollen. *Pinus* (2773 grains/g) dominated the assemblage. Cheno-am (741 grains/g) and Poaceae (27 grains/g) were very low, with high amounts of both high-spine and low-spine Asteraceae (82 grains/g each). *Zea mays* (32 grains/g) was also present.

FS 90 was taken from EU-O and contained 957 grains/g total pollen concentration values with 1.14 percent indeterminate pollen. *Pinus* (587 grains/g) was low, with low *Juniperus* (11 grains/g). Cheno-am (283 grains/g) was low, with low amounts of high-spine Asteraceae (22 grains/g) and low-spine Asteraceae and *Artemisia* (11 grains/g). *Cylindropuntia* (22 grains/g) was also present.

Feature 21. FS 71 was taken from EU-M and contained 2,811 grains/g total pollen concentration values with 1.69 percent indeterminate pollen. This field covered 820 sq m. *Pinus* (1,652 grains/g) was moderate to high, with low amounts of *Juniperus, Picea* (16 grains/g), and *Quercus* (32 grains/g). Cheno-am (842 grains/g) was low, with low Poaceae (32 grains/g) and high *Sarcobatus* (64 grains/g). Cheno-am clumps (16/g) were present, along with high-spine and low-spine Asteraceae (32 grains/g each). *Zea mays* (32 grains/g) was also present.

Feature 22. FS 83 was taken from EU-J and contained 2,916 grains/g total pollen concentration values with 3.7 percent indeterminate pollen. This field covered 936 sq m. *Pinus* (1,584 grains/g) was low, with moderate to high amounts of *Juniperus* (72 grains/g). Cheno-am (972 grains/g) was low, with high amounts of *Sarcobatus* (72 grains/g). High-spine (36 grains/g) and low-spine (72 grains/g) Asteraceae were also present.

FS 88 was taken from EU-J and contained 3,362 grains/g total pollen concentration values with 1.04 percent indeterminate pollen. This sample was taken from the cobble mulch layer (Stratum 4). *Pinus* (2,474 grains/g) was high, but no other arboreal taxa were present. Cheno-am (610 grains/g) and Poaceae (17 grains/g) pollen were very low. High-spine (122 grains/g) and low-spine Asteraceae (52 grains/g) were high, with low amounts of *Artemisia* (17 grains/g). *Zea mays* (35 grains/g) pollen was present in moderate to high amounts.

FS 79 was taken from EU-K and contained 7,028 grains/g total pollen concentration values with 1.06 percent indeterminate pollen. *Pinus* (4,810 grains/g) clearly dominated the assemblage, with high amounts of *Juniperus, Picea* (50 grains/g) and *Abies* (25 grains/g). Cheno-am (1,271 grains/g) was moderate, with high amounts of Poaceae (150 grains/g) and *Sarcobatus* (50 grains/g). High-spine (150 grains/g) and low-spine (174 grains/g) Asteraceae were high, with small amounts (25 grains/g) of *Artemisia*. *Zea mays* (150 grains/g) was quite high.

FS 84 was taken from EU-K and contained 1,535 grains/g total pollen concentration values with 2.22 percent indeterminate pollen. This sample was taken from the cobble mulch layer (Stratum 4). *Pinus* (563 grains/g) was very low, with traces of *Juniperus* and *Quercus* (17 grains/g each). Cheno-am (733 grains/g) was low, with high *Sarcobatus* (51 grains/g) and low Poaceae (17 grains/g). Low-spine (68 grains/g) Asteraceae was moderate, with small amounts of *Cylindropuntia* and *Zea mays* (17 grains/g each).

LA 105704

LA 105704 was at an elevation of 6,250 ft. Samples were taken from two features and three excavation units.

Feature 1. FS 3 was taken from EU-A and contained 5,975 grains/g total pollen concentration values with 2.99 percent indeterminate pollen. This field covered 180 sq m. *Pinus* (4,741 grains/g) was high and dominated the assemblage, along with high amounts of *Juniperus* (59 grains/g) and *Picea* (30 grains/g). Cheno-am (654 grains/g) was low, with low to moderate amounts of Poaceae (15 grains/g) and *Sarcobatus* (30 grains/g). High-spine (59 grains/g) and low-spine Asteraceae (115 grains/g) were present, along with *Ephedra* (59 grains/g) and a small amount of *Zea mays* (15 grains/g).

FS 8 was taken from EU-B and contained 1,944 grains/g total pollen concentration values with no indeterminate pollen. *Pinus* (1,515 grains/g) was low, with low *Juniperus* (21 grains/g). Cheno-am (293 grains/g) was very low, with small amounts of Poaceae (21 grains/g), *Eriogonum*, and *Sarcobatus* (10 grains/g each). Low-spine Asteraceae (21 grains/g), high-spine Asteraceae, Liguliflorae, and *Artemisia* (10 grains/g each) were present but in low amounts. A small amount of *Zea mays* (21 grains/g) was also present.

Feature 2. FS 1 was taken from EU-C and contained 3,456 grains/g total pollen concentration values with 0.63 percent indeterminate pollen. This field covered 48 sq m. *Pinus* (2,657 grains/g) was high, with high *Juniperus* (43 grains/g). Cheno-am (475 grains/g) was low, with high Poaceae (86 grains/g). Low-spine (108 grains/g) Asteraceae was high, with high (43 grains/g) amounts of *Zea mays*.

LA 105708

LA 105708 was at an elevation of 6,200 ft. Samples were taken from two features and six excavation units.

Feature 9. FS 22 was taken from EU-A and contained 1,559 grains/g total pollen concentration values with 0.78 percent indeterminate pollen. This field covered 971 sq m. *Pinus* (999 grains/g) was very low, with low cheno-am (438 grains/g) and Poaceae (12 grains/g). High-spine (49 grains/g) and low-spine (24 grains/g) Asteraceae were moderate to low. *Cylindropuntia* (24 grains/g) was also present.

FS 8 was taken from EU-B and contained 4,000 grains/g total pollen concentration values with 0.41 percent indeterminate pollen. *Pinus* (2976 grains/g) was high, with low amounts of *Juniperus* (17 grains/g) and Picea (33 grains/g). Cheno-am (579 grains/g) was low, with moderate Poaceae (66 grains/g) and low *Eriogonum* (17 grains/g). *Artemisia* (99 grains/g) and high-spine and low-spine Asteraceae (50 grains/g each) were present. *Zea mays* (50 grains/g), *Sphaeralcea* (17 grains/g), and *Cylindropuntia* (24 grains/g) were also present.

FS 11 was taken from EU-C and contained 3,287 grains/g total pollen concentration values with 2.14 percent indeterminate pollen. *Pinus* (1,878 grains/g) was moderate, with high *Juniperus* (80 grains/g). Cheno-am (1,080 grains/g) was moderate, with low amounts of high-spine (47 grains/g) and low-spine Asteraceae and *Artemisia* (23 grains/g each). *Zea mays* (47 grains/g) was high.

Feature 3. FS 26 was taken from EU-D and contained 3,408 grains/g total pollen concentration values with 2.73 percent indeterminate pollen. This field covered 225 sq m. *Pinus* (2,253 grains/g) was high, with small amounts of *Picea* and *Quercus* (19 grains/g each). Cheno-am (782 grains/g) and Poaceae (19 grains/g) were low, with moderate to high values of low-spine (74 grains/g) and high-spine Asteraceae and *Artemisia* (37 grains/g each). *Cylindropuntia* (19 grains/g) and *Zea mays* (56 grains/g) were also present.

FS 21 was taken from EU-E and contained 12,741 grains/g total pollen concentration values with 1.03 percent indeterminate pollen. *Pinus* (8188 grains/g) was very high, with high amounts of *Juniperus* (394 grains/g), *Picea* (175 grains/g), and *Quercus* (44 grains/g). Cheno-am (2,715 grains/g) was high, along with Poaceae and *Sarcobatus* (88 grains/g). A large number of cheno-am clumps (44/g) were also present. High-spine (306 grains/g) and low-spine (219 grains/g) Asteraceae and *Artemisia* (175 grains/g) were all high. *Zea mays* was also high (88 grains/g).

FS 29 was taken from EU-F and contained 4,368 grains/g total pollen concentration values with 0.55 percent indeterminate pollen. Pinus (2,640 grains/g) was high, with small amounts of Picea (24 grains/g) and Abies (12 grains/g). Cheno-am (612 grains/g) was low, with low Poaceae (12 grains/g). High-spine (24 grains/g) and low-spine (48 grains/g) Asteraceae and *Artemisia* (12 grains/g) were moderate to low. *Cylindropuntia* (936 grains/g) was extremely high.

LA 105709

LA 105709 was at an elevation of 6,150 ft. Samples were taken from two features and two excavation units.

Feature 1. FS 433 was taken from EU-A and contained 6,238 grains/g total pollen concentration values with 2.69 percent indeterminate pollen. This field covered 444 sq m. *Pinus* (3,910 grains/g) was high, with *Juniperus* (37 grains/g), *Picea* (56 grains/g) and *Quercus* (19 grains/g) also present. Cheno-am (1,303 grains/g) was moderate, with high Poaceae (112 grains/g). High-spine (112 grains/g) and low-spine (186 grains/g) Asteraceae and *Artemisia* (205 grains/g) were also high. *Zea mays* (37 grains/g) and Cactaceae were also present.

Feature 4. FS 430 was taken from EU-C and contained 4,646 grains/g total pollen concentration values with 1.32 percent indeterminate pollen. This field covered 47 sq m. *Pinus* (3,500 grains/g) was high, with traces of *Juniperus, Picea*, and *Abies* (15 grains/g each). Cheno-am (642 grains/g), Poaceae, and *Sarcobatus* (15 grains/g each) were all low. High-spine (61 grains/g) and low-spine (138 grains/g) Asteraceae and *Artemisia* (31 grains/g) were also present. *Cylindropuntia* (15 grains/g) and *Zea mays* (107 grains/g) were present.

LA 118547

LA 118547 was at an elevation of 6,165 ft. Samples were taken from one feature and 12 excavation units.

Feature 15. FS 473 was taken from EU-A and contained 8,870 grains/g total pollen concentration values with 2.69 percent indeterminate pollen. This field covered 3,911 sq m. *Pinus* (5,763 grains/g) was very high, with high to moderate amounts of *Juniperus* (133 grains/g), *Picea* (53 grains/g), and *Quercus* (27 grains/g). Cheno-am (1992 grains/g) was high, with a large amount (53/g) of cheno-am clumps. High-spine (186 grains/g) and low-spine (212 grains/g) Asteraceae and *Artemisia* (80 grains/g) were high. *Cylindropuntia* and *Zea mays* (27 grains/g) were both high.

FS 459 was taken from EU-B and contained 3,367 grains/g total pollen concentration values with 1.89 percent indeterminate pollen. *Pinus* (1715 grains/g) was moderate, with a trace of *Juniperus* (11 grains/g). Cheno-am (1,016 grains/g) was moderate, with high Poaceae (85 grains/g) and moderate *Sarcobatus* (21 grains/g). A small number of cheno-am clumps (11 grains/g) were also present. High-spine (95 grains/g) and low-spine (191 grains/g) Asteraceae were high, with low *Artemisia* (21 grains/g). *Cylindropuntia* and Malvaceae (11 grains/g) and *Zea mays* (42 grains/g) were also present.

FS 456 was taken from EU-C and contained 7,560 grains/g total pollen concentration values with 2.12 percent indeterminate pollen. *Pinus* (4040 grains/g) was high, with high *Picea* (40 grains/g). Cheno-am (2,040 grains/g) was high, with high Poaceae (80 grains/g) and *Sarcobatus* (40 grains/g). Cheno-am clumps were also high (20/g). High-spine (420 grains/g) and low-spine (460 grains/g) Asteraceae were high, as was *Artemisia* (120 grains/g) and *Zea mays* (60 grains/g).

FS 465 was taken from EU-D and contained 1,116 grains/g total pollen concentration values with 2.41 percent indeterminate pollen. *Pinus* (618 grains/g) was low, with a trace (7/g) of *Juniperus* pollen. Cheno-am (336 grains/g) was very low, with low to moderate amounts of high-spine (7 grains/g) and low-spine (60 grains/g) Asteraceae and *Artemisia* (20 grains/g). A small number of cheno-am clumps (7/g) were also present. *Cylindropuntia* (7 grains/g)and *Zea mays* (13 grains/g) were also present.

FS 461 was taken from EU-E and contained 1,682 grains/g total pollen concentration values with 0.81 percent indeterminate pollen. *Pinus* (854 grains/g) was low, with traces of *Juniperus* (14 grains/g) and *Abies* (7 grains/g). Cheno-am (574 grains/g) and Poaceae (21 grains/g) were low, with moderate amounts of both high-spine and low-spine Asteraceae (68 grains/g) and low amounts of Artemisia (7 grains/g). Malvaceae (7 grains/g) and *Zea mays* (41 grains/g) were also present.

FS 497 was taken from EU-F and contained 4,413 grains/g total pollen concentration values with 2.11 percent indeterminate pollen. *Pinus* (2514 grains/g) was high, with *Juniperus* (74 grains/g) and *Abies* (19 grains/g). Cheno-am (875 grains/g) was low, with high Poaceae (74 grains/g) and low *Sarcobatus* (19 grains/g).

High-spine Asteraceae (74 grains/g) and low-spine (503 grains/g) Asteraceae and *Artemisia* (37 grains/g) were present in addition to *Cylindropuntia* (37 grains/g) and *Zea mays* (19 grains/g).

FS 472 was taken from EU-G and contained 1,352 grains/g total pollen concentration values with 3.17 percent indeterminate pollen. *Pinus* (708 grains/g) was low, with a trace of *Juniperus* (11 grains/g). Cheno-am (429 grains/g) and Poaceae (21 grains/g) were low, with low *Artemisia* (11 grains/g) and moderate high-spine (64 grains/g) and low-spine (43 grains/g) Asteraceae.

FS 470 was taken from EU-H and contained 5,987 grains/g total pollen concentration values with 1.57 percent indeterminate pollen. *Pinus* (3663 grains/g) was high, with high *Juniperus* (47 grains/g). Cheno-am (1244 grains/g) was moderate, with high Poaceae (144 grains/g) and moderate *Sarcobatus* (21 grains/g). Cheno-am clumps (23/g) were high. High-spine (211 grains/g) and low-spine Asteraceae (376 grains/g) were high, with moderate *Artemisia* (23 grains/g). Cactaceae (23 grains/g) and *Cylindropuntia* (47 grains/g) were present in addition to *Sphaeralcea* (23 grains/g) and *Zea mays* (47 grains/g).

FS 487 was taken from EU-I and contained 417 grains/g total pollen concentration values with 1.85 percent indeterminate pollen. *Pinus*, Poaceae, cheno-am, high-spine and low-spine Asteraceae, Malvaceae, and *Zea mays* were present in addition to the indeterminate pollen.

FS 492 was taken from EU-J and contained 638 grains/g total pollen concentration values with 1.49 percent indeterminate pollen. *Pinus*, Poaceae, cheno-am, high- and low-spine Asteraceae, *Typha angustifolia*, and *Zea mays* were the only taxa present in addition to indeterminate pollen.

FS 494 was taken from EU-K and contained 6,017 grains/g total pollen concentration values with 4.49 percent indeterminate pollen. *Pinus* (3317 grains/g) was high, with high *Juniperus* (77 grains/g). Cheno-am (1659 grains/g) was moderate, with moderate Poaceae and Fabaceae (39 grains/g each). A large number of cheno-am clumps (39 /g) was present. High-spine and low-spine Asteraceae (231 grains/g each) were high, with moderate *Artemisia* and high Liguliflorae (39 grains/g each). *Zea mays* (39 grains/g) was moderate.

FS 499 was taken from EU-L and contained 1,656 grains/g total pollen concentration values with no indeterminate pollen. *Pinus* (1236 grains/g) was moderate, with a trace (12 grains/g) of *Juniperus*. Cheno-am (324 grains/g) and Poaceae (12 grains/g) were very low. High-spine Asteraceae and *Artemisia* (12 grains/g each) were low. *Cylindropuntia* (12 grains/g) and *Zea mays* (36 grains/g) were also present.

Two additional samples were taken from backhoe trenches from this site. FS 482 was from Trench 1 and contained 4,306 grains/g total pollen concentration values with 0.99 percent indeterminate pollen. *Pinus* (2750 grains/g) was high, with small amounts of *Juniperus* (21 grains/g). Cheno-am (1,087 grains/g) was low, with a moderate number of cheno-am clumps (21/g). High-spine (43 grains/g) and low-spine (171 grains/g) Asteraceae were moderate to high. *Cylindropuntia* (21 grains/g) and *Zea mays* (85 grains/g) were high.

FS 483 was from Trench 2 and contained 3,021 grains/g total pollen concentration values with 1.68 percent indeterminate pollen. *Pinus* (1856 grains/g) was moderate to high, with high Poaceae (84 grains/g) and low cheno-am (776 grains/g). Cheno-am clumps (17/g) were moderate. High-spine (84 grains/g) and low-spine (101 grains/g) Asteraceae were high, with a small amount of Nyctaginaceae (17 grains/g) pollen. *Zea mays* pollen (34 grains/g) was moderate.

Discussion

LA 105710

The pollen column from LA 105710 contained relatively low pollen concentration values, particularly from an area which is now heavily forested. The highest concentration values were obtained from the modern surface, which is to be expected. Only from this level do *Pinus* concentration values reflect the forested environment. *Pinus* values decrease to below 1,000 grains/g in all remaining strata, which normally suggests long-distance transport of pine pollen and a more open or grassland environment. However, in this case, the lowered pollen concentration values are more likely a result of pollen preservation than the absence of these taxa in the local flora. The upper levels also contain small amounts of other arboreal taxa such as *Picea, Abies*, and *Salix*, which were undoubtedly introduced by long-distance transport.

The upper strata (0–25) contain a consistent presence of *Juniperus* pollen. While the concentration values are only moderate to low, the consistent presence indicates its dominance in the local vegetation. *Juniperus* pollen is thin walled and does not preserve well under optimal conditions. Holloway (1981, 1989) demonstrated that over 80 percent of fresh *Juniperus* pollen was altered after only 25 alternating cycles of wet-dry and/or freeze-thaw conditions. *Juniperus* also contains a low percentage of the organic compound sporopollenin in the pollen wall, which has been shown to positively correlate with preservation (Brooks 1971). Thus the moderate to low pollen concentration values for this taxon belie its composition within the local plant community. Low-spine Asteraceae is also much higher in these upper strata, suggesting a rather large component of this taxon was present. Based on these data, I infer that a juniper-dominated assemblage in association with *Pinus* was likely present during the time period represented by Strata 1–25.

Total pollen concentration values and the percentage of indeterminate pollen are plotted against strata in Figure A1.1. The concentration values decrease to below 1,000 grains/g in the upper strata (through Stratum 25). The concentration values increase in Stratum 17, which is expected given the interpretation of this stratum as a buried A horizon. These again decrease gradually and remain below 1,000 grains/g from Stratum 22 through the bottom. Thus, there are apparently two sections of the profile containing very low pollen concentration values separated by increased values in the area of the buried A horizon. Both of these correlate with increased percentages of indeterminate pollen. While the indeterminate pollen percentages remain below 7 percent, they probably indicate that severe weathering has occurred within these strata. It is likely that large components of the assemblage have been lost, thus decreasing the percentage of indeterminate pollen observed.

In Strata 17–19 the assemblages reflect a slightly higher grassland component dominated by higher levels of cheno-am and high-spine Asteraceae, with moderate amounts of Poaceae and low-spine Asteraceae. The general trends of taxa within this area are increasing toward the surface, which is consistent with normal soil development. Thus, these three levels appear to represent a developmental sequence associated with the buried A horizon and not, specifically, with a climate change. Again, the plant community was likely dominated by a piñon-juniper association, which is not reflected in the pollen concentration values.

The number of economic taxa present in this column were fairly low but included *Zea mays, Eriogonum*, Cactaceae, *Cylindropuntia*, and a single occurrence of *Platyopuntia* from Stratum 38. *Zea mays* and *Eriogonum* contained high concentration values from the uppermost strata, which is not totally unexpected. *Eriogonum* was likely present in the area, and this high value corresponds to a naturally occurring deposition.

There appear to be three additional clusters of economic taxa within this column. *Zea mays* and *Cylindropuntia* show slight increases in Strata 25, 21, and 36, with slight increases in Cactaceae at Strata 17 and 21. *Platyopuntia* is present only from Stratum 38. This suggests that the three strata may have been occupational surfaces. The presence of Cactaceae pollen from Stratum 17 is possibly natural, since this level was defined as a buried A horizon.

Based on the pollen data from this profile, I suspect that an open woodland dominated by a piñon-juniper plant association was present throughout the time period represented by these deposits. The profile is thought to date more recently than the associated archaeological site, which is Classic period in age. Thus the profile is likely younger than A.D. 1325–1500.

Agricultural Field Sites

The arboreal pollen is completely dominated by *Pinus*. This taxon is present in fairly high concentration values throughout the sites and features, even in the samples with the lowest pollen concentration values. *Pinus* mean values are present in excess of 1,500 grains/g. This suggests that pines were likely in the immediate vicinity of these sites during the occupation. Both *Picea* and *Abies* pollen was likely introduced via long-distance transport, since neither of these taxa are

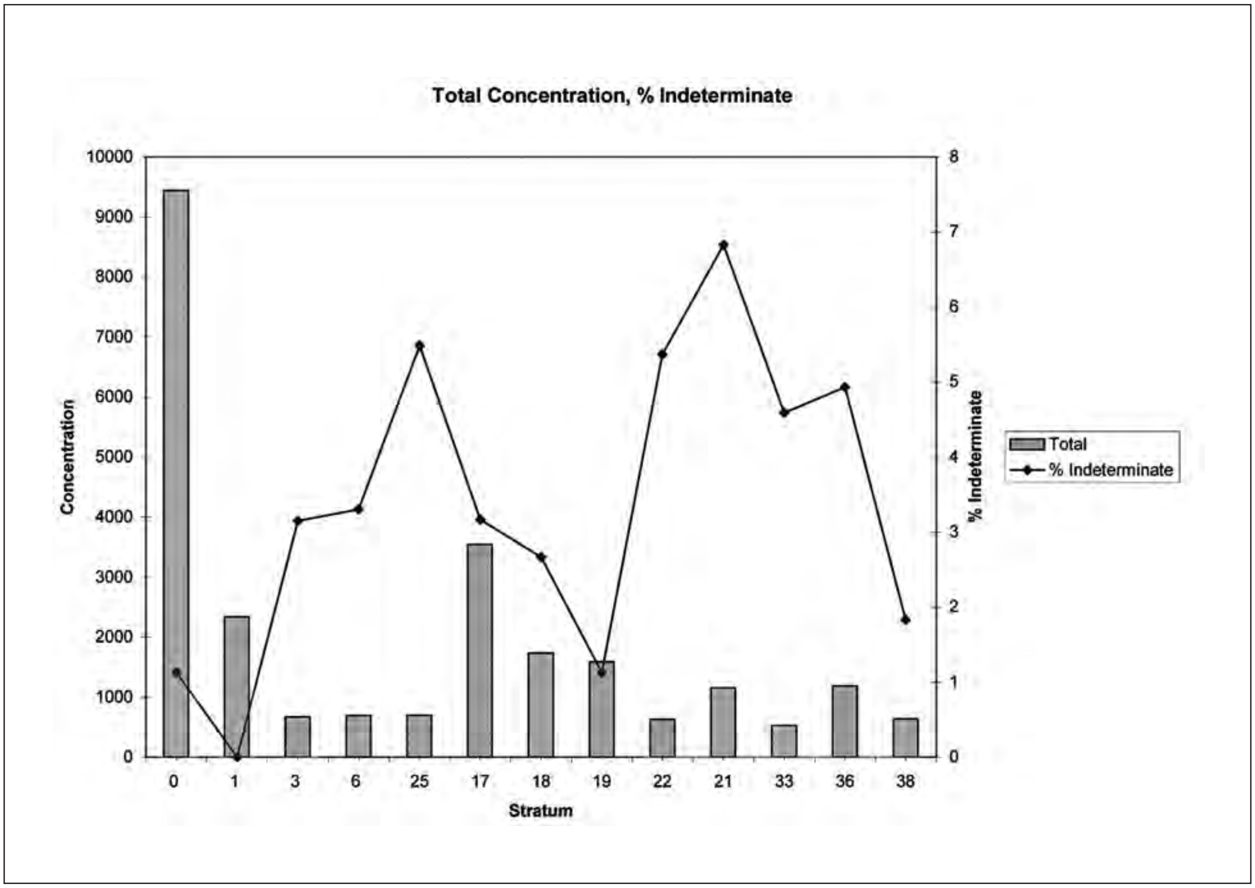

Figure A1.1. Total pollen concentration values and the percentage of indeterminate pollen plotted against strata, LA 105710.

present in the local plant community today. *Abies* is present in three of the four features from LA 105703, the northernmost site. Picea is present at all five sites, but again the concentration values are slightly higher in the northern sites.

The nonarboreal pollen is somewhat wider in distribution. Cheno-am pollen tends to increase in concentration values toward the south, but the difference is minor. The presence of both high-spine and low-spine Asteraceae, Poaceae, *Artemisia*, and Nyctaginaceae pollen is consistent with open field areas such as these. These background pollen types reflect the open character of the vegetation, which is expected given that they are interpreted as agricultural fields.

Principal Components Analysis (PCA)

In order to analyze the data sets from the agricultural field sites and LA 105710, the pollen concentration values were used in a principal components analysis procedure (Kovach 1998). The data from LA 105710 was analyzed separately, since this column was taken primarily for environmental interpretations and was counted using full microscopy instead of ISM. The data set from the agricultural field sites was adjusted prior to using PCA. Economic taxa and some additional arboreal taxa (*Picea* and *Abies*) were observed in the low-magnification scan of the slide. These concentration values were adjusted by using the total number of selected economic taxa grains present on all slides and the total of estimated marker grains per sample. In this study, this may represent a maximum of the total of three slides. Since pollen grains are not evenly distributed over the surface of the microscope slide (Brookes and Thomas 1967), these adjusted pollen concentration values generally result in slightly lowered pollen concentration values. However, these same taxa are present in a greater number of samples. Thus the adjusted pollen concentration values of the economic and arboreal taxa were substituted for the concentration values obtained solely from the actual counts before running the PCA procedure. This eliminated the necessity for explaining why duplicate sets of taxa were used in the PCA, which also would have unnecessarily biased the data by artificially increasing the proportion of economic pollen. Also, I felt that it was more accurate to include the increased number of occurrences of these taxa to obtain more reliable results from the PCA.

LA 105710. Table A1.5 contains the results of the PCA from LA 105710. Table A1.5a contains the results of the Eigenvalue analysis. Axis 1 accounted for 58.6742 percent of the variation, while Axis 2 added an additional 16.7299 percent. Over 92 percent of the total variation in the pollen concentration values was explained by the first five axes. Table A1.5b contains the variable loadings from this analysis; those higher than 0.2250 are indicated in boldface. Axis 1 was dominated by the effects of *Pinus, Juniperus*, cheno-am, high-spine and low-spine Asteraceae, and indeterminate pollen, the dominant pollen taxa recovered from these samples. Axis 2 is dominated by *Acacia*, Poaceae, Cactaceae, *Cylindropuntia*, and indeterminate pollen, which reflects more of the economic taxa along with the variation in grasses. Given the dominance of background pollen types, the results of PCA have really not

Table A1.5a. Eigenvalues, LA 105710
(uncentered, standardized, tolerance of eigenanalysis set at 1E-8)

	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7
Eigenvalues	21.0703	6.0078	2.7772	2.1159	1.3024	1.0848	0.7356
Percentage	58.6742	16.7299	7.7335	5.8921	3.6267	3.0208	2.0483
Cumulative Percentage	58.6742	75.4042	83.1377	89.0298	92.6565	95.6772	97.725

	Axis 8	Axis 9	Axis 10	Axis 11	Axis 12	Axis 13
Eigenvalues	0.3625	0.2122	0.1371	0.0619	0.0342	0.0088
Percentage	1.0094	0.591	0.3818	0.1725	0.0953	0.0245
Cumulative Percentage	98.7349	99.3259	99.7077	99.8802	99.9755	100

Table A1.5b. Variable loadings, LA 105710

	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6
Pinus undifferentiated	0.2439	-0.0828	0.0104	0.0237	0.0504	0.0478
P. ponderosa	0.2186	-0.1357	-0.0516	-0.0045	0.0077	0.0086
P. edulis	0.2117	-0.1377	-0.0928	-0.0420	-0.0274	-0.0119
Juniperus	0.2283	-0.0198	0.3083	0.1593	0.2558	0.0799
Picea	0.2046	-0.1096	0.1562	0.1798	0.2086	0.0780
Abies	0.2171	-0.1337	0.0458	0.0967	0.0983	0.0244
Salix	0.2074	-0.1422	-0.1026	-0.0462	-0.0269	-0.0455
Acacia	0.0392	0.2826	-0.2917	0.3721	0.0803	0.0056
Onagraceae	0.2074	-0.1422	-0.1026	-0.0462	-0.0269	-0.0455
Shepherdia	0.2074	-0.1422	-0.1026	-0.0462	-0.0269	-0.0455
Eriogonum	0.2095	-0.1366	-0.1020	-0.0572	-0.0274	-0.0460
Sarcobatus	0.2094	-0.1239	-0.0703	-0.0182	-0.0325	-0.0488
Poaceae	0.1656	0.4916	0.1099	-0.4699	0.1528	-0.0171
Cheno-am	0.2817	0.1212	0.1218	-0.1283	-0.2173	0.0106
Cheno-am af	0.0666	0.1543	0.5522	0.2990	-0.0699	-0.0437
Asteraceae (hs)	0.2826	0.2094	-0.0650	-0.0434	-0.2115	-0.0170
Asteraceae (ls)	0.2406	-0.0944	0.0168	-0.0092	0.0284	-0.0060
Artemisia	0.2109	-0.1327	-0.1028	-0.0607	-0.0429	-0.0483
Cactaceae	0.0858	0.2394	-0.3299	0.3092	0.0317	-0.0076
Cylindropuntia	0.0766	0.4015	-0.1606	0.3439	0.2162	0.0535
Platyopuntia	0.0076	0.0212	0.0054	-0.0633	-0.2333	0.9498
Ephedra	0.2513	-0.0466	-0.0627	0.0074	0.0345	-0.0148
Nyctaginaceae	0.0199	0.1249	0.0752	-0.3888	0.6370	0.0784
Indeterminate	0.2738	0.3718	-0.1048	-0.1358	-0.2653	-0.0517
Triporate	0.0396	0.1370	0.4402	0.0430	-0.3405	-0.1835
Zea mays	0.2041	-0.0823	0.1976	0.2458	0.2221	0.1448

	Axis 7	Axis 8	Axis 9	Axis 10	Axis 11	Axis 12
Pinus undifferentiated	-0.0289	0.0168	-0.0711	-0.0128	-0.0226	-0.0582
P. ponderosa	0.0872	-0.0448	-0.0741	0.0616	-0.0348	-0.0527
P. edulis	0.1286	-0.1040	-0.0959	0.0127	-0.0065	0.0021
Juniperus	-0.1701	0.0711	0.1786	-0.1555	0.3769	-0.0125
Picea	-0.0780	0.1897	-0.1559	0.0403	-0.3716	-0.3469
Abies	0.0095	0.0762	-0.1292	0.0440	-0.2142	-0.1906
Salix	0.1422	-0.0816	-0.0595	0.0413	0.0162	0.0397
Acacia	0.2474	0.0195	0.1972	0.6146	0.2723	-0.1656
Onagraceae	0.1422	-0.0816	-0.0595	0.0414	0.0163	0.0397
Shepherdia	0.1422	-0.0816	-0.0595	0.0413	0.0163	0.0397
Eriogonum	0.1263	-0.0689	-0.0377	0.0376	0.0126	-0.0021
Sarcobatus	0.1031	-0.4263	0.2267	-0.2915	-0.0443	0.2590
Poaceae	0.0158	-0.0336	-0.3552	0.0931	0.0702	0.0768
Cheno-am	-0.3626	0.2615	0.2734	0.3214	-0.4029	0.3949
Cheno-am af	0.1345	-0.4372	0.3039	-0.0003	-0.1521	-0.0885
Asteraceae (hs)	0.0979	0.1603	0.0252	-0.2338	-0.1447	-0.4929
Asteraceae (ls)	-0.0003	0.0216	-0.0894	0.0116	0.2749	0.2385
Artemisia	0.0995	-0.0549	-0.0202	0.0338	0.0106	-0.0505
Cactaceae	0.2300	0.4129	0.2026	-0.4639	-0.1221	0.2733
Cylindropuntia	-0.0935	-0.3749	-0.4145	-0.0393	-0.2650	0.2270
Platyopuntia	0.1657	-0.0554	0.0050	0.0082	0.0079	0.0343
Ephedra	-0.0554	0.0152	0.2310	0.2671	-0.0073	0.1423
Nyctaginaceae	0.3382	0.0483	0.3409	-0.0362	-0.1011	-0.0214
Indeterminate	-0.2957	-0.1219	0.1608	-0.1842	0.3116	-0.2535
Triporate	0.5419	0.2550	-0.2257	0.0341	0.0824	0.1829
Zea mays	-0.1856	0.2163	-0.2087	-0.0803	0.3298	0.1408

Table A1.5c. Case scores, Backhoe Trench 1, LA 105710

FS No.	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6
108	4.1989	-0.8208	-0.2738	-0.0938	-0.0336	-0.0475
109	0.9909	0.0354	1.0037	0.7487	0.4056	0.1853
110	0.2714	0.0973	0.1228	-0.0057	0.0697	0.0422
111	0.4025	0.7207	0.2006	-0.7904	0.7971	0.0817
112	0.3900	0.3279	0.2908	0.1966	-0.0272	-0.0148
113	0.9061	0.9199	0.0045	-0.4662	-0.3175	-0.0433
114	0.5621	0.7899	0.9358	-0.0988	-0.5318	-0.2396
115	0.2600	0.1884	0.0358	-0.1536	-0.1032	-0.0089
116	0.3049	0.5968	-0.0399	0.2305	0.0520	-0.0021
117	0.7049	1.4635	-0.8209	0.7018	0.0825	0.0074
118	0.1948	0.1982	-0.0111	-0.1272	-0.0795	-0.0154
119	0.4625	0.7991	-0.0457	-0.2323	0.0212	-0.0004
120	0.1535	0.1221	0.0144	-0.1287	-0.2920	0.9899

	Axis 7	Axis 8	Axis 9	Axis 10	Axis 11	Axis 12
108	0.1005	-0.0284	-0.0121	0.0054	0.001	0.0013
109	-0.2337	0.1404	-0.0385	0.0015	-0.0357	-0.0197
110	-0.1711	0.0740	0.0038	-0.0219	0.2180	0.0696
111	0.2390	0.0168	0.0695	-0.0048	-0.0060	-0.0007
112	-0.0924	-0.4289	0.2070	-0.1557	-0.0128	0.0258
113	-0.4864	0.1495	0.1284	-0.0161	-0.0055	-0.0474
114	0.4454	0.0546	-0.0369	0.0042	0.0139	0.0110
115	-0.1782	0.0921	0.0944	0.1337	-0.0953	0.1165
116	-0.0112	-0.2526	0.0273	0.2961	0.0488	-0.0397
117	0.1944	0.1337	0.0298	-0.0606	-0.0069	0.0140
118	-0.0594	0.0204	-0.0032	-0.0304	0.0209	-0.0991
119	-0.2325	-0.1896	-0.3668	-0.0435	-0.0273	0.0285
120	0.1171	-0.0193	0.0010	0.0011	0.0005	0.0011

effectively separated the data. Table A1.5c provides the sample loadings from this analysis.

Agricultural Fields. Table A1.6 contains the results of the PCA from the agricultural sites. Table A1.6a contains the results of the Eigenvalue analysis. Axis 1 accounts for 48.2461 percent of the total variation, and Axis 2 accounts for an additional 7.1713 percent. Axis 5 accounts for a cumulative percentage of only 70.0952, while 90 percent is not attained until Axis 14. Table A1.6b contains the variable loadings from this analysis, with those above 0.2550 in boldface. Axis 1 is dominated by *Pinus*, high-spine and low-spine Asteraceae, indeterminate, and *Zea mays*. Axis 2 is dominated by negative loadings of *Juniperus, Prosopis*, and *Shepherdia*. Table A1.6c provides the sample loadings. The first component is again dominated by the background taxa. A plot of the first and second principal component (not provided) revealed that there was no separation of samples. This is to be expected, since the important aspect of these samples is the presence or absence of selected economic taxa. While I believe that it was important to conduct these analyses, they provided very little information and will not be considered further.

Economic Taxa

The presence or absence of economic taxa is probably the most important aspect in the analysis of these samples. Therefore it was decided initially that these samples would be analyzed using ISM (Dean 1998). Based on the pollen taxa recovered, the question always arises: Are economic taxa absent from these assemblages because they are truly not present, or are they present in such small amounts that they were missed during sampling? To assess the likelihood of their being missed, the estimated maximum potential concentration values of target taxa was computed. It was decided that examination of the pollen residue would cease once the estimated maximum potential concentration value was 1 grain/g or less. Since the entire slide was examined (either by count or low-magnification scan of the slide), the estimated number of marker grains per slide was computed by averaging the number of marker grains per transect and multiplying this by the total number of transects examined. Based on the number of marker grains added, a concentration value of 1.0 grains/g necessitated counting a total of 1,620 marker grains. This necessitated counting a maximum of three slides in some cases, but primarily only two slides were necessary. The raw counts (Table A1.3) are based on the initial count of the first slide. Four transects of each subsequent slide were counted for marker grains, and the estimated mean number of markers per slide was computed separately for each slide examined (Table A1.4). The entire area of these subsequent slides was scanned at low magnification for target taxa. This procedure assumes that the first grain observed on the next hypothetical slide is one of the target taxa, and thus the maximum potential concentration value can be computed. The number of the fossil grains is one, and the estimated number of marker grains (>1,620) observed is substituted for the number of marker grains counted in the pollen concentration formula (Table A1.4). Using this procedure, the estimated maximum potential concentration values for all samples is 1.0 grains/g or less. Without examining the total of the pollen residues, we can never be absolutely sure that target taxa are indeed absent from the assemblage. However, 1 grain/g is sufficiently low to confidently assume that if taxa were not observed, they are likely absent from these assemblages.

Table A1.7 shows the number of samples containing the economic taxa recovered from the initial raw count and the use of ISM. The number of samples containing economic taxa increased dramatically using ISM. Only three taxa—Fabaceae, *Polygonum*, and *Eriogonum*—remained the same. While some members of these taxa are economic, others are naturally occurring members of the local flora. The rare occurrence of these three taxa suggests that they were simply members of the local plant community and will not be considered as economically important for the purposes of this investigation.

There was no apparent correlation between the size of the plot and the total pollen concentration values. The economic taxa recovered are discussed below by site and feature number. The mean concentration values of economic taxa by site and feature number are presented in Table A1.8. The parenthetic values in the following discussion refer to mean concentration.

LA 105703. This was the northernmost site.

Table A1.6a. Eigenvalues, agricultural field sites

	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8
Eigenvalues	22.7235	3.3776	2.6445	2.1554	2.1132	1.3462	1.2542	1.1901
Percentage	48.2461	7.1713	5.6148	4.5762	4.4867	2.8582	2.6628	2.5268
Cumulative Percentage	48.2461	55.4174	61.0323	65.6085	70.0952	72.9534	75.6162	78.143

	Axis 9	Axis 10	Axis 11	Axis 12	Axis 13	Axis 14	Axis 15	Axis 16
Eigenvalues	1.1451	1.0688	1.0428	1.0311	0.9339	0.8607	0.7617	0.6345
Percentage	2.4313	2.2693	2.2141	2.1893	1.9828	1.8275	1.6172	1.3472
Cumulative Percentage	80.5743	82.8436	85.0577	87.247	89.2298	91.0573	92.6745	94.0217

	Axis 17	Axis 18	Axis 19	Axis 20	Axis 21	Axis 22	Axis 23	Axis 24
Eigenvalues	0.5600	0.3969	0.3706	0.2902	0.2721	0.2319	0.1949	0.1598
Percentage	1.1891	0.8427	0.7868	0.6162	0.5777	0.4924	0.4138	0.3393
Cumulative Percentage	95.2107	96.0534	96.8402	97.4565	98.0341	98.5265	98.9403	99.2796

	Axis 25	Axis 26	Axis 27	Axis 28	Axis 29	Axis 30	Axis 31	Axis 32
Eigenvalues	0.1074	0.0801	0.0521	0.0331	0.0261	0.0231	0.0121	0.0052
Percentage	0.2281	0.1700	0.1107	0.0704	0.0554	0.0490	0.0256	0.0111
Cumulative Percentage	99.5077	99.6777	99.7884	99.8588	99.9142	99.9633	99.9889	100.0000

Table A1.6b. Variable loadings, agricultural field sites (1 of 4)

	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8
Pinus	0.3014	-0.1765	0.0607	-0.0984	0.0051	-0.0963	0.0988	0.0013
Juniperus	0.1823	-0.3196	-0.1030	0.0224	-0.0289	0.0055	-0.0199	-0.0166
Picea	0.2192	-0.0598	-0.0823	-0.0653	-0.3095	0.2420	0.0675	-0.1479
Abies	0.1792	-0.1687	-0.1733	-0.0914	-0.1400	0.1224	-0.0727	-0.0718
Quercus	0.1247	-0.1240	-0.1905	0.1098	-0.3448	0.2245	-0.2702	0.0318
Prosopis	0.0654	-0.4005	0.1039	-0.1186	0.2250	-0.1756	0.1294	0.1375
Carya	0.0875	-0.3350	-0.0516	-0.0491	-0.0549	0.0274	-0.0679	-0.0107
Onagraceae	0.1822	0.2960	0.2750	-0.1458	-0.1670	-0.0676	0.0476	0.2834
Fabaceae	0.0456	0.1247	-0.4343	-0.2677	0.3174	-0.0996	-0.0958	0.0233
Shepherdia	0.0686	-0.2762	0.0972	-0.0672	0.1499	-0.1068	-0.0492	0.3524
Polygonum	0.0379	0.0284	0.0204	0.1664	-0.0569	-0.4438	-0.4596	-0.3100
Eriogonum	0.0241	0.0144	0.0128	-0.1852	-0.0719	-0.0999	0.3726	-0.4246
Sarcobatus	0.1868	-0.1675	0.1445	0.1161	0.0964	-0.0431	-0.2152	0.0239
Poaceae	0.2021	-0.1934	0.1865	-0.0064	0.2362	-0.2185	0.1932	-0.0142
Cheno-am	0.3780	0.1297	-0.0491	0.0075	-0.0761	-0.1083	-0.1527	-0.0240
Cheno-am af	0.1565	0.0691	-0.3644	-0.0114	-0.1406	0.0543	0.1449	0.1263
Asteraceae (hs)	0.2579	0.1715	-0.0730	-0.0197	0.0109	-0.0921	-0.0121	-0.0159
Asteraceae (ls)	0.2504	0.1422	0.0956	0.1668	0.2675	0.0637	0.0876	0.0274
Liguliflorae	0.0473	0.1292	-0.4217	-0.2924	0.3036	-0.1188	-0.0532	-0.0207
Artemisia	0.1933	-0.2268	-0.0029	-0.1321	-0.0788	0.0550	0.0209	-0.1815
Cactaceae	0.1738	0.0805	-0.0920	0.4647	0.0972	-0.0470	0.0872	-0.0359
Cylindropuntia	0.0261	0.0628	0.0916	-0.1215	-0.0995	0.0338	0.1120	0.1193
Platyopuntia	0.0133	0.0406	0.0396	-0.0124	-0.0455	0.0080	-0.2640	0.4555
Ephedra	0.2235	-0.0277	0.1896	0.0617	0.1124	0.2890	0.0086	-0.0849
Nyctaginaceae	0.0927	0.1995	0.2503	-0.2535	-0.0889	-0.1611	0.0937	-0.2173
Indeterminate	0.2737	0.1074	-0.1438	0.0204	0.2371	0.1678	0.0067	0.0395
Typha angustifolia	0.0046	0.0067	0.0006	0.0266	0.0174	-0.0716	0.0590	-0.0358
Unknown triporate	0.0375	0.0608	0.0622	0.3325	0.3519	0.3594	-0.0083	-0.2193
Malvaceae	0.1142	0.2343	0.2040	-0.0691	0.0909	0.0001	-0.2586	-0.0009
Cucurbitaceae	0.0866	-0.0168	-0.1225	0.3392	-0.1628	-0.4611	0.0247	-0.0480
Sphaeralcea	0.0762	0.0981	-0.1666	0.3014	-0.1482	-0.1370	0.4608	0.2939
Zea mays	0.3493	0.1694	0.1257	-0.1518	-0.1098	0.0395	-0.0231	0.0507

Table A1.6b. Variable loadings, agricultural field sites (2 of 4)

	Axis 9	Axis 10	Axis 11	Axis 12	Axis 13	Axis 14	Axis 15	Axis 16
Pinus	-0.0811	-0.0706	-0.0391	-0.0146	0.0875	-0.0288	-0.1068	0.0420
Juniperus	0.0982	-0.1211	0.1247	-0.0541	0.0866	0.0607	0.0202	-0.1096
Picea	-0.0546	-0.0672	-0.0318	0.0357	0.0485	-0.1394	-0.0959	0.1285
Abies	0.2401	-0.1612	0.1708	-0.0245	0.0739	0.0017	-0.0164	-0.1125
Quercus	-0.1393	0.1633	-0.0575	0.0643	-0.2626	0.1675	-0.0610	0.0702
Prosopis	0.0043	-0.0551	0.0036	-0.0342	0.1889	0.1658	-0.1477	0.1173
Carya	0.2259	-0.1668	0.1740	-0.0451	0.1958	0.1471	0.2785	-0.2341
Onagraceae	0.0201	-0.0545	0.0512	-0.0593	0.1945	0.1377	-0.0100	-0.5826
Fabaceae	-0.0242	-0.0938	0.0050	-0.0124	-0.0272	-0.0155	-0.0070	-0.0167
Shepherdia	-0.1246	0.2502	-0.1788	0.0535	-0.3800	0.3937	-0.0057	-0.1105
Polygonum	-0.3099	-0.0093	-0.2755	-0.0217	0.2637	0.1305	-0.1521	-0.0877
Eriogonum	-0.3677	0.3896	0.2489	-0.1207	-0.0139	0.1455	0.3729	-0.0629
Sarcobatus	0.0334	0.0554	0.1134	-0.0202	-0.4409	-0.2231	0.2080	-0.0516
Poaceae	-0.0026	0.0525	-0.0251	0.0439	-0.0412	-0.2405	0.0147	0.1761
Cheno-am	-0.0313	0.0119	0.0222	0.0270	-0.0998	0.0715	-0.0207	0.0330
Cheno-am af	0.0500	0.1769	-0.0609	0.0002	-0.0793	0.1578	0.1264	-0.0777
Asteraceae (hs)	0.1763	0.0979	-0.1064	0.0654	-0.0008	-0.1648	0.1121	0.1251
Asteraceae (ls)	-0.0209	0.0480	-0.1189	-0.0278	0.1044	-0.1620	0.0958	-0.1938
Liguliflorae	-0.0662	-0.0566	0.0515	-0.0332	-0.0329	0.0101	0.0398	-0.0806
Artemisia	-0.0976	0.0930	-0.0327	-0.0111	0.2521	0.0597	-0.1160	0.1941
Cactaceae	-0.0683	-0.1325	0.2053	-0.0231	0.0217	0.2888	-0.1669	-0.0253
Cylindropuntia	-0.3742	-0.6990	-0.1838	-0.0341	-0.1451	0.1452	0.3456	0.2336
Platyopuntia	-0.3743	0.1219	0.5902	-0.0988	0.2241	-0.2107	0.0091	0.2186
Ephedra	-0.0222	0.0307	-0.1694	0.0198	0.0257	-0.2026	0.0364	-0.0966
Nyctaginaceae	0.1872	-0.1419	0.3458	-0.0654	-0.3711	0.1535	-0.4543	0.0830
Indeterminate	-0.0680	-0.0320	0.0076	0.0020	-0.0123	-0.0458	-0.2279	0.0982
Typha angustifolia	-0.0656	-0.0592	0.1930	0.9589	0.0508	0.0352	0.0535	-0.0576
Unknown triporate	-0.1291	-0.0960	0.2131	-0.0872	-0.0334	0.2662	0.0549	-0.0418
Malvaceae	0.4125	0.1342	0.0078	0.0200	0.1924	0.3781	0.3569	0.4521
Cucurbitaceae	0.1349	-0.1453	0.1475	-0.1016	-0.1587	-0.2098	0.2513	-0.0043
Sphaeralcea	0.0583	0.0892	-0.0994	-0.0345	0.1314	0.1192	-0.1021	0.2079
Zea mays	-0.1311	0.0459	-0.1135	0.0408	-0.0030	-0.0542	0.0507	-0.0112

Table A1.6b. Variable loadings, agricultural field sites (3 of 4)

	Axis 17	Axis 18	Axis 19	Axis 20	Axis 21	Axis 22	Axis 23	Axis 24
Pinus	-0.1891	-0.1821	-0.0159	-0.1082	0.1393	-0.0920	-0.0939	-0.1776
Juniperus	-0.0959	0.2031	-0.2236	-0.2376	0.1416	-0.1536	-0.0456	-0.1727
Picea	-0.2170	0.1577	0.0476	0.2899	0.0061	0.2054	-0.2060	0.1390
Abies	-0.2270	-0.0719	-0.3305	0.091	-0.1825	-0.1163	-0.0706	0.2722
Quercus	0.0277	0.0840	-0.0226	0.0387	-0.2640	0.0673	0.1481	-0.4187
Prosopis	-0.0018	0.0886	0.0003	-0.3200	0.0871	-0.0115	-0.0445	-0.1378
Carya	0.3828	-0.4161	0.3205	0.2210	-0.0209	0.2518	0.0674	-0.0142
Onagraceae	-0.1412	0.2713	-0.0543	0.0019	-0.1355	0.0566	0.0483	-0.0198
Fabaceae	-0.0423	0.0513	-0.0296	0.0920	-0.0771	0.0772	-0.0255	0.0118
Shepherdia	-0.0083	0.1288	0.0769	0.2752	0.0980	-0.0054	-0.0518	0.3585
Polygonum	0.0955	-0.1698	-0.2264	-0.0121	-0.0330	0.1149	-0.1373	0.1325
Eriogonum	-0.1001	-0.0719	-0.0752	-0.0307	0.0524	-0.0013	0.1644	-0.0005
Sarcobatus	-0.1773	-0.1978	-0.1406	-0.3863	-0.2792	0.1943	0.0845	0.1563
Poaceae	0.0095	-0.0005	-0.1220	0.4940	-0.2451	-0.0725	-0.1738	-0.2708
Cheno-am	0.1995	0.1245	0.0549	0.0545	0.2429	-0.0340	0.0775	-0.3415
Cheno-am af	0.3199	-0.0804	-0.2299	-0.1432	0.1504	-0.1786	-0.2359	0.0163
Asteraceae (hs)	0.2616	0.0089	0.1637	-0.1472	-0.1716	-0.4808	-0.0808	0.2632
Asteraceae (ls)	0.2094	0.0966	0.0001	-0.0444	-0.3091	0.0956	0.1702	-0.1704
Liguliflorae	-0.1027	0.0529	-0.0674	0.0946	-0.1204	0.1405	0.0051	-0.0316
Artemisia	0.1787	0.3874	0.2178	-0.1148	-0.2879	0.0469	0.2205	0.3209
Cactaceae	-0.2520	-0.2001	0.1122	0.2121	-0.0807	-0.4125	0.2984	0.0823
Cylindropuntia	0.1040	0.0075	-0.1039	-0.0342	-0.0767	-0.0657	0.1061	0.0473
Platyopuntia	0.1487	-0.0235	-0.0972	0.0702	0.0297	-0.0467	-0.0571	0.0873
Ephedra	0.1962	-0.0198	-0.4304	0.1958	0.3739	0.0313	0.1678	0.1895
Nyctaginaceae	0.3002	-0.0668	-0.1063	-0.0068	-0.0450	0.0977	-0.0271	0.0454
Indeterminate	-0.0753	-0.0936	0.1571	-0.1331	0.3119	0.2741	0.3345	0.1078
Typha angustifolia	0.0177	0.0310	-0.0464	-0.0608	0.0106	0.0707	-0.0041	0.0260
Unknown triporate	0.0999	0.2047	0.0570	-0.0789	-0.0535	0.1088	-0.5372	0.0126
Malvaceae	-0.1961	0.0482	-0.1402	0.0579	0.0444	0.1026	0.0718	-0.0412
Cucurbitaceae	-0.0396	0.3851	0.1694	0.0570	0.2731	0.1717	-0.0294	0.1037
Sphaeralcea	0.0360	-0.1638	-0.2122	-0.0737	-0.1841	0.4046	-0.0741	0.0865
Zea mays	-0.2395	-0.2876	0.3824	-0.0993	0.0617	0.0251	-0.3661	0.0109

Table A1.6b. Variable loadings, agricultural field sites (4 of 4)

	Axis 25	Axis 26	Axis 27	Axis 28	Axis 29	Axis 30	Axis 31	Axis 32
Pinus	0.1345	0.0802	0.0471	-0.3096	-0.4871	-0.3363	-0.1821	0.3942
Juniperus	-0.0040	0.1609	-0.2849	-0.1416	0.3069	0.4810	0.1208	0.2929
Picea	-0.1140	0.2329	-0.0913	-0.2328	-0.2648	0.1632	0.2692	-0.3715
Abies	0.4349	-0.1521	0.1323	0.1004	0.2424	-0.2670	-0.1561	-0.1727
Quercus	0.0745	0.1658	-0.0090	0.3850	-0.1365	-0.0022	-0.1702	0.0891
Prosopis	-0.0773	0.0589	-0.0408	0.3731	-0.1339	-0.0923	0.0173	-0.5238
Carya	-0.0792	0.1145	0.0067	-0.0138	-0.0347	0.0417	-0.0122	0.0231
Onagraceae	-0.1903	0.1204	0.2690	0.0791	-0.0733	0.0477	-0.0553	0.0253
Fabaceae	-0.1141	-0.1606	-0.0748	-0.0842	-0.2027	0.3633	-0.5708	-0.1183
Shepherdia	0.1984	0.0775	-0.1123	-0.1444	0.0389	0.0050	0.0072	0.0219
Polygonum	0.0641	0.0678	0.0689	0.0130	-0.0012	0.1085	0.0763	-0.0307
Eriogonum	0.0973	0.1210	0.0136	0.0205	0.0457	0.0526	-0.1043	-0.1028
Sarcobatus	-0.3109	-0.0517	0.0963	-0.1544	-0.0576	0.0107	0.0676	-0.0988
Poaceae	-0.0645	-0.0655	0.3564	0.1258	0.1462	0.1763	0.0794	0.1091
Cheno-am	-0.1576	-0.0994	0.0386	-0.3817	0.3902	-0.3042	-0.1084	-0.3081
Cheno-am af	-0.0491	-0.3587	0.2615	0.0396	-0.2635	0.1118	0.3341	-0.0121
Asteraceae (hs)	-0.0041	0.5497	0.0263	0.0691	0.0095	0.0062	-0.1227	-0.0381
Asteraceae (ls)	0.4955	-0.1341	-0.3386	-0.1244	-0.1621	0.0511	0.1737	-0.1549
Liguliflorae	-0.1745	0.1959	-0.2034	0.1681	0.0795	-0.3984	0.4289	0.1950
Artemisia	-0.1866	-0.3523	0.0463	-0.0328	0.0398	-0.0743	-0.0086	0.2547
Cactaceae	-0.2193	-0.1154	-0.1230	0.0469	-0.1157	0.0487	0.0941	-0.0641
Cylindropuntia	0.0537	0.0077	0.0453	0.0112	0.0349	0.0311	0.0274	-0.0014
Platyopuntia	0.0599	0.0124	-0.0676	-0.0095	-0.0389	0.0099	0.0239	0.0089
Ephedra	-0.2596	0.0016	-0.2391	0.2823	-0.0611	-0.1003	-0.1815	0.0703
Nyctaginaceae	0.0790	-0.0034	-0.1617	0.0680	-0.0911	0.0987	0.0463	0.0616
Indeterminate	0.2544	0.1645	0.4592	0.1040	0.1172	0.2032	0.1107	0.0586
Typha angustifolia	0.0226	-0.0065	-0.0158	0.0082	-0.0215	-0.0007	-0.0044	0.0166
Unknown triporate	-0.0255	0.0932	0.1308	0.0042	0.0118	-0.1106	-0.1267	0.0627
Malvaceae	0.0267	-0.0241	-0.0188	0.0002	-0.1239	0.0562	0.0679	0.0461
Cucurbitaceae	0.1302	-0.0779	-0.0243	0.2422	-0.1559	-0.0626	-0.0552	0.0721
Sphaeralcea	-0.0958	0.1274	-0.1278	-0.0687	0.2030	-0.0572	-0.1873	0.0623
Zea mays	0.0057	-0.2835	-0.2791	0.3161	0.2186	0.0911	-0.0217	0.0688

Table A1.7. Samples containing economic taxa

Site	Feature	Size	*Zea mays*		*Sphaeralcea*		Malvaceae		Cucurbitaceae		Cactaceae		*Cylindropuntia*		Onograceae		Fabaceae		*Polygonum*		*Eriogonum*	
		(sq m)	Count	ISM	Count	ISM	Count	ISM	Count	ISM	Count	ISM	Count	ISM	Count	ISM	Count	ISM	Count	ISM	Count	ISM
LA 105703	2	3479	2	3	0	0	2	3	0	1	1	3	1	2	0	1	0	0	2	2	0	0
	8	64	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	18	2715	8	11	0	0	1	5	0	0	1	8	5	11	1	4	0	0	2	2	0	0
	21	820	1	1	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	22	936	3	4	0	0	0	2	0	1	0	1	1	1	0	1	0	0	0	0	0	0
LA 105704	1	180	2	2	0	0	0	1	0	0	0	1	0	2	1	2	0	0	0	0	1	1
	2	48	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
LA 105708	3	225	2	3	0	0	0	0	0	1	0	2	2	3	0	2	0	0	0	0	0	0
	9	971	2	3	1	1	0	1	0	0	0	0	1	3	0	2	0	0	0	0	1	1
LA 105709	1	444	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	4	47	1	1	0	0	0	1	0	0	0	0	1	1	0	1	0	0	0	0	0	0
LA 118547	1	125	1	1	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0
	2	184	1	1	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0
	15	3911	12	12	1	2	3	11	0	1	1	5	6	11	0	6	1	1	0	0	0	0
Total			38	45	2	3	7	26	0	4	4	21	18	39	2	21	1	1	4	4	2	2

Table A1.8. Mean concentration values of selected economic taxa

Site	Feature	Size (sq m)	*Zea mays*	Malvaceae	Sphaeralcea	Cucurbitaceae	Cactaceae	*Cylindropuntia*
LA 105703	2	3479	23.99	1.30	0.00	0.32	1.30	2.01
	8	64	28.37	0.00	0.00	0.00	2.08	0.00
	18	2715	11.60	1.57	0.00	0.00	0.97	2.42
	21	820	21.11	0.81	0.00	0.00	0.00	2.44
	22	936	22.26	2.33	0.00	0.24	0.22	12.28
LA 105704	1	180	22.36	2.18	0.00	0.00	0.87	1.29
	2	48	14.21	0.00	0.00	0.00	0.00	7.58
LA 105708	3	225	29.80	0.00	0.00	0.24	1.15	252.72
	9	971	18.51	1.55	0.30	0.00	0.00	4.77
LA 105709	1	444	32.13	0.00	0.00	0.00	0.00	5.11
	4	47	56.02	0.85	0.00	0.00	0.00	10.19
LA 118547	1	125	18.42	0.00	0.00	0.00	0.00	4.78
	2	184	17.51	0.00	0.00	0.00	0.00	5.63
	15	3911	21.96	2.91	0.26	0.07	0.66	4.26

Five features (fields) were sampled.

Feature 8 was the smallest plot at this site. Non-*Opuntia* Cactaceae (2.08 grains/g) pollen and *Zea mays* (28.37 grains/g) were the only economic taxa present from this plot, but they were present in all three samples taken from this feature.

Feature 21 measured 820 sq m, but only a single pollen sample was submitted from this feature. *Zea mays* (21.11 grains/g), *Cylindropuntia* (2.44 grains/g), and Malvaceae (0.81 grains/g) pollen were all present.

Feature 22 measured 936 sq m and provided four samples, all of which contained *Zea mays* (22.26 grains/g) and *Cylindropuntia* (12.28 grains/g). Two samples contained Malvaceae (2.33 grains/g), while single samples contained Cucurbitaceae (0.24 grains/g), Onagraceae (0.21 grains/g), non-*Opuntia* Cactaceae (0.22 grains/g), and *Platyopuntia* (0.22 grains/g).

Feature 18 measured 2,715 sq m and provided 11 samples, all of which contained both *Zea mays* (11.60 grains/g) and *Cylindropuntia* (2.42 grains/g) pollen. Five of the samples contained Malvaceae (1.57 grains/g), while eight samples contained non-*Opuntia* Cactaceae (0.97 grains/g). A single sample contained *Platyopuntia* (0.21 grains/g).

Feature 2 measured 3,479 sq m and contained three samples, all of which contained *Zea mays* (23.99 grains/g), Malvaceae (1.30 grains/g), and non-*Opuntia* Cactaceae (1.30 grains/g) pollen. Two samples contained *Cylindropuntia* (2.01 grains/g), while single samples contained Cucurbitaceae (0.32 grains/g) and Onagraceae (0.21 grains/g) pollen.

LA 105704. This site was south of LA 105703. Only three samples, two from Feature 1 and one from Feature 2, were submitted. Feature 1 measured 180 sq m; Feature 2, 48 sq m. *Zea mays* (22.36 grains/g), Malvaceae (2.18 grains/g), *Cylindropuntia* (1.29 grains/g), non-*Opuntia* Cactaceae (0.87 grains/g), Onagraceae (0.85 grains/g), and *Eriogonum* (5.23 grains/g) were all present in Feature 1. Feature 2 contained *Zea mays* (14.21 grains/g) and *Cylindropuntia* (7.58 grains/g).

LA 105708. Six samples were provided from this site, three each from Features 3 and 9.

Feature 3 measured 225 sq m. All three samples from this feature contained both *Zea mays* (29.80 grains/g) and *Cylindropuntia* (252.72 grains/g). *Cylindropuntia* pollen was extraordinarily high (748.59 grains/g) in one sample, which acted to artificially increase the mean in the other two samples. The significance of this will be discussed later. Non-*Opuntia* Cactaceae (1.15 grains/g) and Onagraceae (0.50 grains/g) were present in two samples, while Cucurbitaceae (0.24 grains/g) was present in one sample.

Feature 9 measured 971 sq m. Again, all three samples from Feature 9 contained *Zea mays* (18.51 grains/g) and *Cylindropuntia* (4.77 grains/g).

Onagraceae (0.64 grains/g) was present in two of the samples. Malvaceae (1.55 grains/g), *Sphaeralcea* (0.3 grains/g), and *Eriogonum* (5.51 grains/g) were present in single samples.

LA 105709. Single samples were submitted from Features 1 and 4.

Feature 1 measured 444 sq m. *Zea mays* (32.33 grains/g) and *Cylindropuntia* (5.11 grains/g) were present in the sample from this feature.

Feature 4 measured 47 sq m in area. *Zea mays* (56.02 grains/g), Malvaceae (0.85 grains/g), *Cylindropuntia* (10.19 grains/g), and Onagraceae (1.70 grains/g) pollen were present from this feature.

LA 118547. Features 1 and 2 were identified as borrow pits (one sample each). Feature 15 (12 samples) was a gravel-mulched field.

Feature 1 measured 125 sq m. *Zea mays* (18.42 grains/g), *Cylindropuntia* (4.78 grains/g), and Onagraceae (0.68 grains/g) were present from this feature.

Feature 2 measured 184 sq m. *Zea mays* (17.51 grains/g), *Cylindropuntia* (5.61 grains/g), and Onagraceae (0.63 grains/g) were present from this feature.

Feature 15 measured 3,911 sq m. *Zea mays* (21.96 grains/g) was present in all 12 samples, and *Cylindropuntia* (4.26 grains/g) and Malvaceae (2.91 grains/g) were present in 11 samples. Onagraceae (0.56 grains/g) was present in 6 samples, and non-*Opuntia* Cactaceae (0.66 grains/g) was present in 5 samples. *Sphaeralcea* (0.26 grains/g) was present in 2 samples.

Only a relatively few economic pollen types are present within these agricultural fields. These taxa are discussed individually, below.

Zea mays. Pollen of *Zea mays* was recovered from all of these agricultural field samples. Remarkably, the pollen concentration values and the mean concentration values from these fields are quite similar. Commonly, the average concentration value ranged between 20 and 23 grains/g. While certain features contained slightly higher average concentration values, even the mean of all samples was between 20 and 21 grains/g. This might indicate that similar agricultural practices were being conducted at all field locations. The consistent presence of *Zea mays* pollen from these features indicates that all of these fields were being used in corn agriculture.

Cactaceae. All features contained *Cylindropuntia* pollen. Of the 45 samples examined, 42, or 93.3 percent, contained *Cylindropuntia*. Like all members of the Cactaceae family, *Cylindropuntia* are insect pollinated. These plants produce relatively fewer pollen grains per flower than other taxa, and the pollen is only rarely incorporated into the sediments. In a study of the surface sediments obtained from the middle of a prickly pear cactus in flower, Bryant (pers. comm., 1987) obtained less than 1 percent *Opuntia* pollen. Thus, the consistent presence of *Cylindropuntia* from these fields indicates a local presence in the vegetation. These plants are extremely slow growing, and I suspect that they were at least encouraged within these fields by the prehistoric farmers, since their fruits (*tunas*) were routinely harvested and roasted for consumption. A large amount of *Cylindropuntia* pollen was obtained from a prehistoric pueblo near Petroglyph National Monument, in Albuquerque, New Mexico. This site dated between A.D. 1 and 500 and contained grinding stones but no evidence of pottery or corn. It was concluded that the people were subsisting on wild plant foods, including *Cylindropuntia*. Cholla contains few calories, but a two-tablespoon serving contains as much calcium as a glass of milk (Dunmire and Tierney 1995). Whiting (1939) and Moerman (1986) have indicated at least one medicinal use for cholla cactus among the Hopis, which may help explain why it was not removed. The one sample from Feature 3, LA 105708, contained a pollen concentration value of 748.59 grains/g for this taxon, which is extremely high. This may reflect recent contamination from large numbers of plants growing in the immediate area.

Platyopuntia was fairly rare at these sites. It was present in only two samples, one each from Features 18 and 22, LA 105703. While it is certainly likely that these represent naturally occurring components of the local flora, I feel this is unlikely because of its restricted distribution. If these occurrences were a result of the natural pollen rain, I would expect a more equitable distribution among these sites, rather than their being restricted to only a single site. Rather, like the *Cylindropuntia*, these plants may have been encouraged, if not cultivated, in these fields. Members of the *Platyopuntia* are edible in this region of the state, and the flowers, fruits, and stems were all prepared and eaten. Moerman (1986) reports the medicinal use of these plants by the Navajos and Hopis, but not among Pueblo groups in this area.

Non-Opuntia Cactaceae. This taxon was not as ubiquitous as other economically important taxa. Twenty one of the 45 samples (46.6 percent) were positive for non-*Opuntia* Cactaceae. This taxon was absent from LA 105709 and from the borrow pit features at LA 118547. It was present in one feature each at LA 105704 and LA 105708, and in Feature 15, LA 118547, but it was present in four of the five features at LA 105703. Again, plants of this type were probably encouraged within the fields but were probably not cultivated. The elevations of these sites are all fairly similar, ranging from 6,150 to 6,200 ft. This is not sufficiently different to infer an altitudinal gradient, and in fact there is no correlation between the presence of non-*Opuntia* Cactaceae and site elevation. Various components of these plants have routinely been used as food. A combination of cactus and cleome have been used as a dye for thread or weaving fiber at Zuni (Dunmire and Tierney 1995).

Malvaceae. The family Malvaceae has several genera that are native to New Mexico. *Sphaeralcea* is probably the most common member of this family. However, the pollen morphology of *Sphaeralcea* is sufficiently different to allow a determination of this pollen grain to the genus level, and these are treated separately. The pollen grains included within the category Malvaceae all contained well-developed spine bases and compared favorably to the morphology of the genus *Gossypium*. While these grains were less ubiquitous than *Zea mays* or *Cylindropuntia*, they were fairly common. Twenty-five of the 45 samples (55.5 percent) were positive for this taxon. Malvaceae pollen was present in the samples from four of the five fields at LA 105703 and from single features at LA 105704, LA 105708, and LA 105709. The taxon was absent from the borrow pits at LA 118547 but present in the agricultural field (Feature 15) at that site. Malvaceae is insect pollinated and produces relatively few pollen grains. Pollen grains of this taxon are only rarely incorporated into archaeological deposits. The relatively high concentration values obtained for this taxon suggest strongly that members of this taxon were being intentionally cultivated within these fields. While the majority of uses of this taxon, particularly *Gossypium*, are utilitarian, Robbins et al. (1916) and Moerman (1986) have documented its medicinal use among the Tewas.

Sphaeralcea. This taxon was present in only 3 of the 45 samples. The pollen was recovered from Feature 9, LA 105708; and from Feature 15, LA 118547 (two samples). *Sphaeralcea* is usually much more common in archaeological deposits than these samples indicate. The sporadic occurrence of *Sphaeralcea* may simply reflect its presence in these areas as a naturally occurring component of the vegetation. Alternatively, its presence may represent sites in which *Sphaeralcea* was intentionally cultivated. *Sphaeralcea* is known to have been used as a condiment and a medicine (Moerman 1986) among the Navajos (Wyman and Harris 1951), Hopis (Whiting 1939), and Tewas (Robbins et al. 1916). This plant is very common in disturbed habitats in northern and central New Mexico. The fruits of all species are edible. Its pollen and seeds have been recovered from Chaco Canyon, and from Pecos, Zia, and Santa Ana Pueblos from archaeological contexts. Santo Domingo residents boiled the plant, adding it to gypsum as a glue for calcimine house paint. The pulp of *Sphaeralcea* was mixed with mud at Taos Pueblo to make very hard floors, and the root was pounded and mixed with salt-water as a poultice for sores and boils. At Santa Clara, the leaves were rubbed on sore muscles. The peltate trichomes probably irritate the skin and thus bring blood to the infected area (Dunmire and Tierney 1995).

Cucurbitaceae. This family contains cultivated and wild plant forms in several genera. In fact, many of the cultivated varieties of squash and pumpkin, as well as the common wild form, *Cucurbita foetidissima*, belong to the same genus. It is not possible, therefore, to differentiate palynologically among the various varieties of this genus. The pollen grains of all members of this family are very large and fragile. They are easily broken and rarely become incorporated into archaeological samples. Members of the Cucurbitaceae are insect pollinated and thus produce fewer pollen grains than the arboreal taxa. The members of this family are vines and produce male and female flowers separately and at different times. Male flowers are produced initially, and only later are the female flowers produced. This mechanism promotes cross-pollination. Given the context of these samples in agricultural fields dating to the Classic period, I suspect that the majority of them represent the cultivated varieties.

Cucurbitaceae pollen was present in only 4 of the 45 (8.8 percent) samples. It was present in Features 2 and 22, LA 105703; Feature 3, LA 105708; and Feature 15, LA 118547. Again, there was no correlation among field size and the presence of this taxon, and it was present in sites at both extremes of the study area.

Cucurbita, particularly the cultivated varieties, was commonly used for food, often belying its trace presence in the pollen assemblages. *Curcurbita* has been long used by native populations of the Southwest. The flowers were eaten as a soup by the Hopis (Beaglehole 1937) and Navajos (Bailey 1940; Vestal 1952) and as a seasoning by several of the Rio Grande Pueblos (Bailey 1940; Hughes 1972). The blossoms were also utilized medicinally by the Zunis (Stevenson 1915). Wild relatives of cultivated squash, such as *Cucurbita foetidissima* (buffalo gourd), were also utilized. The gourd was crushed and mixed with water at Cochiti and then sprinkled on plants as an insect repellent. The compound cucurbitacin is known to be an effective insecticide. At Isleta, the roots were boiled to extract a compound used to treat chest pains, and the ground root was used by the Tewas as a laxative (Dunmire and Tierney 1995; Robbins et al. 1916). The Hopis used the flowers as baking containers (Cutler and Whitaker (1961). The Zunis used the seeds and flowers as a medicine for cactus scratches (Moerman 1986; Whiting 1939) and as an ingredient in "schumaakwe cakes," used in the treatment of rheumatism and swelling.

Onagraceae. Pollen of this family was recovered from 22 of the 45 samples (48.8 percent). It was recovered from three of the five features at LA 105703, both features from LA 105708, one feature from LA 105704 and LA 105709, and all three features at LA 118547. Onagraceae are insect pollinated and thus produce relatively little pollen. It is possible that this taxon is a naturally occurring component of the vegetation, but more likely it was cultivated. This plant is normally used medicinally or ceremonially (Castetter 1935; Wyman and Harris 1951; Elmore 1944; Moerman 1986). *Oenothera caespitosa* pollen was used by the Kayenta Navajo singers in sand paintings (Wyman and Harris 1951). *Oenothera pallida* was used with other medicinal plants as an infusion for kidney disease (Wyman and Harris 1951). *Oenothera albicaulis* fruits were eaten by the Mescalero Apaches (Castetter 1935).

Polygonaceae. Polygonum pollen was present in only 4 of the 45 samples (8.8 percent) examined. This taxon was restricted to LA 105703, where it was present in two of the five features. While this taxon can be used economically, its presence may also be attributed to local flora. Again, if this presence reflects a natural component to the pollen rain, I would expect a more equitable dispersion. This taxon could have been grown or at least encouraged as part of the agricultural system.

Wild dock was semicultivated by the Hopis and the Kayenta Navajos for food and medicine (Winter 1974). It was also taken internally by the Navajos (Vestal 1952) and Zunis (Whiting 1939)

Eriogonum, another member of this family, was also sparsely represented. This taxon was present at only two sites, but when present, its occurrence was quite high (10 and 17 grains/g). It was present in a single field each at LA 105704 and LA 105708. Winter (1974) has reported that the Hopis cultivated this plant as a tobacco substitute. This plant was used both internally and externally as a medicine for a variety of complaints among the Navajos (Elmore 1944; Wyman and Harris 1952; Vestal 1952), Zunis (Stevenson 1915), and Hopis (Whiting 1939).

Based on the above, it is at least possible, and probably likely, that these fields were used to grow a wide variety of crops in addition to *Zea mays*. LA 105703 contained evidence of eight of these taxa, including corn. Cucurbitaceae (Features 2 and 22) and *Platyopuntia* (Features 18 and 22) were present in only two features. This may reflect intentional use, or, more likely, factors related to pollen production, dispersion, and preservation. LA 105709 contained only four taxa, LA 105704 contained five taxa, and LA 105708 contained six taxa. LA 118547 contained seven taxa from the agricultural field but only three from the borrow pits.

While a weak case could be made for agricultural specialization, the variation in both the concentration values and the presence/absence of particular economic taxa is better explained by a combination of factors including pollen production, dispersion, and preservation. With the exception of *Zea mays*, all of the economic taxa are insect pollinated. This adaptation was a later development in the history of the angiosperms and correlated with a marked decrease in the amount of pollen produced. If the dispersion mechanism is effective, as it is with insect-pollinated types, then production of large quantities of pollen is unnecessary and a drain on the biological reserves of the plant. Thus, insect-pollinated plants produce only a fraction of the pollen grains produced by taxa relying upon wind pollination, but delivery is absolutely more assured. Several taxa, including *Platyopuntia* and *Cylindropuntia,* produce very large, massive grains that resist deterioration. However, other taxa, such as Cucurbitaceae, produce very fragile grains. The pollen grains of Cucurbitaceae, while being heavily ornamented, also have the tendency to break apart very quickly after being released from the anther. If these fragments do not contain an aperture, there is really no positive means of identification. It is rare that the pollen of members of this family preserve in sufficiently large pieces to be identifiable. The presence of even a single grain from this family indicates a presence in the immediate flora far exceeding its numbers.

Based on these factors, I suspect that the people who cared for these agricultural fields grew a variety of crops, including most, if not all, of these economic taxa in each field. The agricultural practices inferred from these sites are far more reminiscent of "kitchen gardens" than of the modern practice of monoculture. This might also explain why food and medicinal plants were both grown in the same fields.

The samples taken from LA 118547 were somewhat unusual in that two of the features were identified as terrace-edge borrow pits. It was hoped that the pollen analysis of these features would provide clues to additional functions of these borrow pits besides the obvious. The pollen assemblages examined from this site are quite different, particularly in the type and number of taxa recovered. The concentration values of *Zea mays* pollen are slightly lower in the borrow pits but certainly no lower than those from field areas in other sites. Therefore, it is fairly obvious that these borrow pits also functioned in corn agriculture. *Cylindropuntia* and Onagraceae were the only other economic taxa present from these borrow pits. Both of these taxa *could* have been present as part of the natural pollen rain. While I do not conclude that *Cylindropuntia* and Onagraceae were intentionally planted in these features, had they been present naturally, they would in all likelihood have been encouraged to grow. While the prepared fields contained a much larger variety of species, it is very likely that corn was planted, that the other crops occurred naturally, and that the naturally occurring species were coincidentally exploited.

Most of the samples from this investigation were taken from Stratum 2, which was identified as a gravel-mulched agricultural field. However, several samples were taken from Stratum 4, which was identified as a cobble mulch deposit underlying the gravel mulch. In each case, paired samples consisting of a sample from Stratum 2 and Stratum 4 were analyzed to compare the pollen assemblages.

The one-way Anova test was conducted using Microsoft Data Analysis. As expected, the means of the two samples were not statistically different. In spite of this statistical argument, there did appear to be differences in the distribution of the economic taxa. For example, Malvaceae was recovered from six of the ten samples, yet four of them were from the cobble mulch, while only two samples of the gravel mulch contained this taxon. Onagraceae pollen had the opposite distribution. Only a single sample from the cobble mulch contained this taxon, while three samples of the gravel mulch were positive for Onagraceae. Cucurbitaceae may have had a similar distribution, but it was present in only a single sample and was in the gravel-mulched layer. *Zea mays* was present in all ten samples. However, the mean concentration value for the gravel mulch was 20.95, whereas that from the cobble mulch was 11.9, an increase of almost 100 percent in the gravel-mulched levels. This suggests that the gravel-mulched layers retain higher concentration values of economic taxa and a higher number of these taxa. But, particularly in the case of Malvaceae, some taxa in these fields may well be underrepresented because their pollen grains have migrated downward into the underlying cobble layer.

Malvaceae pollen is similar in size to the other taxa; therefore, all or none should migrate. Alternatively, the features containing these underlying cobble mulch layers may be more complex than originally thought. Perhaps the cobble mulch was initially used for growing cotton, and later the field was altered for other crops by the addition of a gravel-mulched layer. If so, then Malvaceae pollen might be more common in this area than originally thought. Unfortunately, we have only five paired samples with which to investigate this phenomenon. These data are intriguing, and it would be useful to obtain additional paired samples to investigate them further.

Conclusions

Except for the surface sample, the pollen column from LA 105710 contained very low pollen concentration values. This is somewhat expected, since the column was taken through dune deposits. Pollen of the more resistant taxa, such as grass, forbs, and herbaceous plants, dominated the assemblages. However, given the time range inferred for the deposition of these sediments and the modern vegetational community, I suspect that the prehistoric plant community was dominated by piñon and juniper and that the low pollen concentration values for these taxa are the result of weathering, not absence from the communities.

The samples from the suspected agricultural fields were dominated by arboreal taxa, but this is somewhat expected given their proximity to the surface. Pollen of Poaceae, cheno-am, high-spine and low-spine Asteraceae, *Artemisia,* and Nyctaginaceae are present in generally high levels, indicating the open nature of these field areas.

The fields examined differ in size, and no correlation was found between the size or elevation of the plot and the pollen concentration values or number of economic taxa recovered. All 45 samples from these fields were analyzed using the ISM method (Dean 1998). The increased number of economic taxa recovered using this procedure demonstrates its utility. This methodology is highly recommended for the analysis of suspected agricultural fields.

A variety of statistical analyses were performed on the data set, including Principal Components Analysis and the Anova test. These analyses were inconclusive in identifying the source of the variation among the pollen types present, probably because each plot contained several crops.

The agricultural fields were interpreted as "kitchen gardens" in which multiple crops were grown within each field. Although direct evidence was absent, I suspect that other crops, such as *Phaseolus*, were also present in these fields. Besides cultivated crops, other economically important plants used for food and medicine were at least encouraged, if not cultivated in these areas.

One sample from LA 105708 contained exceedingly large concentration values for *Cylindropuntia* pollen. The sample was so heavily dominated by pollen of this taxon that it looked like a reference slide. I suspect that much of this pollen was the result of downward movement of the pollen from more recent deposits, but it is impossible to distinguish between modern and prehistoric pollen in such a situation. Alternatively, the high concentration values may be prehistoric and reflect an overrepresentation of this taxon by a fortuitous deposition of floral material.

Five sets of paired samples were taken from fields characterized by a gravel-mulched layer underlain by a cobble mulch zone. The pollen analysis demonstrated that the upper gravel-mulched layer contained much higher (almost 100 percent) values of *Zea mays* pollen and consistently contained greater numbers of economic taxa. At the same time, Malvaceae pollen occurred in a greater number of samples from the cobble layer than from the gravel layer. While it is possible that this reflects downward percolation of this taxon, this explanation is dubious. The size of Malvaceae pollen is similar to that of other taxa present in higher amounts in the gravel layer. Grains of similar size should all be susceptible to this movement. If one accepts that the higher values of Malvaceae are due to environmental factors, then the purpose of the underlying cobble layer remains unexplained. Rather, it is possible that we are dealing with a multipurpose agricultural field. If the field were initially prepared with cobble mulch, this practice may have been a requisite for growing cotton at these altitudes. Later, when the field was to be used for other crops, rather than removing the cobbles, a layer of gravel mulch was simply added. These data are very intriguing as an indication of prehistoric farming practices. Based on only five paired samples, however, this explanation may not apply to the general area. In order to make a more precise interpretation of these farming methods, I would like to see as many additional paired samples analyzed as possible from contexts involving a gravel mulch over a cobble mulch.

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