MUSEUM OF NEW MEXICO

OFFICE OF ARCHAEOLOGICAL STUDIES

DATA RECOVERY RESULTS FROM TWO ARCHAEOLOGICAL SITES ALONG NORTH RIDGETOP ROAD, SANTA FE COUNTY, NEW MEXICO

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ADMINISTRATIVE SUMMARY

Between August 23 and September 6, 1999, the Museum of New Mexico, Office of Archaeological Studies, conducted a data recovery program at two archaeological sites for the North Ridgetop Road corridor. This paved road intersects with Avenida Rincon on the south and with Tano Road, 800 m (2,600 ft) to the north. The roadway is in the Santa Fe Estates subdivision, which is located within the northwest quadrant of Santa Fe, New Mexico.

It was recommended that data recovery be completed for portions of LA 127576 and LA 127578 that were within the construction right-of-way. The remaining portions of these sites were to be placed into preservation easements. Additional examination at LA 127579 determined that the cultural deposit lacked data potential beyond survey level and a preservation easement would not be necessary. A professional survey crew recorded the preservation easements for LA 127576 and LA 127578.

Excavation was completed at two areas within LA 127576. Excavation Area 1 and Excavation Area 2 were defined around a cluster of fire-cracked rock. Both concentrations represented deflated thermal features, Feature 1 and Feature 2, that could not be assigned to a temporal period. Excavation of these areas revealed no buried cultural deposits and demonstrated that archaeological material was restricted to surface and near-surface contexts. LA 127576 represents limited activity site geared toward low-level resource procurement and processing. Temporally diagnostic ceramics suggest this site was occupied between the Coalition period (A.D. 1200-1325) and Historic period (A.D. 1750-1950). The remaining cultural materials within the proposed construction area were mapped and collected.

Excavation was completed within three areas at LA 127578. Excavations within Area 1 identified the base of a shallow structure. Excavations within Area 2 identified an extramural activity area associated with Area 1 containing three fire-cracked rock concentrations. Excavations within Area 3 identified a midden or discard area associated with the use and maintenance of Area 1 and Area 2.

Excavation of Area 1 identified a shallow, steep-sided basin containing 3 soil layers and 12 internal features including hearths, storage pits, and post supports. This structure(s) appears to have been burned at the time of abandonment. Based on radiocarbon dates, it appears to have two temporal occupations. The two radiocarbon dates obtained indicate the structure was occupied between 1505 B.C. and 1375 B.C. and between 1280 B.C. and 815 B.C. Excavation of Area 2 exhibited three fire-cracked rock concentrations, remains from deflated thermal features. Although excavation of these concentrations revealed no buried cultural deposits, this location appears to be an activity area associated with the structure(s). Excavation of Area 3 exposed a layer of charcoal-stained soil associated with a high density of fire-cracked rock. The remaining cultural materials within the proposed construction area were mapped and collected.

The research design for LA 127576 and LA 127578 focused on chronology, subsistence, and land-use patterns for Archaic and ancestral Pueblo populations. These broad questions were addressed through artifact collection, feature excavation, and sample collection and the analysis of artifact and feature data. These data are analyzed on the site and intersite level and compared with data recovered from similar sites along the Northwest Santa Fe Relief Route, Las Campanas, and Santa Fe River areas. Excavation at LA 127578 produced unexpected results: a formal structure associated with an activity area and midden.

Excavation of an aceramic habitation site with formal site structure provided an opportunity to address land-use and settlement patterns in regard to duration of occupation. In addition to analysis of feature data with regards to morphology and contents, analysis of lithic and ground stone material yielded information on subsistence strategy and land use.

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INTRODUCTION

Between August 23 and September 6, 1999, the Office of Archaeological Studies, Museum of New Mexico, conducted a data recovery program at two archaeological sites for the North Ridgetop Road corridor. The roadway is in the Santa Fe Estates subdivision, which is located within the northwest quadrant of Santa Fe, New Mexico. The investigation was undertaken at the request of Mr. Cliff Walbridge and conducted in compliance with Santa Fe County Land Development Code, Article VI, Special Review Districts, Section 3. Steven A. Lakatos was the project field director assisted by OAS staff members Stephen S. Post, Richard H. Montoya, Jesse B. Murrell, and Friends of Archaeology volunteers George Price and Bob Greene. The OAS would like to thank Mr. Walbridge and acknowledge his support in ensuring that cultural resources associated with this project were treated responsibly.

The project area is located in the unplatted lands of the Santa Fe Grant, Santa Fe County (Fig. 1, Appendix 4). Only the portions of sites within the project corridor were investigated. The remaining portions outside the construction corridor were avoided and placed in protective easements. The locations of these sensitive areas were placed on the Santa Fe Estates master plan. The land is owned by Santa Fe Estates of Santa Fe. A site location map and legal descriptions are provided in Appendix 4 (removed from copies in general circulation).

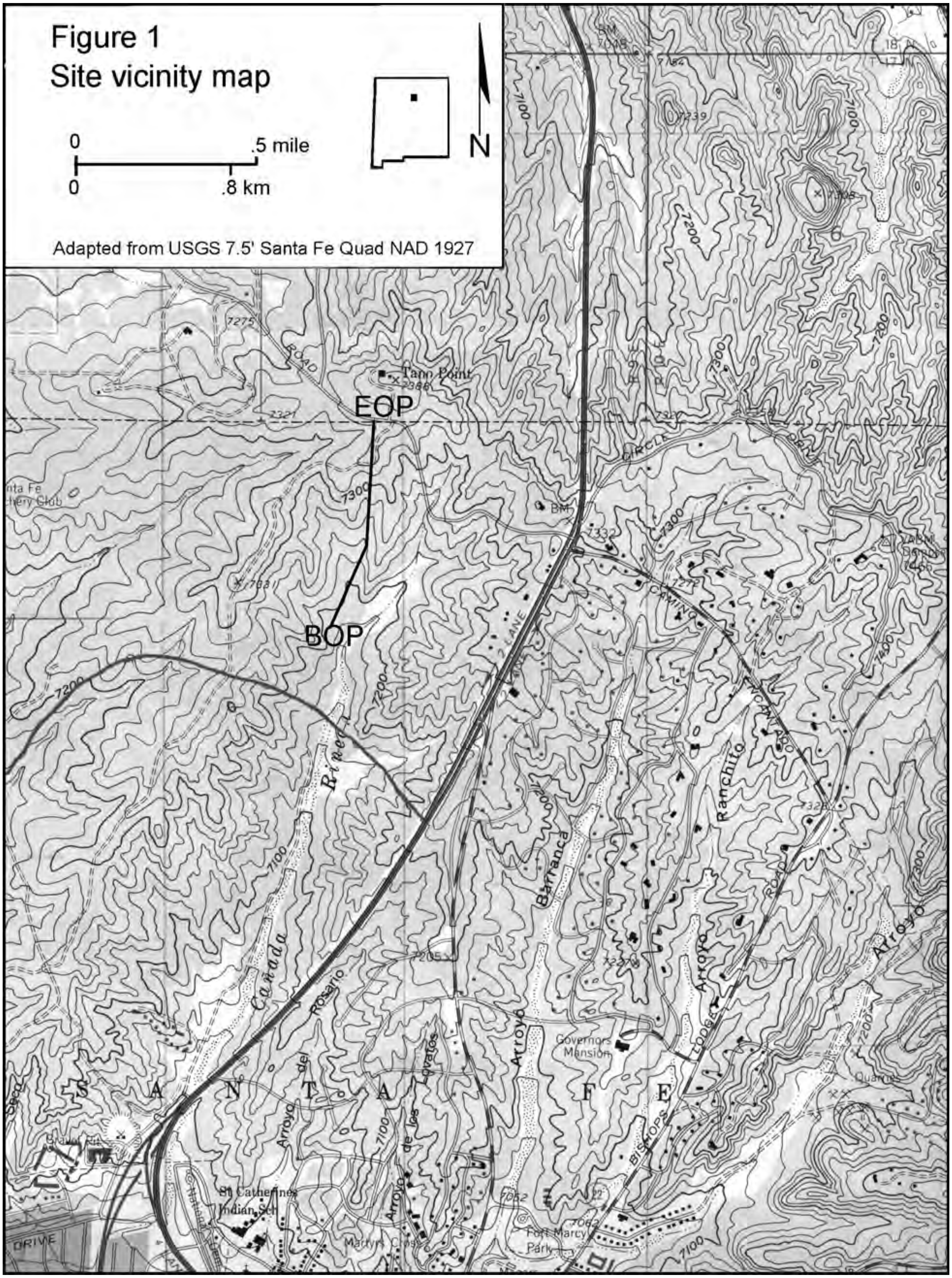

Figure 1
Site vicinity map
0
.5 mile
0
.8 km
N
Adapted from USGS 7.5' Santa Fe Quad NAD 1927
EOP
BOP
Tano Point
Governors Mansion
Fort Marcy Park
St Catherines Indian Sch
S A N T A F E

PROJECT ENVIRONMENT

The project area is within a structural subdivision of the Southern Rocky Mountain physiographic zone (Folks 1975:110). The basin is bounded on the west by the Jemez Mountains and to the east by the Sangre de Cristo Mountains. An alluvial plain, dissected by many arroyos, stretches westward from the foothills at the base of the Sangre de Cristos. This alluvial plain forms the piñon-juniper or Plains surface piedmont. The piedmont includes the Santa Fe-Tesuque Divide, which is the headwaters for the main tributaries of the middle Santa Fe River basin. The piedmont ends at an extensive drainage trough that extends northwest to the Cerros del Rio, west to the edge of La Bajada, and southwest to the Cerrillos Hills and La Cienega.

Local topography alternates among nearly level piedmont table land, rolling gravel terraces, and steep, rocky slopes. The major drainage is the Santa Fe River. Four major tributaries, Cañada Rincon, Arroyo Gallinas, Arroyo de las Trampas, and Arroyo de los Frijoles, drain much of the south piedmont slope. The arroyo floodplains were farmed during historic times (Spivey 1996) and may have been farmed during the Pueblo period, although no evidence of fields or field structures has been identified (Post 1996b). These major tributary arroyos are separated by low, broad ridges that are heavily incised by primary and secondary arroyos. These smaller tributary arroyos have grassy areas at their headwaters that provided protected settings for foraging and processing camps–a site location pattern that is evident repeatedly along the Northwest Santa Fe Relief Route (Post 1997) and in the Las Campanas area (Post 1996b; Lang 1996).

The southern three-quarters of the project area is within a minor tributary basin of the Cañada Rincon and the northern one-quarter incorporates the headwaters of the Arroyo de los Frijoles. The drainage and slope orientation is primarily south-southeast with the elongated finger ridges emanating from the Tano Divide bounding the corridor on the east and west. The topography is gentle to moderately sloped with the colluvial surfaces dissected by numerous ancient and recent arroyos. Elevation within the project area ranges from 2,202 m to 2,240 m (7,220 ft to 7,345 ft).

Project area soils are typical of the dissected piedmont plains (Folks 1975:3-4). Two of the major soil associations of the piedmont plains occur within the project area: Pojoaque Panky Rolling and Pojoaque Rough Broken Land.

Pojoaque Panky Rolling is the predominant soil association. It covers the ridge tops and slopes. It is interspersed with patches of Pojoaque Rough Broken Land. It consists of 60 percent Pojoaque sandy clay loam on slopes of 5 to 25 percent and 35 percent Panky Loam on slopes of 0 to 9 percent (Folks 1975:43). Bluewing, Cerrillos, and Agua Fria soils make up the remaining 5 percent. Pojoaque soil has moderate permeability, an effective rooting depth of 60 inches, and a water-holding capacity of 8 to 9.5 inches.

Pojoaque Rough Broken Land soils occur on the ridges that divide the major drainages. The Pojoaque soils make up 50 percent of the association and are well drained on upland terraces with an 8-inch-thick surface layer of reddish brown sandy clay loam. The substratum is 32 inches of a light reddish brown gravelly sandy clay loam with mild calcareous content (Folks 1975:43). The Rough Broken Land soils are on steep slopes, have shallow depth, and consist of sandy to sandy loam with greatest depth as colluvium at the base of rock slopes.

Most of the archaeological deposits encountered occurred within the modern or A horizons of the predominant soil associations. The common and abundant occurrence of prehistoric and historic deposits on similar soil horizon surfaces suggest many of the land forms in the project area have not undergone radical geomorphological change in the last 2,000 to 3,000 years. However, recent excavation of sites along the Northwest Santa Fe Relief Route (Post 1996a) and Las Campanas projects (Post 1996b) revealed deeply buried early to late Archaic period deposits in topographic settings that have experienced substantial colluvial aggradation. Deeply buried cultural deposits may co-occur with later near-surface deposits or they may be visible as a faint, gray-colored soil lens. Close examination of these gray soil lenses usually reveals charcoal flecks and dark-stained soil. The cultural deposit may have fire-cracked rock, an occasional artifact, or there may be no indicator except the soil stain. These soil lenses are often missed or were interpreted as tree burns or evidence of grass or forest fires. Ranging from 10 to 40 cm thick, these buried deposits exposed by modern erosion or ancient channel meandering, have been found 20 to 200 cm below the modern ground surface. Radiocarbon dating has placed the earliest of these deposits in the sixth millennium B.C. (Anschuetz 1998; Post 1999b). Topographic settings with a high percentage of south, southeast, or southwest-facing slopes, sheltered swales and drainage heads, and a 1- to 2-km proximity to seasonal water are proving to have high densities of these deeply buried, presumably Archaic period deposits (Anschuetz and Viklund 1996; Anschuetz 1998; Post 1997, 1999b, n.d.)

An important environmental factor that seems to have a strong influence on the structure of the piedmont archaeological record is the relative abundance of lithic raw material suitable for core reduction and tool manufacture. Exposed along the Arroyo de los Frijoles, Arroyo de las Trampas, Arroyo Gallinas, and their major upland tributary arroyos, are gravel deposits of Santa Fe and Ancha Formation origin dating to the middle to late Tertiary. They contain a wide range of igneous and metamorphic rock. Mixed with these gravel deposits are the alluvial deposits from the Sangre de Cristo Mountains that contain redeposited nodules of chert and chalcedony from the bedded Pennsylvanian Age Madera Limestone Formation (Lang 1993). These combined deposits provided a wide range of chert, chalcedony, silicified wood, quartzite, igneous, and metamorphic materials. There is differential distribution of suitable lithic raw materials throughout the piedmont hills with particularly thick deposits noted along the Arroyo de los Frijoles (Lang 1996). These local raw materials make up 95 percent of the chipped stone recovered by the excavations at Las Campanas (Post 1996b).

Two main plant communities as described by Kelley (1980) are common within the project area: piñon-juniper woodlands and the rabbitbrush community. Other important plant communities include the grassland community that extends to the edge of La Bajada and the riparian environment of the Santa Fe River. Together these plant communities would have provided a diverse array of floral resources for prehistoric populations.

Within the project area, the piñon-juniper woodland is the dominant plant community covering an estimated 80 percent of the land. Piñon-juniper woodlands had 135 of the 271 plant species observed within the Arroyo Hondo Pueblo catchment (Kelley 1980:60). Of these, 63 species are edible or have medicinal qualities. However, with the exception of piñon, most of the species are not abundant or are most productive in disturbed soils. Economic plant species in addition to piñon found in the piñon-juniper woodland and in archaeological contexts include yucca, prickly pear and pin cushion cacti, *Chenopodium* sp., *Amaranthus* sp., and Indian ricegrass. Wetterstrom (1986) suggests that intensive gathering of these species might off-set years of moderately poor agricultural production. However, consecutive years of poor moisture would affect the productivity of wild plants and cultigens alike, rendering their buffering potential unpredictable. Total available economic plant species of the piñon-juniper woodland project high wild-resource productivity, but conditions that favor grasses and shrubs might off-set piñon-juniper productivity.

The rabbitbrush community of the arroyo channels and terrace slopes may have provided abundance and variability in plant species when the piñon-juniper yield was decreased or less predictable. Affected by run-off, flooding, and erosion, arroyo channels and terraces are more disturbed and support the grasses, shrubs, and succulents that favor disturbed conditions. The arroyo channels or terraces also may have been dry-farmed, which would have created disturbed soils zones when left uncultivated. Plant species of the rabbitbrush community include prickly pear, yucca, *Chenopodium* sp., *Amaranthus* sp., and Indian ricegrass.

The fauna of the piedmont has been described in Wetterstrom (1986), Lang and Harris (1984), and Kelley (1980). Mammals most abundant on the piedmont would have been cottontail and black-tailed jackrabbit, a variety of squirrels, rats, mice, and gophers, prairie dogs, coyote, and mule deer. Pronghorn would have roamed the shortgrass plains. Distribution and abundance of these species would have depended on available forage and prey species. It is likely that in good years a full range of small, medium, and large mammals would have been available. However, during the Pueblo period, Lang and Harris (1984) suggest that Arroyo Hondo residents became more reliant on small mammals and long-distance hunting trips for large game.

The Santa Fe area has a semiarid climate. Most of the local precipitation occurs as intense summer thunderstorms that produce severe runoff and reduce usable moisture. The area receives an average of 229 to 254 mm of precipitation per year and a mean snowfall of 356 mm (Kelley 1980:112). The growing season ranges from 130 to 220 days and averages 170 days. The last spring frost usually occurs in the first week of May and the first fall frost occurs around the middle of October. The mean yearly temperature is 10.5 degrees C.

Paleoenvironment

Paleoenvironmental reconstructions for the Northern Rio Grande are few. The most recent and perhaps most reliable study used dendrochronological data from Arroyo Hondo Pueblo (Rose et al. 1981). This temporally extensive study is very useful for Pueblo period investigations. Unfortunately, the detail that it provides begins with A.D. 985, which is more than 2,000 years later than the LA 127578 occupation. Periodicity of rainfall exhibited by the Arroyo Hondo study might be of interest for evaluating potential late Archaic period settlement patterns, except that general climatological evidence for the American Southwest indicate long-term trends that do not fit the Arroyo Hondo profile (Cordell 1979; Cully 1977; Wills 1988). Inferences about late Archaic period climate can be drawn from the general studies and are provided in the following, though they lack the temporal control and regional specificity that would make them more applicable to the LA 127578 occupations.

Occupation of LA 127578 occurred in the Medithermal, which began after 4000 B.P. (Antevs 1955). As proposed by Antevs (1955) the Medithermal was substantially similar to modern climate in the ranges of precipitation and temperature. Evidence of this climatic regime was a decrease in xerothermic plants, accumulation of water in desert basins, stabilization of dunes, arroyo filling, and the development of glaciers in high mountains (Antevs 1955). Sedimentary evidence from the San Augustin Basin in southwestern New Mexico shows an increase in moisture from 5000 to 3500 B.P. with dry periods of unspecified length at 2500, 1500, and 500 B.P. (Powers 1939; Cully 1977:97).

Palynological evidence from western New Mexico and eastern Arizona suggests that between 5000 B.P. and 3000 B.P. light summer rains were more prevalent with a winter dominant precipitation pattern (Schoenwetter 1962). From 3000 to 500 B.P. there was a return to summer-dominant precipitation pattern typified by heavy rains. Periodicity in precipitation is indicated in the pollen record by a span of increased summer rainfall from 3400 to 2800 B.P.; decreased annual precipitation with cooler temperatures between 2800 and 2500 B.P.; warmer temperatures and more precipitation between 2500 and 2300 B.P.; warmer temperatures with less precipitation between 2300 and 2100 B.P.; and a return to cool temperatures with more precipitation between 2100 and 1600 B.P. (Peterson 1981).

The actual length of these periods of different temperature and moisture regimes is generalized and the variation within any of the 200 to 500 year spans undoubtedly is comparable to the more recent record provided by Rose et al. (1981) for Arroyo Hondo Pueblo. The importance of the variability within the long term patterns for late Archaic populations is the effect on the distribution and abundance of food sources. Changes in the range of the major plant communities, such as the piñon-juniper woodlands or shortgrass plains, should be reflected in the temporal and spatial patterning of site types and subsistence strategies (Wills 1988). Examples of corresponding changes in climate and affect on biotic community range include an extension of shortgrass plains with an increase in summer available seeds and increased or greater distribution of antelope herds. Extension of piñon-juniper woodlands would result in a decrease of local antelope herds, but an increase in mule deer and piñon nut harvests that occur in the fall.

Locating late Archaic base camps at or near the shortgrass plains-piñon-juniper community would reap the benefits of both zones within daily foraging radii of 5 to 7.5 km. Late Archaic period sites with pit structures and evidence for periodic reoccupation emphasizes the importance of the piñon-juniper-shortgrass plains transition zone to hunter-gatherers.

CULTURAL-HISTORICAL BACKGROUND

Archaic Period

The Archaic period in the Santa Fe area has been defined according to the Desert Culture Oshara and Cochise traditions (Cordell 1979; Biella and Chapman 1977; Lang 1977). These traditions span 5500 B.C. to A.D. 400 and are primarily distinguished by morphologically and temporally distinct projectile points, and to some extent, stone tool assemblages, site structure, and settlement patterns (Irwin-Williams 1973, 1979). Archaic period sites identified in the Santa Fe area date from the Bajada phase (4800 to 3200 B.C.) to the En Medio or Basketmaker II period (800 B.C. to A.D. 400). Recent archaeological investigations throughout the Santa Fe area have revealed some aspects of the settlement and subsistence patterns of Archaic period populations.

The Middle Archaic

Middle Archaic sites remain rare in the Santa Fe archaeological record. LA 86139 in the Las Campanas project area was a late San Jose phase site (3800 to 1800 B.C.) (Post 1996b). It was highly deflated and eroded, but did yield an assemblage of obsidian and biface tools, tool production debris, and basin metate fragments. While not abundant, these artifacts and features suggested a slightly more formal and longer occupied camp than was evidenced by the early Bajada phase sites. Excavations along the Northwest Santa Fe Relief Route at LA 61286, LA 61289, and LA 61290 yielded intensively reoccupied base camps (Post 1997) with burned remains of structure foundations, a wide range of processing pits, and except for isolated proveniences, a focus on expedient tool production and use and plant processing. Within each site there is a consistency in the feature and artifact assemblages that suggests a relatively short span between reoccupations. Between sites there is variability in feature construction and arrangement that could relate to changes in the environment that required different subsistence organization. Radiocarbon dates for these sites range from 3500 to 2200 B.C. These deeply buried sites indicate that San Jose phase sites may not be as rare as surface sites indicate, but instead that they may be buried and difficult to detect.

The Armijo Phase

The Armijo phase is dated between 1800 and 800 B.C. based on sites excavated in the Middle Rio Puerco River Valley (Irwin-Williams 1973). During the Armijo phase there were two major changes in settlement and subsistence. Settlement patterns showed the first evidence of seasonal aggregations as indicated by the dense and extensive occupation floors at the Armijo shelter (Irwin-Williams 1973:10). A change in subsistence is evidenced by the first indications of corn use and the presence of a stone tool kit that exhibited a wider selection of plant processing implements. The temporal indicator is the Armijo-style projectile point, which has an ovate blade with shallow corner notches and a concave or slightly indented base.

Locally, the best evidence for Armijo phase occupation is from the margins of the Santa Fe River, near the Santa Fe Airport at Tierra Contenta (Schmader 1994a) and along Airport Road (Post 2000). The data from the Tierra Contenta and Airport Road sites suggest that during the Armijo phase the Santa Fe drainage there were repeated seasonal occupations by small groups that coincided with the availability of abundant subsistence resources. Different occupation patterns are evidenced by the presence of shallow pit structures or dense clusters of hearths, roasting pits, and processing and discard areas. Sites with pit structures show evidence of generalized subsistence (Schmader 1994a). Wood charcoal from pit structures and associated features yielded calibrated two-sigma date ranges between 1930 B.C. and 830 B.C. The tightest cluster of dates indicate occupations during the ninth and tenth centuries B.C. (Schmader 1994a:92). The Airport Road site, LA 61282, had a cluster of 30 thermal and processing features and a high density biface manufacture discard area (Post 2000). Faunal remains indicated hunting and processing of deer and antelope at different times between the twentieth and fifteenth centuries B.C. The clustered spatial distribution of these sites indicates that a periodic, semipermanent water source was available. The occurrence of these sites suggest Armijo populations regularly moved in and out of the Santa Fe area with site clusters near water sources as well as near the juniper grass plains and at the edge of the higher elevation piedmont.

The late Archaic periods (Armijo, En Medio, and Basketmaker II, 1800 B.C. to A.D. 400) are characterized by an increasing number of sites through time that were occupied longer and located in a broad range of environmental settings. Small Armijo phase camp sites have been identified north of the Santa Fe River (Post 1993:8-10). Late Armijo phase pit structures and base camps have been excavated in the low piedmont area separating the Arroyo Calabasas from the Santa Fe River near the airport in Santa Fe (Schmader 1994a; Post 1999b). Radiocarbon intercept dates ranging from 1740 B.C. to 940 B.C. were obtained from hearths and structural elements from three sites. As late Archaic populations remained longer in the Santa Fe area, they left more sites with formal facilities and distinctive discard patterns. Small logistical sites increase in number, but are widely dispersed suggesting expansive foraging ranges.

Pueblo Period

The Pueblo period chronology follows the framework presented by Wendorf and Reed (1955). This framework was modified by Dickson (1979) and coined the "Rio Grande Classification" by Peckham (1984:275). The Pueblo period spans A.D. 600 to 1600 and is subdivided into the Developmental, Coalition, and Classic periods.

Developmental Period (A.D. 600-1200)

The Developmental period in the Northern Rio Grande spans A.D. 600 and A.D. 1200. This period is divided into the early Developmental (A.D. 600 to 900) and late Developmental (A.D. 900 to 1200). The early Developmental correlates to the Basketmaker III and Pueblo I periods of the Pecos Classification. Early Developmental sites, prior to A.D. 800, are relatively rare in the Northern Rio Grande as compared to the Colorado Plateau. 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 of the reported early Developmental sites are located in the Albuquerque area and south of La Bajada with few reported at higher elevations along the Tesuque, Nambe, and Santa Fe river drainages (Lang 1995; McNutt 1969; Peckham 1984; Skinner et al. 1980; Wendorf and Reed 1955). Archaeological survey at Cochiti Reservoir found only 12 sites that could be assigned to this period (Biella and Chapman 1977:203). McNutt (1969:70) located no early Developmental period components north of La Bajada and White Rock Canyon.

In the eastern Galisteo Basin only five components may date to this period (Lang 1977; Scheick and Viklund 1989). The lack of evidence for sedentism, during the first part of this period, suggests that there was a long-term pattern of hunting and gathering in the Northern Rio Grande. Recent excavations near the Santa Fe Community College yielded a seventh-century A.D. radiocarbon date from small hearth supporting the hypothesis of continued small-scale hunting and gathering (Post 1998). This continued focus on hunting and gathering may be in part attributed to the rich resource diversity of the Northern Rio Grande Valley, forestalling an early reliance on small-scale farming (Cordell 1979:2).

The adaptation of cultigens and construction of architecture are identified during the later part of this period. Recent excavations near Cochiti have uncovered evidence of intensive settlement by pithouse-dwelling farmers by A.D. 750 (Ware 1998). Early Developmental habitation sites are typically situated along low terraces overlooking primary and secondary tributaries of the Rio Grande. These locations were presumably chosen for their access to water, arable farming land, and different environmental zones with hunting and gathering resources (Cordell 1978; Anscheutz et al. 1997). Excavated early Developmental habitation sites consist of one to ten circular pit structures with little or no evidence of associated surface structures (Allen and McNutt 1955; Peckham 1954, 1957; Stuart and Gauthier 1981).

Ceramics associated with early Developmental sites includes 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 with the addition of neckbanded types, similar to Alma Neckbanded and Kana'a Gray, and decorated types including Kiatuthlana Black-on-white, La Plata Black-on-red, and Abajo Black-on-orange (Wendorf and Reed 1955). Although decorated pottery suggests a cultural affiliation with people to the west and northwest, early Developmental inhabitants also obtained red and brown wares through trade with Mogollon people to the south and southeast (Cordell 1978).

During the late Developmental period (A.D.900 to 1200), the first population increase occurred in the Santa Fe area, as inferred from increased size and number of sites as well as the settlement of higher elevations along the Rio Grande, Tesuque, Nambe, and Santa Fe river drainages (Allen 1972; Ellis 1975; McNutt 1969; Peckham 1984; Skinner et al. 1980; Wendorf and Reed 1955).

Late Developmental sites have been identified throughout the Middle and Northern Rio Grande Valley. These sites are commonly located along low terraces overlooking primary and secondary tributaries of Rio Grande, Tesuque, Nambe, and Santa Fe river drainages. Although late Developmental period sites are more common at higher elevations than early Developmental period sites, there is little evidence for late Developmental sites on the Pajarito Plateau (Kohler 1990; Orcutt 1991; Steen 1977). The appearance of these sites does not necessarily suggest that population increased. Instead, the settlement and subsistence pattern may have shifted from one of mobility, which left ephemeral archaeological remains, to a more sedentary lifestyle, which left more structural remains and artifact accumulations. The general pattern was still one of low population density.

A typical late Developmental residential unit consists of one to two pit structures associated with 5 to 20 surface rooms and a shallow midden (Ellis 1975; Lange 1968; Peckham 1984; Stubbs 1954; Stuart and Gauthier 1981; Wendorf and Reed 1955). These habitation locations occur as single units or in clusters of units referred to as a community (Anschuetz et al. 1997; Wendorf and Reed 1955). LA 835 (the Pojoaque Grant site) is often used to illustrate this example. Larger village size suggests year-round residential occupation.

By far the most common ceramics associated with late Developmental sites are utility wares. Utility wares include the plain gray, plain brown, and neckbanded types commonly associated with the early Developmental period with the addition of types displaying corrugated and incised exteriors. Decorated white wares are imported and manufactured locally. The decorated white ware was Kwahe'e Black-on-white, originally identified by Mera (1935) as a local Rio Grande variant of Chaco-style pottery. Common imported white ware types include Red Mesa Black-on-white, Gallup Black-on-white, and Escavada Black-on-white with Socorro Black-on-white, Chupadero Black-on-white, Chaco Black-on-white, and Chuska Black-on-white identified in low frequencies (Wilson 2000; Allen 1972; Franklin 1992; Lange 1968; McKenna pers. comm.). Although decorated red wares are present, they are not found in high frequencies. Common decorated red wares include types from the Upper San Juan , Tusayan, and Cibolan regions (Wilson 2000).

The quantity of imported decorated pottery (Wiseman and Olinger 1991) and appearance of Kwahe'e Black-on-white, a locally made copy of the white wares produced in the northern San Juan region (Mera 1935; Gladwin 1945), is believed to illustrate a continued affiliation between the Northern Rio Grande and San Juan Basin (Warren 1980). Although decorated pottery suggests a continued relationship with people to the west and northwest, late Developmental inhabitants also obtained decorated ceramics and brown wares through trade with Mogollon people to the south and southeast (Cordell 1978). The array of decorated ceramics acquired from different regions suggests that the inhabitants of Northern Rio Grande Valley participated in trade with neighboring cultural groups.

Known sites in the project area include LA 114 (Arroyo Negro), LA 15969 (Wiseman 1978), LA

46300 (the KP site) (Wiseman 1989), and a minor component at Pindi Pueblo (LA 1) (Stubbs and Stallings 1953). The Pindi Pueblo component shows that some large Coalition period sites had their origins in this period (Stubbs and Stallings 1953:14-15).

Arroyo Negro (LA 114) was originally recorded by Mera in the 1920s. It has seven small (less than 10 rooms) to medium (11-25) room blocks constructed of adobe with cobble foundations. In 1934, W. S. Stallings collected 95 tree-ring samples from pothunted rooms and four kivas (Smiley et al. 1953:27-29). The tree-ring dates indicate an occupation span between A.D. 1050 and 1150, with less reliable A.D. 950 to 1000 dates for Kiva C. Two construction episodes occurred between the A.D. 1050s and A.D. 1130 to 1145 (Smiley et al. 1953:29). Identified pottery types at LA 114 included Kwahe'e Black-on-white, Santa Fe Black-on-white, Socorro Black-on-white, and Wingate Black-on-red.

LA 15969 was identified by Wiseman (1978:8) on top of the gravel terrace overlooking the north prehistoric floodplain of the Santa Fe River. The site included a U-shaped 14-room structure with a kiva. It is estimated to have been occupied between A.D. 1100 and 1150. LA 46300 (the KP site), also investigated by Wiseman (1989), displayed limited evidence of small surface rooms and a subterranean structure. These deposits date between A.D. 1050 and 1100 making both LA 15969 and LA 46300 contemporaneous with the occupation of LA 114.

The late Developmental component at Pindi Pueblo (LA 1) had two jacal structural remnants, a pithouse, and sparse refuse (Stubbs and Stallings 1953:9). The refuse was in the central portion of the site on a knoll. Stubbs and Stallings (1953:15) observed that the pre-Pindi material was very sparse and the deposit ranged from 2 to 50 cm deep. These deposits were beneath the later Coalition period occupation.

Coalition Period (A.D. 1200-1325)

The Coalition period is marked by three major changes in the archaeological record in the Northern Rio Grande. These changes include the continued increase in number and size of residential sites; contiguous surface rooms are used more as domiciles than the previous period; and the shift from mineral paint to vegetal-based paint (Cordell 1978; Peckham 1984; Stuart and Gathier 1981; Wendorf and Reed 1955). These changes were sufficiently important to warrant a new period in the Northern Rio Grande cultural sequence. The Coalition is divided into two phases: Pindi (A.D. 1220-1300) and Galisteo (A.D. 1300-1325) (Wendorf and Reed 1955). Most of the large sites were established during the Pindi phase. The largest sites continued to grow during the Galisteo phase, anticipating the large villages of the Classic period.

An increase in the number and size of residential sites during this period suggests population increase and an extension of a village-level community organization identified during late Developmental period. Although there is an apparent increase in the number of Coalition period sites in areas like the Pajarito Plateau, areas such as the Española Basin, occupied during the late Developmental, are abandoned. The expanse into higher elevations during the Coalition is a trend identified during the late Developmental period. These locations provided access to water, arable farming land, and a variety of hunting and gathering resources (Cordell 1978). Although inhabiting higher elevations provided reliable water and arable farming land, innovative methods were needed for producing crops in this cooler setting (Anscheutz et al. 1997). Evidence of these newly developed methods may include intensification of water management and agricultural practices. The use of checkdams, reservoirs, and grid gardens, especially during the later part of this period, are examples of this intensification (Anscheutz et al. 1997; Maxwell and Anscheutz 1992; Moore 1981).

Coalition period residential units typically consist of one to two pit structures, or kivas, associated with 10 to 30 surface rooms, and a shallow midden (Peckham 1984; Stuart and Gauthier 1981:51; Wendorf and Reed 1955:51). Site plans commonly consists of small linear or L-shaped room blocks oriented approximately north to south. These room blocks are one to two rooms deep with a pit structure or kiva incorporated in or to the east of the room block (Kohler 1990; Steen 1977; 1982; Worman 1967). Sites that exhibit this layout are generally considered to be earlier in the Coalition period.

Although most Coalition period sites are relatively small, some are reported to contain up to 200 ground-floor rooms (Stuart and Gauthier 1981). These larger sites are commonly U-shaped, enclosing a plaza(s) to the east. Generally, large Coalition period sites with an enclosed plaza(s) are considered to be a later development (Steen 1977; Stuart and Gauthier 1981). In the Santa Fe River Valley, large villages on the prehistoric floodplain near the river channel were established during the early Coalition period. The only reported excavations are at Pindi Pueblo (LA 1) (Stubbs and Stallings 1953) and the Agua Fria Schoolhouse site (LA 2) (Lang and Scheick 1989). Site data for the late Coalition period show a thriving community along the Santa Fe River. Farming along the Santa Fe River, the presence of fresh-water springs, and access to diverse environments for subsistence items and raw material all contributed to successful settlement.

Although Coalition sites are commonly cited as habitation locations, investigations at Las Campanas identified 20 components (Post 1996b) and the Northwest Santa Fe Relief Route inventory and testing (Maxwell 1988; Wolfman et al. 1989) yielded 16 components from the Coalition or early Classic period. These components appear to be what had remained from short duration or daily use of the piedmont hills. Thermal features were mainly shallow, oval-shaped pits with cobble linings or fire-cracked rock moderately abundant to absent. Site frequencies in all areas of the Northern Rio Grande increased enormously at this time (Biella and Chapman 1977:203; Orcutt 1991; McNutt 1969; Lang 1977). Two sites from the Las Campanas project, LA 86159 and LA 84793, yielded pottery-firing pit kilns associated with Santa Fe Black-on-white pottery (Lakatos 1996). Other sites exhibited chipped stone reduction patterns, which reflect material procurement and testing, and exhibited all stages of core reduction, supporting daily foraging activities. Local raw material made up 95 percent of the chipped stone debris. Sites were formed by single, high-intensity episodes or from many brief visits that left a dispersed artifact scatter. Excavation of LA 61299 along the Northwest Santa Fe Relief Route yielded a cobble-paved pottery kiln with a misfired, but complete Santa Fe Black-on-white ladle lying along the periphery. These small sites could easily be overlooked because they are often visible as isolated hearths associated with a few artifacts. We know now that in some instances these isolated hearths are in fact an important and formerly missing component of the origins of the Tewa pottery tradition (Post and Maxwell 1998).

Utility ware ceramics include types with corrugated, smeared corrugated, and plain exteriors. Less common utility ware types include striated, incised, or tooled exteriors. The decorated pottery was divided into Santa Fe Black-on-white and all its local variants (Stubbs and Stallings 1953) for the Pindi phase, and Galisteo Black-on-white (Mera 1935) for the later phase. Few trade wares are reported from Coalition period sites and commonly consist of White Mountain Redwares (Kohler 1990; Steen 1977, 1982; Steen and Worman 1978; Worman 1967). LA 1, LA 2, LA 109, LA 117, LA 118, and LA 119 have Santa Fe and Galisteo Black-on-white pottery, and at least a small amount of glaze-paint pottery, suggesting that all six sites are roughly contemporaneous. These villages formed a large continuous community that was 3.2 km (2 miles) long. Sites in the Santa Fe River Valley recorded by Carter and Reiter (1933), but not by Mera, include CR (Carter-Reiter) 178, 180, 182, 183, and 185. These sites may have Coalition and early Classic period components, since LA 1 (Pindi Pueblo) and LA 2 (Agua Fria Schoolhouse) were recorded by Carter and Reiter as historic sites.

Classic Period (A.D. 1325-1600)

Wendorf and Reed (1955) mark the beginning of this period (A.D. 1325-1600) by the appearance of Glaze A and locally manufactured red-slipped pottery (see also Mera 1935; Warren 1979). Characterized by Wendorf and Reed as a “time of general cultural fluorescence,” regional populations reached their maximum size, and large communities with multiple plaza and room block complexes were established. Although the reasons for the appearance and proliferation of the glaze wares are debatable, many researchers, including Eggan (1950), Hewett (1953), Mera (1935, 1940), Reed (1949), Stubbs and Stallings (1953), and Wendorf and Reed (1955), believe that the similarity of the new pottery to White

Mountain Redware is evidence for large-scale immigration into the area from the San Juan Basin and Zuni region.

Steen (1977) argues, however, that the changes seen during this period resulted from rapid indigenous population growth. Steen believes that the population growth was enabled by favorable climatic conditions, which allowed Rio Grande populations to practice dry-farming in previously unusable areas. Steen also suggests that there was "free and open" trade between the Northern Rio Grande region and other areas, accounting for the observed changes in Classic period material culture. It is therefore unclear how much of the population increase during this period resulted from immigration or from intrinsic growth. Besides populations migrating from the west, it has also been suggested that some population growth was due to the arrival of people from the Jornada branch of the Mogollon to the south, and perhaps from northern Mexico (Schaafsma and Schaafsma 1974).

The construction of large multiplaza communities supersedes the village-level community organization identified during late Developmental period and Coalition periods. In the Santa Fe area large villages such as 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, only Cieneguilla remained occupied after A.D. 1425, when Glaze B pottery appeared (ca. A.D. 1425). Dickson (1979) believes that abandonment of the large villages was due to the drought conditions, revealed by tree-ring studies (Fritts 1965; Rose et al. 1981), and subsequent agricultural failure.

In the Santa Fe River Valley, LA 1 and LA 2 are the best known Classic period sites. LA 1 was occupied between A.D. 1325 and 1350, which is the early part of the period (Stubbs and Stallings 1953:155). This may have been a time of population movement and village reorganization. Pindi Pueblo experienced a short interlude of decreased occupation before A.D. 1325, but by A.D. 1330 there was new building and renewed use of older parts of the pueblo (Stubbs and Stallings 1953:14). A similar pattern was suggested for LA 12 (Arroyo Hondo Pueblo) (Lang and Scheick 1989:196). A change in kiva function may be indicated by a change in frequency (four to two) within villages and a change in their location from subterranean to surface placement. Perhaps as kiva function became more specialized, the number decreased. Plazas were more conspicuous at this time suggesting a more centralized social organization that may have required larger community areas for social or ceremonial functions. It is known that the large villages of the Galisteo Basin, the Rio Grande, and Rio Chama showed the same trends in the construction of fewer kivas and use of larger, more centrally located community space, as early Classic period Pindi Pueblo. The full fluorescence of the Classic period was not realized at Pindi Pueblo because it was abandoned in A.D. 1350, just as the larger villages were being established.

The limited excavation data for LA 2 suggests an occupation that lasted until A.D. 1420, which corresponds to Arroyo Hondo Pueblo and La Cieneguilla. Little is known about the early Classic period at LA 2. The abundance of Glaze A pottery suggests that the residents were engaged in regular social or economic interaction with the more southern Classic period villages (Lang and Scheick 1989). Lang and Scheick (1989:195) surmise that LA 2 was the largest village in the Santa Fe River Valley until A.D. 1420. If the village did house between 1,000 and 2,000 people as suggested by Lang and Scheick (1989:196), then the smaller surrounding villages (LA 117, LA 118, and LA 119) may have been abandoned by A.D. 1350 with the local population coalescing at LA 2. An untested hypothesis suggests that this coalescence may have been brought on by a change in social organization, and not environmental conditions. The resources of the Santa Fe River could have been successfully exploited by many little villages. Success notwithstanding, sometime after A.D. 1350, everyone may have moved into one large village. If economic resources were equally available to all, then there must have been other social or religious factors that contributed heavily to population aggregation (Cordell 1978:58).

For whatever reason, this was a time of village reorganization. Sites such as Pindi and Arroyo Hondo experienced reoccupation of older portions of the pueblo during this time (Lang and Scheick 1989; Stubbs and Stallings 1953). Intracommunity changes are also suggested by the decrease in kiva to room ratio

(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 a social organization that required centrally located communal space. Defined communal space may have been used to integrate aggregated populations through ceremonial functions.

The need for defined communal space may also be related to the occurrence of the Kastina Cult in the Northern Rio Grande during this time (Schaafsma and Schaafsma 1974). A shift from geometric designs to masked figures and horned serpents in kiva murals (Hayes et al. 1981; Dutton 1963; Hibben 1975) and the occurrence of shield-bearing anthropomorphic rock art figures (Schaafsma 1992) suggest the acceptance of new ideological concepts. Changes in community structure and settlement patterns during the Classic period may reflect indigenous inhabitants adapting to, or adopting new populations, ideological elements, and organizational systems.

Along with the development of large aggregated sites, Glaze A, a red-slipped locally manufactured pottery, was introduced. Glaze painted pottery is common on Classic period sites south of Santa Fe while Biscuit Ware pottery is common on Classic period sites north of Santa Fe. Although the reasons for the appearance and proliferation of glaze painted pottery are ambiguous, many researchers believe this early glaze pottery developed from White Mountain Redwares. The similarities between these two types is viewed as evidence for large-scale immigration into the Northern Rio Grande from the Zuni region and 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 as the result of expanding indigenous populations (Steen 1977) or the arrival of populations from the Jornada branch of the Mogollon to the south (Schaafsma and Schaafsma 1974).

After A.D. 1420, Santa Fe River Valley, east of Agua Fria, was mostly abandoned. The large settlement at La Cieneguilla increased in size and was still occupied by Native Americans until the Pueblo Revolt in A.D 1680. The settlement pattern that prevailed throughout the Rio Grande, Rio Chama, and Galisteo Basin was a decrease in small villages or large farmsteads. The remaining large villages dramatically increased in size (Stuart and Gauthier 1981). Presumably, these large villages had extensive subsistence catchment basins and extensive networks of social and economic interaction. The pattern of few or no Native American sites dating between A.D. 1420 and 1680 is graphically reflected in the survey results from large parcels near the Santa Fe River Valley (Hannaford 1986; Maxwell 1988; Wiseman 1978).

Historic Period (A.D. 1540 to 1940)

The Historic period in the Santa Fe area spans more than 400 years of interaction among Native American, Spanish, and Anglo-American cultures. A detailed summary of historical events and trends for the Middle Rio Grande and the Santa Fe area is beyond the scope of this report. Interested readers are referred to the many sources that detail the events and patterns of the historical period (Jenkins and Schroeder 1974; Lamar 1966; Larson 1968; Bannon 1979; Noble 1989; Pratt and Snow 1988; Kessell 1979; Twitchell 1925; Athearn 1989).

Except for the period of Spanish exploration, the Historic period is divided into time spans that reflect changes in political control in New Mexico. The Spanish exploration period includes the period between Coronado’s entrada into New Mexico in 1540, and in 1598 when Don Juan de Oñate arrived at San Juan de Caballeros along the Rio Grande at modern San Juan Pueblo. The early Spanish Colonial period spans 1599 to 1680, which includes the founding of Santa Fe (1609-1610) and the beginning of the Pueblo Revolt. The return to Native American self-determination spanned 1680 to 1696. Beginning in 1696 and ending in 1698, Don Diego de Vargas recaptured New Mexico and returned political and economic control to Spain. The later Spanish Colonial period spanned A.D. 1698 to 1821, the year of Mexican independence from Spain. It was a time of settlement growth and expansion in New Mexico. The Mexican period lasted from A.D. 1821 to 1848. This period was a short interlude with minor changes in New

Mexico social and political life, except for the initiation of trade with the United States and the official opening of the Santa Fe Trail. The Territorial period began in 1848, with the end of the Mexican-American War and the signing of the Treaty of Guadalupe Hidalgo. The Territorial period continued the expansion of the Anglo-American social, economic, and political system into the American Southwest that had begun with the opening of the Santa Fe Trail. The Territorial period ended with Statehood in 1912. From Statehood to World War II (A.D. 1912 to 1945), New Mexico continued to become more integrated into the national political, economic, and social system. There was increased education and economic opportunity outside New Mexico and a steady flow of Anglo-Americans into New Mexico. These factors combined to crystallize the tricultural traditions that are a recognized part of New Mexico's past and present.

EXCAVATION METHODS

LA 127576 and LA 127578 were defined through surface artifact concentrations and features. The general excavation and recording methods were suited to recovering data needed to address the research issues. Field methods concentrated on defining individual occupations, associated features, and artifacts for comparisons between the North Ridgetop Road sites and sites along the Northwest Santa Fe Relief Route, Las Campanas, and Rancho Viejo. Following are general and specific field methods that were used at LA 127576 and LA 127578.

1. The site surface was reexamined and the artifact concentrations, artifact scatters, features, and site limits were pinflagged.

2. A 1-by-1-m grid system was superimposed across the site, oriented to magnetic north, and tied into the project centerline. Each 1-by-1-m grid unit was identified by the north and east coordinate of the southwest corner.

3. Excavation areas were established within artifact concentrations or around identified features. Depending on size and extent of the associated cultural deposits, excavation areas ranged in size from 2-by-2 m to 6-by-6 m at each feature. Surface artifacts within the excavation areas were collected in 1-by-1-m units. Surface artifacts outside the excavation areas were piece-plotted and collected using an optical transit.

4. Excavation emphasized data collection from contiguous units to support site structure analysis and to document the associations between features and artifacts. The excavation methods included a combination of surface stripping, arbitrary 10-cm levels, and careful feature excavation.

5. The surface of each feature area was stripped using a trowel or shovel until the outline of the feature was defined. Feature excavation proceeded by exposing the surrounding area. Once the stain, soil change, or rock concentration was fully exposed, it was mapped and photographed. Artifacts encountered were piece-plotted or collected by grid and level.

Large features, such as structures, were bisected using arbitrary 10-cm levels. The exposed cross sections were profiled and the soil levels were described using a Munsell Color Chart and standard geomorphological terms. Small features, such as hearths, were bisected with one level exposing the internal stratigraphy. The second half of the feature was excavated in natural levels or arbitrary 5-cm levels. With the exception of LA 127578, Area 1, Feature 1, a structure(s), all feature fill was screened through 1/8-inch steel mesh and up to 3-liter flotation samples were collected from strata that were heavily burned or contained visible charred macrobotanical remains.

Following complete feature excavation, scale plan and profile maps were drawn and their relationship to the grid system and site elevations were documented. Scaled drawings included a scale, north arrow, and a key to any abbreviations or symbols. In addition, feature documentation also included a written description of provenience, dimensions, soil matrix, artifact content, construction, time frame, excavation technique, and other relevant data.

6. Photographs were taken prior to, during, and after excavation. All photo documentation included a metric scale, north arrow, and photo board indicating the LA number, feature number, and date. All photographs were recorded on a photo data sheet indicating the LA number, feature number, date, direction of photo, roll number, frame number, and photographer.

7. Artifacts recovered from each provenience were counted, bagged, and labeled by horizontal unit and stratigraphic or arbitrary level. Consecutive field specimen numbers were assigned for each site to all bags from a specific provenience unit. Large lithic and ground stone artifacts were bagged separately to minimize bag wear and inadvertent damage to smaller artifacts. Very small flakes and angular debris were placed in vials within the artifact bag to insure preservation and prevent loss.

8. Charcoal samples for radiocarbon dating were collected from all thermal features and burned contexts. Samples were rated according to their context and data potential. First priority samples were taken from lower strata and internal floors. Second priority samples were collected from the upper feature fill. Sample locations were plotted on plan and profile drawings of features and proveniences. Sample bags were labeled with the provenience designation, feature number, location within the feature, and stratigraphic position. Recovered samples were recorded on specimen forms with labeling information, environmental data, contextual information, and any other comments that may be useful to the laboratory analyst.

General excavation documentation was compiled by the excavator. This documentation consisted of completing field notes and grid forms, which included locational, dimensional, stratigraphic, and contextual information. Notes outlining the decisions and rationale regarding deviation from the general excavation methods were compiled by the project director.

9. Excavation field methods were modified to speed the data recovery efforts and to maximize available time and funds at LA 127578, Area 1, Feature 1. These modifications were minimal and included use of ¼-inch mesh and bisecting the first half of features in one level. The use of ¼-inch mesh was limited to upper fill levels, a sample of which did not produce any fine debris using 1/8-inch mesh.

LA 127576

Setting

LA 127576 is a sherd and lithic artifact scatter with two deflated thermal features and three checkdams located in the middle portion of the project corridor between centerline stations 29+00 and 31+75. The site is on a gentle south-southeast-facing slope at the base of two north-south trending ridges and covers approximately 2,450 sq m (Fig. 2). This protected setting is bounded on both sides by deeply dissected arroyos that expose thick deposits of sandy loam colluvium intermittent with gravel and cobble outcrops, typical of the Pojoaque-Rough Broken Land complex. The site is eroded and deflated, and the collapsed remains of the thermal features are exposed on the surface. Shallow erosion channels have cut through the thin, low density cultural deposits creating the dispersed artifact scatter. Artifacts and fire-cracked rock occur in the shallow erosion channels and are scattered across the site showing the effects of slope wash and creep.

Excavation Results

Areas surrounding thermal feature locations were excavated to identify subsurface cultural deposits. Additional features within the project limits were described, mapped, and photographed. Visible surface artifacts, within the project area, were point-located and collected. Results are presented by area and include feature descriptions. Artifact analysis and specialist results are presented for the entire site, followed by an assessment of the research questions.

Area 1

Area 1 was the location of a deflated thermal feature associated with a ground stone mano. A 2-by-2-m area (81N/93E, southwest corner) was surface stripped with limited results. The soil within Area 1 consisted of 5 to 10 cm of loose brown colluvial sandy loam with 20 to 30 percent small gravel. The soil reflects a highly active geomorphological environment subject to water and wind erosion. Within and adjacent to the excavation area were several small erosional channels that have reduced the feature and transported several pieces of fire-cracked rock downslope.

Area 2

Area 2 was the location of a deflated thermal feature. A 2-by-2-m area (105N/103E, southwest corner) was surface stripped with limited results. A single core flake was recovered from this excavation area. The soil within Area 2 was similar to that of Area 1. It consisted of 5 to 10 cm of loose brown colluvial sandy loam with 10 to 20 percent small gravel. The soil reflects a highly active geomorphological environment subject to water and wind erosion. Within and adjacent to the excavation area were several small erosional channels that have reduced the feature and transported several pieces of fire-cracked rock downslope.

Features

Feature 1. Feature 1 was located in the southwest portion of the site and was identified as a 50-by-50-cm concentration of fire-cracked rock exposed in a drainage channel. This feature consisted of ten pieces of fire-cracked rock and one piece of ground stone within a 2-by-2-m area. No additional fire-cracked rock, discernible pit, or charcoal-stained soil were identified through excavation. The fire-cracked rock consisted of fractured quartzite cobbles, typical of the Ancha Formation, materials which are available on site. These fragments were no larger than 10-by-10-by-8 cm. The ground stone consisted of a sandstone

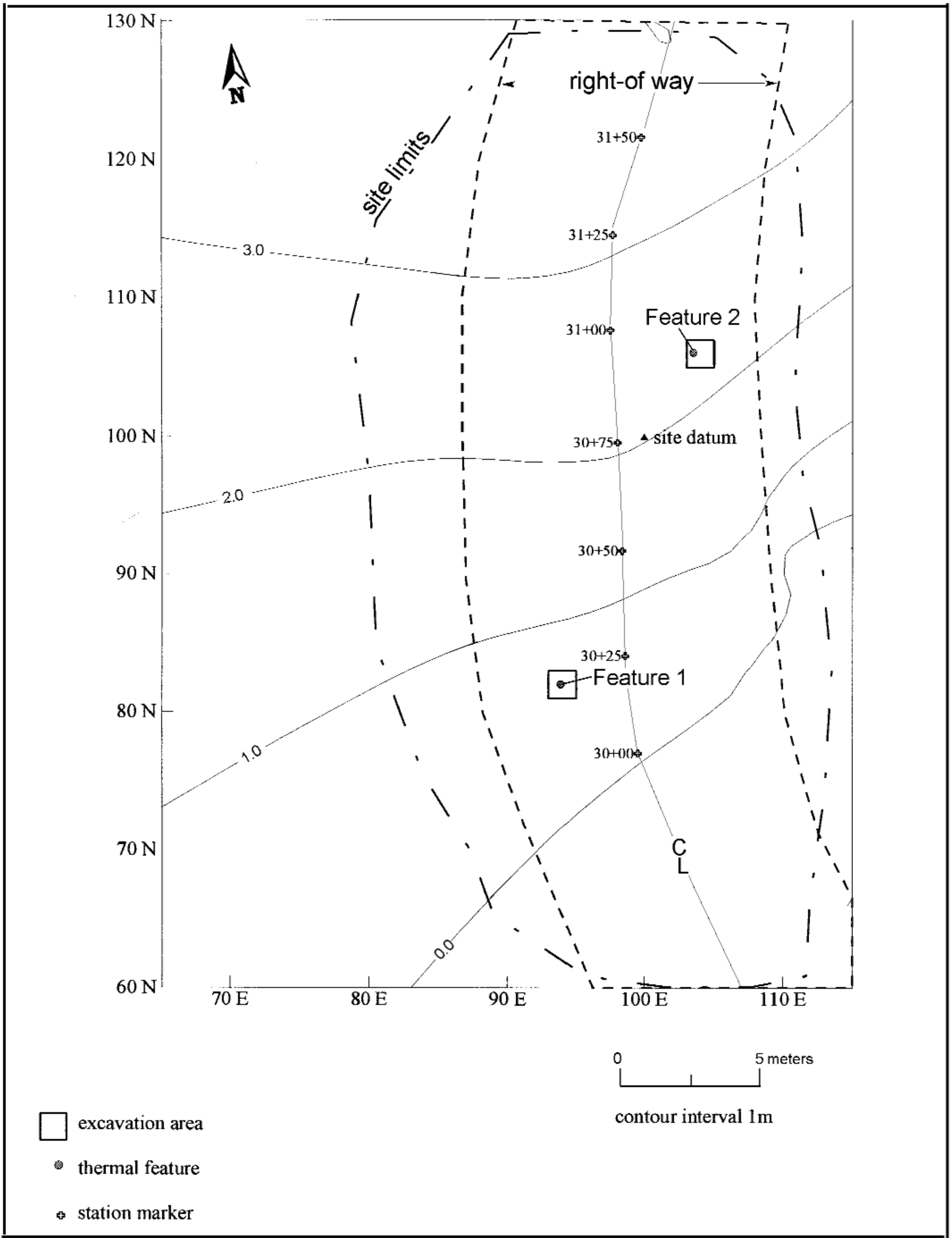

Figure 2. LA 127576, excavation overview.

mano bifacially ground and shaped along its margins. This tool was associated with the fire-cracked rock scatter but no evidence of thermal alteration was observed.

Feature 2. Feature 2 was located in the northeast portion of the site and comprised a 50-by-50-cm concentration of fire-cracked rock exposed in a drainage channel. Feature 2, similar to Feature 1, consisted of ten pieces of fire-cracked rock within a 2- by-2-m area. The fire-cracked rock consisted of fractured quartzite cobbles, materials which are available on the site. These fragments were no larger than 10-by-10-by-8 cm. No additional fire-cracked rock, discernible pit, or charcoal-stained soil were observed during excavation.

Conclusions

Excavations at LA 127576 have determined that this site has limited potential for addressing the research questions outlined in the data recovery plan. Both thermal features within the right-of-way were deflated and eroded and yielded no datable charcoal or potential for ethnobotanical information. Feature 1 and Feature 2 may have once been rock-filled and the feature contents were spread out by erosion and deflation. Shallow, open, rock-filled features are most commonly associated with short-term occupations focused on processing meat, seeds, nuts, or fruit. The associated surface artifact assemblage suggests this was a repeatedly used, briefly occupied foraging camp that may be partly associated with the thermal feature remnants. Feature age and cultural affinity could not be determined by excavation or by its contents.

MATERIAL CULTURE

Excavation focused on point-proveniencing artifacts within excavation areas and site surface. Pottery, chipped stone, and ground stone artifacts were recovered from LA 127576. This section will present the artifact assemblage descriptive data. Interpretations will be general and will primarily be addressed in the research question discussion. Comparisons with LA 127578 and similar sites in the area will also be presented in a later section.

Lithic and Ground Stone Artifacts by Jesse B. Murrell

A total of 31 chipped stone artifacts, weighing 2,609.3 g, and one ground stone artifact were recovered from LA 127576. All artifacts were analyzed and recorded according to the OAS Standard Lithic Artifact Analysis: Attributes and Variable Coding List (Office of Archaeological Studies Staff 1994). The analysis monitored morphological and functional attributes, stage of reduction, manufacture and maintenance, and tool use and discard. Definition and discussion of the attributes are provided in the analysis manual, which can be obtained from the OAS. The following describes the characteristics of the assemblage.

The chipped stone assemblage consists mainly of debitage with a smaller proportion of cores and a single formal tool (Table 1). The cores weigh a total of 2,258.5 g, accounting for 86.6 percent of the total assemblage weight. In general, the assemblage reflects raw material procurement, core reduction, and very limited tool production.

Material Type

The Cenozoic era Santa Fe group gravel, namely the Ancha Formation, contains chert. These sedimentary deposits also contain metaquartzite cobbles and small amounts of silicified wood. The Sangre de Cristo foothills contain Precambrian era granite and gneiss overlain by Paleozoic era Pennsylvanian deposits of sandstone, shale, and limestone. Within some of this limestone, namely of the Madera Formation, are bedded nodules and veins of chert, which were quarried prehistorically (Lang 1993:6, 13, 1995: 5; Viklund 1995:1; Ambler and Viklund 1995:5). Madera chert also occurs as residual cobbles and pebbles in the later

TABLE 1. LA 127576 ARTIFACT TYPE BY MATERIAL TYPE

N ROW % COLUMN %	CHERT	MADERA CHERT, YELLOW/RED MOTTLED	MADERA CHERT, RED AND MOTTLED RED	MADERA CHERT, NON-RED	PEDERNAL CHERT	SILICIFIED WOOD	OBSIDIAN	META-QUARTZITE	ORTHO-QUARTZITE	TOTAL
Angular debris			2 25.0 15.4	1 12.5 100.0	1 12.5 100.0	1 12.5 50.0			3 37.5 100.0	8 25.8
Core flake	4 25.0 66.7		8 50.0 61.5			1 6.3 50.0	1 6.3 50.0	2 12.5 100.0		16 51.6
Biface flake							1 100.0 50.0			1 3.2
Tested cobble		1 100.0 100.0								1 3.2
Unidirectional core	1 50.0 16.7		1 50.0 7.7							2 6.5
Multidirectional core			2 100.0 15.4							2 6.5
Middle stage biface	1 100.0 16.7									1 3.2
Total	6 19.4	1 3.2	13 41.9	1 3.2	1 3.2	2 6.5	2 6.5	2 6.5	3 9.7	31 100.0

Santa Fe group gravel. Nonlocal materials, such as obsidian and Pedernal chert, are found in the axial gravel of the Rio Grande. However, the primary sources of these materials lie in the Jemez Mountains. A small amount of obsidian can also be found scattered across Caja del Rio Mesa (Kelley 1980:11-17).

Since all cortical chert (n=18), silicified wood (n=2), and quartzite (n=5) artifacts have waterworn cortex, it is likely that these raw materials were obtained from secondary sources, such as a nearby or on-site gravel deposit. A single obsidian core flake retains an indeterminate type of cortex. All other materials including Pedernal chert and obsidian do not retain cortex.

The undifferentiated chert, red and red-mottled Madera chert, silicified wood, and obsidian exhibit flaws. Flawed material accounts for 41.9 percent of the total assemblage. The flaws mainly take the form of cracks or incipient fracture planes, but also include crystals and voids, and in the case of the obsidian, spherule inclusions.

Fine-grained material types include undifferentiated chert, yellow-red mottled Madera chert, Pedernal chert, silicified wood, and the quartzites. The red and red-mottled Madera chert range from fine to medium-grained. Medium-grained material types include nonred Madera chert. The fine, medium, and coarse-grained scheme rates relative grain size within a single material type as opposed to among differing material types. None of the artifacts appear to be thermally altered.

Debitage

Debitage, including core flakes, angular debris, and a single biface flake, comprises 80.6 percent of the total chipped stone assemblage (see Table 1). Core flakes and angular debris are reflective of core reduction, whereas the biface flake points to very limited bifacial tool production or maintenance. For core flakes, the distributions of flake attributes, including dorsal cortex retention, dorsal flake scar count, platform type, portion, and mean whole measurements, are mainly suggestive of early to middle stage core reduction debris with little late stage reduction debris.

The majority of the core flakes are cortical, including 50 percent that retain 10-50 percent dorsal cortex and 37.5 percent that retain 60-100 percent cortex. These flakes suggest early to middle stage reduction. The remaining two core flakes (12.5 percent) lack dorsal cortex, which suggests middle to late stage reduction. Core flakes with 0-2 dorsal scars predominate (75 percent). This also suggests early to middle stage core reduction. The remaining 25 percent have 3-5 dorsal scars, which reflects latter stage core reduction.

Single facet and cortical platforms, which reflect the early to middle stages of core reduction, are the most prevalent (68.8 percent). The remaining core flakes (31.2 percent) exhibit various forms of platform breakage including absent and collapsed platforms. No core flakes with complex platform types, such as multifaceted platforms, which reflect the latter stages of core reduction, were recovered.

Flake portions represented in the assemblage include lateral (37.5 percent), proximal (31.3 percent), whole (18.8 percent), medial (6.8 percent), and distal (6.8 percent). The whole to fragmentary core flake ratio is 1:4.3, which indicates a preponderance of flake fragments. Generally, flake breakage increases in the later stages of reduction as flakes get thinner, however, other post-reduction cultural and natural processes, such as trampling or solifluction, must be considered as well (Moore 1996:247). The high frequency of core flake breakage (81.2 percent) may indicate the later stages of reduction. Yet, comparable proportions of distal and proximal portions can indicate post-reduction breakage, whereas a prevalence of distal portions points to breakage during reduction (Moore 1996:254). In this assemblage, proximal portions are five times more frequent than distal portions. Material flaws should also be taken into account when examining flake breakage distributions. A substantial proportion of core flakes (37.9 percent) are of flawed materials. Breakage along an incipient fracture plane or other flaw can contribute to the representation of all fragmentary portions and can occur in all stages of reduction, although it seems less likely that a flawed material would be intensely reduced if a more suitable raw material is easily obtainable.

Maximum linear dimensions were recorded for all core flakes. Platform width is a measurement that

TABLE 2. LA 127576, CORE FLAKE MEAN WHOLE MEASUREMENT SUMMARY

	PLATFORM WIDTH (MM)	LENGTH (MM)	WIDTH (MM)	THICKNESS (MM)	WEIGHT (G)
N	11	8	8	8	3
Mean	7.6	33.5	43.0	10.5	11.0
Standard deviation	2.4	11.5	14.3	2.9	8.8
Minimum	2.2	18	21	7	4.1
Maximum	10.5	48	59	17	20.9

TABLE 3. LA 127576, SELECT CORE ATTRIBUTES

FS #	ARTIFACT MORPHOLOGY	MATERIAL TYPE	CORTEX %	FLAKE SCARS	LENGTH (MM)	WIDTH (MM)	THICKNESS (MM)	WEIGHT (G)
4	Unidirectional core	Madera chert, red and mottled red	40	9	88	70	53	406.3
7	Angular debris	Madera chert, red and mottled red	30	2	61	37	36	56.1
21	Multidirectional core	Madera chert, red and mottled red	50	5	64	63	43	145.8
22	Multidirectional core	Madera chert, red and mottled red	60	8	83	52	46	237.8
23	Tested cobble	Madera chert, yellow/red mottled	80	2	126	90	86	1089.0
26	Unidirectional core	Chert	70	3	63	62	39	269.4
28	Angular debris	Orthoquartzite	50	2	58	26	23	54.1

parallels the platform from the platform-ventral surface juncture to platform-dorsal surface juncture. Platform width is considered whole if the platform is present. Whole lengths were obtained from whole core flakes as well as lateral core flakes that have intact platforms and distal terminations. Whole widths and thicknesses were obtained from whole core flakes as well as proximal portions. Whole weights were obtained from whole core flakes only. Table 2 presents central tendency and dispersion statistics for whole maximum linear dimensions of core flakes. The relatively large mean statistics, especially for width, lends additional support to the notion that the assemblage contains an abundance of earlier stage reduction debris. However, the dispersion statistics, especially the minimums, allude to presence of a small amount of later stage reduction debris.

A single biface flake indicates at least very limited formal tool production or maintenance. This obsidian flake exhibits a multifaceted platform and snap fractured termination. It lacks cortex and manifests five dorsal scars. Dorsal surface topography is regular. It has a relatively even thicknessfrom proximal to distal end with a diffuse bulb of percussion and a pronounced ventral curvature. Its platform measures 0.7 mm. The artifact measures 28 mm long by 17 mm wide by 3 mm thick and weighs 1.5 g.

Cores

Cores comprise a sizeable proportion (22.4 percent) of the total chipped stone assemblage (Table 3). Core types include a tested cobble, unidirectional cores, multidirectional cores, and angular debris. All cores are of locally available materials and all retain cortex. In fact, the majority of cores (71.4 percent) retain 50-100 percent waterworn cortex. Material type and cortex retention distributions for cores indicate the exploitation of a local gravel deposit, probably on-site, for raw material procurement. With the possible exception of angular debris, which may represent core fragments, dimensions and weight suggest that none of the cores are exhausted. The informal platforms of the multidirectional cores as well as their discard prior to exhaustion implies the practice of an expedient or nonintensive core reduction strategy. The low core to core flake ratio (1:2.3) reflects a nonintensive strategy. An interesting contrast is evident in the core to core negative flake scar ratio (1:4.4), which reflects a greater reduction intensity. The disparate ratios may reflect the curation of flakes that were suitable to use as informal tools or as flake blanks for further bifacial or unifacial reduction.

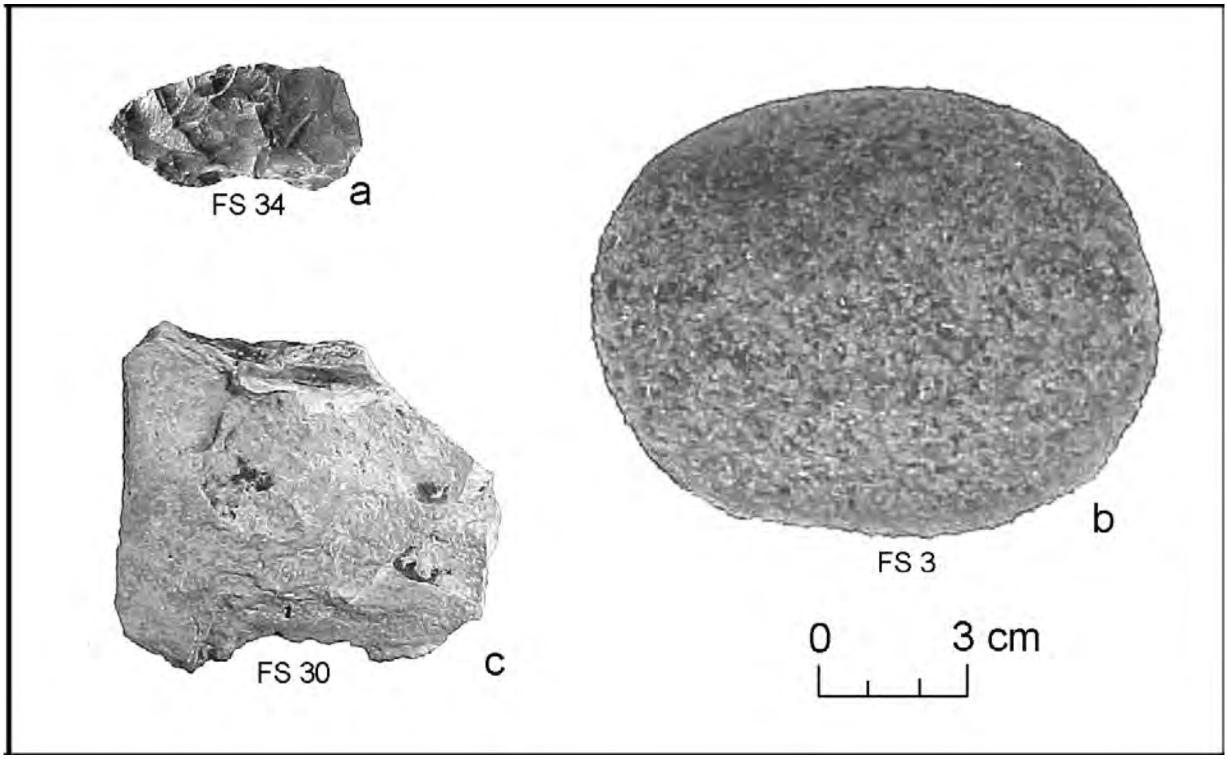

Figure 3. LA 127576 artifacts: (a) middle-stage biface; (b) one-hand mano; (c) Santa Fe Black-on-white sherd.

Formal Tools

FS 34, PP 31, is a small, middle-stage biface that exhibits a semiregular facial scarring pattern and discontinuous bimarginal scarring and step fracturing (Fig. 3a). The biface is whole, roughly ovate in plan, and manufactured from a dark brown chert. One short axis edge is more tapered than the other. The artifact measures 47 mm long by 24 mm wide by 8 mm thick and weighs 9.0 g. This artifact may represent a projectile point preform.

Ground Stone

A single ground stone artifact was recovered from Feature 1, a fire-cracked rock concentration, from what appears to be a secondary context. FS 3, PP 1, is a medium-grained metaquartzite cobble one-hand mano (Fig. 3b). It lacks evidence of initial shaping, is oval-shaped in plan view, and is biconvex in transverse cross section. The single use surface lacks evidence of sharpening. It measures 105 mm long by 85 mm wide by 50 mm thick and weighs 709.4 g. Its grinding surface area is 5,055.2 sq mm.

Ceramics

Data recovery efforts at LA 127576 recovered a total of three sherds. These artifacts were collected from the general site surface and are from three different vessels. Separation by vessel was based on physical characteristics such as surface treatment and paste attributes. This limited assemblage contains two jar body sherds and one bowl body sherd.

FS 6 was recovered from the southern portion of the site and is a brown ware jar body. The interior surface was polished and reduced while the exterior surface was plain, unpolished, and oxidized. It displayed a coarse paste with coarse, white crushed igneous temper. Ceramics that display similar qualities are often identified as El Paso Brown. In general, brown wares are most common on Developmental period sites (A.D. 600-1200) in the Northern Rio Grande (Allen and McNutt 1955; Condie 1987, 1996; Hammack et al. 1983; Peckham 1957).

FS 30 was recovered from the northern portion of the site and is a Santa Fe Black-on-white bowl body (Fig. 3c). The interior surface was extensively spalled with intact portions of the surface exhibiting a high polish, washy white slip, and black organic paint. The exterior surface was plain, unpolished, and exhibited the incidental application of a washy white slip in one area. The paste was fine and gray with coarse, white sandstone or ash inclusions. Ceramics displaying similar spalled surfaces have been associated with pottery firing features (Lakatos 1996; Post and Lakatos 1995) However, spalled surfaces could also be the result of exfoliation, trampling, or freeze-thaw action. Santa Fe Black-on-white was produced between A. D. 1200 and A.D. 1350 in the Northern Rio Grande.

FS 24 was recovered from the north-central portion of the site and represents an undifferentiated Tewa Polychrome jar body. Both surfaces were highly eroded, however, the exterior surface displayed remnants of a red slip. The paste was oxidized and displayed a tuff and sand temper. Tewa Polychrome ceramics was manufactured during the eighteenth and nineteenth centuries in the Northern Rio Grande.

Site Summary

Data recovery efforts at LA 127576 focused on the excavation of Area 1 and Area 2. In addition, artifacts within the project area were point located and collected. The intact portion of the site, located outside the project area, was defined and placed in a preservation easement. LA 127576, located on a low ridge between Cañada Rincon and Arroyo de los Frjoles, is a spatially extensive site that appears to be the result of many short-term occupations occurring over several temporal periods. Excavations revealed that cultural material was limited to surface or near-surface contexts. Artifacts and their stratigraphic context tentatively suggest occupation dates sometime between A.D. 1 and A.D. 1800. The presence of two deflated thermal features are additional evidence that LA 127576 was used for acquiring and processing a wide range of lithic and biotic resources.

LA 127578

Setting

LA 127578 was originally recorded as a dispersed lithic artifact scatter and three thermal features associated with lithic artifact concentrations or activity areas (Post 1999). The site is located between centerline stations 22+75 and 34+50 on a gentle south-southeast-facing slope at the base of two north-south trending ridges. LA 127578 measures 60 m northwest-southeast by 30 m east-west, and covers approximately 1,800 sq m (Fig. 4). This protected setting is bounded on the northeast and southwest by deeply dissected arroyos that expose thick deposits of sandy loam colluvium intermittent with gravel and cobble outcrops, typical of the Pojoaque-Rough Broken Land complex. Portions of the site are eroded and deflated with the collapsed remains of the thermal features exposed on the surface. Small erosion channels have cut through the shallow, low density cultural deposits creating the dispersed artifact scatter. Artifacts and fire-cracked rock occur in the shallow erosion channels and are scattered across the site showing the effects of slope wash and creep.

Excavation Methods

Initially the excavation methods at LA 127578 followed the procedures outlined in the data recovery plan. However, during excavation, field methods were modified in Area 1, Feature 1, to maximize available time and funds. These modifications were minimal and included use of ¼-inch mesh and bisecting the first half of features in one level. The use of ¼-inch mesh was limited to the upper fill levels of the structure following a sample of units, screened using 1/8-inch mesh, which did not produce any fine debris.

Vertical control was maintained relative to modern ground surface for grid unit excavations, and soil was removed in arbitrary 10-cm levels. Vertical control for feature excavation and point located artifacts was maintained through a series of subdatums. Feature limits were defined through surface stripping. Feature depth and stratigraphy were defined by exploratory trenches. Depending on the size of the feature, the exploratory trench was excavated in a single level or in arbitrary 10-cm levels. Throughout the excavation process artifacts and estimated fire-cracked rock data were collected.

Excavation Results

Three excavation areas surrounding thermal feature and charcoal-stained soil locations were excavated to identify subsurface cultural deposits. These excavations identified a habitation area, Area 1, associated with an activity area containing extramural features, Area 2, and a discard area or midden Area 3 (see Fig. 4). All features within the project limits were described, mapped, and photographed. Visible surface artifacts within the project area were point-located and collected. Results are presented by area and include feature descriptions. Artifact analysis and specialist results will be presented for the entire site, followed by an assessment of the research questions.

Area 1

Area 1 was originally recorded as an artifact concentration associated with an intact cultural deposit consisting of charcoal-infused soil and fire-cracked rock (Post 1999a). The surface of this, and other areas of the site, reflects a highly active geomorphological environment subject to water and wind erosion. Within and adjacent to the excavation area were several small erosional channels that have reduced the feature and transported several artifacts and pieces of fire-cracked rock downslope. Excavation of this area revealed that the depth and extent of this deposit was underestimated by the inventory.

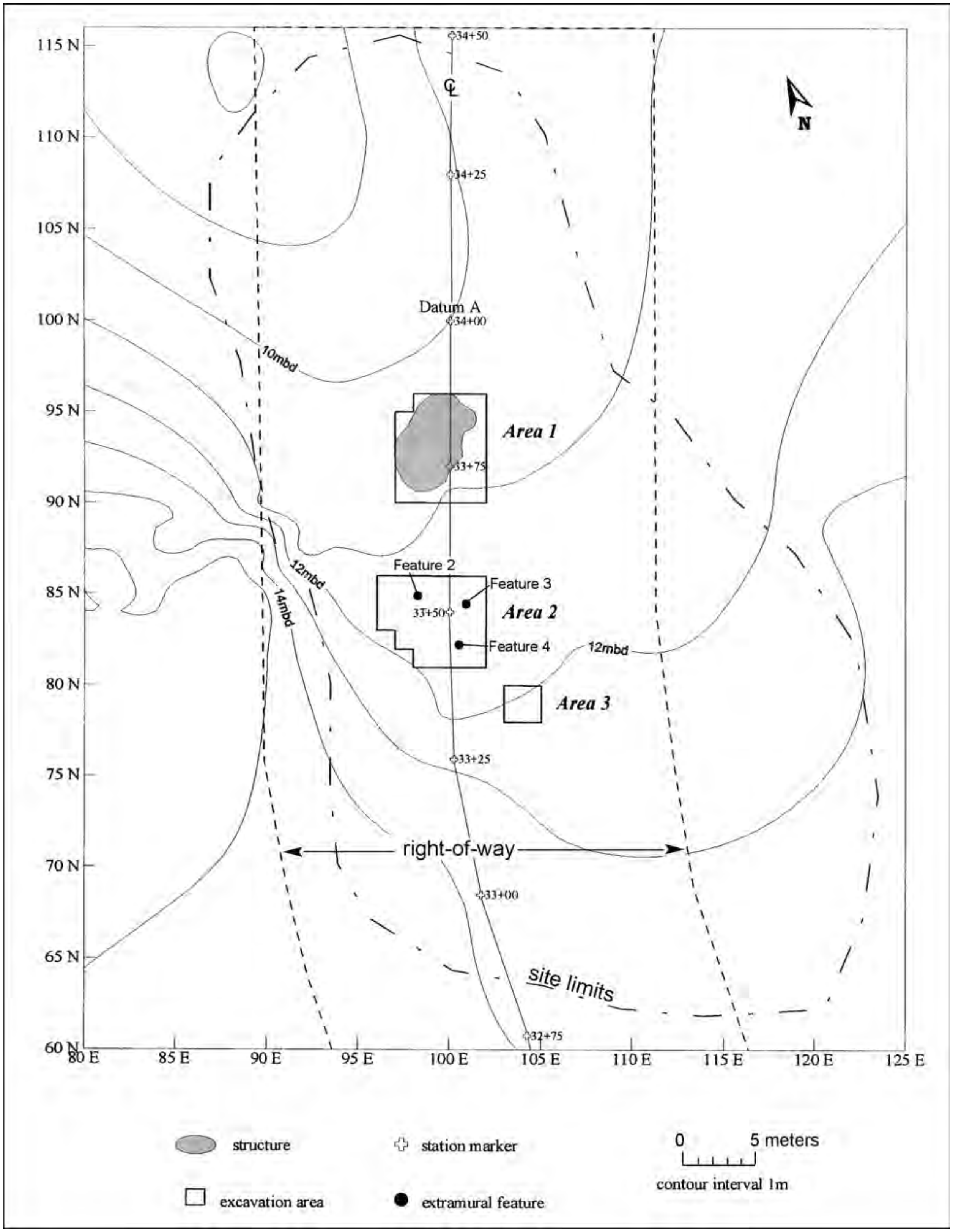

Figure 4. LA 127578 excavation overview.

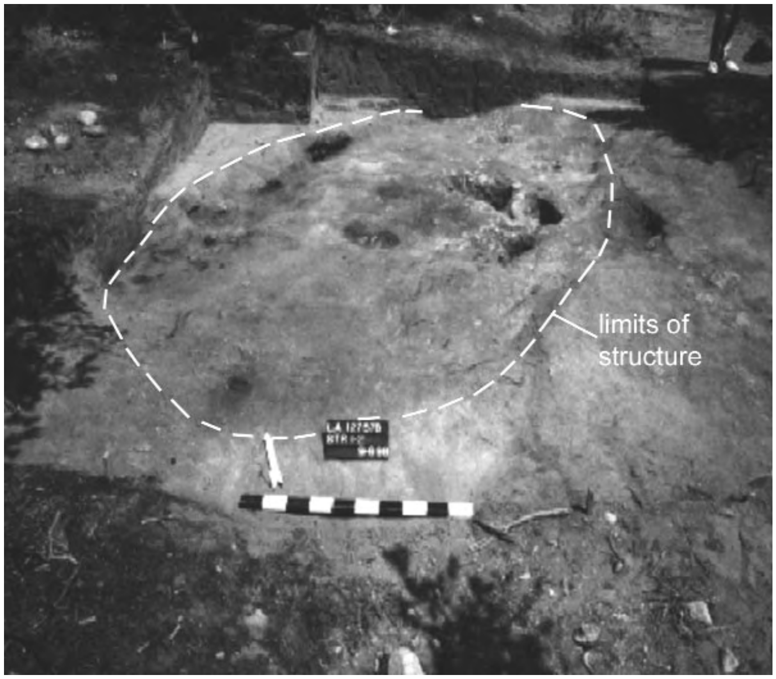

Figure 5. LA 127578, Area 1, Structure 1, overview.

Excavation identified the remains of a substructure or foundation (Fig. 5). This structure, Structure 1, contained 12 internal features and extended approximately 6 m north, into the modern slope, from the original location identified during inventory. The southern portion of the structure was visible on modern ground surface while the northern portion was buried under a maximum of 85 cm of overburden. A 5-by-6-m area (90N/97E, southwest corner), covering 29 sq m, was excavated to identify the extent of the structure. Stratigraphy and the extent of the structure were defined by excavating two perpendicular 1-by-1-m grids, in 10-cm levels, to the floor surface. Excavation of Structure 1 indicated this may have been two small superimposed structures (Post and Lakatos 1999).

Area 2

Area 2 was the location of three deflated thermal features and a low density artifact scatter. A 5-by-6-m excavation area (81N/98E, southwest corner), covering 32 sq m was surface stripped (Fig. 6). Excavations identified three deflated thermal features comprised of fire-cracked rock concentrations, Feature 2, Feature 3, and Feature 4 (Table 4). These features were morphologically similar and evenly spaced 2 m to 2.5 m apart. The regular spacing between features suggests they were contemporaneous. The intervening space between features would have been sufficient for simultaneous use. This complex of features may be an activity area associated with the occupation of Structure 1.

Several pieces of chipped stone debitage were recovered from this excavation area. Although these artifacts were associated spatially with Feature 2, Feature 3, and Feature 4, their temporal relationship could not be accurately determined. The actively eroding surface reflects water and wind erosion. The dynamic nature of the modern ground surface within this area had obscured the artifact-to-feature contexts useful for determining spatial and temporal relationships.

Area 3

Area 3 was the location of a buried charcoal-stained soil horizon exposed in an erosion channel associated with a low density artifact scatter. A 2-by-2-m excavation area (78N/103E, southwest corner), cover-

TABLE 4. FEATURE DATA, LA 127578

Area	Feature No.	Feature Type	Shape	Dimensions	Matrix	Condition	Artifacts	Samples
1	1	Substructure, Structure 1	Irregular oval	5.40 m 3.90 m 20 cm	Layer 1 Layer 2 Layer 3	intact to deflated	lithics ground stone bone	^{14}C
2	2	Possible hearth or roasting pit	Roughly circular (inferred)	70 cm N-S 80 cm E-W deflated	Fine sandy loam with diffused charcoal stained soil and FCR 10 YR 5/3 brown (dry)	Deflated	Lithics	Flotation
2	3	Possible roasting pit or discard	Oval (inferred)	1.80 m N-S 1.6 m E-W deflated	Fine sandy loam with FCR. 10YR 4/3 brown (wet)	Deflated	Lithics	Flotation
2	4	Possible hearth or discard	Roughly oval (inferred)	85 cm N-S 70 cm E-W deflated	Fine sandy loam with FCR. 10YR 4/3 brown (wet)	Deflated	Lithics	Flotation
1	5	Posthole	Irregular circle with steep sloping sides and basin-shaped bottom	10 cm N-S 10 cm E-W 20 cm deep	Fine charcoal stained sandy loam similar to Layer 3. 7.5YR 4/1 dark gray (dry)	Intact	N/A	Flotation
1	6	Posthole or post support	irregular circle with steep sloping sides and basin-shaped bottom	28 cm N-S 25 cm E-W 13 cm deep	Fine charcoal stained sandy loam similar to Layer 3. 7.5 YR 4/1 dark gray (dry)	Intact	Lithics	Flotation ^{14}C
1	7	Hearth	Roughly circular with steep sides with flat bottom	47 cm N-S 41 cm E-W 28 cm deep	Fine charcoal stained sandy loam with FCR. 7.5YR 3/1 very dark gray (dry)	Intact	Lithics	Flotation ^{14}C
1	8	Storage pit	oval with steep sides and basin-shaped bottom	55 cm N-S 42 cm E-W 22 cm deep	Fine charcoal stained sandy loam similar to Layer 3. 7.5YR 4/1dark gray (dry)	Intact	Lithics	Flotation
1	9	Hearth	Roughly circular with steep sides and basin-shaped bottom	35 cm N-S 38 cm E-W 18 cm deep	Fine charcoal stained sandy loam with FCR. 7.5YR 4/0 dark gray (dry)	Intact	Lithics	^{14}C
1	10	Hearth	Roughly circular with steep sides and basin-shaped bottom	40 cm N-S 37 cm E-W 17 cm deep	Fine charcoal stained sandy loam. 7.5YR 3/2 very dark brown (dry)	Intact	Lithics	Flotation ^{14}C
1	11	Possible parching pit	irregular oval with steep sides and irregularly shaped bottom	95 cm N-S 61 cm E-W 8 cm deep	Fine charcoal stained sandy loam with few burned cobbles. 7.5YR 3/2 very dark brown (dry)	Intact	Lithics	Flotation ^{14}C

TABLE 4. CONTINUED.

Area	Feature No.	Feature type	Shape	Dimensions	Matrix	Condition	Artifacts	Samples
1	12	Possible hearth	Roughly crescent shaped with steep sides	20 cm N-S 30 cm E-W 16 cm deep	Fine charcoal stained sandy loam partially lined with few burned cobbles 7.5YR 4/0 dark gray (dry)	Intact	Lithics	Flotation
1	13	Posthole	Circular with steep sloping sides and basin-shaped bottom	12 cm N-S 12 cm E-W 8 cm deep	Fine charcoal stained sandy loam similar to Layer 3. 7.5YR 3/2 very dark brown (dry)	Intact	N/A	N/A
1	14	Posthole or post support	irregular circle with steep sloping sides and basin-shaped bottom	22 cm N-S 23 cm E-W 10 cm deep	Fine charcoal stained sandy loam similar to Layer 3. 7.5YR 4/1 dark gray (dry)	Intact	N/A	^{14}C-14
1	15	Posthole	irregular circle with steep sloping sides and basin-shaped bottom	10 cm N-S 10 cm E-W 8cm deep	Fine charcoal stained sandy loam similar to Layer 3. 7.5YR 4/1 dark gray (dry)	Intact	N/A	N/A
1	16	Posthole	irregular circle with steep sloping sides and basin-shaped bottom	10 cm N-S 10 cm E-W 8 cm deep	Fine charcoal stained sandy loam similar to Layer 3. 7.5YR 4/1 dark gray (dry)	Intact	N/A	N/A

Figure 6. LA 127578, Area 2 and Area 3, overview.

ing 4 sq m, was excavated to a maximum depth of 55 cm below modern ground surface (see background, Fig. 6). Excavations identified a 30-40-cm layer of diffuse charcoal-stained soil. Although few artifacts were recovered from this layer, numerous pieces of fire-cracked rock were identified. The quantity of fire cracked rock associated with the charcoal-stained soil indicates Area 3 was a refuse area or midden associated with the occupation of Area 1 and Area 2.

Features

Area 1

Feature 1. Feature 1 represents the remains of a substructure or foundation of Structure 1 (Fig. 7). This structure was constructed by excavating a shallow oval basin with steep sloping sides into the native sterile substratum and friable sandstone bedrock. Structure 1 measured approximately 5.50 m northeast by 3.80 m. The limits of the structure were easily defined along the northern and western perimeter by the extent of dark charcoal-stained interior fill. Wall definition became increasingly more difficult toward the east and southeast where the edge becomes deflated and the interior fill had migrated out.

Three stratigraphic layers were identified within Structure 1 (Fig. 8). Stratum 1 represents a moderately consolidated modern colluvial deposit. This homogeneous layer of coarse silty sand was pale brown in color (10YR 4/3 dry) and contained 10-15 percent gravel with an occasional cobble, organic debris, and artifacts. Stratum1 had a maximum thickness of 30 cm and displayed a gradual transition to Stratum 2. Disturbance within this layer was limited to root activity and insect burrows.

Stratum 2 represents a mixed deposit of Stratum 1 and Stratum 3. This homogeneous, loosely consolidated, charcoal-stained colluvial deposit of coarse sandy loam was dark gray in color (10YR 4/1 dry). Stratum 2 contained less than 10 percent gravel, disbursed charcoal flecks, fire-cracked rock, and artifacts. This layer had a maximum thickness of 40 cm and displayed a gradual transition to Stratum 3. Disturbance

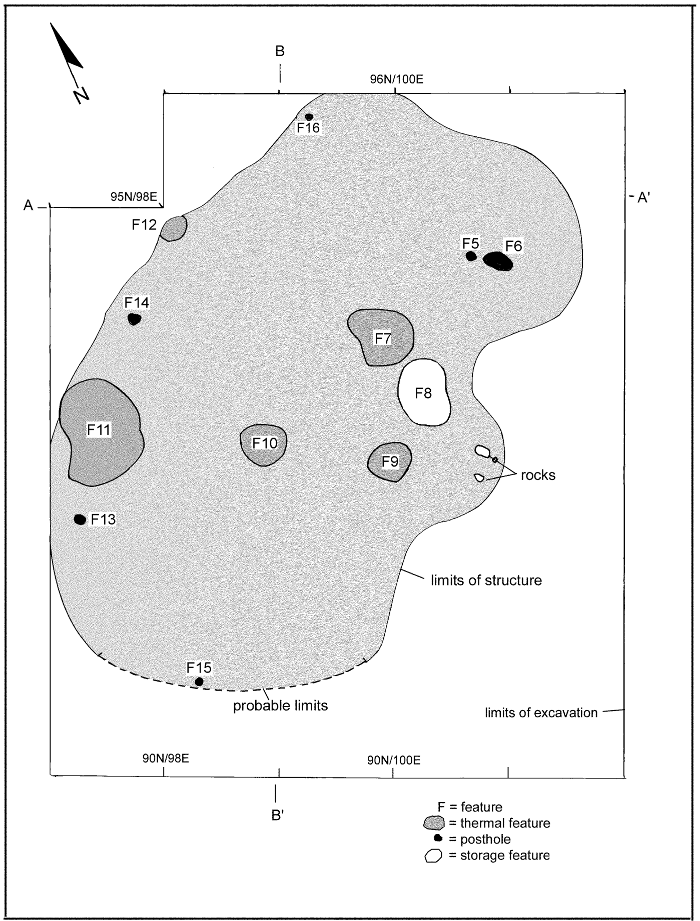

Figure 7. LA 127578, Structure 1, plan view.

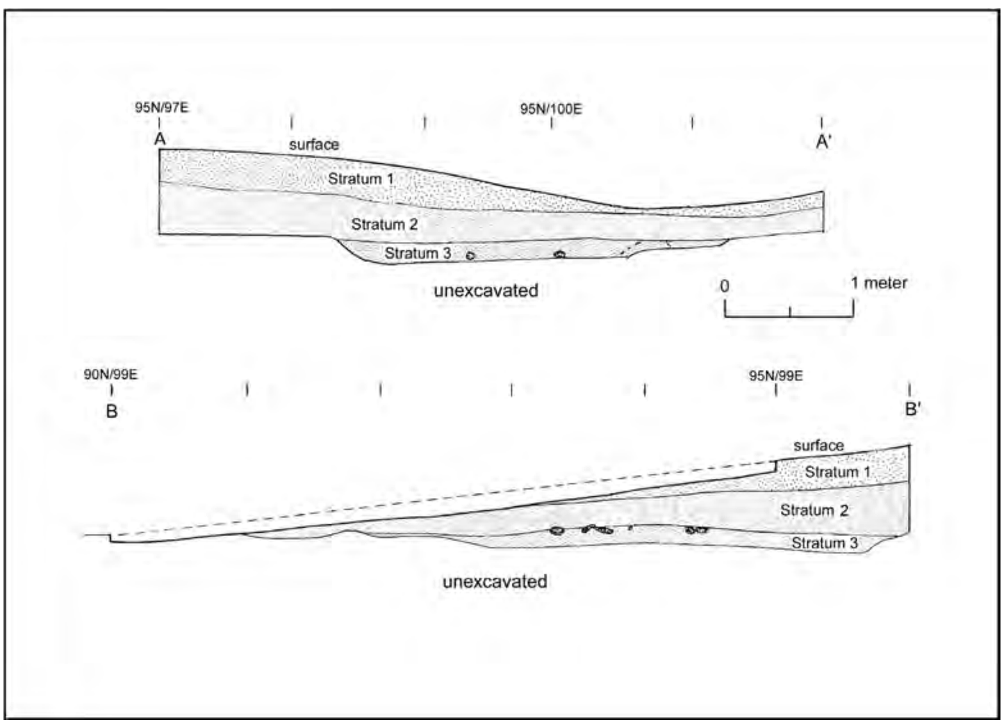

Figure 8. LA 127578, Structure 1, profile.

within this layer consisted of dense root activity and numerous insect burrows.

Stratum 3 represents an in situ deposit of burned structural fill. This homogeneous, loosely consolidated, dense charcoal-stained deposit of sandy loam was very dark gray in color (10YR 3/1 dry). Stratum 3 contained less than 10 percent gravel, charcoal and charcoal flecks, fire-cracked rock, and artifacts. Stratum 3 had a maximum thickness of 15 cm and displayed an abrupt transition at the floor surface. Disturbance within this layer consisted of dense root activity and numerous insect burrows.

Following stratigraphic documentation the remaining 1-by-1-m grid units were excavated in 10-cm levels to floor fill, Stratum 3. Stratum 3 was removed in 10-cm levels to the floor surface and screened using 1/8-inch mesh. Artifacts in direct contact with or within 5 cm of this surface were point-located and collected separately.

Stratum 3 contained a proportionately high quantity of primary and de facto refuse. Six whole manos, one whole metate, and one metate fragment were recovered from this layer (Fig. 9). In addition, this layer contained the highest amount of lithic debitage identified on the site. Furthermore, most items recovered from this layer displayed evidence of thermal alteration presumably as a result of the structure burning.

The distribution pattern and context of these artifacts may reflect behavior other than the use of intramural features (see Fig. 9). Density plots of floor and floor fill lithic debitage, from other excavated structures, often correlate with intramural features (Schmader 1994b). Debitage in Structure 1 is concentrated in the middle of the structure leaving little maintained space for domestic activities (Binford 1983). The poor patterning with internal features and the minimal amount of maintained space indicates these items were not deposited while the structure was occupied.

The majority of the ground stone, six out of eight pieces, were also located within a 2-by-2- m area near the center of the structure. Planned abandonment of an area may preclude transporting relatively heavy items such as manos and metates. Although manos were left behind they are also relatively easy to procure, eliminating the necessity to transport them to another location. What is interesting however is that the ground stone tools left behind, especially the manos, can no longer be used as tools. The amount of thermal fracturing, presumably endured when the superstructure burned, has left these tools friable and flawed (Fig. 10).

After the structure limits were defined and all fill removed, the floor surface was completely exposed. The floor surface was comprised predominantly of caliche-impregnated, friable sandstone and it displayed evidence of burning. A total of 12 intramural floor features were identified within Structure 1 (see Fig. 7). These features fall into three broad categories: construction for a superstructure, processing, and storage (Table 4).

Features 5, 6, 13-16. Evidence for a superstructure was identified through a series of six postholes, Feature 5, Feature 6, Feature 13, Feature 14, Feature 15, and Feature 16. These features were positioned at the wall-floor juncture around the perimeter of the structure and evenly spaced between 1.80 m and 2.25 m apart. The posthole pattern suggests a superstructure was constructed along the northern, eastern, and western perimeter and opened toward the south. The southern aspect of the structure may have been used as an entryway and to provide passive solar gain. Although this seems likely, the lack of superstructure evidence along the southern perimeter may also reflect poor preservation and may not be related to structure orientation.

Evidence of processing was identified through a series of thermal features. Based on morphology, construction, and contents, Feature 7, Feature 9, Feature 10, Feature 11, and Feature 12 had different functions related to subsistence.

Features 7, 9, and 10. Feature 7, Feature 9, and Feature 10 are hearths and in each case consisted of steep-sided basins excavated into the friable sandstone bedrock. These features contained lithics, fire-cracked rock, and were hardened from burning. Feature 7, Feature 9, and Feature 10 were positioned toward the south-central portion of the structure and evenly spaced 1.20 m to 1.40 m apart. This complex of features may have been used to process items requiring intense heat in addition to internal heating.

Feature 11. Feature 11 was constructed by excavating a relatively large, irregularly shaped, shallow,

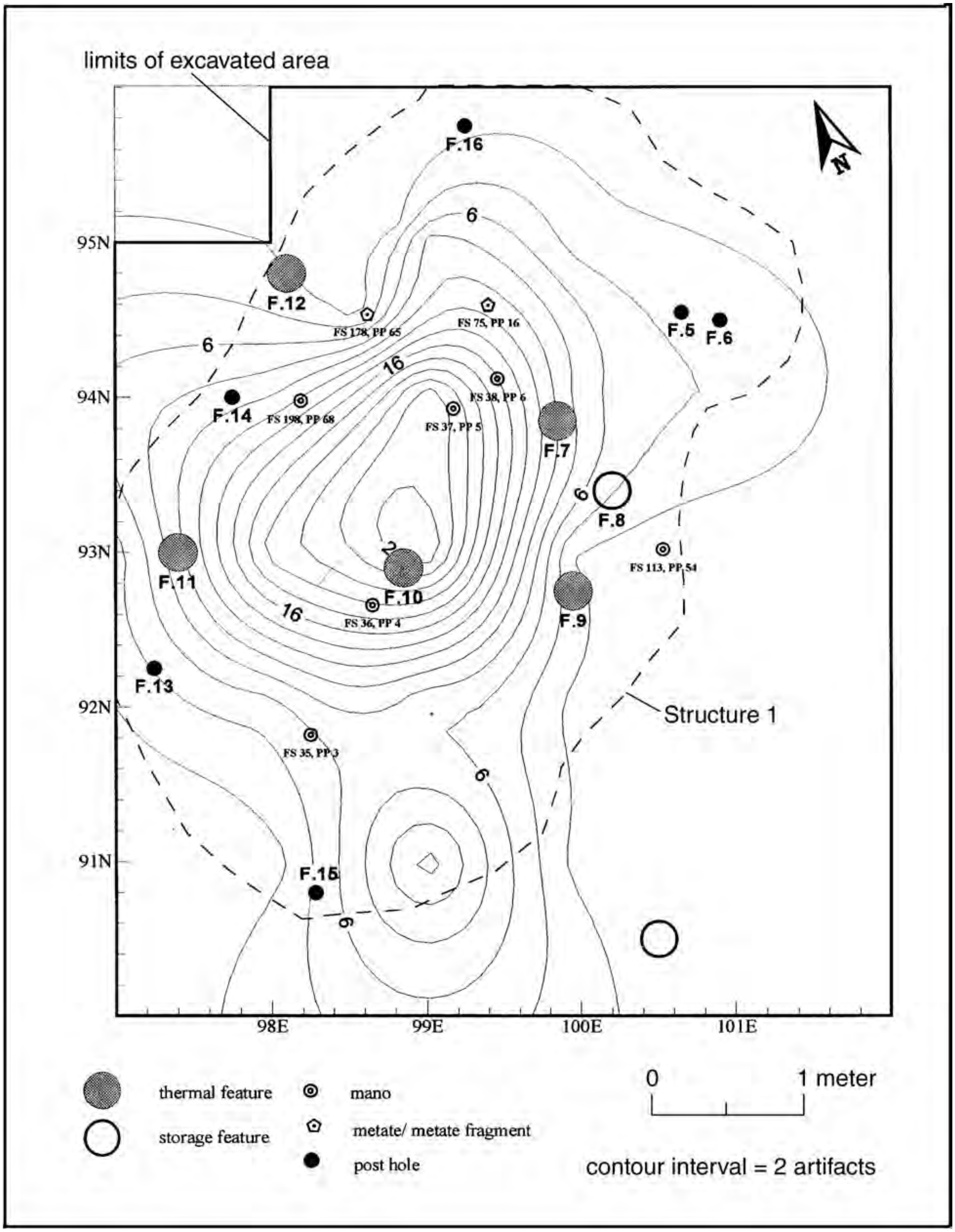

Figure 9. LA 127578, Structure 1, Stratum 3, lithic and ground stone density plot.

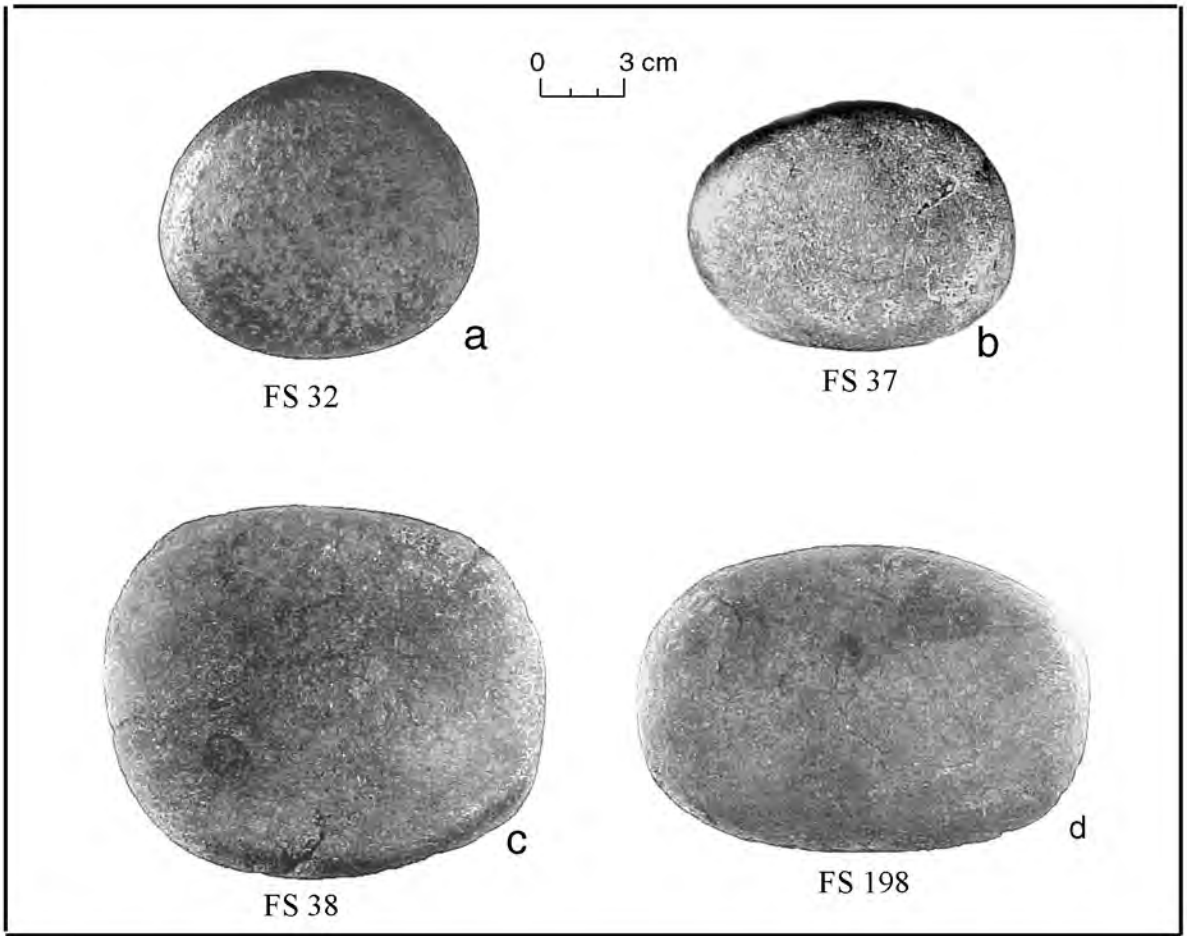

Figure 10. LA 127578, one-hand manos.

steep-sided basin into the native substrate. The base of the feature was also irregular and comprised of friable sandstone. This feature was positioned adjacent to the western perimeter and extended into the structure. Evidence of burning was more noticeable in the north half. The south half contained four burned cobbles. Feature 11 appears have been used to process materials that required staged use of low-level heat.

Feature 12. Feature 12 was constructed by excavating a small, shallow, steep-sided- basin into the sterile substrate. This feature was positioned adjacent to the north-central perimeter of the structure. The northern half of the feature was cobble-lined and the interior, including the cobbles, was burned and sooted. Feature 12 appears have been used to process materials that required low-level heat.

Feature 8. Feature 8 was constructed by excavating a deep, steep-sided basin into the friable sandstone bedrock. The interior of the feature was unmodified and no evidence of burning was identified. Feature 8 was positioned toward the south-central portion of the structure, between Feature 7 and Feature 9. Feature 8 appears to be associated with the hearth complex and may have been used to store processed or unprocessed food or other materials related to the use of these features.

Area 2

Feature 2. Feature 2 was located in the north-central portion of Area 2 and appeared as a 80-by-70-cm concentration of fire-cracked rock exposed in an erosional drainage channel (see Fig. 6). This feature consisted of 40 to 50 pieces of fire-cracked rock within a 1-by-1-m area. Although no discernible pit was identified through excavation, feature construction may have incorporated a slight depression observed in

Figure 11. LA 127578, Area 2, Feature 3, excavation overview.

the friable sandstone bedrock. The fire-cracked rock consisted of fractured locally available quartzite cobbles and friable sandstone clasts. These fragments ranged in size from 5-by-5 cm by 8 to 20 cm by 17-by-15 cm. These materials were typically spalled and fractured indicating the use of intense focused heat.

Feature 3. Feature 3 was in the northeast portion of Area 2 and appeared as a 180-by- 160-cm concentration of fire-cracked rock partially exposed in an erosion channel (Fig. 11). Feature 3, similar to Feature 2, consisted of 70 to 75 pieces of fire-cracked rock within a 1.5-by-1.5 m area. The fire-cracked rock consisted of fractured, locally available quartzite cobbles. These fragments were no larger than 10-by-10-by-8 cm. No discernible pit or charcoal-stained soil were identified through excavation. The lack of charcoal-stained soil suggests this feature may be discard from another feature or the effects of deflation.

Feature 4. Feature 4 was in the south-central portion of Area 2 and appeared as an 85-by-70-cm concentration of fire-cracked rock exposed in an erosion channel (see Fig. 6). Feature 4, similar to Feature 3, consisted of 35 to 40 pieces of fire-cracked rock within a 1- by-1-m area. The fire-cracked rock consisted of fractured, locally available quartzite cobbles. These fragments were no larger than 10-by-10-by-8 cm. No discernible pit or charcoal- stained soil were identified through excavation. The lack of charcoal-stained soil suggests this feature may be discard from another feature or the effects of deflation.

Material Culture

Excavation focused on point-proveniencing artifacts within excavation areas and the site surface. Chipped and ground stone artifacts were recovered from LA 127578. This section will present the artifact assemblage descriptive data. General interpretations will be expanded on in the research questions discussion. Comparisons with LA 127576 and similar sites in the area will also be presented in a later section.

Lithic and Ground Stone Artifacts by Jesse B. Murrell

A total of 422 chipped stone artifacts were recovered from the site surface (Area 0) and three excavation areas, Area 1, Area 2, and Area 3. All artifacts were analyzed and recorded according to the OAS Standard Lithic Artifact Analysis: Attributes and Variable Coding List (Office of Archaeological Studies Staff 1994). The analysis monitored morphological and functional attributes, stage of reduction, manufacture and maintenance, and tool use and discard. Definition and discussion of the attributes is provided in the analysis manual which can be obtained from the OAS. The following describes characteristics of the assemblage. Table 5 lists material type by artifact morphology.

A total of 156 pieces of nonutilized debitage from the surface scatter and the upper strata of excavation Area 1 were given an abbreviated analysis to maximize the use of available time and funds. An abbreviated analysis was chosen for artifacts recovered from these contexts because they were the most likely to have been redeposited. Although abbreviated analysis did not monitor material quality, cortex type, thermal alteration, platform width, and weight, it did monitor a basic set of attributes. This set of attributes included material type, morphology, portion, platform type, distal termination, percent of cortex, dorsal scar count, length, width, and thickness. By monitoring these basic attributes the data from the abbreviated analysis was comparable to the remainder of the assemblage and to LA 127576. In addition, all tools and cores were subjected to the full analysis. In general, the assemblage reflects raw material procurement, core reduction, limited bifacial and/or unifacial reduction, and a variety of tool usage. Table 6 presents artifact type by Area.

Material. The Cenozoic era Santa Fe group gravel, namely the Ancha Formation, contains chert. These sedimentary deposits also contain metaquartzite cobbles and small amounts of silicified wood. The Sangre de Cristo foothills contain Precambrian era granite and gneiss overlain by Paleozoic era Pennsylvanian deposits of sandstone, shale, and limestone. Within some of this limestone, namely of the Madera Formation, are bedded nodules and veins of chert, which were quarried prehistorically (Lang 1993:6, 13, 1995:5; Viklund 1995:1; Ambler and Viklund 1995:5). Madera chert also occurs as residual cobbles and pebbles in the later Santa Fe group gravel.

Nonlocal materials, such as obsidian, Pedernal chert, and basalt, are found in secondary context in the axial gravel of the Rio Grande. However, the primary sources of the obsidian and Pedernal chert lie in the Jemez Mountains. A small amount of obsidian can also be found scattered across Caja del Rio Mesa. Basalt outcrops are found along the La Bajada and Caja del Rio escarpments and mesa tops (Kelley 1980:11-17).

All of the fully analyzed cortical chert (n=90), chalcedony (n=1), silicified wood (n=3), and metaquartzite (n=16) artifacts have waterworn cortex suggesting that these artifacts were obtained from secondary sources, such as an on-site or nearby gravel deposit. A single obsidian biface flake retains an indeterminate type of cortex, a basalt biface flake, and piece of angular debris retain nonwaterworn cortex, and a piece of Pedernal chert angular debris lacks cortex. The cortical nature of this obsidian and basalt points to the curation of these materials in a partially reduced state and their subsequent further reduction on-site. The cortex of the obsidian does not appear to be waterworn, which may discount the Rio Grande gravel source. In turn, this material may have been obtained from the Caja del Rio or Jemez Mountain source. The nonwaterworn cortex of the basalt indicates procurement from a primary source, such as the Caja del Rio or the more distant La Bajada.

The undifferentiated chert, Madera chert, chalcedony, Pedernal chert, silicified wood, metaquartzite, and obsidian material types exhibit flaws. Flawed material accounts for 29.3 percent of the total fully analyzed assemblage (n=266). The flaws mainly take the form of cracks or incipient fracture planes, but also include crystals and voids, and in the case of the obsidian, spherule inclusions.

Fine-grained material types include yellow-red mottled Madera chert, chalcedony, Pedernal chert, silicified wood, and basalt. The undifferentiated chert, red and red-mottled Madera chert, non-red Madera chert, and metaquartzite range from fine to medium-grained. Table 7 presents artifact material quality by

TABLE 5. LA 127578 ARTIFACT TYPE BY MATERIAL TYPE

OUNT OW % OLUMN %	CHERT	MADERA CHERT (YELLOW/RED MOTTLED)	MADERA CHERT (RED MOTTLED)	MADERA CHERT (NONRED)	CHALCEDONY	CHALCEDONY (BLUE/GRAY)	PEDERNAL CHERT	SILICIFIED WOOD	OBSIDIAN	BASALT	META-QUARTZITE	TOTAL
ngular debris	24	4	59	42	1	1		3	3	1	7	145
	16.6	2.8	40.7	29.0	.7	.7		2.1	2.1	.7	4.8	100.0
	40.7	33.3	33.0	37.2	16.7	100.0		25.0	42.9	25.0	25.0	34.4
ore flake	33	6	112	66	5		1	7	3	1	17	251
	13.1	2.4	44.6	26.3	2.0		.4	2.8	1.2	.4	6.8	100.0
	55.9	50.0	62.6	58.4	83.3		100.0	58.3	42.9	25.0	60.7	59.5
iface flake		2	2	4				2	1	1		12
		16.7	16.7	33.3				16.7	8.3	8.3		100.0
		16.7	1.1	3.5				16.7	14.3	25.0		2.8
ested cobble	1										1	2
	50.0										50.0	100.0
	1.7										3.6	.5
nidirectional core			2									2
			100.0									100.0
			1.1									.5
ultidirectional core			1								1	2
			50.0								50.0	100.0
			.6								3.6	.5
idirectional cobble tool											2	2
											100.0	100.0
											7.1	.5
niface				1								1
				100.0								100.0
				.9								.2
arly stage uniface			3									3
			100.0									100.0
			1.7									.7
arly stage biface	1											1
	100.0											100.0
	1.7											.2
iddle stage biface										1		1
										100.0		100.0
										25.0		.2
able Total	59	12	179	113	6	1	1	12	7	4	28	422
	14.0	2.8	42.4	26.8	1.4	.2	.2	2.8	1.7	.9	6.6	100.0
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE 6. LA127578, ARTIFACT BY AREA

N ROW% COLUMN %	AREA 0	AREA 1	AREA 2	AREA 3	TOTAL
Angular debris	8	112	22	3	145
	5.5	77.2	15.2	2.1	34.4
	16.7	37.2	36.7	23.1	
Core flake	33	173	36	9	251
	13.1	68.9	14.3	3.6	59.5
	68.8	57.5	60.0	69.2	
Biface flake		10	1	1	12
		83.3	8.3	8.3	2.8
		3.3	1.7	7.7	
Tested cobble	1		1		2
	50.0		50.0		.5
	2.1		1.7		
Unidirectional core	1	1			2
	50.0	50.0			.5
	2.1	.3			
Multidirectional core	1	1			2
	50.0	50.0			.5
	2.1	.3			
Cobble tool	1	1			2
	50.0	50.0			.5
	2.1	.3			
Uniface		1			1
		100.0			.2
		.3			
Early stage uniface	1	2			3
	33.3	66.7			.7
	2.1	.7			
Early stage biface	1				1
	100.0				.2
	2.1				
Middle stage biface	1				1
	100.0				.2
	2.1				
Total	48	301	60	13	422
	11.4	71.3	14.2	3.1	100.0

area.

A total of 25 artifacts from the fully analyzed assemblage display evidence of thermal alteration. These artifacts include angular debris and core flakes of local chert as well as a single metaquartzite cobble hammerstone that displays a crenated fracture. Local chert types that exhibit evidence of thermal alteration include undifferentiated chert, red or red-mottled Madera chert, and nonred Madera chert. A total of 13 core flakes and 11 pieces of angular debris display evidence of thermal alteration. With the exception of tools that exhibit luster variation in nonretouched and retouched portions, which are lacking from this assemblage, it is difficult to determine if these thermal signatures are the product of intentional heat treatment or are incidentally incurred. Table 8 presents thermal alteration type by area.

Area 0 (General Site Surface)

A total of 48 chipped stone artifacts were recovered from the surface. This total consists mainly of core reduction debris with much smaller proportions of tools and cores (Table 9). These artifacts are reflective of limited raw material procurement, core reduction, tool production, and a diversity of tool usage.

TABLE 7. LA 127578, MATERIAL QUALITY BY AREA

N ROW % COLUMN %	AREA 0	AREA 1	AREA 2	AREA 3	TOTAL
Glassy and flawed				1 100.0 7.7	1 .4
Fine grained	6 3.8 46.2	122 76.7 67.8	24 15.1 40.0	7 4.4 53.8	159 59.8
Fine grained and flawed	6 9.8 46.2	29 47.5 16.1	23 37.7 38.3	3 4.9 23.1	61 22.9
Medium grained	1 3.4 7.7	19 65.5 10.6	8 27.6 13.3	1 3.4 7.7	29 10.9
Medium grained and flawed		10 62.5 5.6	5 31.3 8.3	1 6.3 7.7	16 6.0
Total	13 4.9	180 67.7	60 22.6	13 4.9	266 100.0

TABLE 8. LA 127578, THERMAL ALTERATION BY AREA

N ROW % COLUMN %	AREA 0	AREA 1	AREA 2	AREA 3	TOTAL
None	12 5.0 92.3	159 66.0 88.3	57 23.7 95.0	13 5.4 100.0	241 90.6
Ventral potlids			1 100.0 1.7		1 .4
Potlids		6 100.0 3.3			6 2.3
Crazed	1 8.3 7.7	10 83.3 5.6	1 8.3 1.7		12 4.5
Crazed & potlids			1 100.0 1.7		1 .4
Color change		1 100.0 .6			1 .4
Luster variation		2 100.0 1.1			2 .8
Color change & crazed		1 100.0 .6			1 .4
Crenated fracture		1 100.0 .6			1 .4
Total	13 4.9	180 67.7	60 22.6	13 4.9	266 100.0

TABLE 9. LA 127578, AREA 0, ARTIFACT BY MATERIAL TYPE

N Row % Column %	Chert	Madera chert, yellow/red mottled	Madera chert, red & mottled red	Madera chert, non-red	Pedernal chert	Silicified wood	Obsidian	Basalt	Metaquartzite	Total
Angular debris		1 12.5 25.0	4 50.0 14.8	1 12.5 50.0			1 12.5 50.0	1 12.5 50.0		8 16.7
Core flake	4 12.1 80.0	3 9.1 75.0	21 63.6 77.8	1 3.0 50.0	1 3.0 100.0	1 3.0 100.0	1 3.0 50.0		1 3.0 25.0	33 68.8
Tested cobble									1 100.0 25.0	1 2.1
Unidirectional core			1 100.0 3.7							1 2.1
Multidirectional core									1 100.0 25.0	1 2.1
Cobble tool									1 100.0 25.0	1 2.1
Early stage uniface			1 100.0 3.7							1 2.1
Early stage biface	1 100.0 20.0									1 2.1
Middle stage biface								1 100.0 50.0		1 2.1
Total	5 10.4	4 8.3	27 56.3	2 4.2	1 2.1	1 2.1	2 4.2	2 4.2	4 8.3	48 100.0

Debitage. Debitage comprises 85.5 percent of the Area 0 assemblage (see Table 9). These artifacts are primarily reflective of core reduction. For the core flakes, the distributions of flake attributes including dorsal cortex retention, dorsal flake scar count, platform type, portion, and mean whole measurements are suggestive of a predominance of earlier stage core reduction debris with fewer pieces of later stage debris.

The majority of the core flakes are cortical, including 39.4 percent that retain 10-50 percent dorsal cortex and 33.3 percent that retain 60-100 percent cortex. This reflects early to middle stage reduction. The remaining nine core flakes (27.3 percent) lack dorsal cortex, which suggests middle to late stage reduction. Core flakes with zero to two dorsal scars predominate (69.7 percent). This also suggests early to middle stage core reduction. Later stage core reduction is reflected by 27.3 percent of the assemblage, which have three to five dorsal scars. A single flake has an indeterminate number of dorsal scars. The inconsistent fracture of this flawed material prevents an accurate dorsal scar count.

Single facet and cortical platforms, which reflect the earlier stages of core reduction, are the most prevalent (72.7 percent). The remaining core flakes (27.3 percent) exhibit various forms of platform breakage including absent, crushed, and collapsed platforms. No core flakes with complex platform types, which reflect the latter stages of core reduction, were recovered.

Represented portions of core flakes include whole (42.4 percent), proximal and lateral, which are equally represented (21.2 percent), and distal (15.2 percent). The whole to fragmentary core flake ratio is 1:1.4. Generally, flake breakage increases in the later stages of reduction as flakes get thinner; however, other post-reduction cultural and natural processes, such as trampling or solifluction, must be considered as well (Moore 1996:247). The higher frequency of core flake breakage (57.6 percent) may indicate the later stages of reduction. Yet, comparable proportions of distal and proximal portions can indicate post-reduction breakage, whereas a prevalence of distal portions points to breakage during reduction (Moore 1996:254). In this assemblage, proximal portions (n=7) are only slightly more frequent than distal portions (n=5) suggesting some degree of post-reduction breakage. The surficial nature of this assemblage further corroborates this notion. Exposed artifacts are more subjected to more post-abandonment processes, such as trampling, that may lead to breakage.

TABLE 10. LA 127578, AREA 0, CORE FLAKE MEAN WHOLE MEASUREMENT SUMMARY

	Length (mm)	Width (mm)	Thickness (mm)
N	18	21	21
Mean	41.3	33.4	11.5
Standard deviation	15.2	13.5	5.1
Minimum	14	14	4
Maximum	70	70	22

Table 10 presents central tendency and dispersion statistics for the whole maximum linear dimensions of core flakes. Recall that platform width and weight were not monitored in this abbreviated analysis. The relatively large mean statistics, especially for length, lends additional support to the notion that the assemblage contains an abundance of earlier stage reduction debris. However, the dispersion statistics, especially the minimums, allude to the presence of a small amount of later stage reduction debris.

Informal Tools. In Area 0, excavation yielded six pieces of utilized-retouched debitage. These include whole and fragmentary portions of Madera chert, undifferentiated chert, and basalt core flakes and angular debris (Table 9).

All have a single utilized or retouched edge. For all core flakes, edge location is the lateral margins. Since by definition angular debris cannot be oriented, edge location cannot be determined. Edge outline forms are convex (n=4), slightly convex (n=1), or straight (n=1).

Unidirectional wear is evident on three edges and bidirectional wear is evident on two. Edge FS 44, which exhibits bidirectional wear, retains a cortical backing. A single artifact, FS 95, exhibits unidirectional retouch scars, but no wear scars. In this analysis, wear scars are defined as scalar scars measuring under 2 mm, while retouch scars measure over 2 mm. Bidirectional scars suggest use in a longitudinal motion such as cutting, slicing, or sawing, whereas unidirectional scars suggest use in transverse motion, such as scraping, whittling, or planing (Chapman and Schutt 1977:86-92; Odell and Odell-Vereecken 1980:98-99). The wear patterns of a single artifact (FS 85) includes discontinuous step fracturing. Step fractures or stepped terminations are diagnostic of wear incurred by working a hard or resistant material such as bone or antler (Odell and Odell-Vereecken 1980:101). One (FS 103) includes bidirectional rounding. In experimental context, bidirectional rounding was produced when using tools in both longitudinal and transverse motions at high contact angles. Generally, rounding is produced with intensive use, although material type and worked substance must be considered (Vaughan 1985:26). Some use-wear analysts, who use high-power magnification (100-200 power) to examine experimental stone tools, caution against the reliability of interpretations based solely on scarring. Patterned scarring can also be attributed to natural processes such as solifluction or cryoturbation as well as by trampling. In experimental context, both bidirectional and unidirectional scarring has been produced when using tools in both transverse and longitudinal motions (Keeley 1980:30–36; Vaughan 1985:10-12, 19-24).

The majority of edge angles (n=4) measure over 40 degrees. The remaining two edges measure 40 degrees or under. Post, citing experiments by Schutt (1982), suggests that tools with edge angles of 40 degrees or below are better suited for cutting, while tools with edge angles above 40 degrees are better suited for scraping. Furthermore, he suggests that tools with edge angles measuring over 60 degrees could accommodate more heavy-duty or intensive use (Post 1996b:418). All tools with edge angles measuring over 60 degrees display unidirectional retouch or wear.

Formal Tools. FS 34, PP 2, is a middle stage biface fragment that was manufactured from a fine-grained basalt (Fig. 12a). It has a semiregular facial scarring pattern and exhibits discontinuous marginal step fracturing. It is truncated by a lateral snap. This type of fracture is most often attributed to a manufacturing failure (Johnson 1977:25; Office of Archaeological Studies Staff 1993:18). It measures 47 mm long by 34 mm wide by 10 mm thick and weighs 20.2 g.

FS 84, PP 25, is an early stage uniface fragment that was manufactured from a fine-grained, flawed, gray-red-brown mottled Madera chert. Facial retouch is irregular and covers approximately half of the surface. The opposing surface retains 100 percent cortex. Facial retouch originates from all intact margins. The artifact exhibits discontinuous unimarginal step fracturing, and is truncated by a lateral snap. It measures 60 mm long by 45 mm wide by 23 mm thick and weighs 77.5 g.

FS 115, PP 56, is a whole early stage biface that was manufactured from a fine-grained, flawed, undifferentiated chert (Fig. 12b). Its surface appears to be well patinated. The facial scarring pattern is fairly irregular in the spacing and size of scars. The marginal scarring pattern consists of discontinuous step fracturing. It is roughly oval shaped in plan. It measures 72 mm long by 61 mm wide by 31 mm thick and weighs 131.3 g.

Hand Tools. FS 87 is a multidirectional core that was utilized as a chopper. It was manufactured from a fine-grained gray-green metaquartzite cobble. It exhibits five complete negative flake scars removed from multiple platforms. This core-chopper retains 40 percent waterworn cortex. The utilized edge is slightly convex and displays battering wear in the form of crushing and step fracturing. This edge is opposed by a flattened area created by an earlier flake removal. This area serves as a backing that facilitated comfortable, nonhazardous manual prehension.

FS 104 is a fine-grained, gray- light brown metaquartzite cobble tool. It shows two discrete areas with battering wear (Fig. 12c). One area is along a ridge created the removal of two flakes. These flake scars do not originate from the battered area. The other is along an unmodified portion of cobble ridge. The artifact may have functioned as a hammerstone. It measures 82 mm long by 57 mm wide by 39 mm thick and weighs 235.6 g.

Cores. The following core and tested cobble reflect raw material procurement and expedient core reduction geared toward flake production. FS 76 is a tested cobble of a fine-grained, dark gray metaquartzite cobble. It exhibits two complete negative flake scars and retains 70 percent waterworn cor-

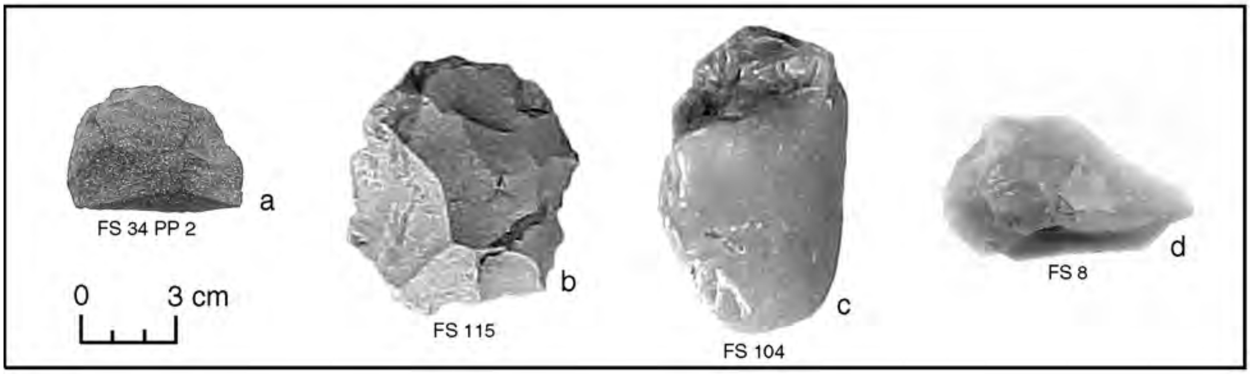

Figure 12. LA 127578 tools: (a) FS 34, PP 2, middle stage biface fragment; (b) FS 115, PP 56, early stage biface; FS 104, cobble tool; (d) FS 8-1, unifacial end scraper.

tex. Apparently the cobble was deemed unsuitable for further reduction or was discarded prior to exhaustion. It measures 124 mm long by 88 mm wide by 45 mm thick and weighs 561.9 g.

FS 101, PP 42, is a fine grained, flawed, red Madera chert unidirectional core. It exhibits four complete negative flake scars and retains 70 percent cortex. The core was discarded prior to exhaustion. It measures 98 mm long by 84 mm wide by 59 mm thick and weighs 436.5 g.

Area 1

A total of 301 chipped stone artifacts were recovered from Area 1. The abbreviated analysis was conducted on 121 pieces of debitage from the upper levels of this excavation area. The total assemblage consists mainly of debitage and a smaller proportion of tools and cores (Table 11). These artifacts reflect core reduction, tool production, and a variety of tool usages.

Debitage. Debitage, including core flakes, angular debris, and biface flakes, comprises 98.0 percent of the Area 1 assemblage (Table 11). These artifacts reflect core reduction as well as tool production or maintenance. For the core flakes, the distributions of flake attributes including dorsal cortex retention, dorsal flake scar count, platform type, portion, and mean whole measurements are suggestive of all stages of core reduction with a greater representation of later stage reduction debris than some other areas.

The majority of the core flakes (60.1 percent) lack dorsal cortex suggesting middle to late stage reduction. A substantial proportion (22.0 percent) retain 60-100 percent dorsal cortex and reflect early stage core reduction. The remaining 17 percent retain 10-50 percent dorsal cortex and reflect early to middle stage core reduction. Core flakes with zero to two dorsal scars predominate (76.3 percent). This also suggests early to middle stage core reduction. Middle to late stage core reduction is reflected by 21.4 percent of the assemblage having three to five dorsal scars. Late stage core reduction is reflected by a single flake (0.6 percent) that has six or more dorsal scars. Three flakes (1.7 percent) have an indeterminate number of dorsal scars. These are the result of a fracture that is inhibited by a flaw in the material, which complicates an accurate dorsal scar count.

Single facet and cortical platforms, which reflect the earlier stages of core reduction, are represented by 51.4 percent. Core flakes that exhibit various forms of platform breakage, including collapsed, crushed, absent, or broken-in-manufacture platforms, are represented by 47.4 percent. Two core flakes with multifaceted platforms, which reflect the later stages of core reduction, were recovered.

Core flake portions that are represented in the assemblage include lateral (36.4 percent), whole (23.1 percent), proximal (19.7 percent), distal (13.9 percent), and medial (6.9 percent). The whole to fragmentary core flake ratio is 1:3.3. Generally, flake breakage increases in the later stages of reduction as flakes get thinner, however, other post-reduction cultural and natural processes, such as trampling or solifluction, must be considered as well (Moore 1996:247). The higher frequency of core flake breakage (76.9 percent) may indicate some later stage reduction debris. Yet, comparable proportions of distal and proximal por-

TABLE 11. LA 127578, AREA 1, ARTIFACT TYPE BY MATERIAL TYPE

N Row % Column %	Chert	Madera chert, yellow/red mottled	Madera chert red/mottled red	Madera chert, non-red	Chalcedony	Silicified wood	Obsidian	Basalt	Meta-quartzite	Total
Angular debris	22 19.6 46.8	3 2.7 42.9	43 38.4 37.1	35 31.3 36.8		2 1.8 20.0	2 1.8 50.0		5 4.5 29.4	112 37.2
Core flake	25 14.5 53.2	2 1.2 28.6	67 38.7 57.8	55 31.8 57.9	4 2.3 100.0	6 3.5 60.0	2 1.2 50.0	1 .6 100.0	11 6.4 64.7	173 57.5
Biface flake		2 20.0 28.6	2 20.0 1.7	4 40.0 4.2		2 20.0 20.0				10 3.3
Unidirectional core			1 100.0 .9							1 .3
Multidirectional core			1 100.0 .9							1 .3
Cobble tool									1 100.0 5.9	1 .3
Uniface				1 100.0 1.1						1 .3
Early stage uniface			2 100.0 1.7							2 .7
Total	47 15.6	2.3	116 38.5	95 31.6	4 1.3	10 3.3	4 1.3	1 .3	17 5.6	301 100.0

tions can indicate post-reduction breakage, whereas a prevalence of distal portions points to breakage during reduction (Moore 1996:254). In this assemblage, proximal portions (n=34) are more frequent than distal portions (n=24). This may indicate some degree of post-reduction breakage. Material flaws should also be taken into account when examining flake breakage distributions. A considerable proportion (21.7 percent) of core flakes that were fully analyzed (n=180) are made from flawed materials. Breakage along an incipient fracture plane or other flaw can contribute to the representation of all fragmentary portions and can occur in all stages of reduction, although it seems less likely that a flawed material would be intensely reduced if a more suitable raw material is easily obtainable.

Table 12 presents central tendency and dispersion statistics for whole maximum linear dimensions of the core flakes. Recall that platform width and weight were not monitored for the 121 pieces of debitage given the abbreviated analysis. The mean statistics are consistently smaller than the mean statistics for LA 126576 as well as LA 127578, Areas 0 and 2. This lends additional support to the notion that the assemblage contains a higher proportion of later stage reduction debris. However, the dispersion statistics also allude to the presence of debris from all stages of reduction.

TABLE 12. LA 127578, AREA 1, CORE FLAKE WHOLE MEAN MEASUREMENT SUMMARY

	PLATFORM WIDTH (MM)*	LENGTH (MM)	WIDTH (MM)	THICKNESS (MM)	WEIGHT (G)*
N	39	69	74	74	15
Mean	6.9	28.2	28.5	9.2	6.5
Standard deviation	3.4	14.6	11.4	5.5	7.1
Minimum	1.6	7	8	2	.2
Maximum	17.0	72	63	27	20.4

*measurement not recorded for surface and Layer 1 core flakes.

Ten biface flakes were recovered from Area 1. All are made from local materials including Madera chert and silicified wood. All lack dorsal cortex. Half exhibit zero to two dorsal scars and the other half exhibit three to five dorsal scars. The majority (60 percent) display various forms of platform breakage including absent, crushed, and collapsed platforms. A small proportion (20 percent) display single-facet platforms and relatively steep platform angles and are more likely uniface flakes. A small proportion (20 percent) display multifaceted platforms. Half are whole, 40 percent are proximal portions, and 10 percent are distal portions. Table 13 presents the central tendency and dispersion statistics for biface flake whole measurements. As expected, the mean statistics are consistently smaller than the core flake statistics. The standard deviation statistics are also smaller, so that, in size, these flakes are smaller and less variable than core flakes. These flakes indicate that at least limited bifacial and unifacial reduction occurred on-site.

TABLE 13. LA 127578, AREA 1, BIFACE FLAKE WHOLE MEAN MEASUREMENT SUMMARY

	PLATFORM WIDTH (MM)*	LENGTH (MM)	WIDTH (MM)	THICKNESS (MM)	WEIGHT (G)*
N	2	5	9	9	5
Mean	1.6	10.2	10.4	2.0	.2
Standard deviation	.8	3.8	2.4	.7	.2
Minimum	1.0	7	6	1	.1
Maximum	2.1	16	13	3	.5

*measurement not recorded for surface and Area 1, Layer 1 biface flakes

Informal Tools. Area 1 excavation yielded seven pieces of utilized-retouched debitage. These include whole and fragmentary portions of Madera chert and undifferentiated chert core flakes and angular debris (Table 8). All of artifacts have a single utilized-retouched edge. For all core flakes, edge location includes distal (n=2) and lateral (n=2) margins. Since, by definition, angular debris cannot be oriented, edge location cannot be determined. Edge outlines are convex (n=1), slightly convex (n=1), slightly concave (n=2), straight (n=1), or sinuous (n=2).

Unidirectional wear is included in five wear patterns, while evidence of bidirectional wear is lacking. A single artifact (FS 197) exhibits unidirectional retouch scars, but no wear scars. Unidirectional scars suggest use in transverse motion such as scraping, whittling, or planing (Chapman and Schutt 1977:86-92; Odell and Odell-Vereecken 1980:98-99). The wear patterns of a single artifact (FS 105) include step fracturing. Step fractures or stepped terminations are diagnostic of wear incurred by working a hard or resistant material such as bone or antler (Odell and Odell-Vereecken 1980:101). This artifact may represent a chopper fragment. Some use-wear analysts, who use high-power magnification (100-200 power) to examine experimental stone tools, caution against the reliability of interpretations based solely on scarring. Patterned scarring can also be attributed to natural processes such as solifluction or cryoturbation as well as by trampling. In experimental context, both bidirectional and unidirectional scarring has been produced when using tools in both transverse and longitudinal motions (Keeley 1980:30 –36; Vaughan 1985:10-12, 19-24).

The majority of edge angles (n=5) measure over 40 degrees. The remaining two edges measure under 40 degrees. Post, citing experiments by Schutt (1982), suggests that tools with edge angles of 40 degrees or below are better suited for cutting, while tools with edge angles above 40 degrees are better suited for scraping. Furthermore, he suggests that tools with edge angles measuring over 60 degrees could accommodate more heavy-duty or intensive use (Post 1996b: 418). Of the two tools with edge angles measuring over 60 degrees, one displays unidirectional retouch, the other is the possible chopper fragment.

Formal Tools. FS 8-1 is a unifacial end scraper manufactured from fine-grained, gray Madera chert (Fig. 12d). It displays a fairly irregular facial scarring pattern as well as discontinuous unimarginal wear and step fracturing. The artifact shows evidence of thermal alteration in the form of crazing. This is not unexpected since it was recovered from Level 1 fill of Feature 1, which is a burned structure. It measures 79 mm long by 47 mm wide by 26 mm thick and weighs 80.8 g.

FS 9-5 is an early stage uniface manufactured from a fine-grained, red Madera chert. The facial scarring pattern is irregular. It displays discontinuous unimarginal wear and step fracturing. This artifact could accommodate heavy-duty scraping. It measures 40 mm long by 40 mm wide by 18 mm thick by 30.0 g.

FS 62-1 is an early stage uniface manufactured from a fine-grained, flawed, red-gray mottled Madera chert. Facial retouch scars cover slightly more than half of one surface and remain fairly irregular in spacing and size. These scars extend from a single long axis margin. The opposing surface remains cortical. The margin displays discontinuous step fracturing, but it is more likely the product of retouch flake removal rather than wear. The artifact measures 41 mm long by 33 mm wide by 18 mm thick and weighs 27.3 g.

Hand Tools. FS 170 is a metaquartzite cobble tool that functioned as a hammerstone. It displays localized battering wear along the ridge of one short axis margin. The artifact displays a crenated fracture from heat exposure, but it is incompletely broken. Maximum linear dimensions are 128 mm in length, 83 mm in width, 69 mm in thickness, and 1,008.9 g in weight.

Cores. The following artifacts reflect expedient core reduction of locally available materials. None appear exhausted. FS 14-1 is a fine-grained, red, banded chert. It exhibits two negative flake scars that resemble core reduction scars rather than retouch scars. The core retains 50 percent cortex. It measures 45 mm long by 27 mm wide by 21 mm thick and weighs 10.4 g.

FS 111, PP 52, is a medium-grained, red-gray mottled Madera chert unidirectional core. It displays three complete negative flake scars and retains 10 percent waterworn cortex. It measures 83 mm long by 63 mm wide 31 mm thick and weighs 131.7 g.

FS 176 is a fine-grained, flawed, red Madera chert multidirectional core that exhibits four complete negative flake scars and retains 50 percent waterworn cortex. It measures 134 mm long 96 mm wide by 67 mm thick and weighs 1,006.7 g.

Area 2

A total of 60 chipped stone artifacts weighing 1,217.5 g were recovered from Area 2. This total consists mainly of debitage and a single tested cobble (Table 14). In general, the assemblage reflects limited raw material procurement, core reduction, and very limited tool production.

TABLE 14. LA 127578, AREA 2, ARTIFACT TYPE BY MATERIAL TYPE

N Row % Column %	Chert	Madera Chert (Mottled Red)	Madera Chert (Non-Red)	Chalcedony	Pedernal Chert	Silicified Wood	Basalt	Meta-quartzite	Total
Angular debris	1 4.5 16.7	12 54.5 40.0	5 22.7 38.5	1 4.5 50.0	1 4.5 100.0	1 4.5 100.0		1 4.5 16.7	22 36.7
Core flake	4 11.1 66.7	18 50.0 60.0	8 22.2 61.5	1 2.8 50.0				5 13.9 83.3	36 60.0
Biface flake							1 100.0 100.0		1 1.7
Tested cobble	1 100.0 16.7								1 1.7
Total	6 10.0	30 50.0	13 21.7	2 3.3	1 1.7	1 1.7	1 1.7	6 10.0	60 100.0

Debitage. Debitage, including core flakes, angular debris, and a single biface flake, comprises 98.4 percent of this area’s chipped stone assemblage (Table 14). The core flakes and angular debris reflect core reduction, whereas the biface flake points to very limited bifacial tool production. For core flakes, the distributions of flake attributes, including dorsal cortex retention, dorsal flake scar count, platform type, portion, and mean whole measurements are suggestive of an abundance of earlier stage core reduction debris with few pieces of later stage debris.

The majority of the core flakes are cortical, including 38.9 percent that retain 10-50 percent dorsal cortex and 16.7 percent that retain 60-100 percent cortex. These flakes suggest early to middle stage reduction. The remaining core flakes (44.4 percent) lack dorsal cortex, which suggests middle to late stage reduction. Core flakes with zero to two dorsal scars are the most frequent (52.8 percent). This also suggests early to middle stage core reduction. A substantial proportion (38.9 percent) exhibit three to five dorsal scars, which suggests middle to late stage reduction. A single core flake (2.8 percent) displays six or more dorsal scars indicating late stage reduction. Two core flakes (5.6 percent) have an indeterminate number of dorsal scars. These are the result of a fracture that is inhibited by a flaw in the material, which complicates an accurate dorsal scar count.

Single facet and cortical platforms, which reflect the earlier stages of core reduction, are the most prevalent (66.7 percent). The remaining core flakes (33.3 percent) exhibit various forms of platform breakage including absent and collapsed platforms. No core flakes with complex platform types, such as multifaceted platforms, which reflect the latter stages of core reduction, were recovered.

Core flake portions represented in the assemblage include whole (47.2 percent), lateral (27.8 percent), distal (19.4 percent), and proximal (5.6 percent). The whole to fragmentary core flake ratio is 1:1.1. Generally, flake breakage increases in the later stages of reduction as flakes get thinner, however, other post-reduction cultural and natural processes, such as trampling or solifluction, must be considered as well (Moore 1996:247). The slightly higher frequency of core flake breakage (52.8 percent) may indicate some later stage reduction debris. Yet, comparable proportions of distal and proximal portions can indicate post-reduction breakage, whereas a prevalence of distal portions points to breakage during reduction (Moore 1996: 254). In this assemblage, distal portions (n=7) are more frequent than proximal portions (n=2). This also may indicate a small degree of later stage reduction breakage. Material flaws should also be taken into account when examining flake breakage distributions. A considerable proportion (38.9 percent) of core flakes are of flawed materials. Breakage along an incipient fracture plane or other flaws can contribute to the representation of all fragmentary portions and can occur in all stages of reduction, although it seems less likely that a flawed material would be intensely reduced if a more suitable raw material is easily obtainable.

Table 15 presents central tendency and dispersion statistics for the whole maximum linear dimensions of core flakes. The relatively large mean statistics lends additional support to the notion that the assemblage contains a preponderance of early to middle stage reduction debris. However, the dispersion statistics, especially the minimums, reflect the presence of a small amount of late stage reduction debris.

The single basalt biface flake has an overshoot distal termination, which contains a substantial portion of biface edge, therefore, it will be treated as a biface fragment and discussed in the formal tool section.

TABLE 15. LA 127578, AREA 2, CORE FLAKE WHOLE MEAN MEASUREMENT SUMMARY

	Platform width (mm)	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)
N	25	24	19	19	17
Mean	8.5	36.0	35.9	12.4	26.0
Standard deviation	4.2	15.8	15.5	7.4	38.1
Minimum	.1	15	14	4	3.3
Maximum	21.2	69	83	35	160.2

Informal Tools. Four pieces of debitage, including two pieces of angular debris and two core flake fragments, display utilized edges. It is unlikely that any of the following represent whole tools. FS 54 is a piece of fine-grained, flawed, Pedernal chert angular debris. It exhibits discontinuous unidirectional retouch, wear, and step fracturing. Its edge outline is convex and its edge angle measures 68 degrees. Its wear pattern and edge angle are consistent with those of a scraper that could accommodate heavy-duty use. It measures 37 mm long by 32 mm wide by 18 mm thick and weighs 16.5 g.

FS 58-4 is angular debris of a fine-grained and flawed purple Madera chert. It exhibits discontinuous unidirectional retouch, wear, and step fracturing. Its edge outline is sinuous and its edge angle measures 70 degrees. Based on wear pattern and edge angle, it may represent a portion of a scraper that could accommodate heavy-duty use. It measures 40 mm long by 29 mm wide by 20 mm thick and weighs 13.1 g.

FS 107 is a fine-grained, flawed, purple Madera chert core flake fragment that manifests discontinuous bidirectional retouch, wear, and step fracturing along its single intact lateral margin. The sinuous or roughly denticulate edge created by the retouch may have served a sawing function. The step fracturing suggests its use on a hard or resistant material. Its edge angle measures 43 degrees. Maximum linear dimensions are 53 mm in length, 31 mm in width, and 11 mm in thickness. It weighs 17.4 g.

FS 134 is a fine grained, red-white mottled Madera chert core flake fragment with a distal termination that is obscured by cultural modification. It displays unidirectional retouch and wear along this sinuous edge. With its acute edge angle of 45 degrees, it could accommodate light-duty scraping. It measures 26 mm long by 30 mm wide by 8 mm thick and weighs 5.1 g.

Formal Tools. FS 106, PP 47, is a whole overshoot or outrepasse flake. Overshoot flakes, which typically occur during soft hammer percussion, are produced when the crack of a flake continues to the end of a biface and bends removing a portion of the opposing biface edge (Whittaker 1994:19, 163). This type of flake is diagnostic of a biface production failure and has also been termed reverse fracture (Johnson 1979:25). The facial scarring pattern, a portion of which is evident on the dorsal surface of the flake, is irregular. It retains 70 percent nonwaterworn cortex. The cortex type alludes to its procurement from a primary source, such as the Caja del Rio or La Bajada. On the portion of biface edge that is present, the marginal scarring pattern consists of discontinuous bidirectional wear and step fracturing. The artifact suggests the curation of an early stage bifacial form, which incurred use-wear. A later attempt at further reduction met with an unexpected complication. This artifact was recovered from Feature 3. It measures 61 mm long by 38 mm wide by 19 mm thick and weighs 32.7 g.

Cores. A total of five cores and a single tested cobble were recovered during excavation of Area 2 (Table 7). These comprise 8.5 percent of the chipped stone assemblage of this area. The cores appear to be pieces of angular debris that were large enough to remove usable flakes rather than attempts at formal tool production. Platforms are informal and multidirectionally oriented suggesting that the cores were expediently used. Dimensions and weights suggest that two cores (FS 138-1 and 138-3) were probably exhausted. Their diminutive sizes could render free-hand reduction a dangerous activity. Those remaining appear to be discarded prior to exhaustion, also suggesting some degree of expediency. The tested cobble reflects very limited raw material procurement. Table16 presents select core attributes.

TABLE 16. LA 127578, AREA 2, SELECT CORE ATTRIBUTES

FS #	Artifact Morphology	Material type	Cortex %	Flake scars	Length (mm)	Width (mm)	Thickness (mm)	Weight (mm)
59	Angular debris	Silicified wood	40	2	92	46	26	131.4
70	Angular debris	Madera chert, red and mottled red	0	5	63	57	28	79.6
138 -1	Angular debris	Madera chert, red and mottled red	0	4	53	38	21	27.8
138 -2	Angular debris	Madera chert, non-red	20	4	57	53	31	60.1
138 -3	Angular debris	Madera chert, red and mottled red	0	4	57	35	18	28.7
149	Tested cobble	Chert	80	1	62	48	45	156.1

Area 3

A total of 13 chipped stone artifacts weighing 47.1 g were recovered during excavation of Area 3. Debitage, including nine core flakes, three pieces of angular debris, and a single biface flake, comprises the entire assemblage (Table 17). These artifacts reflect core reduction and limited tool production. For the core flakes, the distributions of flake attributes including dorsal cortex retention, dorsal flake scar count, platform type, portion, and mean whole measurements are suggestive of all stages of core reduction with a greater representation of middle stage reduction debris.

TABLE 17. LA 127578, AREA 3, ARTIFACT BY MATERIAL TYPE

N row % column %	Chert	Madera chert, yellow/red mottled	Madera chert, red and mottled red	Madera chert, non-red	Obsidian	Meta-quartzite	Total
Angular debris	1 33.3 100.0			1 33.3 33.3		1 33.3 100.0	3 23.1
Core flake		1 11.1 100.0	6 66.7 100.0	2 22.2 66.7			9 69.2
Biface flake					1 100.0 100.0		1 7.7
Total	1 7.7	1 7.7	6 46.2	3 23.1	1 7.7	1 7.7	13 100.0

The majority of the core flakes (55.6 percent) lack dorsal cortex, which suggests middle to late stage reduction. Equal proportions (22.2 percent) retain 60-100 percent dorsal cortex and 10-50 percent reflect early and middle stage core reduction. Core flakes with zero to two dorsal scars predominate (77.8 percent). This also suggests early to middle stage core reduction. Middle to late stage core reduction, evidenced by three to five dorsal scars, is reflected by 22.2 percent of the assemblage.

Single facet and cortical platforms, which reflect the earlier stages of core reduction, and flakes that exhibit various forms of platform breakage, including collapsed, crushed, absent, or broken-in-manufacture platforms, are comparably represented by 55.6 percent (n=5) and 44.4 percent (n=4), respectively. The single facet and cortical platforms reflect early to middle stage reduction. The platform breakage is somewhat ambiguous, but a discussion of breakage follows.

Core flake portions that are represented in the assemblage include lateral (33.3 percent), whole (33.3 percent), medial (22.2 percent), and distal (11.1 percent). The whole to fragmentary core flake ratio is 1:3. Generally, flake breakage increases in the later stages of reduction as flakes get thinner, however, other post-reduction cultural and natural processes, such as trampling or solifluction, must be considered as well (Moore 1996:247). The higher frequency of core flake breakage (66.7 percent) may indicate some later stage reduction debris. Material flaws should also be taken into account when examining flake breakage distributions. A considerable proportion (33.3 percent) are of flawed materials.

Table 18 presents central tendency and dispersion statistics for the whole maximum linear dimensions of core flakes. The mean and standard deviation statistics are consistently smaller than the statistics for all other areas of the site. These statistics suggest smaller and less variably sized core flakes. Taken alone they appear to reflect middle stage reduction. However, other flake attribute distributions, namely dorsal cortex retention and dorsal scar counts, point to the representation of small amounts of both early and late stage reduction debris.

TABLE 18. LA 127578, AREA 3, CORE FLAKE WHOLE MEAN MEASUREMENT SUMMARY

	PLATFORM WIDTH (MM)	LENGTH (MM)	WIDTH (MM)	THICKNESS (MM)	WEIGHT (G)
N	5	4	3	3	3
Mean	5.3	22.0	26.0	6.3	2.9
Standard deviation	2.4	1.8	2.7	1.5	1.1
Minimum	1.5	20	23	5	2.1
Maximum	8.0	24	28	8	4.2

The single biface flake (FS 29) indicates at least very limited formal tool production or maintenance. The flake is obsidian with a crushed noncortical platform and feathered distal termination. It retains 100 percent dorsal cortex. The cortex is of an indeterminate type, although it is not exceptionally waterworn, which would rule out the Rio Grande gravel source leaving the Caja del Rio or Jemez Mountain sources. The cortical nature of this flake may suggest the curation of obsidian nodules in a natural or only partially reduced state. Subsequently, these were further reduced on-site. The flake has a relatively even thickness from proximal to distal end with a diffuse bulb of percussion and a pronounced ventral curvature. The artifact measures 17 mm long by 13 mm wide by 3 mm thick and weighs 0.7 g.

Ground Stone. LA 127578 yielded nine ground stone artifacts. With the exception of an indeterminate ground stone fragment recovered from Area 2, all ground stone was recovered from Area 1. These artifacts include one-hand manos/hammerstones (n=2), one-hand manos (n=3), indeterminate fragments (n=2), a single basin metate, and a single one-hand mano/possible hide processing handstone. None appear to have adhering material, such as pigment residue, or appear to have alterations, such as drilling, incising, notching, or grooving.

All one-hand manos and one-hand manos/hammerstones are of locally available flattened cobbles of metaquartzite. All manos have biconvex transverse cross sections, are oval in outline, and lack evidence of initial shaping. Two of these manos (FS 36, PP 4, and FS 198, PP 68) have two opposing use surfaces indicating the practice of a wear management technique that may prolong the tool's use-life and may reflect grinding intensity (Mauldin 1993:322; Adams 1993:335-336) (Fig. 10). Grinding wear is evident in the faceting cobble surfaces. Those that exhibit secondary pecking wear are thought to have been sharpened. FS 36, PP 4, use surface 2, also shows evidence of sharpening as well as striations, which parallel its use in a linear motion on a hard surface. One-hand manos/hammerstones display localized areas of battering wear, usually along the manos' short axis margin. Wear patterns suggest that these manos were used in food processing activities. This does not discount their use in other activities, such as the processing of pigments or hides. Table 19 presents the central tendency and dispersion statistics for whole maximum linear dimensions and ground surface area. Since all manos have oval-shaped ground surfaces, area was calculated by multiplying maximum ground surface length by maximum ground surface width by 0.8. The relatively small mean ground surface area of these food processing manos may point to the tool users' primary reliance on hunting and gathering (Hard 1990).

TABLE 19. LA 127578, WHOLE ONE-HAND MANO AND ONE-HAND MANO/HAMMERSTONE MEASUREMENT SUMMARY

	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)	Ground surface area (mm²)
N	5	5	5	5	8
Mean	128.4	105.2	62.2	1350.1	5699.8
Standard deviation	15.1	8.9	8.0	439.8	451.7
Minimum	112	95	54	963.3	5055.2
Maximum	148	119	75	2000.0	6393.6

The two indeterminate fragments are of locally available orthoquartzite. FS 75, PP 16, is slightly concave in ground surface cross section, suggesting that it is a metate fragment, and FS 70 is flat. Both appear to be edge fragments. FS 75, PP 16, is fire-cracked.

FS 178, PP 65, is a basin metate made from a large flattened cobble of metaquartzite (Fig. 13a). It lacks evidence of initial shaping. The ground surface is oval shaped in plan and concave in cross section with a maximum depth of 23 mm. This surface exhibits pecking to sharpen. The artifact is fire-cracked. Table 20 presents additional attributes. Ground surface area was calculated in the same manner as the manos.

FS113, PP 54, was a single one-hand abrader or possible hide processing tool made from a nonlocal basalt scoria (Fig. 13b). Warren (1977:24, 28) notes that this material is usually red to reddish gray in color, is much lighter than vesicular basalt, occurs abundantly on Cerros del Rio, and outcrops on both sides of the river at the confluence of Bland Canyon and the Rio Grande. Warren mentions its use as a tempering material for glaze ware pottery as well as for ground stone artifacts including stone balls and mortars.

A similar mano was recovered from LA 61286, Area 1, a site with Archaic affiliation that was excavated during the Northwest Santa Fe Relief Route project (Post n.d.). The mano has single convex use surface. The wear pattern consists of rounded and polished high points between the vesicles, which is inconsistent with grinding on a hard surface. It is plausible that it functioned as a hide processing handstone for the removal of unwanted hair and soft tissue from a hide. After a six hour hide processing experiment, Adams (1988:312-313) reports a similar tool wear pattern consisting of decreased angularity of grains and the tribochemical deposition of polish.

With the exception of the possible hide processing handstone, all ground stone material types and the lack of initial shaping alludes to an expedient ground stone technology. Manos with two use surfaces, FS 36, PP 4, and FS 198, PP 68, may reflect a greater relative use-intensity. The material type and specialized function of the possible hide processing stone point to its curation.

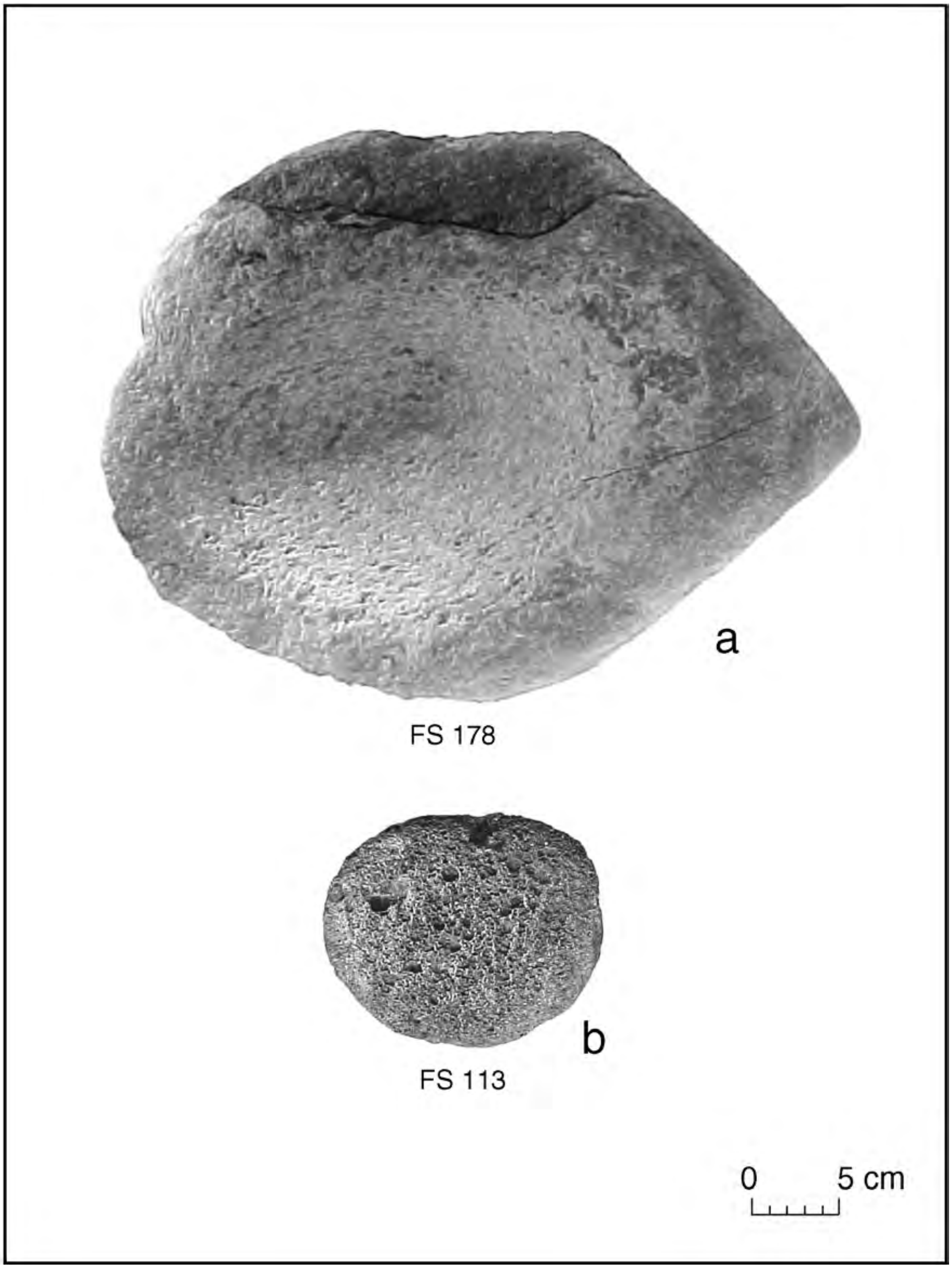

Figure 13. Ground stone from LA 127578; (a) FS 178, PP 65, basin metate, (b) FS 113, PP 54, basalt scoria abrader.

TABLE 20. LA 127578, GROUND STONE TOOL DATA

FS#	Area	Material Type	Use Surfaces	Artifact Function	Primary Wear	Secondary Wear	Length (mm)	Width (mm)	Thickness (mm)	Ground Surface Area (mm²)	Weight (g)
35-PP 3	1	metaquartzite	1	one-hand mano/ hammerstone	grinding	pecking	112	104	57	5904.0	997.8
36-PP 4	1	metaquartzite	1	one-hand mano/ hammerstone	grinding	pecking	118	107	62	6054.4	1203.0
36-PP 4	1	metaquartzite	2	one-hand mano/ hammerstone	furrow striations, linear, parallel to long axis	polishing	118	107	62	5616.0	1203.0
37-PP 5	1	metaquartzite	1	one-hand mano	grinding	none	124	95	54	5168.8	963.3
38-PP 6	1	metaquartzite	1	one-hand mano	grinding	none	140	119	75	5896.8	2000.0
198-PP 68	1	metaquartzite	1	one-hand mano	grinding	pecking	148	101	63	6393.6	1586.3
198-PP 68	1	metaquartzite	2	one-hand mano	grinding	none	148	101	63	5509.6	1586.3
113-PP 54	1	basalt scoria	1	one-hand mano/ hide processing handstone	polishing	none	138	112	47	12364.8	424.7
178-PP 65	1	metaquartzite	1	basin metate	grinding	pecking	354	273	141	33748.8	17900.0
70	2	orthoquartzite	1	indeterminate fragment	grinding	none	70	70	22	.	151.2
75-PP 16	1	orthoquartzite	1	indeterminate fragment	grinding	none	145	130	74	.	1389.2

Faunal Remains

Faunal remains collected from LA 127578 consisted of five bone fragments (Table 21). Analysis and identification was conducted by Nancy J. Akins of the Office of Archaeological Studies. All faunal material, aside from FS 22 recovered from Area 3, was recovered from Area 1, Structure 1. Within Structure 1, these materials were recovered from a limited area near the northern wall (94-95N/99E, Stratum 3). The presence of fragmentary burned and unburned faunal material derived from medium to large size mammals provides limited evidence that game processing was conducted on site. Game processing is also suggested by the recovery of a basalt scoria abrader used in the processing of animal hide (Fig. 13b).

TABLE 21. LA 127578, FAUNAL DATA BY AREA

Area	FS-Art #	Taxon	Element	Comments
3	22-1	Large mammal; wolf to deer size	Long bone shaft fragment	Mature; heavily pitted; unburned; spiral break on one end
1	64-1	Medium to large mammal; dog or larger	Long bone shaft fragment?	Mature; slight pitting; unburned
1	64-2	Medium to large mammal; dog or larger	Rib shaft fragment?	Mature; slight pitting; unburned
1	131-1-2	Large mammal; wolf or larger	Long bone shaft fragment-two pieces of the same bone -old break	Mature; calcined; possibly a medium artiodactyl metatarsal shaft fragment

Ethnobotanical Remains

Botanical samples were recovered from a variety of contexts at LA 127578. To provide the most efficient use of available time and funds, processing of botanical samples was limited to well-defined features and contexts. Each feature and artifact sampled for botanical information provided positive results. Botanical information was obtained from carbonized seeds and a single pollen wash from the grinding surface of a basin metate (FS 178). Although no cultigens were identified, the botanical assemblage is robust and diversified.

Goosefoot, pigweed, and indiscriminate Cheno-ams account for 94 percent of all seeds identified at LA 127578. Other taxa identified include seepweed, purslane, dropseed grass, hedgehog cactus, juniper, and two unknowns. All of these taxa are harvestable from middle to late summer in the Santa Fe area, and have been recovered from other sites in the Rio Grande Valley. In addition to Cheno-ams, the single pollen wash also identified Poaceae, high spine Asteraceae, and Artemisia. Detailed macrobotanical and pollen analysis results are reported by Molly S. Toll and Pamela J. McBride in Appendix 1 and by Richard G. Holloway in Appendix 2.

Site Summary

LA 127578, located on a low ridge between Cañada Rincon and Arroyo de los Frijoles, is the result of residential occupation that occurred between 1505 B.C. and 815 B.C. Excavation focused on the habitation area, Area 1, an activity area, Area 2, and a discard area, Area 3. In addition, surface artifacts within the right-of-way were point-located and collected. Excavation of Area 1 and Area 3 identified intact subsurface deposits, while excavation of Area 2 revealed that cultural material was limited to surface or near-surface contexts.

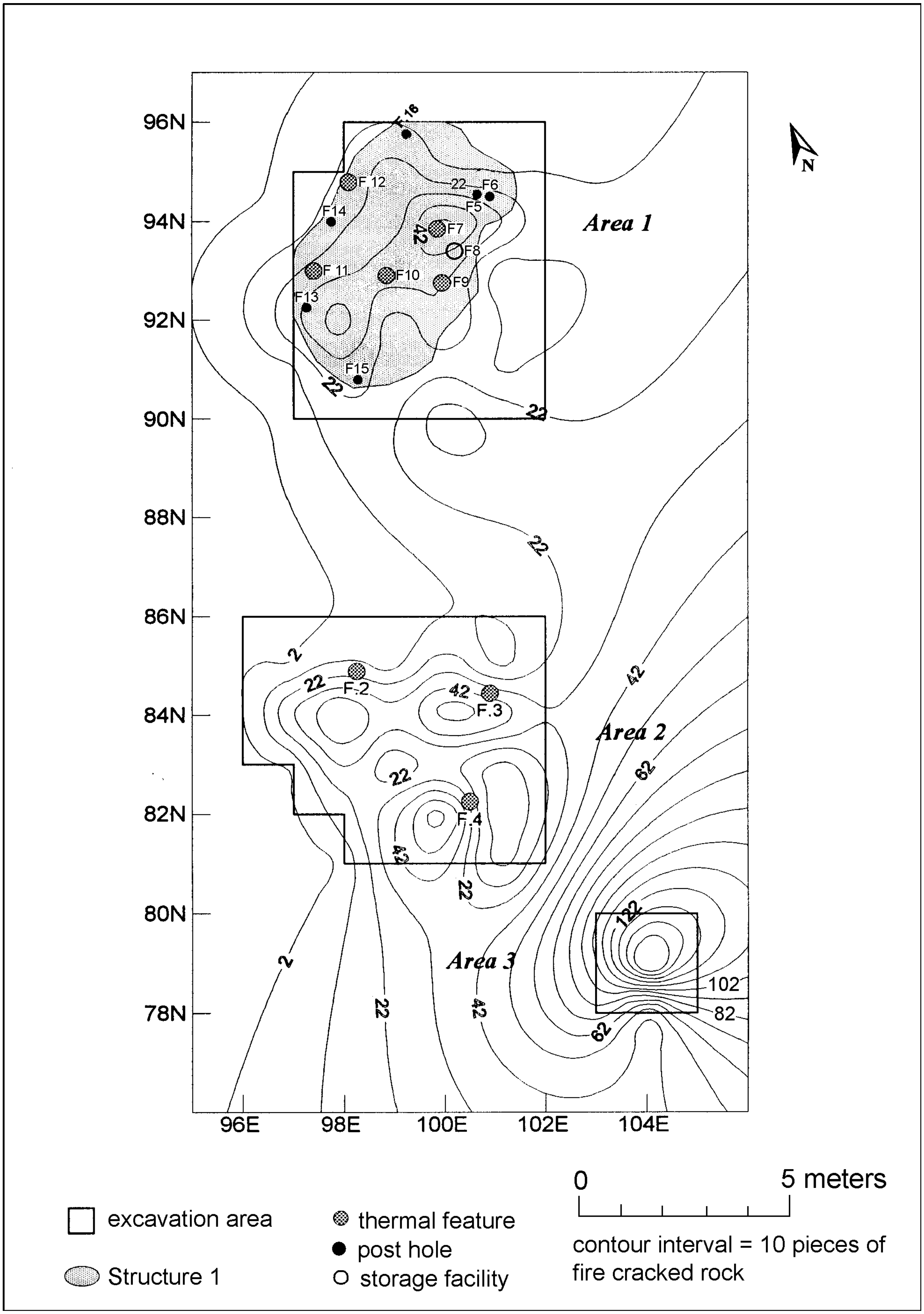

Figure 14. LA 127578, fire-cracked rock densities for excavation areas.

Area 1 was a residential location. Excavations conducted within Area 1 identified a formal structure including evidence of a foundation and superstructure. Processing and storage features were identified within the limits of this structure. Ground stone tools and lithic debitage were deposited during the abandonment process, which included burning the superstructure.

The distribution, context, and condition of artifacts associated with the floor and floor fill of Structure 1 indicate the final use of this structure was related to something other than habitation. Stratum 3 contained the highest amount of artifacts recovered from the site. The majority of the artifacts associated with Stratum 3 were suspended within the layer of burned superstructure. This suggests these items were deposited while or very shortly after the structure burned. This layer appears to reflect behavior related to abandonment processes. Intentionally filling the structure with debris and burning it would essentially make the footprint uninhabitable and its contents unuseable for subsequent occupants.

Area 2 was an associated activity area that contained three deflated thermal features. These features were similar in size, construction, and were evenly spaced apart. Based on the morphological attributes and placement, these features appear to be contemporaneous. Area 3 was a refuse area containing charcoal-stained soil and abundant fire-cracked rock (Fig. 14). This deposit appears to have formed through multiple depositional events related to the use and maintenance of Area 1 and Area 2.

LA 127578 appears to have been geared toward intense foraging and resource processing activities. Of the wide variety of botanical remains identified,*Artemisia* or sage pollen was identified from the grinding surface of FS 178 (Appendix 2). Among its potential uses, sage can be processed to dye protein fibers. The identification of sage, a potential protein fiber dye, combined with a basalt scoria abrader and medium to large mammal remains, suggests one function of LA 127578 was to process faunal remains including hides. In addition, the identification of a structure, an array of feature types, and formal use of space suggest this location was occupied for an extended period of time.

THE RESEARCH DESIGN

LA 127576 and LA 127578 were expected to have potential for addressing research problems related to chronology, subsistence, and mobility for the Archaic and early Puebloan inhabitants of the Northern Rio Grande. In this section excavation and artifact data are analyzed at the site and intersite level. These data will be compared to data collected from projects conducted in the surrounding area.

Chronology

Chronology was examined by collecting temporally diagnostic artifacts and chronometric samples from features or other occupation context. Survey data indicated that LA 127576 and LA 127578 were multicomponent artifact scatters with thermal features occupied from 1800 B.C. to A.D. 1500. The primary question was when were LA 127576 and LA 127578 occupied?

LA 127576

Chronometric data from LA 127576 was limited to temporally diagnostic artifacts, despite the excavation of two thermal features. Diagnostics collected include three ceramic and one ground stone artifact. The ceramics are from the general site surface and the ground stone mano was loosely associated with a Feature 1, a fire-cracked rock concentration. The mano provides ambiguous temporal information. One-hand manos are often attributed to Archaic occupations, but have also been recovered from Pueblo village sites (Phagan 1993; Stubbs and Stallings 1953). While it is most likely the mano is a by-product of an Archaic hunter- gather occupation, it may have been recycled by later Puebloan foragers.

The ceramic assemblage consists of two jar body sherds and one bowl body sherd. These sherds may or may not be temporally associated with the dispersed lithic scatter that comprises the majority of the artifact assemblage. A brown ware jar body displayed a coarse paste with coarse white crushed igneous temper. Ceramics displaying similar qualities are often identified as El Paso Brown Wares. In general, brown wares are most common on Developmental period sites (A.D. 600-1200) in the Northern Rio Grande (Allen and McNutt 1955; Condie 1987, 1996; Hammack et al. 1983; Peckham 1957).

A Santa Fe Black-on-white bowl body displayed a fine and gray color paste with coarse, white sandstone or ash inclusions similar to sherds classified as Pindi Black-on-white. Santa Fe and Pindi Black-on-white were produced during the Coalition period (A.D. 1200 to A.D. 1350) in the Northern Rio Grande. The interior surface was extensively spalled. Ceramics displaying similar spalled surfaces have been identified with pottery-firing features (Lakatos 1996; Post and Lakatos 1995; Purcell 1993). However, spalled surfaces could also be the result of exfoliation, trampling, or freeze-thaw action.

A single Tewa Polychrome jar body was recovered that displayed an oxidized paste with tuff and sand temper. Tewa Polychrome ceramics were manufactured during the eighteenth and nineteenth centuries in the Northern Rio Grande.

Excavation of the two deflated features did not yield charcoal samples suitable for 14C dating. The poor state of preservation negates the use of comparative studies to glean temporal information. The chipped stone assemblage consists mainly of debitage and cores which primarily reflects raw material procurement and the early stages of core reduction. The surface obsidian is poorly suitable for obsidian hydration dating. Sites that display similar assemblages are tentatively assigned to the Puebloan period (A.D. 600-1600) based on the lack of formal tool production (Post 1996b).

The artifact assemblage is consistent with the expectations that LA 127576 was repeatedly occupied for low-level procurement of locally available resources. Partial vessels may have been brought from villages to foraging camps to serve as expedient tools or temporary containers. Such tools may have been left at these foraging locations and reused in subsequent visits. Contemporaneous village sites that may account for these deposits include the Tesuque By-Pass site (LA 3294), Arroyo Negro (LA 114), Pindi (LA 1), and historic occupations of Santa Fe.

LA 127578

Excavations at LA 127578 were successful in recovering data useful for addressing the research questions outlined in the data recovery plan. Chronometric dates were obtained from two internal features, Feature 9 and Feature 11. Feature 11 yielded a two-sigma date of 1280 B.C. to 815 B.C. while Feature 9 yielded a two-sigma date of 1505 B.C. to 1375 B.C. Results of the radiocarbon samples are reported in Appendix 3. These dates do not statistically overlap suggesting that the structure may have been reoccupied. In addition, the intramural area is 6 sq m above the mean intramural space reported for other contemporaneous structures in the area (Table 22). The large amount of intramural space may be the result of two superimposed structures supporting the chronometric data. On the other hand, the internal morphology, posthole pattern, and abandonment evidence indicate this was a single structure with one occupation. Discrepancies in the chronometric data versus morphological and contextual data indicate Archaic habitation sites have complex occupation histories. This complexity makes it difficult to isolate individual temporal components.

TABLE 22. MIDDLE TO LATE ARCHAIC STRUCTURE MORPHOLOGY IN THE SANTA FE AREA

Project	Site No.	Structure No.	Shape	Depth (m)	Area (m^2)
Santa Fe Relief Route West (Post 1997)	LA 61293	1	Circular	.18	8.30
Tierra Contenta (Schmader 1994)	LA 54749	1	Circular	.08	12.57
		2	Circular	.25	15.90
	LA 54751	3	Subrectangular	.12	7.07
		5	Circular	.20	3.14
North Ridgetop Rd.	**LA 127578**	**1**	**Oval**	**.20**	**16.40**
Mean				.17	10.56
Std Deviation				.06	5.27

Other projects conducted in the surrounding area also identified structural remains contemporaneous to those at LA 127578 (see Table 22). By most accounts these structures appear on the surface as diffused charcoal stains associated with a dispersed artifact scatter and some fire-cracked rock. Seeking the limits of the charcoal-stained soil typically requires the removal of several cubic meters of colluvial overburden. Structure limits are often amorphous and may show evidence of a superstructure in the form of postholes. There is considerable variability in the number and types of internal features. This variability may be related to the duration of occupation, site function, or number of occupants.

Identification of formal structures with an array of internal features indicates some Archaic populations, or a segment of the population, may hold up in locations that have increased economic wealth or diversity. This pause in mobility may be related to favorable environmental conditions, logistical preparation time, or the momentary congregation of several groups. Whatever the reasons, the construction of durable, stationary shelters and the extended occupation at one location leads to more formal spacial organization.

Archaic populations are traditionally viewed as being highly mobile. The identification of a habitation area, activity area, and discard area suggests that Archaic populations more formally organized their space when residing, or intending to reside, at a single location for an extended period of time. The pres-

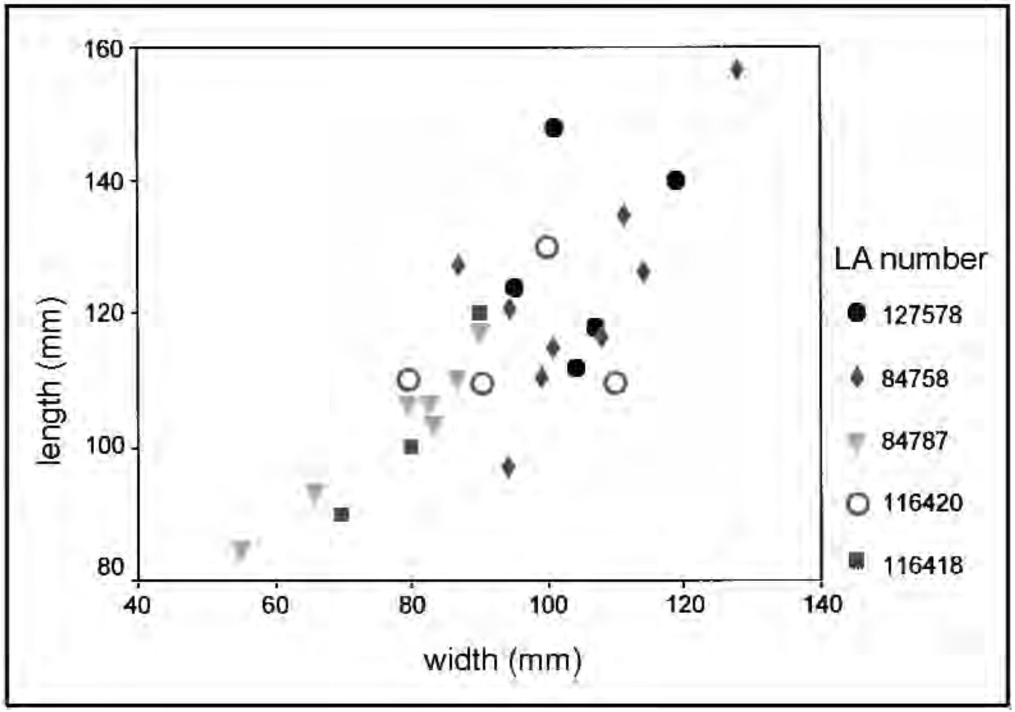

Figure 15. LA 127578, one-hand mano comparison for Middle to Late Archaic sites in the Santa Fe area.

ence of a structure, with numerous floor features and considerable intramural space, combined with extramural features and a midden, suggests some Archaic inhabitants of the Northern Rio Grande maintained a settlement plan for extended occupations, prior to the use of cultigens. The development and use of organized space, combined with the knowledge of procuring and processing an array of biotic resources, suggests that the use of cultigens may not have been necessary or advantageous for another 2,000 years.

Subsistence data were obtained from carbonized plant remains, pollen identification, and faunal remains. Relative to other projects in the area the botanical assemblage is robust and diversified. The stable environment provided by the structure and internal features is believed to have enhanced the preservation of botanical remains. In addition, these studies identified several types of grinding implements used in processing these resources.

Botanical materials identified at LA 127578 are similar to what has been identified from contemporaneous sites in the area (Kennedy 1998; Post 1996b; Schmader 1994a), with one exception. This exception is the identification of Artemisia or sage identified on the grinding surface of FS 178, a metate (Appendix 2). This item was recovered from the surface of the structure, grinding side down. Although sage is not commonly cited as a food source, it is cited as a medicinal herb (Dunmire and Tierney 1995:152). Sage can be prepared in several ways including grinding to make a paste, boiling to make tea or to inhale the steam, or chewing the leaves directly.

Alternatively, sage can be used as a dye for protein fibers such as wool, pelts, or hides, and produces a soft yellow to gold color. Although sage remains green and may be used year-round (Bryan and Young 1940:63), the brightest colors are achieved by using the yellow blossoms available in early September combined with raw alum (calcium carbonate) and mordants (ash) (Bliss 1993:212). The identification of raw Artemisia pollen from the grinding surface of the metate suggests the sage flower was included at the time of processing.

Faunal data are scant and consist of five burned and unburned bone fragments derived from medium to large size mammals. The absence of small mammals or complete elements in the assemblage suggests large game processing was conducted on site. Game processing is also suggested by the recovery of a basalt scoria abrader (Fig.13b). These tools are used in processing animal hides to remove hair and soft tissue.

Ground stone was well represented in the LA 127578 artifact assemblage. Manos, in particular, may be useful in contributing additional information about site function. Mano dimensions have been used to identify functional patterns for Archaic period sites (Post 1998). Post (1998) compared mano dimensions among Rancho Viejo, Las Campanas, and Arroyo Hondo Pueblo. The study showed that smaller and narrower one-hand manos were associated with nonresidential sites and that larger and thicker one-hand manos were more commonly associated with residential or habitation sites. One-hand mano dimensions from LA 127578 were compared to a sample of 23 one-hand manos, from Archaic sites with different functional interpretations, recovered during the Rancho Viejo and Las Campanas archaeological projects (Post 1996b, 1998). One-hand manos recovered from LA 127578 tend to be large, corresponding strongly with those recovered from LA 84758, another Archaic habitation site (Fig. 15).

The identification of large one-hand manos at Archaic residential sites may be related to their increased efficiency in processing activities. In addition, Archaic sites that were occupied for extended periods of time may have required ground stone tools which could be used for a variety of processing activities. Furthermore, the use and subsequent discard of large one-hand manos suggests these tools were selected because they were durable, efficient, yet expedient.

Data recovery investigations at LA 127578 have provided useful information on the middle to late Archaic inhabitants of the Santa Fe area. These studies have presented evidence that the occupants of this site planned to reside at this location for an extended period of time and had a diverse subsistence-based economy. Continued research into the organization and site structure of the middle to late Archaic periods may provide insight into the organization and site structure of later periods. Research conducted at LA 127578 indicates that the basic organizational framework for the later use of agriculture and "pueblo" sedentism may have evolved from established and enduring settlement patterns developed during the middle and late Archaic periods.

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APPENDIX 1. BOTANICAL REMAINS FROM AN ARCHAIC STRUCTURE: LA 127578, RIDGETOP ROAD, SANTA FE, NEW MEXICO

Molly S. Toll and Pamela J. McBride[1]

INTRODUCTION AND METHODS

Proveniences sampled for botanical remains were located inside a bean-shaped Archaic structure, dating to about 995 B.C. The floor, cut about 30 cm into the prehistoric ground surface, is not really deep enough to qualify this dwelling as a pit structure, but apparently provided sufficient protection for better-than-average preservation of perishables. Archaic sites in the Santa Fe area are generally shallow and eroded, and notorious for abysmal preservation of prehistoric floral debris (Post, pers. comm.). Floor fill and five interior features at LA 127578 produced carbonized seeds in every sample, with an average density of 72.1 seeds per liter of soil. Unsampled extramural proveniences included a midden and several fire-cracked concentrations.

LA 127578 is located in piñon-juniper woodland (Brown 1982). Plant taxa that occur in this zone include piñon, juniper, gray oak, rabbit brush, snakeweed, big sagebrush, four-wing saltbush, prickly pear and cholla cacti, and a variety of weedy annual and grass species. The flotation assemblage is dominated by a short list of widely used economic annuals. Wood use is focused completely on coniferous species, with none of the panoply of local shrubs making an appearance.

The six soil samples collected during excavation were processed by Tess Fresquez using the simplified "bucket" version of flotation (see Bohrer and Adams 1977). The volume of each sample was measured using a graduated cylinder (volume ranged from 2.7 to 4.6 liters, with an average of 3.7 liters). Each soil sample was immersed in a bucket of water, and a 30-40 second interval allowed for settling out of heavy particles. The solution was then poured through a fine screen (about 0.35 mm mesh) lined with a square of "chiffon" fabric, catching organic materials floating or in suspension. The fabric was lifted out and laid flat on coarse mesh screen trays, until the recovered material had dried. Each sample was sorted using a series of nested geological screens (4.0, 2.0, 1.0, 0.5 mm mesh), and then reviewed under a binocular microscope at 7-45x. As the "floated" samples were large and contained numerous seeds, it was necessary to subsample the smallest screen sizes in several of the samples. Data tables include the actual number of seeds recovered, and a calculated "seeds per liter," which takes into account both subsampling and different sample volumes.

Only the flotation sample from Feature 10 contained sufficient charcoal to identify a sample of 20 pieces (10 from the 4 mm screen, and 10 from the 2 mm screen). A smaller sample was examined from Feature 11. Each piece was snapped to expose a fresh transverse section, and identified at 45x. Charcoal specimens from Features 7, 9, and 11 were examined prior to submission for radiocarbon dating. Here, selection was adapted to securing a minimal sufficient sample (the objective was 5 g) with the fewest pieces, rather than aiming to examine both large and small pieces.

RESULTS AND DISCUSSION

Every single seed encountered at LA 127578 was carbonized. This is an especially unusual pattern for an old and relatively shallow site. Many of the seeds exhibited a consistent burning configuration: seeds were expanded like an accordion in their thickness dimension, with most or all of the seed coat popped off. The "popped" seed coats were also recovered. It would be interesting to experiment with seed maturity or moisture content as well as temperature and other burning conditions, to replicate this burning pattern.

[1] Museum of New Mexico, Office of Archaeological Studies, Technical Series #76.

APPENDIX 1.1. FLOTATION RESULTS, LA 127578 (RIDGETOP ROAD)

	Structure 1-2 Floor fill FS 178	Feature 9 Hearth FS 179	Feature 7 Hearth FS 180	Feature 10 Hearth FS 185	Feature 11 Thermal Pit FS 186	Feature 8 Storage Pit FS 187
Goosefoot	20/ 7.5	33/ 20.9	137/ 148.9	63/ 22.0	5/ 3.0	40/ 40.0
Seepweed		5/ 2.4	4/ 4.3	6/ 2.0	5/ 3.0	2/ 1.8
Pigweed	1/ 0.4	5/ 1.7	15/ 13.7	1/ 0.3	1/ 0.6	1/ 0.9
Cheno-ams	15/ 5.6	19/ 12.3	49/ 53.3	39/ 21.0	8/ 4.2	48/ 51.7
Purslane			1/ 1.1		1/ 0.6	
Dropseed grass			1/ 1.1			
Hedgehog cactus	1/ 0.4					
Juniper	1/ 0.4					
Unknown 9208			3/ 0.7			
Unknown 9209		1/ 0.5				
Unidentifiable seeds	1/ 0.4	5/ 2.4	1/ 0.2	1/ 1.3		2/ 4.4
Total burned taxa	4	4	6	3	3	3
Total seeds/liter	14.3	40.2	222.2	46.6	11.4	98.8

a/b: a = the actual number of seeds recovered; b = estimated number of seeds per liter of soil
All seeds were carbonized.

Goosefoot seeds were the most frequently encountered taxon (56 percent of all seeds; Appendix 1.1). Seeds classified as cheno-ams lacked seed coats or were damaged to the point where they could not be differentiated between goosefoot and pigweed. Very few pigweed seeds were noted (present in all samples, but accounting for only 4 percent of all seeds). Goosefoot, pigweed, and cheno-ams together account for 94 percent of all seeds at the site. Other taxa encountered include seepweed (another weedy annual from the goosefoot family), and relatively rare occurrences of purslane, dropseed grass, hedgehog cactus, juniper, and two unknowns. All of these taxa are harvestable from mid to late-summer in the Santa Fe area, and have been recovered widely from prehistoric sites in the Rio Grande Valley and Colorado Plateau.

All charcoal at LA 127578 was coniferous, and largely juniper (Appendix 1.2). Piñon was more frequent in two of the central hearths, Features 9 and 10. A similar pattern held true at the nearby project of the Northwest Santa Fe Relief Route (McBride and Toll 1999, tables 4, 6). In that project, juniper dominated in interior locations, and piñon in extramural thermal features.

The highest densities of cultural seeds were found in the three hearths (Features 7,9,10), and in the

APPENDIX 1.2. SPECIES COMPOSITION OF CHARCOAL, LA 127578, RIDGETOP ROAD

	Juniper	Piñon	Undeter. Conifer	Total
Feature 7 Hearth, FS 180 [C14]	0.61g	0.08g	0.07g	0.76g
Feature 9 Hearth, FS 194 [C14]	0.22g	0.84g	0.08g	1.14g
Feature 10 Hearth, FS 185 [flot]	0.05g	0.09g	–	0.14g
Feature 11 Parching Basin, FS 186 [C14]	2.37g	<.01g	0.12g	2.49g
Feature 11 Parching Basin, FS 186 [flot]	0.07g	–	–	0.07g
Total	3.32g	1.01g	0.27g	4.60g

storage pit (Feature 8; Appendix 1.3). Feature 8 walls showed no signs of burning, but I suspect the fill to be secondary deposits from thermal features. Feature 7 stands out as having a particularly high density of economic seeds, as well as the greatest variety of types. Feature 7 also had a couple of intriguing links to Feature 11 (a thermal pit with less intense burning, perhaps for parching rather than high-heat processing such as boiling and roasting). While Features 9 and 10 had fuel that was high in piñon, Feature 7 was like Feature 11 with a predominance of juniper. Features 7 and 11 also shared the only occurrences of purslane.

APPENDIX 1.3. PLANT REMAINS COMPARED BY PROVENIENCE TYPE

FLOTATION	Floor Fill 1 flot. sample [2.7 liters]	Hearths Features 7,9,10 3 flot. samples [11.8 liters]	Parching hearth Feature 11 1 flot. sample [3.4 liters]	Storage Pit Feature 8 1 flot. sample [4.5 liters]
ANNUALS	goosefoot pigweed	goosefoot pigweed purslane seepweed	goosefoot pigweed purslane seepweed	goosefoot pigweed seepweed
PERENNIALS	hedgehog cactus juniper			
GRASSES		dropseed		
Total taxa [Average per sample]	4	5 [Fea. 7= 6 Fea. 9,10 = 3.5]	4	3
Average density [seeds/liter]	14.3	103.0 [Fea. 7 =222.2 Fea. 9,10 = 43.4]	11.4	98.8
WOOD	No samples	2 C-14 samples, 1 flot. sample 2.04g	1 C-14 sample, 1 flot. sample 2.56g	No samples
% Juniper		43% [Fea. 7 = 80% Fea. 9,10 = 21%]	98%	
% Piñon		50% [Fea. 7= 11% Fea. 9,10 = 73%]	--	
% Undetermined conifer		7%	2%	

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APPENDIX 2. POLLEN ANALYSIS OF A SINGLE POLLEN WASH SAMPLE FROM A METATE, SITE LA 127578, SANTA FE COUNTY, NEW MEXICO

Richard G. Holloway, Ph.D.[1]

A single pollen wash sample was sent for analysis to Quaternary Services. This sample was washed from a metate recovered during excavations at LA 127578, in Santa Fe County. The site is an aceramic site containing a pit structure, an extramural activity area, three fire-cracked rock concentrations, and a possible midden. The site was tentatively dated to the late Archaic-early Developmental period (800 B.C.-A.D. 400). The site was excavated by personnel of the Office of Archaeological Studies, Museum of New Mexico, in conjunction with MNM Project 41.684. The site is at an elevation of 7,300 ft.

Methods and Materials

Pollen Extraction Methods

Chemical extraction of the pollen wash sample was conducted at the Palynology Laboratory at Texas A&M University, using a procedure designed for semi-arid Southwestern sediments. The method, detailed below, specifically avoids use of such reagents as nitric acid and bleach, which have been demonstrated experimentally to be destructive to pollen grains (Holloway 1981).

The pollen wash sample, in liquid form, was washed from a measured area of the metate of 337.488 cm^2. 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 sample was treated with 35 percent hydrochloric acid (HCl) overnight to remove carbonates and to release the *Lycopodium* spores from their matrix. After neutralizing the acid with distilled water, the sample was allowed to settle for a period of 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 5 seconds. The suspended fine fraction was decanted through 150F 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 revolutions per minute (rpm).

The fine fraction was treated with concentrated hydrofluoric acid (HF) overnight to remove silicates. After completely neutralizing the acid with distilled water, the sample was 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 sample was dehydrated in glacial acetic acid in preparation for acetolyis. Acetolysis solution (acetic anhydride: concentrated sulfuric acid in 9:1 ratio) following Erdtman (1960), was added to each sample. Centrifuge tubes containing the solution were heated in a boiling water bath for approximately 8 minutes and then cooled for an additional 8 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, yet from periodic examination of the residue, did not remove

[1]Quaternary Services Technical Report Series Report Number 2000-12

fossil palynomorphs.

Heavy density separation ensued using zinc bromide ($ZnBr2$), 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 sample was washed repeatedly in distilled water until neutral. The residue was 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 sample was mixed with a small quantity of glycerine and allowed to stand overnight for evaporation of the TBA. The storage vial was capped and returned to the Museum of New Mexico at the completion of the project.

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 either 400x or 1,000x oil immersion to obtain a positive identification to either the family or genus level.

Abbreviated microscopy was performed on the 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.

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 = area of metate sampled (cm)

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. The use of "pollen concentration values" are preferred because it accentuates 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 (1981), a pollen concentration value below 1,000 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; Bryant and Holloway 1983). 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 (about 70 percent) Angiosperm pollen has either 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 that includes 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 contains those grains with spine length greater than or equal to 2.5F while the low spine group have spines less than 2.5: in length (Bryant 1969; Martin 1963). *Artemisia* pollen is identifiable to the genus level because of its unique morphology of 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 includes 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 (about 80F), 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 is dependent on the presence of the single pore. Only complete or fragmented grains containing this pore were tabulated as members of the 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 for the presence of flowers at the sampling locale (Bohrer 1981). This enables the analyst to infer possible human behavior.

Finally, 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 both 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 those samples where the total pollen concentration values are approximately 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 indeterminate category), counting was also terminated after abbreviated microscopy even if the pollen concentration values slightly exceeded 1,000 grains/g.

RESULTS AND DISCUSSION

The metate contained a total pollen concentration value of 40 grains/cm2. This was based on a pollen sum of only 34 grains. Appendix 2.1 also contains the pollen concentration values per artifact. *Pinus* (7 grains/cm2) pollen was fairly low with low amounts of Cheno-am (16 grains/cm2), Poaceae (1 grains/cm2), high spine Asteraceae (9 grains/cm2), and *Artemisia* (5 grains/cm2). The total calculated number of grains on the artifact were somewhat high with a total amount of 13,500 grains. *Pinus* contained 2,382 grains with 5,559 grains of Cheno- am, 397 grains of Poaceae, 2,176 grains of high spine Asteraceae, and 1,588 grains of *Artemisia.*

The metate was located upside down on the floor of the structure, which probably acted to protect the grinding surface from deposition of the normal pollen rain. *Pinus* pollen likely is background pollen and does not reflect a processing activity. *Pinus* pollen is produced in structures called strobili which are located in clusters of 7-10+ on the terminal branch ends. Each strobilus produces in excess of 1 million pollen grains and thus the presence of this taxon is not unexpected. Alternatively, small amounts of *pinus* pollen could have been deposited during processing of pine nuts, particularly piñon, but the larger total concentration values from the artifact would argue for a background deposition.

The other taxa present on the metate are all local components of the vegetation. These taxa, including Poaceae, Cheno-am, high spine Asteraceae, and *Artemisia,* while locally present, can also be used economically. I suspect that the pollen concentration values of these taxa may indicate processing of at least some of these taxa. Given the presence of the metate in an inverted position on the floor and within a pit structure, the accidental deposition of a local pollen assemblage is unlikely. Rather, Poaceae, Cheno-am, and Asteraceae pollen were probably present as the result of grinding activities of gathered plant materials.

While *Artemisia* was not noted in the local plant community, this taxon is a common component of the vegetation, even at this elevation of 7,300 ft. At this elevation, the canopy is more closed and the arboreal component more common than at lower elevations. *Artemisia* is also adapted for wind pollination. *Artemisia* is more commonly used either medicinally or ceremonially (Dunmire and Tierney 1995) and its presence within a pit structure may suggest storage of these plants within the pit structure. The active ingredients in sagebrush are contained within the leaves of the plant and it is possible that these plants may also have been processed on the metate.

Surprisingly, no cultivated plant materials were obtained from this artifact, at least from the pollen assemblage. Given the date of the occupation (Pueblo I) some corn materials might logically be expected. The macrobotanical remains may contain some cultivated materials but the indications are that these are absent. This might suggest a short-term occupation of the site for a particular purpose or function, but from the pollen assemblage, there is no clear indication of seasonality of the site.

CONCLUSIONS

All of the taxa obtained from the pollen wash of the metate are locally available. The indications from this pollen wash are that the metate was being used to process a variety of gathered plant materials. There

APPENDIX 2.1. RAW POLLEN COUNTS AND CONCENTRATION VALUES FOR LA 127578, SANTA FE COUNTY, NEW MEXICO

FS#	Provenience	Locus/Unit	Level	Feature	Type	Period	Age	*Pinus*	Poaceae	Cheno-am
Raw Counts										
178	N94.54/E98.62	pp 65	98 cmbd	1	ground stone metate, pollen wash	Late Archaic-early Developmental	800 B.C.-A.D.400	6	1	14
Concentration Values grains/cm^2										
178	N94.54/E98.62	pp 65	98 cmbd	1	ground stone metate, pollen wash	Late Archaic-early Developmental	800 B.C.-A.D.400	7	1	16
Concentration Values grains/artifact								2382	397	5559

FS #	Asteraceae hs.	*Artemisia*	Indeterminate	Sum	Total	Marker	% Indeterminate	Trans	Tot trans	Mark/Slide	Lycopodium added
Raw Counts											
178	8	4	1	34	40	102	3	4	24	612	40500
Concentration Values grains/cm^2											
178	9	5	1	34	40	102	3	4	24	612	40500
Concentration Values grains/artifact											
	3176	1588	397		13500						

FS #	Wt/Area	Max. Potential Concentration
178	337.488	
Concentration Values grains/cm^2		
178	337	1961.000

should also have been a somewhat more diverse plant community at lower elevations so the reason for this particular occupation is unknown. Perhaps this indicates the collection and processing of particular taxa, but this cannot be determined based on the pollen assemblage recovered.

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APPENDIX 3. RADIOCARBON DATING ANALYSIS

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: est. C13/C12=-25:lab. mult=1)

Laboratory number: **Beta-142608**

Conventional radiocarbon age[1]: **2840±90 BP**

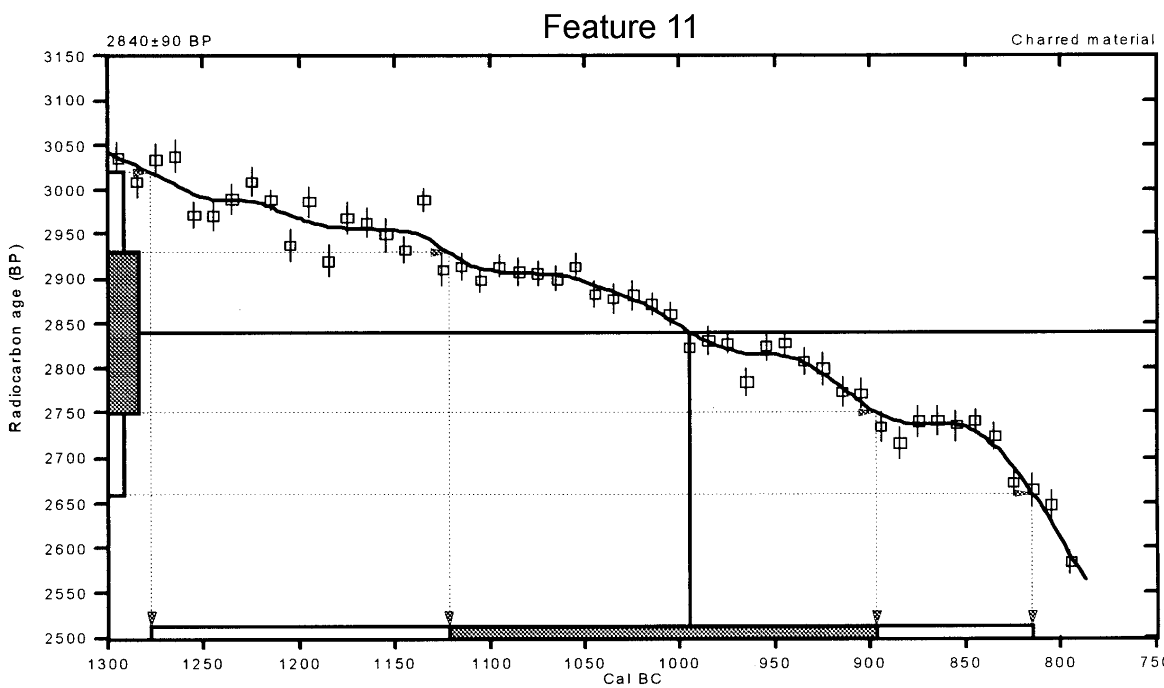
2 Sigma calibrated result: (95% probability) **Cal BC 1280 to 815 (Cal BP 3230 to 2765)**

[1] C13/C12 ratio estimated

Intercept data

Intercept of radiocarbon age with calibration curve: Cal BC 995 (Cal BP 2945)

1 Sigma calibrated result: (68% probability) Cal BC 1120 to 895 (Cal BP 3070 to 2845)



References:

Database used

INTCAL98

Calibration Database

Editorial Comment

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INTCAL98 Radiocarbon Age Calibration

Stuiver, M., et. al., 1998, Radiocarbon 40(3), p1041-1083

Mathematics

A Simplified Approach to Calibrating C14 Dates

Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

Beta Analytic Radiocarbon Dating Laboratory

4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • E-Mail: beta@radiocarbon.com

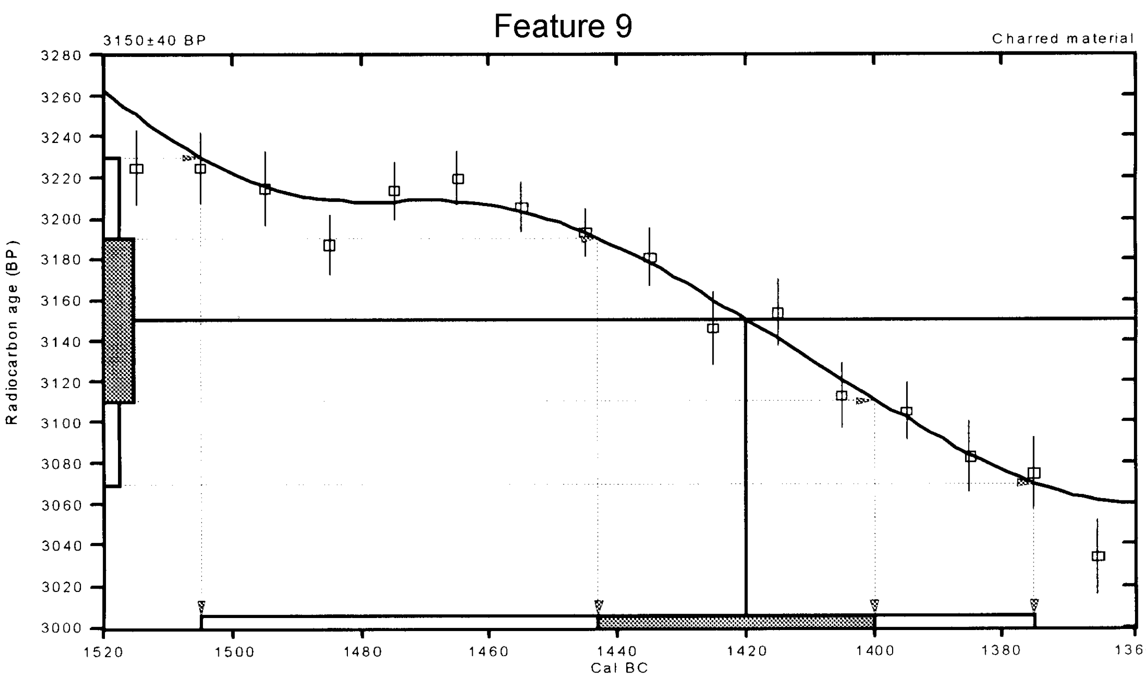
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-21.3:lab. mult=1)

Laboratory number:	**Beta-142609**
Conventional radiocarbon age:	**3150±40 BP**
2 Sigma calibrated result: (95% probability)	**Cal BC 1505 to 1375 (Cal BP 3455 to 3325)**

Intercept data

Intercept of radiocarbon age with calibration curve:	Cal BC 1420 (Cal BP 3370)
1 Sigma calibrated result: (68% probability)	Cal BC 1445 to 1400 (Cal BP 3395 to 3350)



References:

Database used

INTCAL98

Calibration Database

Editorial Comment

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INTCAL98 Radiocarbon Age Calibration

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Mathematics

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