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OFFICE OF ARCHAEOLOGICAL STUDIES

PREHISTORIC AND HISTORIC OCCUPATION OF LOS ALAMOS AND GUAJE CANYONS: DATA RECOVERY AT THREE SITES NEAR THE PUEBLO OF SAN ILDEFONSO

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ADMINISTRATIVE SUMMARY

Between November 15, 1990, and January 11, 1991, the Office of Archaeological Studies of the Museum of New Mexico conducted archaeological data recovery at three sites along NM 502 in Santa Fe Country, New Mexico. This project was conducted at the request of the New Mexico State Highway and Transportation Department; all sites were on land owned by the Pueblo of San Ildefonso and administered by the USDI Bureau of Indian Affairs. The project was funded by the Federal Highway Administration.

Data recovery investigations were aimed at recovering information relevant to local prehistory and history. The Pedro Sánchez site (LA 65005) was a Spanish Colonial rancho occupied in the mid-eighteenth century. Most of this site was outside project limits and was not excavated; included in the part investigated were a trash pit and associated scatter of surface artifacts. The San Ildefonso Springs site (LA 65006) was a late Archaic camp that also functioned as a biface manufacturing locale. While a large part of this site was investigated, much of it was outside project limits and was only cursorily examined. Classic period Pueblo and historic components also exist at the San Ildefonso Springs site, but are mostly outside project limits and were not studied in detail. Finally, the FH site (LA 65013) was a Classic period Pueblo fieldhouse and associated trash scatter that was mostly within project limits. This study is felt to have exhausted the potential of the parts of these sites within project limits to yield information relevant to local prehistory and history.

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ACKNOWLEDGMENTS

The successful completion of an archaeological project usually hinges on many more people than are listed on the cover of a report, and this endeavor is no exception. The authors would like to express their appreciation to all who participated in this project–thank you everyone, for working through those cold snowy days, suffering through the artifact analysis, and making this a successful project. Stephen C. Lentz and Jeffrey L. Boyer graciously stepped in and acted as substitutes for the senior project director when he was temporarily called away by other duties. Our field assistants were Laurie Evans and Vernon Lujan. The crew of laborers included Patrick Marian, Timothy Martínez, Marcy Snow, and Ivan Trujillo. Laurie, Vern, and Marcy also helped with the laboratory analysis. The ceramic analysis was supervised by Daisy F. Levine, and faunal analysis was done by Susan Moga and supervised by Linda Mick-O'Hara. Mollie Toll examined the charcoal, macrobotanical, and flotation samples. Historic artifacts were examined by Guadalupe Martinez, and Lynn Drake provided important geomorphological guidance. We would especially like to thank Sam Sweezy of Santa Fe and Dean Maret of Los Alamos who volunteered their services and helped us move a lot of dirt. Maps and illustrations were produced by Ann Noble and Robin Gould edited the manuscript.

Some of our specialized analyses were completed by consultants. Richard G. Holloway of the Castetter Laboratory for Ethnobotanical Studies examined pollen samples. Radiocarbon samples were run by Beta Analytic, Inc. This project also benefitted from the expertise of several archaeologists and historians from outside the OAS who were generous with their time and ideas and contributed greatly to the outcome of this study. In particular, we would like to thank Cordelia Snow for allowing us to bounce ideas off of her, and for the information and expertise she shared with us. Discussions with Jonathan Batkin and David Snow helped formulate ideas concerning the dating of the Tewa polychrome series, and Dave directed us to the documents that allowed identification of LA 65005 as the Pedro Sánchez rancho. José Antonio Esquibel graciously shared his research on Juana Luján and others in the San Ildefonso area, adding substantially to our understanding of the relationship between those families. Rick Hendricks of the Vargas Project furnished unpublished (at the time) information on Pedro Sánchez and his family.

Our special thanks go to the New Mexico State Highway and Transportation Department for their funding and assistance. In particular, we would like to thank William Taylor and Steven Koczan of the Environmental Section.

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PART 1. INTRODUCTION AND PROJECT BACKGROUND

CHAPTER 1. INTRODUCTION

James L. Moore

At the request of the New Mexico State Highway and Transportation Department (NMSHTD), the Office of Archaeological Studies of the Museum of New Mexico (OAS) conducted data recovery investigations at three sites along NM 502 in Santa Fe County, New Mexico (Fig. 1.1). Portions of LA 65005, LA 65006, and LA 65013 that extended into the NM 502 right-of-way were excavated. The impetus for these investigations was the rebuilding of NM 502 (formerly NM 4), including a new interchange at its junction with NM 30. The right-of-way was surveyed in 1987 (Moore and Levine 1987), and sites that extended into the right-of-way were tested in 1989 (J. Moore 1989). Three sites were found to contain deposits or features that might contribute information concerning local prehistory and history, and it was suggested that those data should be recovered through excavation (J. Moore 1993). This report presents the results of our investigations at those sites.

Fieldwork for the data recovery phase was conducted between November 15, 1990, and January 11, 1991. James L. Moore was project director during the field phase, and supervised excavations at LA 65006; fieldwork at LA 65005 and LA 65013 was supervised by Joan K. Gaunt. Moore and Gaunt co-directed the project during laboratory analysis and report preparation. David A. Phillips was principal investigator until he left the OAS, at which time Timothy D. Maxwell assumed those duties. Laboratory analyses were supervised by James L. Moore (chipped and ground stone artifacts), Daisy F. Levine (pottery), Linda Mick-O'Hara (bone), and Mollie S. Toll (floral). The few historic artifacts recovered were examined by Guadalupe Martinez. All three sites were on Pueblo of San Ildefonso land and were excavated under USDI Bureau of Indian Affairs permit no. BIA/AAO-91-001 (expired 1-31-91) and a letter of permission from the Pueblo of San Ildefonso dated 2-27-89.

Our study area was on the south edge of the Pajarito Plateau in Los Alamos Canyon, which is drained by Totavi Creek. The confluence of Totavi Creek and Guaje Canyon occurs just west of our sites. Two of the excavated sites reflected prehistoric occupations in the Los Alamos-Guaje Canyon area. The San Ildefonso Springs site (LA 65006) was an open-air locale that contained stratified Late Archaic deposits overlain by a veneer of Pueblo and historic period remains. The two later components were mostly outside project limits, and our investigations focused on the Archaic deposits. One of the main activities performed during that occupation was the production of large bifaces, which appear to have been manufactured to serve as part of a curated tool kit. A considerable amount of debris from this activity was recovered and analyzed, providing detailed information about site structure and formation processes. Other classes of cultural materials indicate that this site had a residential function in addition to being a tool manufacturing locale.

The FH site (LA 65013) was a Classic period Pueblo fieldhouse containing the remains of an ephemeral structure, a shallow associated midden, and a scatter of surface artifacts. A rather limited array of tasks appear to have been performed at this locus, which was probably occupied by people tending crops in its immediate vicinity. Analysis of the assemblage from LA 65013 provided information on the types of activities carried out at this limited occupation site, and how it fit into the general settlement system.

One historic site was also investigated. The Pedro Sánchez site (LA 65005) partly extended into construction limits, and excavations were conducted in that area. This site contains the remains of a mid-eighteenth-century Spanish Colonial rancho. At least two trash pits and the probable remains of a structure exist outside construction limits. The surface expressions of these features were examined, but they were not excavated. Features investigated within construction limits included a shallow trash pit and a scatter of surface artifacts. While archaeological remains were important to the interpretation of this site, some of the most critical information was provided by documents generated during a series of lawsuits filed in the eighteenth and nineteenth centuries concerning Spanish land grants in this area, which are on file at the New Mexico State Records Center and Archives in Santa Fe.

The excavation of these sites and the analysis of materials recovered from them were aimed at answering a series of questions posed in the data recovery plan (J. Moore 1989). The main question proposed was:

> What can these sites tell us about patterns of use of this area during three different periods? Were there any similarities among these sites or did varying social, economic, and political characteristics result in different patterns of use?

Separate models were generated for each site, but all were aimed at illuminating how they functioned in their respective settlement and subsistence systems. Artifact analyses were tailored to provide data that would help

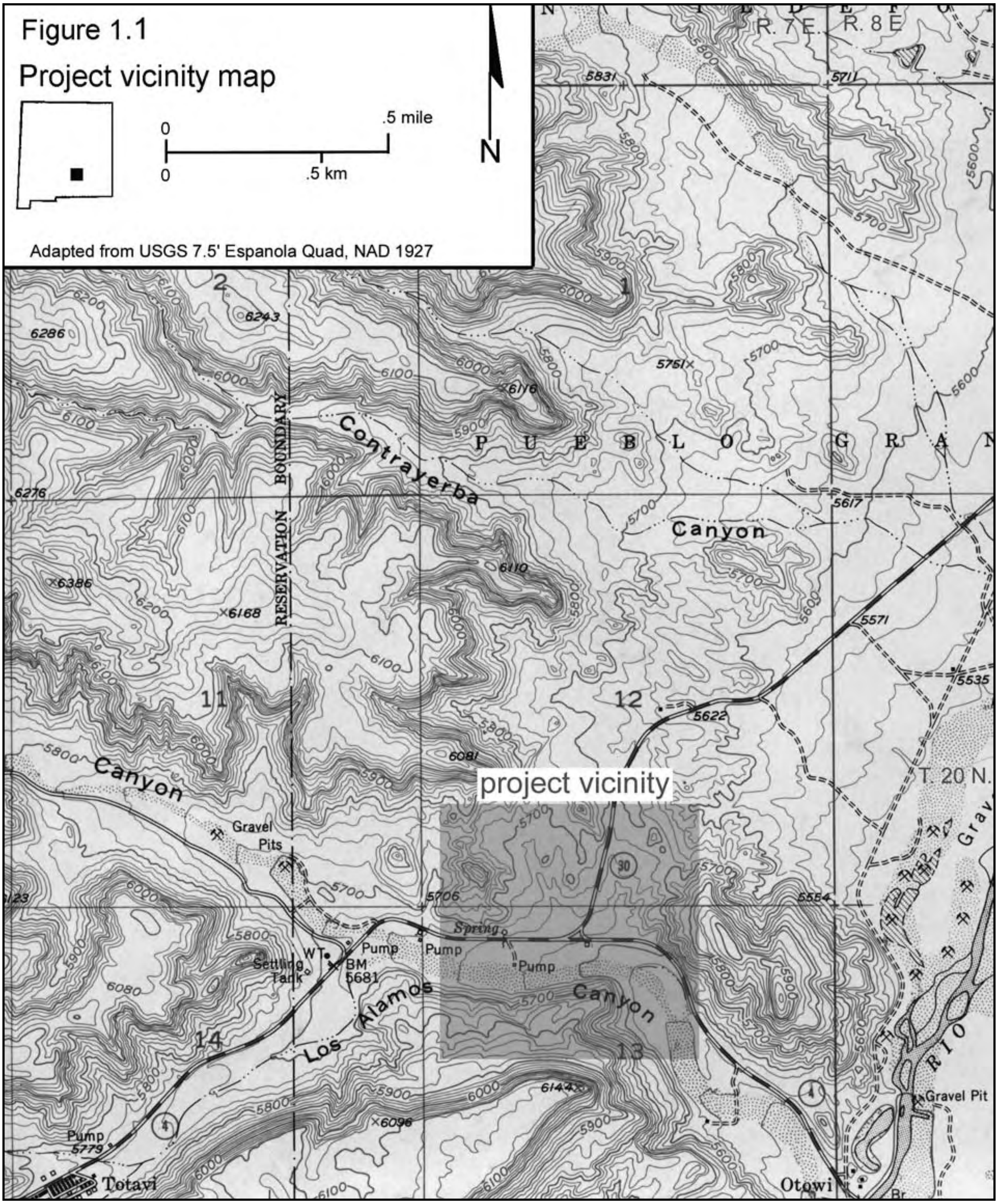
Figure 1.1
Project vicinity map
0
.5 mile
0
.5 km
N
Adapted from USGS 7.5' Espanola Quad, NAD 1927
R. 7 E.
R. 8 E
PUEBLO GRAN
RESERVATION BOUNDARY
Contrayerba
Canyon
Canyon
Gravel Pits
Settling Tank
WT
BM 5681
Pump
Pump
Spring
Pump
Los Alamos
Canyon
project vicinity
T. 20 N.
Gravel Pit
Totavi
Otowi
RIO
5831
5711
6243
6286
6116
5751
6276
5617
6110
6386
6168
5571
5535
5622
6081
5706
5554
6080
6144
6096
5779

address these questions.

This report is structured in several sections. Descriptions of the local physical and cultural environments, and discussions of field and analytical methods are included in an introductory section. The second part contains a description of excavations that were conducted and summaries of artifact assemblages recovered. More extensive discussions of several assemblages are provided in the third section, which contains chapters focusing on the description and interpretation of various classes of artifacts. The fourth section contains discussions of the sites in light of the models developed in the data recovery plan.

Based on our findings during the excavation and analysis of materials from LA 65005, LA 65006, and LA 65013, we feel that our studies exhausted the potential for the parts of these sites within project limits to provide information on local prehistory and history. No further investigations within project limits were suggested. However, parts of LA 65005 and LA 65006 outside construction limits still contain intact deposits with data potential. At LA 65005, this includes other trash pits and the apparent remains of an associated structure. The Classic period Pueblo and historic components at LA 65006 were mostly outside project limits, and have not been investigated in detail, and the Archaic component also extends outside project limits. Further studies may be necessary should construction extend outside the limits of these investigations in the vicinity of LA 65005 or LA 65006 at a later time.

CHAPTER 2. CULTURAL RESOURCES OVERVIEW

James L. Moore

Paleoindian Occupation (10,000 to 5500 B.C.)

The earliest occupation of the Southwest was during the Paleoindian period, which contains three broad temporal divisions: Clovis (10,000 to 9000 B.C.), Folsom (9000 B.C. to 8300 B.C.), and Plano (8300 B.C. to 5500 B.C.). The latter period groups several similar traditions together (Agogino 1968; Irwin-Williams 1965, 1973; Irwin-Williams and Haynes 1970; Neuman 1967). A few isolated Paleoindian points have been recovered from the upper Rio Grande Valley, but no major Paleoindian loci have been found north of La Bajada Hill (Stuart and Gauthier 1981:46). Cordell's (1979) overview of the Northern Rio Grande discusses no Paleoindian sites in this area.

Archaic Occupation (5500 B.C. to A.D. 400)

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

The Oshara tradition is divided into five phases: Jay (5500 to 4800 B.C.), Bajada (4800 to 3200 B.C.), San José (3200 to 1800 B.C.), Armijo (1800 to 800 B.C.), and En Medio (800 B.C. to A.D. 400). Jay and Bajada sites are usually small camps occupied by microbands for short periods of time (J. Moore 1980; Vierra 1980). The population was probably grouped into small, highly mobile nuclear or extended families during these phases.

San José sites are larger and more common than those of the earlier phases, and this is interpreted as evidence of population growth. Ground stone tools are common at San José sites, suggesting a significant dietary reliance on grass seeds. Irwin-Williams (1973) feels that corn horticulture was introduced by the beginning of the Armijo phase ca. 1800 B.C. Others (Berry 1982; Wills 1988) feel that corn did not appear in the Southwest until somewhat later, perhaps no earlier than 1000 B.C. Base camps occupied by macrobands appeared by the late Armijo phase, providing the first evidence of a seasonal pattern of population aggregation and dispersal.

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

Variation from this pattern occurs in southeast Utah, where Basketmaker II people appear to have been nearly sedentary and highly dependent on corn (Matson 1991). Similarly, during the late San Pedro phase in southeast Arizona (which corresponds to Basketmaker II in many ways), nearly sedentary villages dependent on corn agriculture appear to have existed (Roth 1996). Thus, in many areas of the Southwest, the Archaic was coming to an end during this period. Currently, northern New Mexico seems to vary from this pattern, but it is uncertain whether this is because of actual differences or a lack of data. In any case, the Archaic period formally ended in northern New Mexico around A.D. 400 when innovations (including pottery and the bow) were introduced, and the shift to a more sedentary agricultural subsistence system occurred.

The upper Rio Grande Archaic is probably related to Irwin-Williams's Oshara Tradition. Projectile points illustrated by Renaud (1942a, 1942b) resemble the Jay, Bajada, and San José types commonly attributed to the Oshara. Cordell (1979) compared Archaic remains from the Northern Rio Grande to those in the Arroyo Cuervo district and saw many similarities. During the survey of this section of NM 502, Moore and Levine (1987) found projectile points similar to those defined for the Oshara at LA 65020 and LA 65022, again suggesting affiliation with that tradition.

Several Archaic sites have been recorded in this area, and a few have been studied in detail. During the initial survey of this section of NM 502, three sites containing possible Archaic components were recorded, and eight sites comprised of chipped stone debris scatters with no visible diagnostic artifacts were found that might also represent Archaic occupations (Moore and Levine 1987). The sites that contain probable Archaic components were also used during at least one later time period. Projectile points diagnostic of Middle and Late Archaic occupations were noted at LA 65020, and included a San José point and an Armijo or early En Medio point (Moore and Levine 1987:27). The other two sites (LA 65019 and LA 65022) contained Late Archaic En Medio points. At least seven of the eight lithic scatters were located in topographic situations that suggested they might have functioned primarily as quarries, though parts of LA 65011 and LA 65012 could have been used as short-term camps. If the main function of most of these sites was the procurement of lithic materials, they could have been used during any prehistoric period, and indeed were probably used at many different times.

Nine of the sites located during survey were subsequently tested, and four were found to contain Archaic components (J. Moore 1993; Moore and Levine 1987). Of the three sites on which artifacts diagnostic of Archaic occupations were found during survey, only LA 65022 was tested. This more intensive examination suggested that LA 65022 was used as a temporary camp during the Basketmaker II period, with later Pueblo use of the same locale (J. Moore 1993). However, since no intact cultural features or deposits were found within project limits at this site, data recovery was not recommended.

Analysis of chipped stone artifacts suggested that both LA 65006 and LA 65007 mostly represented Archaic occupations, though evidence of later uses was also present (J. Moore 1993). Similarly, a provenience at LA 65012 contained an Archaic component, though some mixture with materials from a later Pueblo occupation was suspected (J. Moore 1993). Since none of these sites contained temporally diagnostic artifacts, no specific occupational dates could be assigned. Interestingly, analysis suggested that LA 65011, which was also located during survey and suspected of being an Archaic locus, actually represented a Pueblo occupation (J. Moore 1993:93-94). Of these sites, intact cultural deposits within project limits were only found at LA 65006, which was recommended for data recovery.

Another Archaic site examined along NM 502 south of our study area was LA 51912, which contained a Basketmaker II structure and activity area as well as a scatter of Classic period Pueblo artifacts (Haecker 1986; Lent 1991; Sullivan and Lent 1987). Biella (1992) discusses test excavations at LA 70029, located near Los Alamos on land administered by the Department of Energy. This is another multicomponent locale, demonstrating episodic uses during the Armijo and En Medio phases, as well as a Pueblo use during the Coalition period (Biella 1992:99).

PUEBLO OCCUPATION (A.D. 400 TO 1540)

Developmental Period

Wendorf and Reed (1955) divide the Pueblo occupation of the Northern Rio Grande into four periods: Developmental (A.D. 600 to 1200), Coalition (A.D. 1200 to 1325), Classic (A.D. 1325 to 1600), and Historic (A.D. 1600 to present). The first half of the Developmental period (A.D. 600 to 900) corresponds to Basketmaker III and Pueblo I of the Pecos Classification. Early Developmental sites are rare in the Northern Rio Grande (Wendorf and Reed 1955), and usually contain one to three circular pithouses in association with rectilinear surface storage structures (Stuart and Gauthier 1981).

The second half of the Developmental period (A.D. 900 to 1200) corresponds to Pueblo II and early Pueblo III. A large population increase occurred in the Northern Rio Grande during this period (Wendorf and Reed 1955), along with major changes in settlement pattern, architecture, and site size (Anschuetz 1986). The number of sites and range of environmental zones being exploited increased, and areas of higher elevation began to be used (Stuart and Gauthier 1981:59). A shift from residence in pithouses to above-ground structures began, and communities consisting of definable clusters of villages appeared. Mineral-painted wares, including Kwahe'e Black-on-white, were the most common decorated ceramics (Mera 1935).

By approximately A.D. 1150, Pueblo peoples were moving onto the Pajarito Plateau (Orcutt 1991), which was not used as a residential zone before that time. Preucel (1987:22) suggests that the scale of population growth between A.D. 1150 and 1325 was too great to be the result of biological growth, and suggests that it represents migration onto the plateau. While this could have been the result of population migrating into the Northern Rio Grande from the San Juan Basin (Preucel 1987), it could also be indicative of population being forced into this area. Roney (1996) presents information on numerous Pueblo III villages in the eastern and southern San Juan Basin, which may have contained much of the population that moved out of the central basin at the time of the Chacoan collapse between A.D. 1130 and 1150. If so, this movement could have forced other groups living on the east margin of the basin into adjacent highlands, including the Pajarito Plateau.

Coalition Period

The Coalition period (A.D. 1200 to 1325) corresponds to late Pueblo III. Carbon-painted wares replaced mineral-painted ceramics, and the appearance of Santa Fe Black-on-white marks the beginning of this period. During the early Coalition period, the size of population and amount of aggregation on the Pajarito Plateau were both small (Crown et al. 1996:195). Major changes occurred during the late Coalition, including the development of larger communities containing plaza-type or U-shaped villages (Crown et al. 1996). The Pajarito Plateau can be divided into northern and southern districts, with Frijoles Canyon acting as a dividing line (Crown et al. 1996:195). These areas demonstrate different developmental trajectories, especially after A.D. 1250 (Crown et al. 1996), which may reflect their role as homeland to both the Tewa and Keres.

Evidence suggests that this was a time of great population movement and cultural change. In addition to the Pajarito Plateau, the Coalition period saw large-scale population movement into the Chama and Ojo Caliente valleys, the Galisteo Basin, the Cochiti Reservoir district, and the Santa Fe area. For example, Biella (1979:110) indicates that the number of Coalition period sites in the Cochiti Reservoir district represents an 800 percent increase over a rather ephemeral Developmental period occupation. While more recent investigations in that area suggest that the Developmental occupation was not quite as ephemeral as originally thought (John Ware, pers. comm. 1998), the scale of population increase seems to have been immense.

Sites of this time period usually range in size from 13 to 30 rooms, and are generally arranged in linear or L-shaped roomblocks (Stuart and Gauthier 1981:51). Within Preucel's (1987) study area on the Pajarito Plateau, early Coalition villages averaged 28 rooms, with the largest containing over 100 rooms; fieldhouses and farming features dating to this period have also been found (Preucel 1987:23). The late Coalition settlement pattern consists of clusters of villages forming communities that include both small and large pueblos, as well as associated talus pueblos and caveate complexes (Preucel 1987:24). There is a large range in structure size, from 10-room single-story structures up to 300-room multistory villages (Preucel 1987:24).

Classic Period

The Classic, or Pueblo IV to V period (A.D. 1325 to 1600), is marked by aggregation into large multistoried pueblos, often with several plazas. The Northern Rio Grande population reached its prehistoric zenith during this period, and village locations shifted from uplands to major river valleys. Specialization in ceramic production split the Northern Rio Grande into two zones–a northern Biscuit Ware area and a southern Glaze Ware area. Biscuit Wares were produced by the ancestors of the Northern Tewa, while ancestral Tano (Southern Tewa), Keres, and Southern Tiwa made glazed pottery.

The Biscuit series and incised wares were produced in the study area. Beginning with Wiyo Black-on-white (A.D. 1300 to 1400), the series includes Biscuit A (A.D. 1375 to 1450), Biscuit B (A.D. 1400 to 1500 or 1550), and Sankawi Black-on-cream (A.D. 1500 to 1600) (Breternitz 1966). The appearance of Potsuwi'i Incised about the time that Biscuit B became common may be indicative of Plains contacts, but this remains uncertain.

The movement into major river valleys that marks this period may have resulted from degradation of floodplains and a long drought between A.D. 1338 and 1352 that made high-altitude farming too risky (Crown et al. 1996:197). Depletion of high-altitude resources by the large populations that lived there for a relatively long period of time may also have contributed to this problem (Crown et al. 1996:197). On the Pajarito Plateau, several new multistory and multiplaza villages were founded as villages occupied during the Coalition period were abandoned (Orcutt 1991:316). The population began declining in that area during the early Classic, and this trend continued through the middle Classic. Most of the large Pajarito Plateau villages were abandoned by A.D. 1550, but some were occupied as late as A.D. 1600 (Orcutt 1991:316).

Large-scale population movements continued to be rather common during the Classic period. In addition to the Pajarito Plateau, the Chama and Ojo Caliente valleys were mostly abandoned by the end of this period, and much of the Pueblo population was concentrated along the Rio Grande when the Spanish arrived in A.D. 1540. Native groups underwent many changes in lifestyle, social organization, and religion after the Spanish settlement of New Mexico. Attacks by Plains Indians caused the abandonment of many villages and a constriction of the region occupied by Pueblo groups (Chávez 1979; Schroeder 1979). A combination of new diseases to which the Pueblos had no natural defenses, intermarriage, conflict attendant with the Pueblo Revolt, attacks by Athabaskans and Plains Indians, and abandonment of their traditional life for that of the Spanish contributed to a large decrease in Pueblo population over the next few centuries (Dozier 1970; Eggan 1979). The addition of a red slip to Sankawi Black-on-cream was the origin of the Tewa Polychrome series, which is ancestral to types that are still produced in the Rio Grande pueblos.

Several Pueblo sites and components have been found in the study area (Moore and Levine 1987). Components containing Biscuit Wares (both A and B) and Potsuwi'i Incised were most common, and date to the A.D. 1375 to 1600 period. They include five lithic and ceramic artifact scatters, four fieldhouses, four water and soil control systems, and a small residential site. A historic fieldhouse dating to the mid-twentieth century was also found. Three large Classic villages are located nearby: Tsankawi sits on a mesa southwest of the study area, while Perage and Pohoge (San Ildefonso Pueblo) are located a few kilometers to the east.

During survey of NM 502 west of White Rock, Wiseman (1987) found a number of Pueblo sites, mostly consisting of lithic and ceramic artifact scatters. Only one residential site, a small adobe pueblo dating to the thirteenth or fourteenth century, was found. This site also contained a historic component, represented by a scatter of seventeenth-century sherds. Three sites were recorded during a survey south of Perage (J. Moore 1990). They included a Developmental period pithouse and associated artifact scatter adjacent to a series of eroded cobble-bordered grids, and two series of probable Classic period farming features.

Historic Occupation (A.D. 1540 to Present)

Exploration Period (1539 to 1597)

Based on information gathered by Alvar Nuñez Cabeza de Vaca and his companions, New Spain turned its attention northward in the mid to late 1500s. Fray Marcos de Niza was dispatched on a scouting mission into the Southwest in 1539, and a major expedition under Francisco Vásquez de Coronado explored the region between 1540 and 1542. The historic period formally began with Coronado's entry into the Southwest. No other contact between New Spain and New Mexico is known to have occurred until 1581, when Father Augustín Rodríguez and Captain Francisco Sánchez Chamuscado led an expedition up the Rio Grande to the Pueblo country (Hammond and Rey 1966). Ostensibly to rescue two priests left by the Rodríguez-Chamuscado expedition, Antonio de Espejo led a party of explorers into New Mexico in 1582. Gaspar Castaño de Sosa entered the region in 1590 to 1591, but was arrested for colonizing without a license and returned to Mexico (Simmons 1979). In 1593 a second attempt at colonization was made by Francisco de Legua Bonilla and Antonio Gutiérrez de Humaña, but their party was decimated by conflict with the local Indians (Hammond and Rey 1953).

Early Spanish Colonial Period (1598 to 1680)

Juan de Oñate established the first successful European colony in New Mexico at San Juan Pueblo in 1598. By 1600 the Spanish had moved into San Gabriel del Yunque, sister village to San Juan, which was abandoned for their use by its residents (F. Ellis 1987). The lack of visible wealth in the new province caused unrest among the Spanish (Espinosa 1988:7), many of whom seem to have accepted the challenge of establishing a new colony because they thought they would soon get rich. This unrest in addition to Oñate's neglect of the colony while on frequent journeys of exploration eventually contributed to his loss of the governorship. Oñate was removed as governor in 1607, and was replaced by Pedro de Peralta, who arrived in New Mexico in 1609 (Simmons 1979:181). Peralta founded Santa Fe in 1609 or 1610, and moved the capital there.

Having failed to find the wealth that was expected to exist in this far northern part of New Spain, Oñate's colony was considered a disappointment. Some of the settlers wanted to abandon the colony, and the government was seriously considering doing just that (Espinosa 1988:8-9). With the continued existence of the New Mexican colony in such a perilous state, the baptism of 7,000 Pueblo Indians in 1608 and reports that many others were ready for baptism provided a viable alternative to an economically autonomous colony (Espinosa 1988:9). Thus, New Mexico was maintained as a mission area in the seventeenth century, its primary function being the conversion of the Pueblos. The church was extraordinarily powerful and influential, and this caused considerable conflict with the secular government (R. Ellis 1971:30-31). Beginning in the 1640s, this struggle weakened the Spanish hold on the province (Simmons 1979:184).

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

New Mexico was supplied by wagons from New Spain during this period, a service that was controlled by the missions (Moorhead 1958). Caravans were scheduled for every three years, but their departures were actually quite irregular (Moorhead 1958). This system led to serious shortages of important supplies, such as metal, and kept the cost of manufactured goods high.

Only a few pre-Revolt Spanish sites have been excavated. Materials from this period were found in Santa Fe at the Palace of the Governors and during excavations at the La Fonda parking lot (Seifert 1979; Wiseman 1988). A few early Spanish sites were excavated at Cochiti Reservoir. The Cochiti Springs (LA 34) and Las Majadas (LA 591) sites were occupied by Spanish settlers, while a third, LA 5013, was inhabited by either Spaniards or Pueblos (Bussey and Honea 1971; Laumbach et al. 1977; C. Snow 1979; D. Snow 1973). Evidence of a pre-Revolt occupation was found at the Torreon site (Snow and Warren 1973), and the Signal site (LA 9142) near the Galisteo Dam may also date to this period (Alexander 1971).

The Pueblo Revolt and Reconquest (1680 to 1693)

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

Attempts at reconquest were made by Antonio de Otermín in 1681 and Domingo Jironza Petriz de Cruzate in 1687, but both failed (R. Ellis 1971). In 1692 Don Diego de Vargas negotiated the Spanish return, exploiting the factionalism that had once again developed among the Pueblos (R. Ellis 1971:64; Simmons 1979:186). Vargas returned to Santa Fe in 1693, and reestablished the colony. Hostilities continued until around 1700, including a serious flareup in 1696 that once again threatened to extinguish the Spanish hold on their colony. After Vargas put down the rebellion of 1696, the period of serious threats was over and by the early years of the eighteenth century the Spanish were again firmly in control.

Late Spanish Colonial Period (1694 to 1821)

Though failing in its attempt to throw off the Spanish yoke, the Pueblo Revolt led to many important economic and governmental changes. The hated *encomienda* system of tribute was never reestablished, the *repartimiento* system of forced labor was abolished, and the missionary system was scaled down (Simmons 1979). The new Spanish population grew rapidly and eventually surpassed that of the Pueblos. Relations between Spanish and Pueblos became considerably more cordial during this period. This was at least partly due to changes in the structure of both Spanish and Pueblo populations. The increased number of settlers created a great demand for land in the Rio Grande core area, and a drop in the Pueblo population caused a shortage of cheap labor. These trends resulted in a shift from large land holdings to smaller grants (Simmons 1969). A large labor force was no longer needed to work Spanish holdings, which was just as well since the demise of the *repartimiento* system meant that the Pueblos could no longer be forced to provide labor. Also contributing to this trend was the increasing danger of attack by Plains Indians beginning in the early eighteenth century.

The royal government continued to subsidize the province, but it now served as a buffer against the enemies of New Spain (Bannon 1963), not as a mission field. New Mexico was a distant province on the frontier of New Spain, and continually suffered from a shortage of supplies while shielding the inner provinces from Plains Indian raids and the ambitions of the French in Louisiana. These aspects of frontier life are critical to an understanding of Spanish Colonial New Mexico.

The caravan service continued to supply New Mexico after the Pueblo Revolt, but by the middle of the eighteenth century the merchants of Chihuahua had gained control (Moorhead 1958). A considerable trade developed between New Mexico and Chihuahua during this period (Athearn 1974), mostly to the benefit of the Chihuahuan merchants. This was documented by Father Juan Augustín de Morfi in 1778, who described the dismal situation (Simmons 1977). Not only did the Chihuahuan merchants inflate prices, they also invented an illusory monetary system that they manipulated to further increase profits (Simmons 1977:16). Thus, New Mexico was poorly supplied with goods sold at exorbitant prices. This problem was partly rectified by trading with local Indians for pottery, hides, and farm produce, and some goods were apparently produced by cottage industries. Unfortunately, many products had no local substitutes.

Metal, especially iron, was in short supply in New

Mexico (Simmons and Turley 1980). Nearly all iron was imported from Spain, and royal policy forbade colonial iron production to protect the monopoly enjoyed by Vizcaya (Simmons and Turley 1980:18). While imported iron was relatively cheap in Mexico, by the time it arrived in New Mexico it was quite costly. Production of tools and weapons was limited by the lack of metal, and those that were produced were very expensive.

The lack of metal as well as the unreliable supply system hurt New Mexico in its role as a defensive buffer. Many accounts mention the scarcity of firearms and other weapons (Kinnaird 1958; R. Miller 1975; Reeve 1960; Thomas 1940). In addition, few soldiers were stationed in New Mexico, forcing the use of militia and other auxiliary troops. Continued conflict with nomadic Indians caused many settlements to adopt a defensive posture, and even individual ranches were built as fortresses.

Several late Spanish Colonial sites have been studied in New Mexico. Investigations at LA 16769 found a large rectangular casa-corral and possible tower (Levine et al. 1985). Seven late Spanish Colonial sites were excavated at Cochiti Reservoir (Chapman et al. 1977; Hunter-Anderson et al. 1979; D. Snow 1973, 1976; Snow and Warren 1973). They ranged from one-room structures up to the multiroomed Torreon site (LA 6178). Three Spanish Colonial homesteads were excavated in the Puerco River Valley (Haecker 1976). Investigations have been conducted near Placitas at San Antonio de las Huertas (LA 25674) and the Ideal site (LA 8671) (Brody and Colberg 1966; Ferg 1984). Several late Spanish Colonial to Territorial period sites have been recorded in Albuquerque's North Valley (Rudecoff 1987; Sargeant 1985). Near Abiquiú, the late Spanish Colonial to Territorial period plaza at Santa Rosa de Lima de Abiquiú (LA 806) and settlement at La Puente (LA 54313) have been examined (Boyer 1992; Carrillo 1978; Salazar 1976).

Mexican and American Territorial Periods (1821 to 1912)

Mexico declared its independence from Spain in 1821, bringing two major changes to New Mexico, a more lenient land grant policy and expansion of the trade network (Levine et al. 1985). Trade between Missouri and Santa Fe began soon after independence, and dominated events in New Mexico for the next quarter century (Connor and Skaggs 1977). Trade with the United States brought ample and comparatively inexpensive goods to New Mexico, and broke the Chihuahuan monopoly. This is reflected in the material culture of sites from this period, with more manufactured goods occurring than ever before. New Mexico remained a part of Mexico until 1846 when war broke out with the United States. American troops led by Colonel Stephen W. Kearny took possession of New Mexico on August 15, 1846 (Twitchell 1963). New Mexico remained an American territory until it was granted statehood in 1912.

A few Mexican and American Territorial period sites have been studied. They include Sena Plaza (LA 55368) in Santa Fe (Elliot 1986), Paraje de Fra Cristobal (LA 1124) in south-central New Mexico (Boyd 1984, 1986), the Trujillo House (LA 59658) near Abiquiú, the Ontiberos site (LA 27573) near Roswell (Oakes 1983), and Plaza de San José (LA 6992) (Schaafsma and Mayer n.d.).

CHAPTER 3. PHYSICAL ENVIRONMENT

Laurie Evans

Geology

The study area is located in the Española Basin, the topography of which includes alluvial slopes, valley bottoms, and mesa tops. Elevations range from 1,707 m (5,600 ft) at the east end to 1,920 m (6,300 ft) at the west end. Los Alamos Canyon forms the southern boundary of the study area. Local rock formations belong to two major groups of volcanically derived materials and are of Pliocene or Pleistocene age (Dane and Bachman 1965). The Española Basin was probably internally drained during the Miocene through mid-Pliocene epochs, and sediments of the Santa Fe Group from upland areas to the west, north, and northeast accumulated in fans.

The Rio Grande-Rio Chama drainage system first became integrated through the Española Basin in the Pliocene, probably between 2.8 and 4 million years ago. The end of Santa Fe deposition (about 3 million years ago) is marked by an erosional unconformity and a layer of resistant cobble gravel in areas near the Rio Grande, and by erosion surfaces near the Sangre de Cristo and Ortiz mountains. Basin deposition of channel gravels near the Rio Grande resumed after cutting of the Ortiz pediment, covering that surface with the Ancha Formation east of the Rio Grande, and with the Puye Formation west of the river.

General basin aggradation apparently continued until after the Puye fanglomerate was covered by local basalt flows and the Bandelier Tuff. Surfaces of pediments, fans, and terraces cut during Quaternary time are prominent landforms of the northern Española Basin, particularly in the area along the east flank of the northeast Jemez Mountains (Dethier and Demsey 1984). The east end of the study area is part of an alluvial fan deposit, including channel alluvium in tributary arroyos, and is upper Pleistocene and Holocene in age (Menges 1987). The easternmost sites in the study area are on reworked Puye Formation materials. Valley bottoms contain materials belonging primarily to the upper part of the Santa Fe Group, including Puye conglomerate and the Ancha Formation. Bandelier Tuff forms mesa tops, cliffs, and talus slopes.

Soils

Soils fall primarily into the Torriorthents-Rough Broken Land association, and are an important source of sediments. They are mostly forming in unconsolidated or weakly consolidated sedimentary materials that are dominantly coarse to medium in texture and contain gravels. Composition of the soils varies from sandy clay loam with a depth of 1.5 m or more, to very shallow, gravelly soils. These soils are dissected by numerous intermittent drainages and arroyos and occur on undulating to rolling and hilly uplands. Steep slopes are common on breaks and in severely dissected areas. A few nearly level to gently sloping valley bottoms and flood plains are also present. A thin mantle of gravels and cobbles is scattered over much of the land surface. A thin layer of soil lies on the ridge tops between outcrops of sedimentary materials, and the ridges are sharper and the slopes steeper where fine- or medium-textured materials dominate. Geologic erosion is active and vegetation is sparse (Maker et al. 1974). The west end of the study area includes a very small portion of the Basalt Rock Land association, which consists of a complex of shallow rocky soils and outcrops of basalt bedrock.

Flora and Fauna

The study area is in the piñon-juniper vegetative zone, consisting of an overstory dominated by piñon pine and juniper, with occasional ponderosa pines. Numerous cottonwood trees grow along Totavi Wash. The understory contains various shrubs, grasses, and succulents, including snakeweed, rabbitbrush, sagebrush, Indian ricegrass, several varieties of grama grass, other mixed grasses, and prickly pear. A few datura plants are also present.

Animals found in the area include elk, mule deer, mountain sheep, cottontail rabbit, and other small mammals (Findley et al. 1975). Birds observed included hawks, turkey vultures, piñon jays, and ravens. Prairie rattlesnakes were seen in the area, as well as numerous small lizards.

Modern Climate

The climate of the study area is similar to that of Española, and in the extreme western portion to that of Los Alamos. Sunshine occurs during about 70 percent of all possible hours. Winds are predominantly from the west to southwest, but may vary considerably locally because of topography (Maker et al. 1971a). The area has cool winters and warm summers. July normally is the warmest month and January the coldest. The daily range of temperatures is great. The mean annual temperature at the Española weather station is 9.2 degrees C. The average January temperature in Los Alamos is -1.9 degrees C, and the average July temperature is 17.5 degrees C

(Gabin and Lesperance 1977). Spatial and temporal temperature patterns display greater regularity than do precipitation patterns. The generalized range of temperature is determined primarily by latitude and altitude, but in New Mexico altitude is the stronger determinant. The decrease in temperature northward in New Mexico varies from .8 to 1.4 degrees C for every degree of latitude. For every thousand feet, temperatures fall an average of 2.8 degrees C; hence there is a greater likelihood of freezing temperatures in mountainous areas (Tuan et al. 1973).

Precipitation fluctuates widely about the mean in New Mexico, much more so than does temperature, and varies widely over periods of years. Modern rainfall data suggest randomness rather than a regular succession of wet and dry phases. In humid climates such fluctuations are large but do not significantly affect agriculture, because even in relatively dry years there is sufficient moisture for growing crops. In New Mexico the difference in precipitation from year to year is usually less than in humid climates, but in a semiarid climate that difference has a far greater impact on farming. Mean annual precipitation at Española is 260 mm (Tuan et al. 1973), and mean annual total precipitation at Los Alamos is 468 mm (Gabin and Lesperance 1977). The greatest volume of precipitation falls in the summer half-year, when moist air from the Gulf of Mexico reaches the area (Maker et al. 1971b). The snow season (winter half-year) is October through April (Maker et al. 1971a). Precipitation in the winter half-year is much lighter because mountains to the northeast shield the area from cooler air intrusions, and much of the moisture in the eastward-moving Pacific Ocean storms falls on mountain ranges to the west of New Mexico (Maker et al. 1971a).

The frost-free season is used as a liberal measure of the period available for plant growth; however, growth does not normally occur at temperatures below 4.4 to 5.6 degrees C. The average frost-free season for the study area is 160 days, but the actual growing season is shorter and its length varies greatly from year to year (Tuan et al. 1973). Frosts are of greatest agricultural significance only when they occur at the time of year when vegetation is growing. Latitude and altitude influence the occurrence of killing frosts, and local topography complicates the distribution and severity of frost, because cold, dry, dense air tends to collect in hollows. These factors make agriculture at higher elevations a very risky proposition; however, records indicate that Pueblo Indians were irrigating land and growing crops when the Spanish arrived in A.D. 1540 (Maker et al. 1971a). Corn, one of their major crops, requires only 110 frost-free days and a mean temperature of 10 degrees C, reducing the risk of failure from killing frost (Allan 1977).

Climatic Reconstruction

There is general agreement that increased climatic desiccation, caused by increased temperatures and decreased precipitation, characterized the post-Pleistocene environment of the Southwest, but the precise dating of the onset of this trend and fluctuations within it are uncertain. This trend began at different times in different places and in the Southwest it was apparently delayed the farther north one goes. Geological studies indicate that the San Agustín Basin experienced a decrease in moisture, indicated by a lowering of the shoreline, prior to 3000 B.C.; that dry conditions in the Estancia Basin resulted in the disappearance of Lake Willard at 4000 B.C.; and that a cycle of erosion occurred on the Llano Estacado between 5000 and 3000 B.C. Pollen dates from southern Arizona indicate an increase in temperature and moisture between 6000 and 4500 B.C., although other data from the same area suggest dry conditions (Cordell 1979). There is some agreement that at about 2000 B.C. there was was a relatively cooler and moister phase in the Southwest, probably very similar to that of today. An increase in available moisture is indicated by studies from the San Agustín Basin, the Llano Estacado, the Estancia Basin, and southeastern Arizona (Cordell 1979). Widespread arroyo cutting occurred, probably resulting from intense summer thunderstorms on scantily vegetated, dry ground (Moore and Harlow 1980).

The period between A.D. 700 and 900 was characterized by slightly below average precipitation, with a major drought beginning around A.D. 700 and lasting until A.D. 725, when rainfall began to increase. This increase lasted until A.D. 735. In A.D. 765, drought conditions again occurred. Rainfall increased until A.D. 860, with temporary decreases at A.D. 815 and 845. At A.D. 870, a slight decrease in rainfall occurred, followed by low normal conditions (Allan 1977).

Reconstruction of paleoclimate at Arroyo Hondo based on tree-ring data indicates that between A.D. 990 and 1430 annual precipitation was characterized by high frequency and high amplitude variation (Rose et al. 1981). From A.D. 1431 until 1730, precipitation values tended to be no more than 1 standard deviation from the mean, with low frequency and low amplitude variability distinguishing this interval. Spring and annual rainfall volumes were determined by analysis of tree-rings. The reconstruction indicated that annual precipitation trends followed a similar pattern to those of spring rainfall; thus, most variability in the annual reconstruction was attributed to variability in spring precipitation. Spring to early summer rainfall may have been of greater importance to Pueblo subsistence than was the more stable nonspring component (July through February), because spring is the period of seed germination (Rose et al. 1981).

The Southwest was warming between A.D. 900 and 1100, and extensive gullying began on the Colorado

Plateau and in the Rio Grande Valley, probably as a result of increased summer rainfall. A severe drought occurred from A.D. 1080 to 1125 (Allan 1977). Orcutt (1991) reports that the period between A.D. 1150 and 1250 was characterized by aggradation on the Pajarito Plateau (higher water tables, more sediment, and channel filling). However, this period actually began with a short period of degradation (lower water tables, less sediment, and channel cutting). Allan (1977) indicates that from A.D. 1200 to 1250 conditions in the Southwest were above average. However, the period between A.D. 1215 and 1229 was relatively dry on the Pajarito Plateau, and included a severe drought (Orcutt 1991).

The general climatic situation started to deteriorate around A.D. 1250, with a nine-year drought of mild to moderate severity occurring between A.D. 1250 and 1258 and a mild but long drought between A.D. 1275 and 1295. Tree-ring data indicate a period of above-average precipitation starting in A.D. 1295 and lasting until A.D. 1335. A period of variable spring rainfall in the Santa Fe area lasted from A.D. 1335 to 1400, with highs centered at A.D. 1335 and 1370, and lows centered at A.D. 1365 and 1380. Orcutt (1991) also reports greater variability in rainfall on the Pajarito Plateau from A.D. 1325 to 1400, with a higher percentage of wet periods during this time. A long, mild drought bracketing a moderate to severe drought occurred between A.D. 1338 and 1352. Because the four decades prior to this were normal or wet, the drought may have had a major impact on settlements that had functioned successfully during wetter periods (Orcutt 1991).

Rose et al. (1981) report that an extended interval of high precipitation prevailed from A.D. 1400 to 1415, followed by an intense ten-year low centered on A.D. 1420. However, Orcutt (1991) indicates that a mild drought occurred from A.D. 1400 to 1405 on the Pajarito Plateau. She also reports periods of long, mild drought from A.D. 1415 to 1425, A.D. 1445 to 1465, and A.D. 1472 to 1484. Floodplains aggraded and water tables rose between A.D. 1550 and 1600. A drought between A.D. 1574 and 1594 included almost a decade of consecutive moderate and severe drought years, and was the longest and most severe drought during the Pueblo occupation of the Pajarito Plateau (Orcutt 1991).

During the period from A.D. 1250 to 1450, individual years of low precipitation occurred in A.D. 1251, 1288, and 1347, all with reconstructed spring precipitation levels below 50.8 mm. A high was reached in A.D. 1325, when more than 177.8 mm fell (Rose et al. 1981). According to Allan (1977), periods during which conditions were optimal for agriculture (high summer rainfall and the long growing season) were A.D. 1010 to 1080, A.D. 1210 to 1235, and A.D. 1460 to 1480. Although rainfall was high ca. A.D. 1330 to 1430 and A.D. 1610 to 1650, either a shorter growing season or an increase in winter precipitation probably reduced overall agricultural potential (Allan 1977).

CHAPTER 4. FIELD AND ANALYTICAL METHODS

James L. Moore, Daisy F. Levine, Linda Mick-O'Hara, Mollie S. Toll, and Richard Holloway

Field Methods

Although the same general excavation methods were used at each site, specific applications varied because of differences in the remains present and the types of data expected to be recovered. General field methods are described here, and site-specific applications are discussed in individual site reports.

The first step in excavation was establishment of site datums. If a site was previously tested, the datum used during that phase of investigation was relocated and used during data recovery. All horizontal measurements were referenced to that point; vertical measurements were referenced to an elevational datum placed off-site in an area outside construction boundaries. Datums used for horizontal control were arbitrarily designated as the intersection of the 100 m north line and 100 m east line. The ground surface at the base of vertical datums was arbitrarily assigned a depth of 0 meters.

Sites were mapped by transit and stadia rod or 30-m tape, and the locations of all visible cultural features, excavation units, grid lines, surface artifacts (when collected individually), and topographic features were plotted. Sites were contour mapped to provide an accurate depiction of their structure in relation to the immediate physical environment.

Surface artifacts were collected in three ways: (1) by point provenience, (2) in variably sized grids, and (3) as a general collection within disturbed areas. Features and structures outside the right-of-way were described and mapped. Within the right-of-way they were investigated to determine their nature, depth, and artifact content, and to recover dateable materials. Excavated features were photographed, described, and mapped.

Hand tools were used for most excavation, but mechanical equipment was used to remove noncultural fill in some instances. Horizontal excavation units were 1-by-1-m grids unless circumstances warranted otherwise. Grids were provenienced by the lines that intersected at their northeast corners. Thus, a 1-by-1-m grid with the intersection of the 110 north line and the 120 east line at its northeast corner was designated 110N/120E. Exploratory grids were excavated in arbitrary 10-cm levels until soil strata could be defined. Following the identification of soil strata, excavation continued in natural levels.

Soil from exploratory grids and cultural strata was screened through ¼-inch mesh hardware cloth. When noncultural strata were defined, they were removed without screening. However, if intrusive artifacts were noted, they were saved for analysis. Artifacts recovered in screens were bagged, assigned a field specimen number, and transported to the laboratory for analysis. Forms describing soil matrix, and listing ending depths and field specimen numbers were completed for all excavation units. Flotation and radiocarbon samples were collected from cultural strata and features. Pollen samples were taken from strata on prehistoric sites, but were not collected from historic sites. Excavation ended when sterile deposits were encountered.

Profiles showing the relationship of cultural and noncultural strata were drawn for excavation areas and large features. Small features like hearths were excavated as a single unit, and were not profiled unless several internal strata could be defined. When field work was finished, excavated areas were backfilled. Cultural materials and all field and analysis records recovered during these investigations are curated at the Laboratory of Anthropology, Museum of New Mexico.

Chipped Stone Artifact Analysis

Each chipped stone artifact was examined using a binocular microscope to aid in defining morphology and material type, examine platforms, and determine whether it was used as a tool. The level of magnification varied between 15x and 80x, with higher magnification used for wear pattern analysis and identification of platform modifications. Utilized and modified edge angles were measured with a goniometer; other dimensions were measured with a sliding caliper. Analytical results were entered into a computerized database using the Statistical Package for the Social Sciences Data Entry program. Data summaries are included in individual site reports and in a separate synthetic chapter.

Analysis was completed using the Office of Archaeological Studies' (1994a) standardized methodology, and was designed to examine material selection, reduction technology, tool use, and site formation processes. These topics provide information concerning ties to other regions, mobility, site function, and the reliability of specific attributes. While material selection studies cannot reveal *how* materials were obtained, they can usually provide some indication of *where* they were procured. In particular, by examining the type of cortex present on artifacts it is possible to determine whether a material was obtained at its source or from secondary deposits.

By studying the reduction strategy employed at a site it is possible to assess the level of residential mobility. Where a high degree of residential mobility is usually accompanied by the use of a curated reduction strategy, sedentary peoples more commonly use an expedient reduction strategy. The types of tools present on a site can be used to help assign a function, particularly on artifact scatters lacking features. Tools can also be used to help assess the range of activities that occurred at a site.

Finally, the condition of an assemblage can be used to judge the reliability of certain attributes. This entails analysis of artifact breakage and edge damage patterns, and can provide information concerning the source of damage. Thus, as the percentage of artifacts broken after removal and the incidence of edges damaged by noncultural means (erosion or trampling) increase, the reliability of attributes such as artifact size, flake portions, and evidence of use decreases.

Attributes Examined During the Study

Table 4.1 lists the attributes examined during this study, and indicates which relate to each class of chipped stone artifact. Four general chipped stone artifact classes were recognized: flakes, angular debris, cores, and formal tools. Flakes are debitage that exhibit recognizable dorsal and ventral surfaces, a bulb of percussion, and/or a striking platform. Angular debris are debitage that lack these attributes. Cores are pieces of lithic material that have two or more negative flake scars originating from one or more surfaces. Formal tools are debitage that were intentionally altered to produce specific shapes or edge angles. Alterations take the form of unifacial or bifacial retouching, and artifacts were considered intentionally shaped when retouch scars extended across two-thirds or more of a surface, or their shape or edge angle was significantly altered.

Attributes recorded on all artifacts included material type and quality, artifact morphology and function, amount of surface covered by cortex, portion represented, evidence of thermal alteration, edge damage, and dimensions. Material type was coded by gross category (chert, quartzite, basalt, etc.) unless specific sources (i.e., Pedernal chert) could be identified. Artifacts that could be traced to specific cores were visually distinguished when possible, and identified cores were numbered consecutively by site in the order of discovery. Texture was measured subjectively to examine material flakeability. Most materials were divided into fine, medium, and coarse categories depending on grain size, and such measures were applied within material types but not across them. Obsidian was classified as glassy by default, and this category was applied to no other material. The presence of visible flaws that would affect flakeability was also noted.

TABLE 4.1. CORRELATION OF ATTRIBUTES ANALYZED WITH CHIPPED STONE ARTIFACT CATEGORIES

Attribute	Flakes	Angular Debris	Cores	Formal Tools
Material type	X	X	X	X
Material quality	X	X	X	X
Artifact morphology	X	X	X	X
Artifact function	X	X	X	X
Cortex	X	X	X	X
Cortex type	X	X	X	X
Portion	X	X	X	X
Platform type	X			
Platform lipping	X			
Dorsal scarring	X			
Distal termination type	X			
Thermal alteration	X	X	X	X
Wear patterns	X	X	X	
Modified edge angles	X	X	X	X
Dimensions	X	X	X	X
Core number	X	X	X	X

Two attributes were used to provide information about artifact form and function. The first was morphology, which categorized artifacts by general form. The second was function, which categorized artifacts by inferred use (or lack of use). Dorsal cortex was recorded in increments of 10 percent, and cortex type was defined as waterworn or nonwaterworn when possible. All artifacts were coded as whole or fragmentary; when fragmentary, the portion was recorded if it could be identified. Evidence of two types of alteration were noted: thermal and edge damage. When present, the type and location of thermal alteration was recorded. This information was used to determine whether or not the artifact was purposely altered. Edge damage, both cultural and noncultural, was recorded and described when present. Edge angles were measured on all artifacts demonstrating cultural edge damage, and on all formal tools; edges lacking evidence of cultural damage were not measured.

Dimensions were measured on each artifact. On angular debris and cores, length was defined as the artifact's largest measurement, width was the longest dimension perpendicular to the length, and thickness was perpendicular to the width and was usually the smallest measurement. On flakes and formal tools, length was the distance between the platform (or proximal end) and termination (or distal end), width was the distance between the edges paralleling the length, and thickness was the distance between dorsal and ventral surfaces.

Four attributes were examined on flakes only: platform type, platform lipping, dorsal scarring, and distal termination. Platform type is an indicator of reduction technology and stage. Any modifications to platforms were noted, as were missing and collapsed platforms.

Platform lipping usually indicates soft-hammer reduction (Crabtree 1972), and is often an indication of the later reduction stages. Analysis of dorsal scarring entailed noting whether scars originating at the distal end of a flake were present. These are opposing scars, which are often evidence of removal from a biface. The type of distal termination was noted to help determine whether it was a successful removal or ended prematurely, and to provide data on manufacturing versus post-removal breakage.

Flakes were further divided into removals from cores and bifaces using a polythetic set of conditions (Table 4.2). A polythetic framework is one in which fulfilling a majority of conditions is both necessary and sufficient for inclusion in a class (Beckner 1959). The polythetic set contains an array of conditions, and rather than requiring an artifact to fulfill all of them, only a set percentage in any combination need be fulfilled. This array of conditions models an idealized biface flake and includes information on platform morphology, flake shape, and earlier removals. The polythetic set used here was adapted from Acklen et al. (1983). In keeping with that model, when a flake fulfilled 70 percent of the listed conditions, it was considered a removal from a biface. This percentage is high enough to isolate flakes produced during the later stages of biface production from those removed from cores, while at the same time it is low enough to permit flakes that were removed from a biface but do not fulfill the entire set of conditions to be properly identified. While not all flakes removed from bifaces could be isolated using the polythetic set, those that were can be considered definite evidence of biface reduction. Flakes that fulfilled less than 70 percent of the conditions were classified as removals from cores. Instead of rigid definitions, the polythetic set provided a flexible means of categorizing flakes and helped account for some of the variability seen in flakes removed during experiments.

Distinguishing between biface and core flakes in an assemblage is an important step in defining basic reduction technology. A predominance of biface flakes, particularly those removed from large bifaces serving as cores, suggests a high degree of mobility. Conversely, a predominance of core flakes and only a few small biface flakes suggests limited formal tool manufacture by a sedentary population.

TABLE 4.2. POLYTHETIC SET FOR DISTINGUISHING BIFACE FLAKES FROM CORE FLAKES

WHOLE FLAKES

1. Platform:
   a. has more than one facet
   b. is modified (retouched and abraded)
2. Platform is lipped.
3. Platform angle is less than 45 degrees.
4. Dorsal scar orientation is:
   a. parallel
   b. multidirectional
   c. opposing
5. Dorsal topography is regular.
6. Edge outline is even, or flake has a waisted appearance.
7. Flake is less than 5 mm thick.
8. Flake has a relatively even thicknes from proximal to distal end.
9. Bulb of percussion is weak (diffuse).
10. There is a pronounced ventral curvature.

BROKEN FLAKES OR FLAKES WITH COLLAPSED PLATFORM

1. Dorsal scar orientation is:
   a. parallel
   b. multidirectional
   c. opposing
2. Dorsal topography is regular.
3. Edge outline is even.
4. Flake is less than 5 mm thick.
5. Flake has a relatively even thickness from proximal to distal end.
6. Bulb of percussion is weak.
7. There is a pronounced ventral curvature.

ARTIFACT IS A BIFACE FLAKE WHEN:

If whole, it fulfills 7 of 10 attributes
If broken or platform is collapsed, it fulfills 5 of 7 attributes

Ground Stone Artifact Analysis Methods

Ground stone artifact analysis was completed using the Office of Archaeological Studies' (1994b) standardized methodology, and was designed to examine material selection, manufacturing technology, and use. Artifacts were examined macroscopically, and dimensions were measured with a sliding caliper or metal tape. Analytical results were entered into a computerized database using the Statistical Package for the Social Sciences Data Entry program, and are discussed in individual site reports.

In addition to providing information on activities occurring at a site, this analysis measures assemblage cost and value. When these measures are compared it is possible to look at differences between what went into a site and what left it, length and type of occupation, processes of site abandonment, and differences in material wealth among site residents. Considering the types of sites investigated, the latter cannot be examined, but most of the other questions can. For example, in an orderly site abandonment, ground stone tools that retain an intrinsic value outweigh the difficulty of transport. In a hasty or unplanned abandonment, ground stone tools that retain value and are easily transported may be left behind. A long-term sedentary occupation should leave behind an array of broken and exhausted ground stone tools demonstrating a wide range of production activities. On the other hand, a fieldhouse or farmstead should contain few whole ground stone tools, and those that remain should retain little if any value. Ground stone tools on hunter-gatherer sites should exhibit little formal modification. Broken tools and those that are more easily cached than transported should be present. Small ground stone tools that could be transported easily should only be represented by broken fragments, though they might occur in caches.

Attributes Examined during the Study

Several attributes were recorded for each ground stone artifact; other attributes were recorded for a only few specialized tool types. Those recorded for all ground stone artifacts included material type, material texture and quality, function, portion, preform morphology, production input, plan view outline form, ground surface texture and sharpening, shaping, number of uses, wear patterns, evidence of heating, presence of residues, and dimensions. The only specialized attributes recorded in this analysis were mano cross-section form and ground surface cross section.

By examining function it is possible to define the range of activities in which ground stone tools were used. Because these tools are usually large and durable, they may undergo a number of different uses during their lifetime, even after being broken. Several attributes were designed to provide information on the life history of ground stone tools, including dimensions, evidence of heating, portion, ground surface sharpening, wear patterns, alterations, and the presence of adhesions. These measures can help identify post-manufacturing changes in artifact shape and function, and describe the value of an assemblage by identifying how worn or used it is. Such attributes as material type, material texture and quality, production input, preform morphology, plan view outline form, and texture provide information on assemblage cost. In combination they furnish data on raw material choice and the cost of producing various tools. Mano cross-section form and ground surface cross section are specialized measures aimed at describing aspects of form for manos and metates, since as these tools wear, they undergo regular changes in morphology that can be used as relative measures of age.

Ceramic Artifact Analysis

Rough Sort

The first phase of the ceramic analysis was a rough sort, which was intended to provide a count for each site and an idea of what pottery types would be encountered during detailed analysis. All sherds from LA 65005, 65006, and 65013 were examined, and totaled 2,484. Most of the assemblage was from LA 65005 (n=2,373); 32 sherds came from LA 65006, and 79 were from LA 65013. Sherds were coded by general type, vessel form and portion, provenience, and frequency. Painted sherds were separated for inclusion in the detailed analysis.

Sherds were coded by bag rather than individually. The contents of a bag were first sorted by general ceramic types. When the separation of all types was completed, each group was then divided by vessel form and portion, and counted. Counts were then entered on analysis forms.

Definitions of Ceramic Rough Sort Types

Tewa Red. Thick, well-polished red slip, tuff or pumice temper; may be part of an overall red-slipped vessel, the lower portion of a polychrome vessel, or the neck of a San Juan Red-on-tan jar. These categories were lumped together for the rough sort.

Tewa Black. Thick, well-polished black slip, tuff or pumice temper; see detailed analysis below for a more complete description.

Tewa other (gray, buff, brown, eroded). A catch-all category for all other varieties of undecorated Tewa Ware sherds. Tewa Gray is a polished, unslipped ware. Tewa Buff includes polished or unpolished, unslipped body sherds, representing either the lower undecorated portion of polychrome, San Juan Red-on-tan, or red ware vessels; unpolished buff sherds may also be the remains of painted portions of polychrome vessels from which the paint and slip has eroded. Brown sherds were probably intended to be red, but were misfired.

Historic Tewa polychromes. All historic Tewa polychromes were included in this category.

Tewa Black-on-red. Sometimes classified as Powhoge Black-on-red. Same forms and design styles as Powhoge Polychrome, except that the upper two-thirds of vessels are slipped red instead of white.

Puname-area polychromes. Polychromes from this area have a distinctive orange or red brick-colored paste. Distinctions were made between Zia and Santa Ana (Puname area) based on temper. Ceramic types from Zia have crushed basalt temper, while Santa Ana types are tempered with large water-worn sand grains.

Northern Rio Grande painted wares. All prehistoric types, including Kwahe'e Black-on-white, Santa Fe Black-on-white, Wiyo Black-on-white, and Biscuit wares were placed in this category.

Glaze wares. All Rio Grande glaze wares were included in this category.

Micaceous Utility Ware. Both micaceous slipped (nonmicaceous paste) and micaceous paste types were included.

Utility, other. Utility ware sherds that had neither a micaceous paste nor a micaceous slip; generally, these sherds were sand tempered. These may be sherds of Vadito Micaeous from which the micaceous slip has eroded.

Detailed Analysis

The detailed analysis for LA 65005 consisted of a 25.6 percent sample of the assemblage (n=607) that included all sherds from the northwest quadrant of Feature 1, and all other painted sherds from the site. Since the ceramic assemblages from LA 65006 and LA 65013 were small, all sherds from those sites were subjected to detailed analysis.

Assigning sherds to vessel form categories often proved to be difficult. Most utility ware vessels were usually jars. Unfortunately, unless a sherd was part of the rim or neck of a vessel, or showed evidence of smoothing on one side or the other, it was not possible to accurately assign them to a specific category. Thus, these specimens were coded as "indeterminate body sherds." The historic polychromes were also difficult to classify, since both jars and bowls were decorated on the exterior. Further complications included the small size of the sherds (which averaged 2-by-2 cm) and heavy erosion of their surfaces. Erosion often prevented determination of the presence or absence of any surface treatment on vessel interiors, making it impossible to ascertain vessel form (unless the sherd was large enough to exhibit curvature).

Temper was examined with a binocular microscope and recorded for all sherds. Magnification ranged from 10x to 45x. Details of design elements and styles were recorded for painted sherds. This category was useful in temporally separating the polychromes. For example, geometric designs generally occurred later than flowers or feathers. Feathers without filled-in red tips indicated either a very early Powhoge or a transitional Ogapoge/Powhoge Polychrome. A distinction was made between single or double framing lines when present, since this feature can be a temporal indicator. Again, the small size and eroded quality of the sherds often precluded identification of design, and many sherds were assigned to "indeterminate design."

Other attributes recorded for both painted and utility wares included rim form and cross section, paste color, slip (location on vessel), and presence or absence of naturally occurring mica in the paste, slip, or both. Analytical results were entered into a computerized database using the Statistical Package for the Social Sciences Data Entry program. Data summaries are included in individual site reports and in a separate synthetic chapter.

Ceramic Type Descriptions for Detailed Analysis

The ceramic types that occurred most frequently in these assemblages are described below. Polychrome descriptions are from Harlow (1973) and Frank and Harlow (1974). Traditional dates are assigned in this section, though their accuracy for several types is questioned in a later section of the report. In addition, some dubious type distinctions are included, and are also discussed in a later chapter.

Tewa Red (A.D. 1700 to present). Thick, well-polished red slip, tuff or pumice temper; may be part of an overall red-slipped vessel, the lower portion of a polychrome vessel, or the neck of a San Juan Red-on-tan jar.

Tewa Black (A.D. 1720 to present). An inclusive term used to describe slipped and polished black wares with vitric tuff or crystal pumice temper. Other names previously used are Kapo Black and Santa Clara Black. The term *Tewa Polished Black* was suggested by Carlson (1965) since *Kapo Black* was originally used to designate vessels with a specific shape and of a very limited time period (Harlow 1973), and there is an abundance of polished black wares that lack this shape. Vessel forms include jars, bowls, and flange plates, the latter often having a neatly scalloped rim.

Tewa Buff or Brown (A.D. 1600 to present). This category included sherds with Tewa-type temper that did not fit into more specific categories. It includes buff sherds that could represent the basal portions of polychrome or San Juan Red-on-tan vessels, and brown sherds that represent misfired red or black wares. If a sherd was so eroded that no slip remained but it had a buff paste and Tewa temper, it was included in this category.

Tewa Gray (A.D. 1600 to present). Tewa Gray vessels are identical in shape and temper to Tewa Black, the only difference is the surface color. Some Tewa Gray sherds are unslipped and polished; others are unslipped basal portions to black ware vessels.

San Juan Red-on-tan (A.D. 1700 to present). Polished red slip on a stone-smoothed tan paste, with Tewa-type temper. San Juan Red-on-tan vessels have a thick red slip, which generally does not continue over the exterior lip of a jar into the interior, and bowls have no interior decoration except for a red band under the rim.

Sakona Polychrome (A.D. 1600 to 1700). Sakona is an intermediate type between Sankawi Black-on-cream and Tewa Polychrome. It differs from other early Tewa polychromes in that designs are found on bowl interiors rather than exteriors. The surface is divided into several panels, each with an embellished diagonal line. A red slip on the underbody and rim top distinguishes this type from Sakona Black-on-tan. Vessel forms are similar to Tewa Polychrome.

Tewa Polychrome (A.D. 1650 to 1730). This type is characterized by a red slipped upper body, with the under body slipped about two-thirds of the way to the base. The bottom third of the base is polished but unslipped, and therefore buff, not red. A white slip was applied over the red slip in a band at the mid-body, and was decorated with neat, formal, open, fine-lined designs in black carbon paint, outlined by single horizontal framing lines. Bowls were keeled, and jars tended to bulge outward at mid-body. Some soup plates, indicating Spanish influence, also occur.

Pojoaque Polychrome (A.D. 1720 to 1760). A transitional type between Tewa Polychrome and Powhoge Polychrome. It is similar to Tewa Polychrome in that the design occurs only in a band at the mid-body. It differs in that the design is bolder, with geometric figures containing large filled-in black areas. In addition, it has only a red basal band below the white slip (Tewa Polychrome has red slip two-thirds of the way to the base); the upper body is slipped red as in Tewa Polychrome, and jar forms are slightly broader.

Ogapoge Polychrome (A.D. 1720 to 1760). The use of red slip is considerably reduced in Ogapoge Polychrome. The upper body of jars is white slipped, except for red slipped rims. On both bowls and jars the underbody red slip was restricted to a narrow band just below the lowest framing line. Below the red band, the surface is polished but unslipped. Framing lines are generally single, becoming double in later examples, which are transitional to Powhoge Polychrome. Design elements are less geometric, and feathers and flowers are more common. A significant change is the inclusion of red in designs, often filling the tips of feathers. As red comprises only a small part of the design and is not always present on each sherd, it was often difficult to assign small sherds to this category.

Powhoge Polychrome (A.D. 1760 to 1850). This is the first type in the Tewa Polychrome series in which the whole upper part of the body became a decorative area. Simple, bold, heavy geometric designs were painted in a panel just below the rim of a short white-slipped neck using black carbon paint. The use of flower and feather motifs was discontinued in all but the earliest vessels, and red was no longer used in the design, but only occurred on the rim top and in a narrow band below the lowest framing lines. Double framing lines were used, rather than the single lines which are diagnostic of earlier styles. Jars are globular, bowls are depressed hemispherically, and vessels lack the sharp keel seen in previous types.

Tewa Black-on-red (seventeenth century?). Black matte paint designs on a red slip; present at seventeenth-century sites (earlier than Powhoge Black-on-red).

Nambe Polychrome (A.D. 1760 to 1825). Design elements are similar to Powhoge Polychrome. The following characteristics distinguish the types: (1) Nambe Polychrome has larger, although not necessarily more, mica flakes in the paste, (2) the slip on Nambe vessels is softer and erodes more easily, and the underbody is not as well smoothed, and (3) design execution is noticeably sloppier on Nambe vessels.

Unknown Tewa Polychrome(?). Most of the painted wares fell into this category, since many sherds were too small to make accurate type assignments. These sherds have a buff paste, tuff and/or pumice temper, and at least a remnant of white slip. Parts of a design are often present, but are insufficient for assignment to a specific type.

Puname Polychromes (A.D. 1700 to 1750+). Distinctions were made between Zia and Santa Ana (Puname district) pottery based on temper type. Vessels from Zia have crushed basalt temper, while Santa Ana types are tempered with large waterworn sand grains. Both have a distinctive orange or red brick-colored paste.

Vadito Micaceous (A.D. 1600 to early twentieth century). Vadito Micaceous was made at Picuris and Nambe, and is a nonmicaceous-tempered culinary ware that has a prominent micaceous slip, consisting of a serecite mica-rich clay over a rough surface (Dick 1965:42-43, 143; Ellis 1964:38). Dick (1965:142) described the temper of specimens from Picuris as coarse quarzitic and arkosic sand, mica (sometimes as a natural constituent of the clay), and occasional pieces of gravel up to 10 mm in diameter. Most jar interiors have smoothed and smudged surfaces, and are often polished (Schaafsma 1979:145).

Peñasco Micaceous (A.D. 1600 to present). This category includes culinary wares made from micaceous clays or with a micaceous temper, with or without a micaceous slip. The clay contains biotite mica and grains of quartzitic sand. Vessels are usually unslipped, although a biotite micaceous slip does occur.

Sapawe Micaceous-Washboard (A.D. 1450 to 1600). This utility ware is characterized by a micaceous paste and a distinctive surface treatment. Vessel exteriors exhibit ". . . vestiges of ribbed coil marked with shallow indentations, producing a washboard-like appearance" (Hawley 1936:93). It is found in association with the Biscuit wares.

Kwahe'e Black-on-white (A.D. 1125 to 1200). Thin streaky slip or wash; bowls were slipped only on the interior (Mera 1935). Hatchure and solid elements, in mineral paint, are common design styles.

Santa Fe Black-on-white (A.D. 1200 to 1350). Thinly slipped in gray, blue-gray, to white, decorated with carbon paint. The temper is often unrecognizable, but is generally tuff. Designs are generally solid and hatched elements (Amsden 1931; Mera 1935;

Wetherington 1968).

Wiyo Black-on-white (A.D. 1300 to 1400). A predecessor to the Biscuit wares, with a tan, gray, or olive paste and slip. Designs are bold lines and geometrics, in carbon paint. The temper is usually vitric tuff (Warren 1979; Mera 1935).

Biscuit A (A.D. 1375 to 1425). A prehistoric painted ware, with a stone-stroked white or gray slip on the interior, and a rough exterior. Vessel forms are exclusively bowls. Neatly executed formal designs in carbon paint are found only on bowl interiors; design motifs are generally lines and geometrics (Harlow 1973).

Biscuit B (A.D. 1425 to 1475). Distinguished from Biscuit A by an exterior slip to which neat and well-organized designs were applied, often with elements similar to those used in bowl interiors. Biscuit B is otherwise very similar to Biscuit A, except that this type also includes low globular jars with rounded bases (Harlow 1973:22).

Glaze wares (A.D. 1300 to 1700). All sherds with glaze paint decoration were included in this category. Glaze wares were produced in the central Rio Grande region, and represent imports.

Prehistoric indeterminate. A general category used when a sherd was too small or eroded to accurately specify a type, but was obviously of prehistoric manufacture.

Indeterminate. Sherds that were too small or eroded to be classified in any other category.

Faunal Analysis

All bone recovered during excavation was returned to the OAS for processing. Faunal materials were dry brushed to remove dirt from all surfaces so muscle attachments, other identifiable surface features, and processing marks would not be obscured or removed. The remains were then identified to the most specific level possible using comparative faunal collections housed at the OAS and the Museum of Southwest Biology at the University of New Mexico. Identifications were also aided by guides to the taxonomic and element classification of mammals and birds (Gilbert 1990; Gilbert et al. 1985; Olsen 1964, 1968). While these guides were used for preliminary identification, all specimens were subsequently compared to examples in the above collections for final identification.

Attributes recorded for all specimens included taxonomic level, element, portion, completeness, laterality, age, and developmental stage. In addition, each specimen was assessed for any environmental, animal, or thermal alteration that might be present. Finally, any butchering marks, such as cuts or impact scars, were recorded along with any apparent modification for tool manufacture or use (Kidder 1932; Semenov 1964). Analytical results were entered into a computerized database using the Statistical Package for the Social Sciences Data Entry program. Data summaries are included in site descriptions and in a separate synthetic chapter.

Flotation and Macrofloral Analysis

Soil samples collected during excavation were processed by the simplified bucket version of flotation (Bohrer and Adams 1977). Each sample was immersed in a bucket of water, and a 30 to 40 second interval allowed for settling out of heavy particles. The solution was then poured through a fine screen (about .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 dried.

Each floated sample was sorted using a series of nested geological screens (4.0, 2.0, 1.0, 0.5 mm mesh), and was then reviewed under a binocular microscope at 7x to 45x. Scanning, which provides a reliable record of presence and absence of seed taxa in flotation samples, was adopted as a cost-efficient method of systematically reviewing archaeobotanical contents of soil samples without committing to a major time investment in full-sort analysis. In this procedure, all materials caught in the larger screens (4.0, 2.0, and usually 1.0 mm mesh) were sorted completely, and a brief sample of materials from the 0.5 mm screen was examined. Material passing through all screens was not examined at all. Examples of each taxon encountered were retained, but no effort was made to save every seed and fragment present, and seeds were not counted.

Charcoal samples collected in the field were examined prior to submission for radiocarbon dating. Each piece was snapped to expose a fresh transverse section, and identified at 45x. Selection of specimens was geared towards securing a minimal sufficient sample (the objective was 5 g) with the fewest pieces, rather than aiming to examine both large and small pieces. Low-power, incident light identification of wood specimens does not often allow species- or even genus-level precision, but can provide reliable information useful in distinguishing broad patterns of utilization of a major resource class.

Pollen Analysis

Chemical extractions of pollen samples were conducted using a procedure designed for arid Southwestern sediments. The methodology specifically avoids use of such reagents as nitric acid, bleach, and potassium hydroxide, which have been demonstrated experimentally to be destructive to pollen grains (Holloway 1981).

Initially, about 25 g of soil were subsampled from each sample, and prior to chemical extraction, three tablets of concentrated spores (batch #414831, Department of Quaternary Geology, Lund, Sweden) were added to each subsample for a total of 36,231 marker grains each. This was done to permit the later calculation of pollen concentration values and to serve as a means of judging accidental destruction of the pollen assemblage by laboratory methods. The samples were initially treated with 35 percent hydrochloric acid to remove carbonates and to release the *Lycopodium* spores from their matrix. After neutralizing the acid with distilled water, samples were allowed to settle for at least three hours before the supernatant liquid was removed. Additional distilled water was added, the mixture swirled, and then allowed to settle for 5 seconds. The suspended fine fraction was decanted from the original mixture through 230-micron mesh into a second beaker. This procedure, repeated at least three times, differentially removed lighter materials (including pollen grains) from the heavier fractions. The fine material was concentrated by centrifugation at 2,000 rpm.

This fine fraction was treated with cold 49 percent HF overnight to remove silicates. After neutralizing the acid with distilled water, trisodium phosphate (Na_3PO_4, 2.5 percent) was added to each sample. This material was repeatedly washed out by mixing with distilled water followed by centrifugation at 2,000 rpm. This procedure removed fine charcoal and other associated organic matter, and was continued until the supernatant liquid was clear after centrifugation. The residues were washed with glacial acetic acid to remove any remaining water in preparation for acetolysis.

Acetolysis solution (acetic anhydride:concentrated sulfuric acid in a 9:1 ratio) following Erdtman (1960) was added to each sample. The tubes were heated in a boiling water bath for 5 minutes and allowed to cool an additional 5 minutes before centrifugation and removal of the acetolysis solution. The samples were washed with glacial acetic acid to remove all traces of the acetolysis solution prior to multiple washes with hot distilled water. Centrifugation at 2,000 rpm for 90 seconds dramatically reduced the size of the samples and, from periodic examination of the residue, did not remove fossil palynomorphs.

These residues were treated with a heavy density separation using zinc chloride (specific gravity of 1.99 to 2.00) in order to remove other small inorganic particles. The lighter organic portion was removed by pipet, diluted with distilled water (10:1) and concentrated with distilled water. The residue was repeatedly washed with distilled water and centrifugation until the supernatant liquid was clear. The material was rinsed in methanol stained with safranin O suspended in a methanol solution. Three rinses with methanol effectively destained the samples, which were transferred to 1-dram vials with tertiary butyl alcohol (TBA). Subsequent washes (90 second centrifugation) with TBA effectively reduced the residue size of large samples by removing fine charcoal and organic materials. The samples were mixed with a small quantity of 1,000 centistoke (cks) silicon oil and allowed to stand overnight for evaporation of the TBA. The storage vials were capped and are in permanent storage at Castetter Laboratory for Ethnobotanical Studies.

A drop of the polliniferous residue from each sample was mounted on individual microscope slides for examination under 18-by-18-mm cover slips, sealed with fingernail polish. Each slide was examined using 250x or 400x magnification under an aus-Jena Laboval 4 compound microscope. A minimum count of 200 grains was attempted for each sample as suggested by Barkley (1934). After the counts, the remainder of each slide was examined for the presence of cultigen pollen types such as *Zea mays*, *Cucurbita,* or members of the families Malvaceae, Cactaceae, or Nyctaginaceae. After 50 marker grains were tabulated, pollen concentration values were estimated. If the pollen concentration values were low (~1,000 grains per gm) *and* the percentage of indeterminate pollen was greater than 20 percent, tabulation was terminated. The remainder of the slide was examined for cultigen pollen and these were recorded if present.

Pollen concentration values were computed for each sample using the following formula:

$$PC = \frac{K * \Sigma_p}{\Sigma_L * S}$$

where: PC = pollen concentration
K = *Lycopodium* spores added
Σ_p = fossil pollen counted
Σ_L = *Lycopodium* spores counted
S = sediment weight

Statistically, the concentration values provide a more reliable estimate since a minimum number of marker grains were counted rather than relying upon the relative percentages of fossil grains. Concentration values were calculated independently for each taxon and thus, theoretically, a change in the concentration values of a single taxon do not affect values for any other taxa. Relative frequencies on the other hand, tie the taxa together in the sense that a change in one taxon will necessitate a change in all other taxa. This change may be so slight as to be unnoticeable, but it is there nonetheless.

Pollen grains were identified to the lowest taxonomic level whenever possible. Most of these identifications conformed to existing taxonomic schemes but with a few exceptions. For example, the category Cheno-am is an artificial construct that includes pollen of the Chenopodiaceae (goosefoot) and the genus *Amaranthus* (pigweed; Martin 1963), which are indistinguishable from each other. All members are wind pollinated and produce very large quantities of pollen. In many sediment samples from the Southwest, this taxon often dominates the assemblage.

Pollen of the Asteraceae (Composite) family were divided into four groups. The high spine and low spine groups were identified by spine length. High spine Asteraceae were those grains with spines greater than or equal to 2.5 microns in length while the low spine group had spines less than 2.5 microns in length. *Artemisia* is identifiable to the genus level due to its unique morphology of a double tectum in the mesocopial (between furrows) region of the pollen grain. Pollen grains of Liguliflorae are also distinct in shape, and grains of this type are restricted to the tribe Cichoriae, which includes such genera as *Taraxacum* (dandelion) and *Lactuca* (lettuce).

Pollen of the Poaceae (grass) family are generally indistinguishable below the family level, the single exception being pollen of *Zea mays*. All members of this family contain a single pore, are spherical, and have simple wall architecture. Identification of noncorn pollen is dependent on the presence of the pore. Only grains, or grain fragments, containing the pore were tabulated as members of Poaceae.

PART 2. SITE DESCRIPTIONS

CHAPTER 5. PEDRO SÁNCHEZ SITE (LA 65005)

Joan K. Gaunt and James L. Moore

LA 65005 is situated on a terrace 75 m north of Totavi Wash in Los Alamos Canyon at an elevation of 1,707 m, and covers an area of 1,258 sq m. The site was first recorded by Moore and Levine (1987:13-14) as a tentative early historic period Tewa fieldhouse. Upon closer examination during testing it was thought more likely that a Spanish Colonial occupation was represented (J. Moore 1989). This seems to be the case, and is discussed in more detail in Chapter 12, *Spanish Adaptations to the New Mexican Frontier: LA 65005*. The ground surface is covered by a moderate growth of mixed grasses, snakeweed, and low sage. Juniper is common on surrounding hills and terraces, and cottonwood trees line major drainages. Rabbitbrush is common along minor drainages.

LA 65005 contained a small rubble area and three trash pits (Fig. 5.1). The rubble area has been severely disturbed by a gas pipeline, and two trash pits located south of the structure are eroding into Totavi Wash. These features were outside the construction zone and were not investigated in detail. A third trash pit (Feature 1) was within the construction zone just north of the rubble area, and was found to contain intact subsurface deposits during testing (J. Moore 1993). Site measurements were revised to 35-by-32 m, about 34 percent of which was within the construction zone.

Feature 1 was expressed on the surface as a heavy concentration of chipped stone and ceramic artifacts. A test pit in this area revealed five strata including two distinct cultural layers (J. Moore 1993:20). This test pit was re-excavated during data recovery to serve as a center point for north to south and east to west trenches. Most artifacts recovered from the test pit came from Strata 1 and 2. Stratum 3 was a compact homogeneous layer of fine sand and silt and contained very few artifacts, and strata below this level were sterile alluvial deposits. Since testing indicated that a trash pit of substantial depth existed within the construction zone at LA 65005, data recovery was initiated.

Excavation Methods

Surface artifacts were collected in 1-by-1-m units on and around the midden. The test unit in the midden, Grid 100N/76W, was reopened and its stratigraphy examined. From this grid, a trench was excavated in 1-by-1-m units

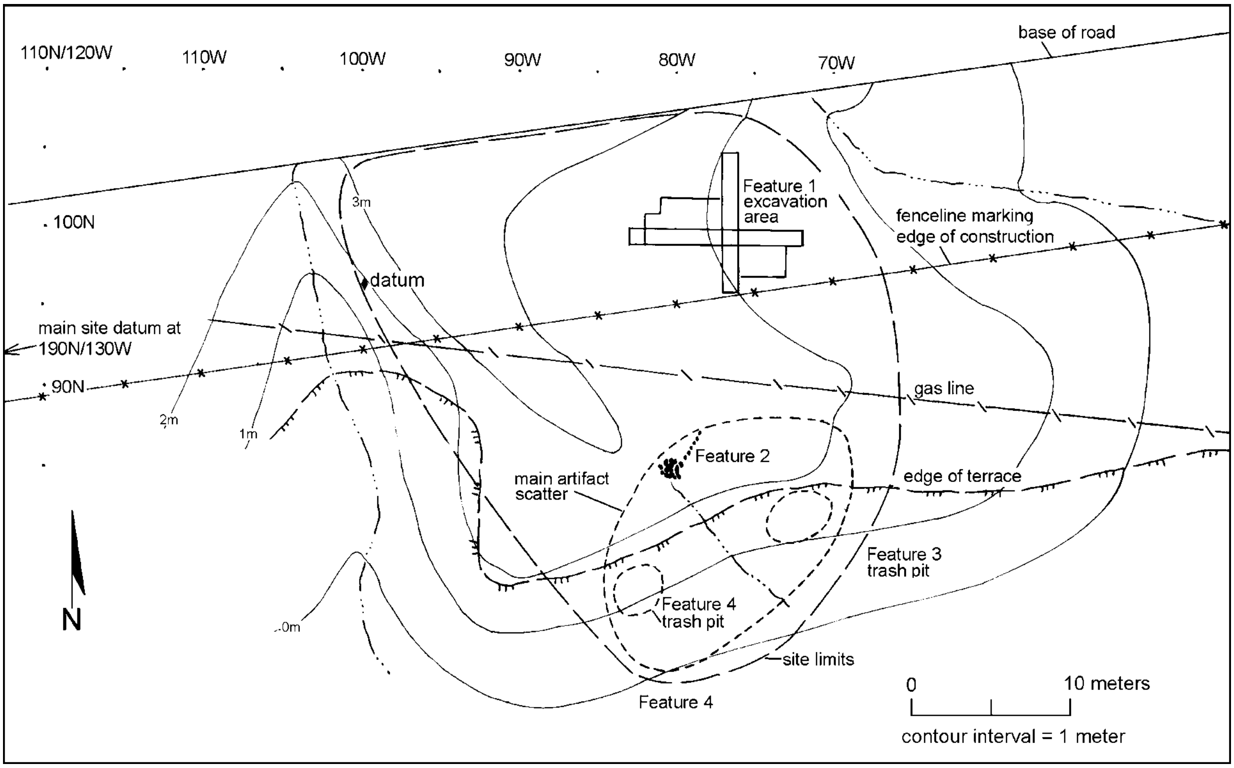

Figure 5.1. Plan view of the Pedro Sánchez site. (Pueblo of San Ildefonso land.)

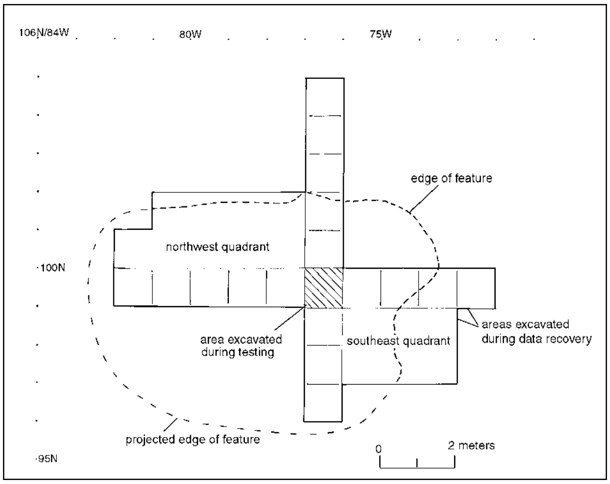

Figure 5.2. Excavated portion of Feature 1 at the Pedro Sánchez site.

extending 5 m north and 3 m south. Again using 100N/76W as a center point, a second trench extended 4 m east and 5 m west (Fig. 5.2). These trenches were used to delineate the extent of the trash deposits and recover materials discarded during occupation of the site. Grids were initially dug in 10 cm levels until the natural stratigraphy could be defined. After this was accomplished, grids were excavated by individual stratum. All soil removed from this area was screened through ¼-inch mesh hardware cloth, and stratigraphic profiles were drawn for both walls of each trench.

Site Stratigraphy

Seven strata were defined in Feature 1, and are shown in the trench profiles (Fig. 5.3). Strata 1 and 2 were of cultural origin, Stratum 3 was largely sterile with a few artifacts introduced through bioturbation, and Strata 4 through 7 were natural deposits (Fig. 5.4). Cultural materials occurred in three of the seven strata; those recovered from sterile alluvial strata are assumed to have been transported through bioturbation. The stratigraphic sequence is described from the surface down to the alluvial deposits.

Stratum 1

This was a 7 to 24-cm-thick layer of brown loosely compacted silty sand and small gravels. The unsorted sands were subrounded to subangular, fine- to medium-textured particles. This was the uppermost stratum, and a considerable amount of bioturbation was noted. Charcoal flecks occurred throughout this layer, and a concentration of ash and charcoal was noted at the west end of the excavation area. Numerous artifacts were recovered from this stratum.

Stratum 2

This was a 3 to 32-cm-thick layer of loosely compacted pale brown silty sand. The sand consisted of unsorted and rounded, fine to medium-textured particles. A considerable amount of bioturbation was noted in this stratum. Charcoal flecks occurred throughout the unit, and a large ash and charcoal concentration was noted in the northwest quadrant. Numerous artifacts were recovered from this stratum.

Stratum 3

This was a 6 to 28-cm-thick layer of pale brown, fine-textured, homogeneous silt and small rounded gravels. The few artifacts recovered from this stratum were probably introduced by bioturbation. Some charcoal fragments were also noted.

Stratum 4

This was a 6 to 30-cm-thick layer of gray brown sand and gravel. The sand was unsorted, subrounded to rounded, and coarse-textured. Numerous gravels were noted, ranging in size from pea-sized gravels to small cobbles 5 cm in diameter. Large alluvially deposited cobbles occurred at the bottom of this stratum, and it contained no artifacts or charcoal.

Stratum 5

This was a 4 to 13-cm-thick layer of yellow-brown sand and gravel. The sand was unsorted and subangular to subrounded, with a medium-coarse texture. Stratum 5 was basically a subunit of Stratum 1, and appeared to be filling a small drainage at the low point of the midden. No artifacts were found in this unit.

Stratum 6

This was a 3 to 22-cm-thick layer of large subangular, angular, and subrounded coarse gravels. It occurred under Stratum 4, and appeared only at the north end of the north-south trench. No artifact deposits were found in this unit.

Stratum 7

This was a 4 to 16-cm-thick layer of light yellowish brown coarse subrounded sand particles. It occurred in two pockets at the north end of the north/south trench, and contained no artifact deposits.

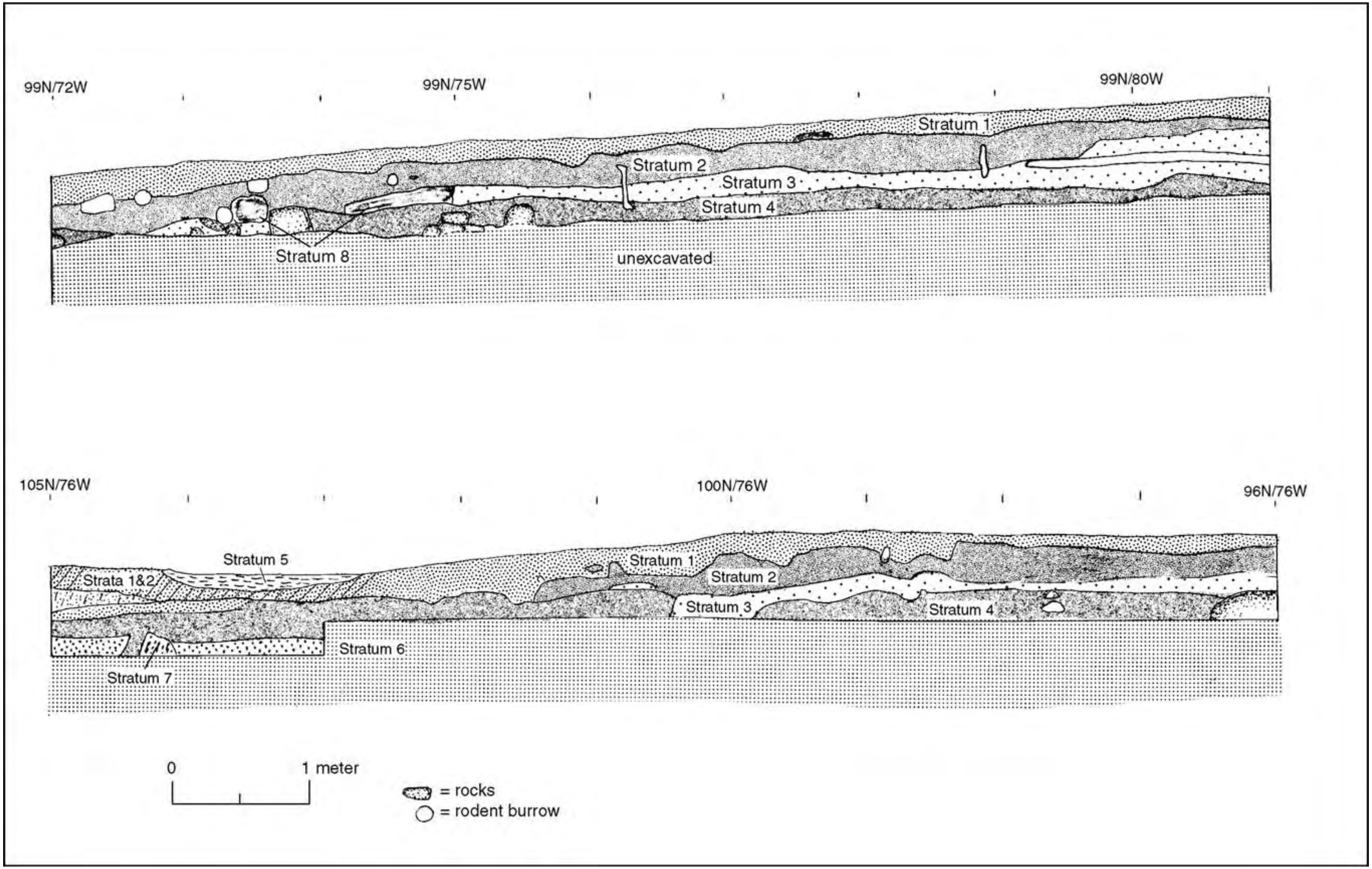

Figure 5.3. (a) Profile of the north wall of the east-west trench through Feature 1 at the Pedro Sánchez site; (b) profile of the west wall of the north-south trench through Feature 1 at the Pedro Sánchez site.

Figure 5.4. Stratigraphic profile in Feature 1, Pedro Sánchez site.

Stratigraphic Summary

As excavation proceeded, the configuration and artifact content of Strata 1 and 2 suggested that Feature 1 represented a trash-filled pit. The structure of Stratum 3 initially appeared to confirm this interpretation. It first appeared to be a cultural manifestation and not a natural stratum, since the clay texture of the soil resembled that of adobe. This coupled with a definite stratigraphic break at the north end of the north-south trench seemed to suggest that the feature represented an adobe mixing pit, and that Stratum 3 was the remains of the adobe that was mixed in it. In order to determine the boundaries of this possible feature, the northwest and southeast quadrants formed by the cross-cut trenches were excavated by strata (Fig. 5.2). Strata 1 and 2 were removed from these quadrants in order to define the limits of Stratum 3.

The north and east edges of Stratum 3 were defined in trench profiles and were used to establish horizontal limits for the feature. The northwest quadrant expanded the north limits, though it was heavily disturbed by bioturbation. The west edge of Stratum 3 could not be defined since it continued past the west end of the trench. Due to time limitations, excavation had to be terminated 5 m west of the center grid (100N/76E). The south limit also could not be defined, since Stratum 3 extended outside the construction zone. While the exact size of Stratum 3 remains undetermined, the large size of the section that was traced (at least 5.86 m north-south by 10.0 m east-west) and uniform configuration combine to suggest that it did not serve as an adobe mixing pit. A look at the surrounding topography may explain why this stratum exists.

The larger topographic picture places LA 65005 at the toe of a large alluvial fan extending into Los Alamos Canyon. The alluvium was eroded from a mesa 700 m northwest of the site, which is drained by a substantial gully that flowed along the northeast edge of LA 65006 before the highway was built. This places the site in a situation that is subject to periodic flooding. Erosional processes, such as cut and fill episodes and channel cutting, are common in a floodplain environment and probably created the noncultural deposits in Feature 1. Floodplains are usually subject to flooding about every year or two, and most rivers leave their channels two out of every three years (Ritter 1986). Analysis of the fine sand and silt sediments from Stratum 3 suggests they are the result of a flood episode (see below). The area in which these deposits were found was apparently a natural depression, perhaps an abandoned stream channel that was partly filled with material deposited during a flood episode. Construction of the highway has altered the local topography and erosional patterns, so the presence of this drainage was not initially suspected. However, close examination indicated that a gully once cut through the site. Thus, it would appear that cultural materials in Strata 1 and 2 were discarded in an inactive channel, especially since they remained in place rather than eroding away.

Feature Descriptions

Feature 1

Feature 1 was a trash midden situated on a gentle east slope between the road bed and the south edge of the construction zone. As discussed above, the exact size of this feature could not be determined, but it measured at least 10.0-by-5.86 m. Cultural deposits were between 17 and 48 cm thick, and the feature covered a minimum of 72 sq m. The soil strata encountered in this feature have already been discussed. It represents the only extensive excavation area at the site, and contained most of the artifacts recovered.

Feature 2

Feature 2 consists of a cobble alignment and cluster of cobbles that may represent the remains of a surface structure (Fig. 5.1). The alignment is 4.6 m long, while the cluster of cobbles measures 1.5-by-1 m. These materials may have been used in the foundation of an adobe structure known to have been in this location historically (see Chapter 12, *Spanish Adaptations to the New Mexican Frontier: LA 65005*). Unfortunately, a buried gas pipeline was run through this part of the site, and the feature was badly damaged. Thus, it is not possible to confirm whether the alignment and cobble cluster are the remains of a structural foundation from surface indications alone. Since this feature was outside the construction zone, it was not excavated.

Features 3 and 4

These features appear to represent the surface expressions of a pair of trash pits. Since they were outside the construction zone and were therefore not excavated, it was not possible to accurately measure their extent. On the surface they appear as heavier concentrations of cultural materials within a general artifact scatter. Both features are on the edge of Totavi Wash and are being actively eroded. Thus, the amounts and types of materials exposed on the surface are continually changing, as are their apparent sizes.

Artifact Analyses

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Chipped Stone Artifacts

A total of 249 chipped stone artifacts was recovered from this site. The distribution of material types by artifact morphology is shown in Table 5.1. Cherts dominate the assemblage, making up nearly 74 percent of the total. Quartzite and obsidian are next in abundance, comprising 6.4 and 6.0 percent of the assemblage, respectively. Only two formal tools were found, a chopper and a gunflint. However, a large proportion of the debitage assemblage (21.2 percent) exhibit use as informal tools (Table 5.2). Seven of 51 informal tools are utilized or retouched debitage, while the remainder are strike-a-light flints. Discrepancies in counts of flakes and angular debris between Tables 5.1 and 5.2 are because many of the artifacts in these morphological categories were used as strike-a-light flints, and are included with that functional class rather than the utilized debitage category. A detailed discussion of the chipped stone artifacts from this site can be found in Chapter 8, *Analysis of the Chipped Stone Assemblages*.

Ground Stone Artifacts

Only eight ground stone artifacts were recovered from the excavated portion of LA 65005. Three of these tools are manos (two quartzite, one vesicular basalt), one is a hammerstone (vesicular basalt), one is a bowl fragment (unidentified igneous material), and the functions of three were unidentified (all sandstone). The latter grouping represents at least two functional categories, as distinguished by the types of wear present; the surfaces of two of these tools are marked by striations, while the third is polished. Thus, while it is likely that the former represent fragments of manos or metates, the latter was used for polishing rather than grinding.

No secondary wear patterns are visible on any of the ground stone artifacts, suggesting that these tools were not recycled after they were no longer suitable for their original use. The hammerstone and one mano are complete; all other tools are fragmentary. The preform morphology of only three ground stone tools could be determined (two manos, one hammerstone); all were manufactured from cobbles, suggesting acquisition of raw materials in nearby gravel deposits.

The bowl fragment is perhaps the most interesting artifact in this part of the assemblage. Though only a fragment is represented, we were able to determine that it was shaped by pecking and grinding. It was not possible to ascertain whether the grinding was wholly attributable to the manufacturing process, or if it was partly caused by use. The definition of this tool as a bowl fragment is also tentative; from its shape and the presence of grinding it may have functioned as a mortar. Since only a small fragment was recovered, these possibilities could not be addressed.

TABLE 5.1. CHIPPED STONE ARTIFACTS FROM THE PEDRO SÁNCHEZ SITE; FREQUENCIES AND ROW PERCENTAGES

MATERIAL TYPE	ANGULAR DEBRIS	CORE FLAKES	BIFACE FLAKES	CORES	COBBLE TOOLS	BIFACES	TOTALS
Chert	3 16.7	12 66.7	0 0.0	3 16.7	0 0.0	0 0.0	18 7.2
Pedernal chert	70 42.2	90 54.2	2 1.2	3 1.8	0 0.0	1 0.6	166 66.7
Silicified wood	9 64.3	5 35.7	0 0.0	0 0.0	0 0.0	0 0.0	14 5.6
Jemez obsidian	5 38.7	7 53.9	1 7.7	0 0.0	0 0.0	0 0.0	13 5.2
Polvadera obsidian	2 100.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	2 0.8
Igneous undifferentiated	2 40.0	3 60.0	0 0.0	0 0.0	0 0.0	0 0.0	5 2.0
Basalt	1 20.0	4 80.0	0 0.0	0 0.0	0 0.0	0 0.0	5 2.0
Rhyolite	0 0.0	1 100.0	0 0.0	0 0.0	0 0.0	0 0.0	1 0.4
Limestone	0 0.0	1 100.0	0 0.0	0 0.0	0 0.0	0 0.0	1 0.4
Quartzite	3 18.8	12 75.0	0 0.0	0 0.0	1 6.3	0 0.0	16 6.4
Quartzitic sandstone	1 25.0	2 50.0	1 25.0	0 0.0	0 0.0	0 0.0	4 1.6
Massive quartz	0 0.0	4 100.0	0 0.0	0 0.0	0 0.0	0 0.0	4 1.6
Totals Percent	96 38.6	141 56.6	4 1.6	6 2.4	1 0.4	1 0.4	249 100.0

Ceramic Artifacts

A total of 2,373 sherds was recovered from this site, of which a sample of 25.6 percent was subjected to intensive analysis. The distribution of pottery types by vessel form for this sample is shown in Table 5.3. Jars dominated the identifiable vessel forms; bowls were also rather common, but soup plates comprised only a small part of the assemblage. A few prehistoric sherds were found, but locally produced historic wares comprised 96 percent of this assemblage. A detailed discussion of the pottery from this site can be found in Chapter 9, *Analysis and Interpretation of Ceramics from the Pedro Sánchez Site*.

Euroamerican Artifacts

Only 13 Euroamerican artifacts were recovered during excavation at LA 65005. Dateable artifacts include a tin can and two glass bottle fragments. Though they were found in Stratum 1, these artifacts date to the twentieth century and are probably road trash, suggesting some contamination of the upper levels of Feature 1 by modern materials. At least two other artifacts found in Feature 1 are probably also modern contaminants: a stamped metal cap from Stratum 1 and a piece of rolled or sheet metal from Stratum 2. A fragment of melted green glass was found in Stratum 1 or 2, and is probably part of the original assemblage. The seven remaining artifacts are iron and are probably of Spanish Colonial date. Forged iron artifacts include three unidentified fragments, a probable clothes hook, a ring, a bolt, and a short length of drawn wire. Thus, of the thirteen Euroamerican artifacts recovered, five can be eliminated as modern contaminants. The eight remaining artifacts (one glass, seven metal) are probably related to the original Spanish Colonial occupation of the site.

TABLE 5.2. CHIPPED STONE INFORMAL TOOLS FROM THE PEDRO SÁNCHEZ SITE; FREQUENCIES AND ROW PERCENTAGES

MATERIAL TYPE	UTILIZED DEBITAGE	STRIKE-A-LIGHT FLINT	UNUTILIZED ANGULAR DEBRIS
Chert	2 13.3	3 20.0	2 13.3
Pedernal chert	1 0.6	39 24.1	49 30.2
Silicified wood	0 0.0	2 14.3	8 57.1
Jemez obsidian	3 23.1	0 0.0	3 23.1
Polvadera obsidian	0 0.0	0 0.0	2 100.0
Igneous undifferentiated	0 0.0	0 0.0	2 40.0
Basalt	0 0.0	0 0.0	1 20.0
Rhyolite	0 0.0	0 0.0	0 0.0
Limestone	0 0.0	0 0.0	0 0.0
Quartzite	1 6.7	0 0.0	3 20.0
Quartzitic sandstone	0 0.0	0 0.0	1 25.0
Massive quartz	0 0.0	0 0.0	0 0.0
Totals Percent	7 2.9	44 18.3	71 29.5

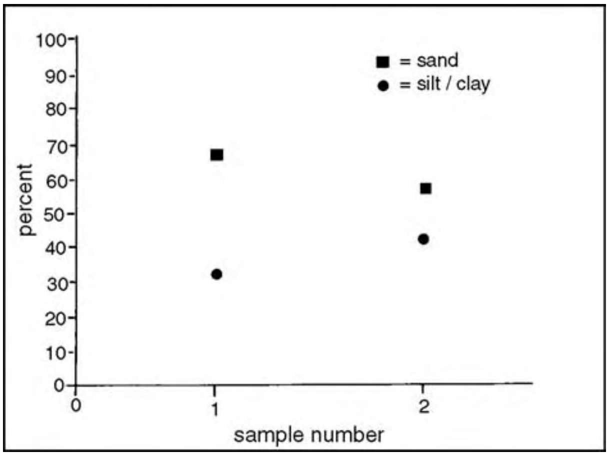

Figure 5.5. Comparison of particle size distributions for soil samples from Feature 1 at the Pedro Sánchez site.

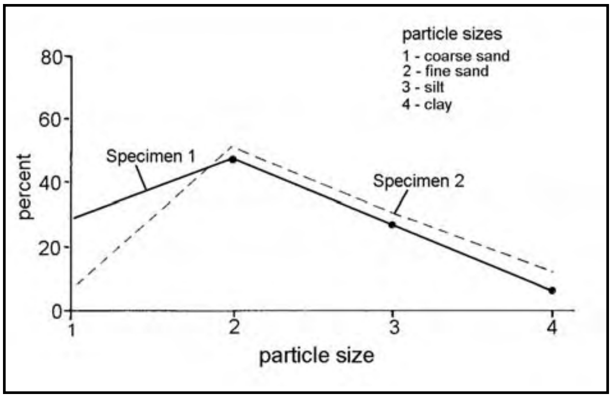

Figure 5.6. Comparison of particle size distributions for soil samples from Feature 1 at the Pedro Sánchez site.

Soil Analysis

As discussed above, Stratum 3 was initially considered a cultural manifestation and not a natural stratum, since the clay texture of the soil resembled that of adobe. Soil tests were conducted to determine whether Stratum 3 was a natural layer or the base of an adobe mixing pit. Two samples were tested; Specimen 1 was a control sample from Stratum 2, which overlay Stratum 3, and Specimen 2 was from Stratum 3, the possible adobe. If the results of these tests maintained physical properties similar to that of adobe, it would tend to support the idea that Feature 1 was an adobe mixing pit, and that Stratum 3 represented unused left-over adobe.

Plasticity index tests measure the threshold between the soil's ability to hold water and remain plastic and the point at which saturation occurs and turns a soil and water mixture to liquid. Specimen 1 had a 7.4 percent plasticity index (liquid limit=28.9 percent, plastic limit=21.5 percent) and Specimen 2 had a 9.3 percent plasticity index (liquid limit=31.5 percent, plastic limit=22.2 percent). Both of these samples are well within the limit for good building material, and have a low capacity for expansion.

Particle size analysis measures the amounts of sand, silt, and clay within soil. The particle size distributions of both specimens were compared to modern construction standards (Fig. 5.5). Both specimens fell within acceptable limits for the sand and silt/clay categories when compared with the Uniform Building Codes (Table 5.4). However, when the U.S. Department of Commerce-National Bureau of Standards limits are applied, only Specimen 1 falls within modern construction standards. Specimen 2 is low in sand (particularly coarse sand, see Fig. 5.6) and high in silt/clay. Despite its good plasticity, this suggests that Specimen 2 may not be adobe, and that similarities between this specimen and adobe simply reflect local soil development and clay content at the site. In addition, the size and shape of Feature 1 suggest that

TABLE 5.3. SAMPLED SHERDS FROM THE PEDRO SÁNCHEZ SITE, CERAMIC TYPE BY VESSEL FORM; FREQUENCIES AND ROW PERCENTAGES

CERAMIC TYPE	JARS	BOWLS	SOUP PLATES	BOWLS OR JARS	INDETERMINATE	WORKED SHERDS	TOTALS
Plain, unpolished	4 5.3	0 0.0	3 3.9	48 63.2	20 26.3	1 1.3	76 12.4
Plain, unpolished, mica paste	1 14.3	0 0.0	0 0.0	6 85.7	0 0.0	0 0.0	7 1.1
Vadito Micaceous	32 32.7	0 0.0	1 1.0	26 26.5	39 39.8	0 0.0	98 16.0
Tewa Black	8 88.9	0 0.0	0 0.0	0 0.0	1 11.1	0 0.0	9 1.5
Tewa Gray	10 55.6	0 0.0	0 0.0	0 0.0	8 44.4	0 0.0	18 2.9
Mineral paint-on-white	1 100.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	1 0.2
Kwahe'e Black-on-white	13 100.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	13 2.1
Carbon-on-white (undifferentiated)	0 0.0	0 0.0	0 0.0	0 0.0	1 100.0	0 0.0	1 0.2
Wiyo Black-on-white	1 100.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	1 0.2
7080	0 0.0	1 100.0	0 0.0	0 0.0	0 0.0	0 0.0	1 0.2
Biscuit A	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	1 100.0	1 0.2
Biscuit B	4 80.0	1 20.0	0 0.0	0 0.0	0 0.0	0 0.0	5 0.8
Prehistoric unknown	1 33.3	0 0.0	0 0.0	2 66.7	0 0.0	0 0.0	3 0.5
Glaze red ware (undifferentiated)	1 100.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	1 0.2
Glaze-on-red body sherd	2 100.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	2 0.3
Glaze-on-yellow and red matte	0 0.0	1 100.0	0 0.0	0 0.0	0 0.0	0 0.0	1 0.2
Espinosa Glaze polychrome	0 0.0	2 100.0	0 0.0	0 0.0	0 0.0	0 0.0	2 0.3
Puname Polychrome	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	1 100.0	1 0.2
San Juan Red-on-tan	1 33.3	1 33.3	0 0.0	0 0.0	1 33.3	0 0.0	3 0.5
Carbon-on-cream (historic)	0 0.0	1 100.0	0 0.0	0 0.0	0 0.0	0 0.0	1 0.2
Tewa Red	41 56.2	10 13.7	0 0.0	10 13.7	12 16.4	0 0.0	73 11.9
Buff or brown (historic)	2 66.7	0 0.0	0 0.0	1 33.3	0 0.0	0 0.0	3 0.5
Tewa buff or brown	10 16.9	2 3.4	1 1.7	25 42.4	21 35.6	0 0.0	59 9.6
Tewa Polychrome	5 27.8	4 22.2	4 22.2	3 16.7	1 5.6	1 5.6	18 2.9

TABLE 5.3. CONTINUED.

CERAMIC TYPE	JARS	BOWLS	SOUP PLATES	BOWLS OR JARS	INDETERMINATE	WORKED SHERDS	TOTALS
Ogapoge Polychrome with red	2 18.2	5 45.5	0 0.0	1 9.1	3 27.3	0 0.0	11 1.8
Pojoaque Polychrome	0 0.0	4 80.0	0 0.0	1 20.0	0 0.0	0 0.0	5 0.8
Powhoge Polychrome	0 0.0	1 100.0	0 0.0	0 0.0	0 0.0	0 0.0	1 0.2
Sakona Polychrome	0 0.0	6 85.7	0 0.0	0 0.0	0 0.0	1 14.3	7 1.1
Tewa or Pojoaque Polychrome	3 33.3	5 55.6	0 0.0	1 11.1	0 0.0	0 0.0	9 1.5
Powhoge Black-on-red	0 0.0	2 50.0	0 0.0	1 25.0	1 25.0	0 0.0	4 0.7
Undifferentiated Tewa polychrome	36 21.3	46 27.2	2 1.2	38 22.5	45 26.6	2 1.2	169 27.6
Indeterminate red-on-buff	0 0.0	2 100.0	0 0.0	0 0.0	0 100.0	0 0.0	2 0.3
Plain, polished, mica slip	0 0.0	0 0.0	0 0.0	6 100.0	0 0.0	0 0.0	1.0 0.2
Totals Percent	178 29.1	94 15.4	11 1.8	169 27.6	153 25.0	7 1.1	612 100.0

TABLE 5.4. SUMMARY OF PARTICLE SIZE ANALYSIS OF SOIL SAMPLES FROM FEATURE 1 AT THE PEDRO SÁNCHEZ SITE

SPECIMEN NO.	LOCATION	SAND PERCENTAGE	SILT/CLAY PERCENTAGE
1	Stratum 2	68	32
2	Stratum 3	58	42
UBC[1]	-	55-75	25-45
USDC-NBS[2]	-	60-80	20-40

[1] Uniform Building Codes
[2] U.S. Department of Commerce-National Bureau of Standards

it probably did not function as an adobe mixing pit as was originally thought. As discussed earlier, this feature appears to represent an abandoned drainage channel that was used for trash disposal rather than a purposely excavated trash pit.

Faunal Remains

Feature 1 produced a total of 417 pieces of bone during testing and excavation. The faunal remains are primarily from domestic species with only a few local wild taxa being identified (Table 5.5). Most of the bone is highly fragmented, and both the cattle and sheep remains display impact marks from axe butchering. Saw cuts on cattle or sheep remains are only present in the surface assemblage, and indicate the presence of more recent trash on the surface, which was also noted during excavation.

This assemblage contains both low and high meat utility elements as defined by Binford (1978a). Their presence along with the indications of axe butchering suggests that most of the animals represented by these remains were butchered and prepared at LA 65005. Cattle and sheep/goat remains dominate the sample, but pig and turkey are also represented, suggesting that these species were either raised at the site or purchased from other ranchers in the area. This assemblage is discussed in more detail in Chapter 10, *Identification and Analysis of the Faunal Remains from LA 65005, LA 65006, and LA 65013*.

DISCUSSION

Although only limited excavations were conducted at LA 65005, they yielded very important data concerning the Spanish Colonial occupation of northern New Mexico. To summarize a few points made early in this discussion, LA 65005 was initially thought to represent a historic Pueblo fieldhouse, probably associated with the Tewa village of San Ildefonso a short distance to the east. This conclusion was based upon the dominance of historic Tewa wares in the ceramic assemblage, the presence of a chipped stone component, and a lack of Euroamerican artifacts.

Table 5.5. Summary of Taxa Identified during Testing and Excavation at the Pedro Sánchez Site

Taxon	Frequency	Percent
Mammal	50	12.0
Small mammal	16	3.8
Medium mammal	78	18.7
Large mammal	199	47.7
Sylvilagus audubonii (Desert cottontail)	2	0.5
Canis familiaris (Domestic dog)	2	0.5
Order Artiodactyla (Even-toed hooved mammals)	22	5.3
Odocoileus sp. (Deer)	2	0.5
Bos/bison (Cattle or bison)	2	0.5
Family Bovidae (Cattle, bison, sheep or goat)	5	1.2
Bos taurus (Cattle)	10	2.4
Ovis/Capra (Sheep/goat)	16	3.8
Ovis aries (Domestic sheep)	4	1.0
Sus scrofa (Domestic swine)	1	0.2
Equus caballus (Horse)	2	0.5
Aves (Bird)	2	0.5
Meleagris gallopavo (Turkey)	4	1.0
Total	417	100.0

Between the initial recording of LA 65005 in 1987 and testing at the site in 1989, the senior project director gained considerably more experience with early historic materials, especially those pertaining to Spanish occupations. It became clear that, rather than representing a Tewa occupation, LA 65005 was more likely evidence of a Spanish residence. Documentary evidence presented in Chapter 12, *Spanish Adaptations to the New Mexican Frontier: LA 65005* demonstrates that this conclusion is almost certainly correct. LA 65005 represents the remains of the rancho and corral of Pedro Sánchez, whose main home was in Santa Cruz de la Cañada.

In drawing this conclusion, we lead directly into another controversy. Using traditional dates for the historic pottery recovered from LA 65005, Levine (Chapter 9, *Analysis and Interpretation of Ceramics from the Pedro Sánchez Site*) suggests that the site was occupied during the late seventeenth century. However, this contradicts the documentary dates obtained for the site, which place its occupation between 1742 and 1763. Either our identification of the residents of this site is incorrect, or there are problems with the dates presented for the associated ceramic types in the literature. As we conclude in *Spanish Adaptations to the New Mexican Frontier: LA 65005,* the latter is most likely.

The presence of chipped stone artifacts in a Spanish Colonial assemblage coupled with the occurrence of a few prehistoric sherds could be considered indicative of an earlier, prehistoric component. However, investigations of Territorial (both Mexican and American) period Hispanic sites near Abiquiú indicate that this conclusion will most often be erroneous. Chipped stone artifacts are very common on Hispanic sites (J. Moore 1992, n.d.), and there was an active Spanish chipped stone industry that has persisted to the present day. Similarly, a few prehistoric sherds commonly occur in Hispanic assemblages, and are probably more an indication of artifact collection and curation than earlier use of a site. While 2.8 percent of the sampled sherds are prehistoric types, this simply does not indicate the presence of an earlier component, especially when they occur in historic trash deposits. Lacking more positive evidence of prehistoric use, such as structural remains or dated features, we must conclude that the remains at LA 65005 represent a single-component Spanish Colonial period occupation.

Similarly, the paucity of Euroamerican artifacts recovered during our excavations at LA 65005 is in no way indicative of a Pueblo rather than Spanish occupation. As shown in *Spanish Adaptations to the New Mexican Frontier: LA 65005*, the lack of Euroamerican goods in Spanish Colonial trash deposits is very common, and indicative of economic conditions on the frontier of New Spain rather than ethnicity.

Feature 1 at the Pedro Sánchez site appears to represent a natural topographic feature that was used for trash disposal by the occupants of this site. Though the other two trash pits (Features 3 and 4) defined at the site were not excavated because they were outside construction limits, they probably represent artificial excavations, perhaps adobe mixing pits, that were subsequently used for trash disposal. However, lacking excavation data, this must remain tentative. Similarly, though not excavated, a collection of cobbles and a possible cobble alignment at the site may represent the remains of a house foundation. Unfortunately, as noted earlier, a large gas pipeline passes through this part of the site, and has effectively eradicated any conclusive surficial evidence of a structure that might once have existed.

In conclusion, LA 65005 is a single-component Spanish Colonial period site. At least part-time residence is suggested by the amount and array of materials recovered from the single trash pit excavated at the site. Documentary evidence indicates that it was used between 1742 and 1763 in association with the Pedro Sánchez Grant. That grant was found to encroach upon the San Ildefonso Grant in 1765, and the associated residence appears to have been abandoned by that time (SANM I 1763).

CHAPTER 6. SAN ILDEFONSO SPRINGS SITE (LA 65006)

James L. Moore

During survey, the San Ildefonso Springs site was recorded as a multicomponent locale containing a Classic period ceramic and chipped stone artifact scatter and historic features including a sheepherder's camp, trash areas, a cobble alignment, and a boulder wall (Moore and Levine 1987:14). As originally recorded, the site measured 65-by-45 m and was next to but mostly outside proposed project boundaries. It sits on a low terrace above the bottom of Los Alamos Canyon, and is eroded by several gullies. The ground surface is covered by a moderate growth of mixed grasses, snakeweed, and low sage. Juniper is common on surrounding hills and terraces, and cottonwood trees line major drainages. Rabbitbrush is common along minor drainages.

Closer examination of gully walls around the edge of the site during testing located at least three superimposed paleosols containing cultural features and chipped stone artifacts (J. Moore 1993). The predominance of biface manufacturing debris and lack of ceramic artifacts suggested that the paleosols contained the remains of Archaic camps. The buried Archaic strata extended into project limits, and comprised most of the cultural remains in that area. Later materials within project limits included a few Pueblo sherds and fragments of historic glass and metal. Site measurements were revised to 134-by-62 m, about 25 percent of which was within project boundaries.

Several buried charcoal stains and chipped stone artifact clusters were noted during testing. Charcoal stains occurred in arroyo banks, slope cuts, and small drainages, and all had chipped stone artifact concentrations in association. Two stains were explored during testing. One was at the west edge of the site and seemed shallow and amorphous. The other was at the east edge of the site and contained a subsurface charcoal lens and fire-cracked rock. These features were thought to represent hearths and associated activity areas. Although no diagnostic artifacts were recovered from test pits, several bifaces (including a probable Basketmaker II projectile point base) were found outside the project limits. This suggested that at least one Archaic component could be assigned a Basketmaker II affinity.

Four historic and two prehistoric features were noted outside project boundaries. The historic features were probably related to use of the area by sheepherders from San Ildefonso Pueblo and include a boulder wall above the nearby spring, a cobble alignment representing the remains of a tent base or temporary structure, a small scatter of cobbles that may represent a second tent base, and a historic dump overlying a concentration of chipped stone artifacts eroding from the lowest paleosol at the terrace edge. Scatters of historic artifacts were associated with both possible tent bases. Associated with the chipped stone artifacts was a dark stain similar to those exposed in nearby gully walls. A second stain and concentration of chipped stone artifacts was noted south and east of the first. The latter was the only feature outside project limits that was examined in any detail.

Data recovery efforts concentrated on two zones within project limits. The main area of excavation was a low terrace in the east part of the site (Fig. 6.1). There, a wide area was included within the construction zone by a pivot in the north right-of-way boundary, providing land for construction of access ramps from NM 30 to NM 502. The second area was a narrow segment of the west part of the site, situated on a slightly higher section of terrace. A fourth paleosol was found during data recovery, indicating a long aggradational history.

Excavation Methods

Excavation controls were provided by two datums. A datum set in the east part of the site during testing was designated as the intersection of the 100 north and 100 east grid lines, and was the point from which all horizontal measurements were taken. A second datum was placed outside site and project limits, and was the point from which all vertical measurements were taken. Most excavation was conducted using hand tools, although virtually sterile strata were removed from part of the site by mechanical equipment.

Two methods were used to collect surface artifacts–those occurring on eroded gully slopes were collected in arbitrary units related to topographic features, while artifacts occurring on top of the terrace were collected in 4-by-4-m grids. A finer control over surface artifact locations was not considered necessary since Pueblo and Archaic materials were mixed together by erosion in that zone. Reexamination of the site showed that several potential features defined during testing were simply slightly darker zones within paleosols. For this reason, new numbers were assigned to features as they were encountered during excavation, and feature numbers do not correspond to those assigned during testing.

Six excavation areas were defined. They represent the imposition of arbitrary boundaries over prehistoric remains. In some cases, however, these boundaries rep-

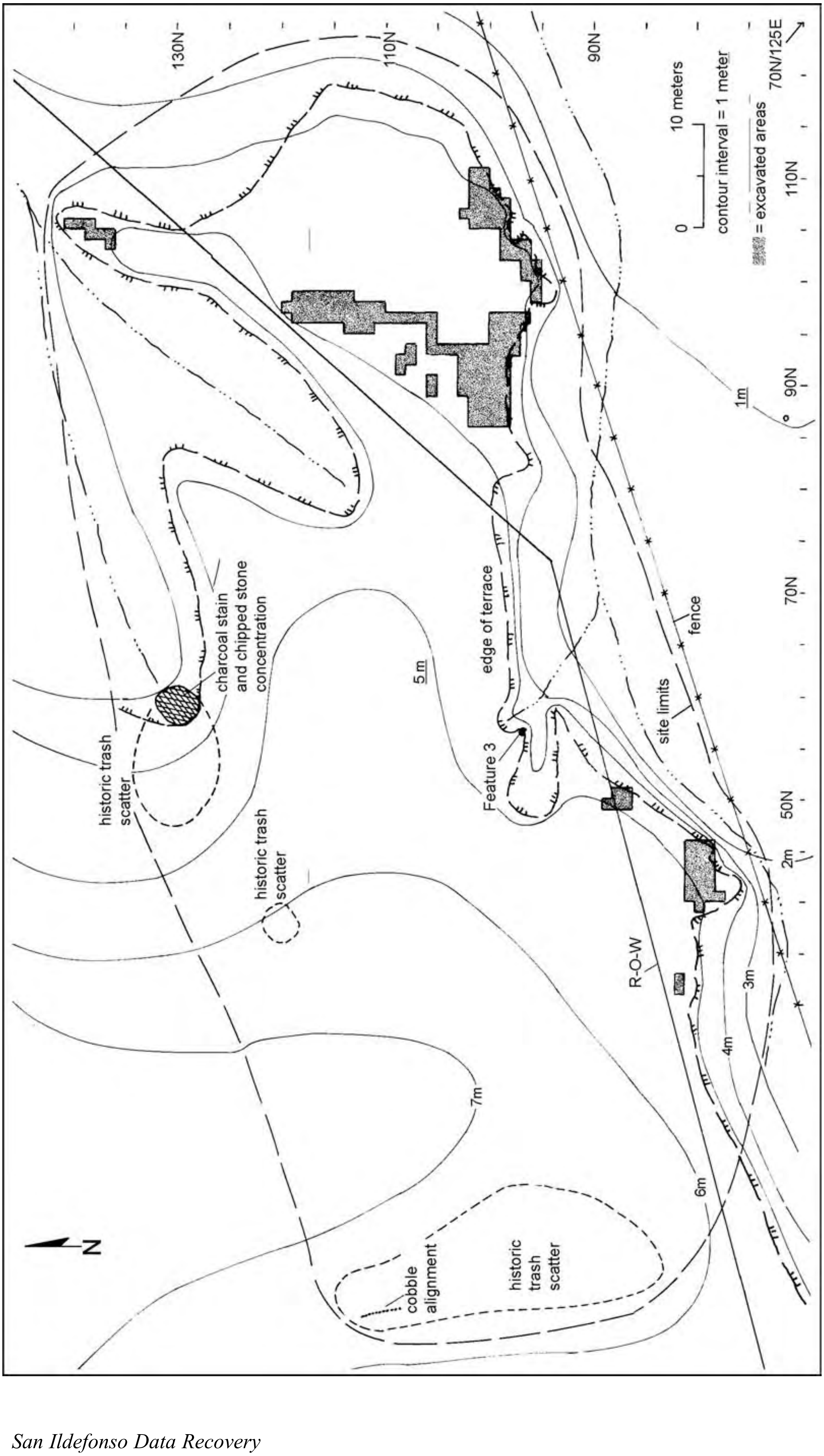

Figure 6.1. Plan view of the San Ildefonso Springs site showing areas of excavation. Pueblo of San Ildefonso land.

resent actual breaks between artifact clusters. Excavation began in two areas at the edge of the lower terrace where cultural deposits were visible in erosional exposures. While those areas were being excavated, a soil auger was used to examine subsurface deposits elsewhere on the lower terrace. Auger holes were bored at 2 m intervals (except in one instance where a mistake was made) to define the extent of cultural deposits. Figure 6.2 shows the pattern of auger coverage, and Table 6.1 presents the results of this investigation. Because of time constraints not every area shown to contain subsurface cultural materials by augering was examined in detail. However, grids were excavated in areas that seemed to contain the densest subsurface deposits.

Area 1 was comprised of 48 grids excavated in the southwest part of the lower terrace (Fig. 6.3). This area was investigated because a large amount of obsidian debitage had eroded out of the gully wall and was exposed on the slope between the terrace top and gully floor. While these artifacts were at first thought to have eroded out of the deepest paleosol found during testing, which capped much of the lower terrace, excavation soon showed that another occupational level occurred 50 to 80 cm below that paleosol. Area 1 contained the highest density of artifacts at the site, and was the main zone of excavation.

Area 2 comprised 31 grids in the southeast part of the lower terrace (Fig. 6.3). There were two reasons for conducting excavations in this area: testing had located a patch of stained soil that probably represented a cultural feature, and a large amount of obsidian debitage was eroding out of a gully wall east of the stain. As was the case with Area 1, these materials were mostly derived from an occupational zone below the deepest paleosol.

Area 3 was in the northeast part of the lower terrace, and was slightly outside project limits (Fig. 6.3). Investigations in this area were confined to surface stripping seven grids in a charcoal-stained area to recover material for radiocarbon dating. This was done because the charcoal stain was exposed on a projection between two gullies and was in imminent danger of eroding away. Since this was one of the few areas in the deepest paleosol found during testing that contained dateable materials, recovery of charcoal from this feature was potentially critical to our understanding of the cultural and geomorphic history of the site.

The higher section of terrace in the western part of the site was Area 4, and 26 grids were examined in that sector (Fig. 6.3). This area was investigated because it contained a charcoal stain in the uppermost paleosol and was the only part of the site within project boundaries that contained all three paleosols found during testing. The charcoal stain was investigated by 19 surface-stripped grids, 2 grids were excavated west of the stain to determine whether cultural deposits occurred in that area, and 5 were placed northeast of the stain to examine stratigraphy between the upper paleosol and the base of cultural deposits.

Area 5 was comprised of 26 grids in the northwest part of the lower terrace near the edge of the construction zone (Fig. 6.3). While augering had located buried cultural deposits in this area, we were initially uncertain about the exact location of the edge of the construction zone. Thus, a grid was excavated into an area that both contained evidence of buried cultural deposits and was definitely within project boundaries. From this initial grid (120N/98E), excavation continued southward toward Area 1.

When right-of-way limits were marked by the NMSHTD, somewhat more of the lower terrace was within project boundaries than originally anticipated. This zone included an area extending northeast from Area 5 that augering suggested contained buried deposits. Area 5 was at the edge of this zone, and represents a sample of these deposits. Rather than expanding to the northeast, it was felt that establishing the relationship between Areas 1 and 5 was a more critical concern, since augering had shown the presence of an almost continuous layer of cultural deposits between those areas. Without further investigation, it would not have been possible to determine whether the arbitrary excavation areas were parts of the same artifact concentration or represented different clusters of cultural materials.

To facilitate these investigations, mechanical equipment was used to strip the virtually sterile strata above the main artifact bearing layer, which was 0.7 to 1.0 m below the surface. Eighteen grids in Area 5 were within this zone. The 16 remaining grids between Areas 1 and 5 were designated Area 6, and all were within the mechanically stripped zone (Fig. 6.3). Ten grids were excavated to link Areas 1 and 5, and 6 were excavated north of Area 1 and southwest of Area 2 to further investigate this zone.

Site Stratigraphy

Stratum designations were assigned as new soil layers were encountered. Thus, the number given to each stratum is unrelated to its physical location. Major soil strata are described sequentially below, and the stratigraphic sequence is summarized. Due to the requirements of our recording system all soil units, including those encountered within features, were assigned unique numbers. Gaps in the following list represent numbers assigned to deposits within features, which are detailed in individual feature descriptions.

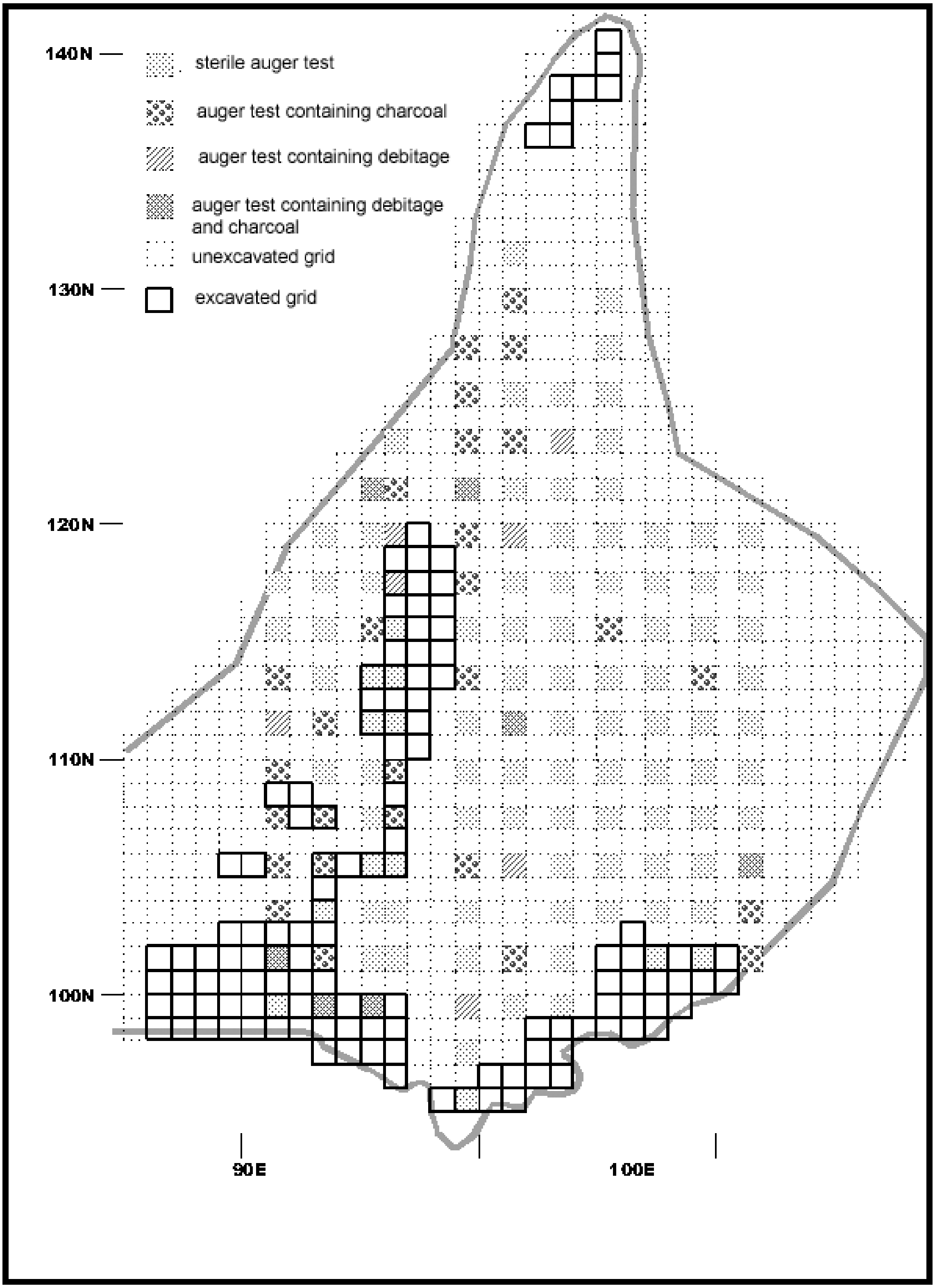

Figure 6.2. Pattern of auger test coverage in the east part of the San Ildefonso Springs site.

TABLE 6.1. RESULTS OF AUGERING AT THE SAN ILDEFONSO SPRINGS SITE

GRID LOCATION	AUGERING DEPTH	CULTURAL MATERIALS	DEPTH OF CULTURAL MATERIALS
100N/92E	1.50 m	-	-
102N/92E	1.00 m	charcoal debitage	.70 m .80 m
104N/92E	1.50 m	charcoal	1.10 m
106N/92E	1.50 m	charcoal	.76 m
108N/92E	1.56 m	charcoal	.88 m
110N/92E	1.58 m	charcoal	.16 m
112N/92E	1.56 m	debitage	1.05 m
114N/92E	1.23 m	charcoal	.92 m .98 m
116N/92E	1.61 m	-	-
118N/92E	1.10 m	-	-
100N/94E	.89 m	charcoal debitage	.70 m
102N/94E	1.58 m	charcoal	.89 m
104N/94E	1.60 m	-	-
106N/94E	1.18 m	charcoal	.90 m
108N/94E	1.08 m	charcoal	.48 m
110N/94E	1.61 m	-	-
112N/94E	1.18 m	charcoal	.60 m .90 m
114N/94E	1.60 m	-	-
114N/94E	1.60 m	-	-
116N/94E	.80 m	-	-
118N/94E	1.60 m	-	-
120N/94E	1.56 m	-	-
100N/96E	1.60 m	debitage charcoal	.60 m 1.00 and 1.10 m
102N/96E	1.60 m	-	-
104N/96E	.87 m	-	-
106N/96E	.53 m	-	-
108N/96E	1.54 m	-	-
110N/96E	1.63 m	-	-
112N/96E	1.57 m	-	-
114N/96E	.76 m	-	-
116N/96E	1.38 m	charcoal	.47 m
118N/96E	1.57 m	-	-
120N/96E	1.38 m	-	-

TABLE 6.1. CONTINUED.

GRID LOCATION	AUGERING DEPTH	CULTURAL MATERIALS	DEPTH OF CULTURAL MATERIALS
122N/96E	.99 m	charcoal debitage	.82 m .92 m
102N/97E	1.57 m	-	-
104N/97E	1.60 m	-	-
106N/97E	1.60 m	-	-
108N/97E	1.60 m	charcoal	.90 m
110N/97E	1.58 m	charcoal	1.00 m
112N/97E	1.60 m	-	-
114N/97E	.88 m	-	-
116N/97E	1.63 m	-	-
118N/97E	1.09 m	debitage	.68 m
120N/97E	1.62 m	debitage	.72 m
122N/97E	1.20 m	charcoal	.90, 1.00, and 1.10 m
124N/97E	1.60 m	-	-
96N/100E	1.06 m	-	-
98N/100E	1.57 m	-	-
100N/100E	1.26 m	debitage	1.26 m
102N/100E	1.60 m	-	-
104N/100E	1.60 m	-	-
106N/100E	1.60 m	charcoal	.50 m
108N/100E	1.60 m	-	-
110N/100E	1.60 m	-	-
112N/100E	1.60 m	-	-
114N/100E	.94 m	charcoal	.71 m
116N/100E	1.63 m	-	-
118N/100E	1.60 m	charcoal	.54 m and .63 m
120N/100E	.75 m	charcoal	.60 m
122N/100E	1.55 m	charcoal debitage	.80 m
124N/100E	1.55 m	charcoal	.64 m
126N/100E	1.55 m	charcoal	.61 and .80 m
128N/100E	1.55 m	charcoal	.65 m
100N/102E	.74 m	-	-
102N/102E	.92 m	charcoal	-
106N/102E	1.00 m	debitage	-
108N/102E	1.60 m	-	-

TABLE 6.1. CONTINUED

GRID LOCATION	AUGERING DEPTH	CULTURAL MATERIALS	DEPTH OF CULTURAL MATERIALS
110N/102E	1.10 m	-	-
112N/102E	1.60 m	charcoal debitage	.99 m 1.34 m
114N/102E	1.60 m	-	-
116N/102E	1.60 m	-	-
118N/102E	1.51 m	-	-
120N/102E	1.60 m	debitage	.36 and 1.54 m
122N/102E	1.52 m	-	-
124N/102E	1.60 m	charcoal	.49 m
126N/102E	.80 m	-	-
128N/102E	.69 m	charcoal	.50 m
130N/102E	.65 m	charcoal	.56 m
132N/102E	.65 m	-	-
100N/104E	1.20 m	-	-
102N/104E	1.50 m	-	-
104N/104E	1.60 m	-	-
106N/104E	.60 m	-	-
108N/104E	1.60 m	-	-
110N/104E	1.60 m	-	-
112N/104E	1.60 m	-	-
114N/104E	.36 m	-	-
116N/104E	1.60 m	-	-
118N/104E	.36 m	-	-
120N/104E	.92 m	-	-
122N/104E	.40 m	-	-
124N/104E	.71	debitage	.38 m
126N/104E	.52 m	-	-
104N/106E	1.36 m	-	-
106N/106E	1.63 m	-	-
108N/106E	1.58 m	-	-
110N/106E	1.56 m	-	-
112N/106E	1.57 m	-	-
114N/106E	.72 m	-	-
116N/106E	1.62 m	charcoal	1.00 m
118N/106E	.60 m	-	-
120N/106E	.84 m	-	-
122N/106E	.87 m	-	-

TABLE 6.1. CONTINUED.

GRID LOCATION	AUGERING DEPTH	CULTURAL MATERIALS	DEPTH OF CULTURAL MATERIALS
124N/106E	.40 m	-	-
126N/106E	1.59 m	-	-
128N/106E	.90 m	-	-
130N/106E	.42 m	-	-
102N/108E	1.62 m	-	-
104N/108E	1.58 m	-	-
106N/108E	1.60 m	-	-
108N/108E	.75 m	-	-
110N/108E	1.08 m	-	-
112N/108E	1.58 m	-	-
114N/108E	1.25 m	-	-
116N/108E	1.57 m	-	-
118N/108E	.68 m	-	-
120N/108E	1.62 m	-	-
102N/110E	1.60 m	-	-
104N/110E	1.58 m	-	-
106N/110E	1.49 m	-	-
108N/110E	1.61 m	-	-
110N/110E	.91 m	-	-
112N/110E	1.62 m	-	-
114N/110E	1.59 m	charcoal	.96 m
116N/110E	.64 m	-	-
118N/110E	1.10 m	-	-
120N/110E	.66 m	-	-
102N/112E	1.61 m	charcoal	.63 and .92 m
104N/112E	1.58 m	charcoal	.85 m
106N/112E	1.61 m	debitage charcoal	.15 m 1.10 m
108N/112E	.95 m	-	-
110N/112E	1.60 m	-	-
112N/112E	1.60 m	-	-
114N/112E	1.00 m	-	-
116N/112E	1.60 m	-	-
118N/112E	1.20 m	-	-
120N/112E	.39 m	-	-

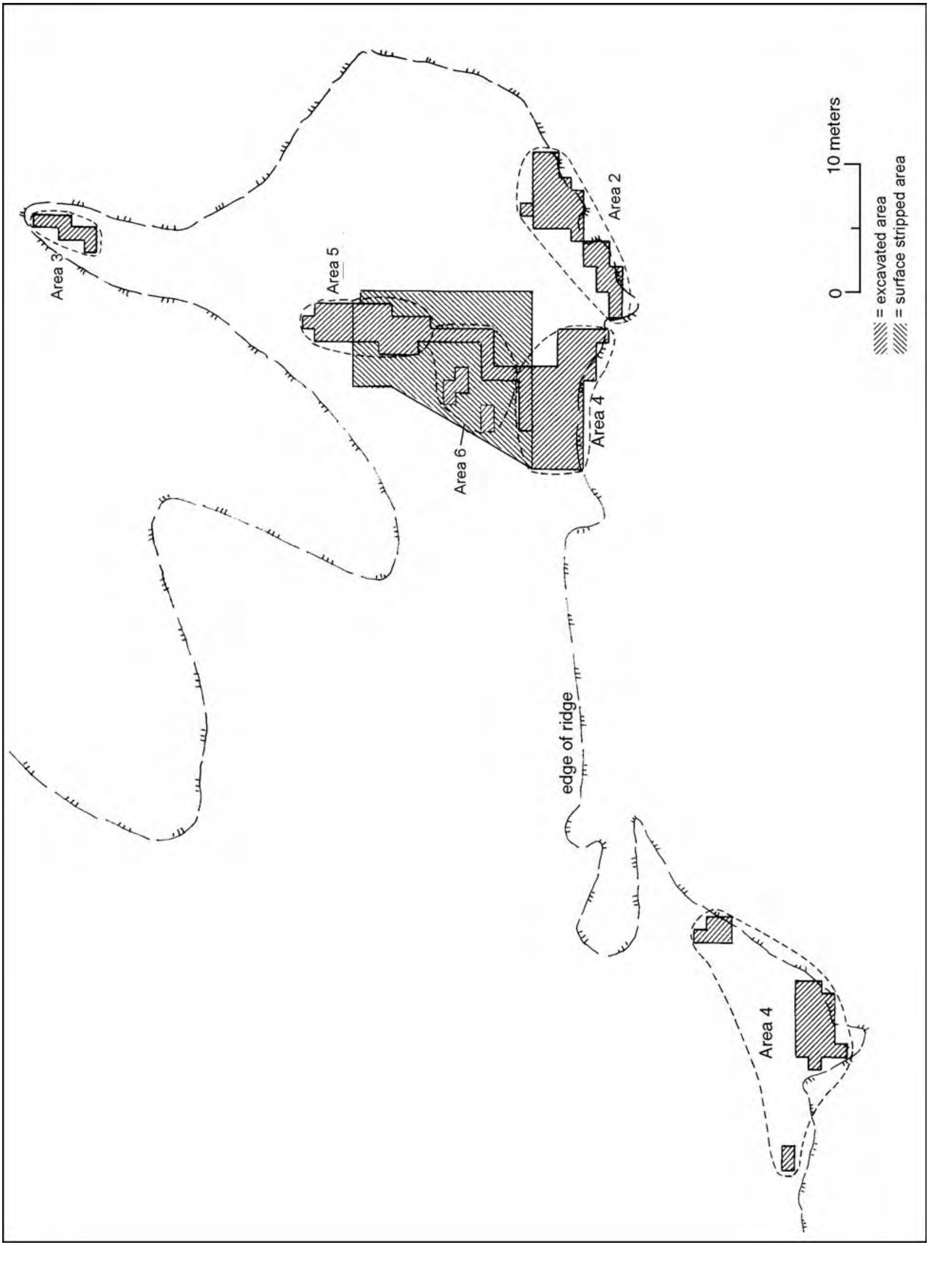

Figure 6.3. Excavation areas at the San Ildefonso Springs site.

Stratum 1

This was the second deepest paleosol identified during testing, and the second oldest of the four paleosols distinguished during data recovery. Stratum 1 was mostly found in the east part of the site, though it was visible in most gully exposures on and off site. It was a light brownish gray fine sandy loam containing 3 to 5 percent small gravel inclusions, and was the A horizon of a weakly developed soil that was buried by alluvial deposits before lower soil horizons could develop. Cultural materials occurred throughout this unit, but were mostly concentrated in and adjacent to charcoal-stained areas. Elsewhere, few or no artifacts occurred in this unit.

Stratum 1 was 20 to 30 cm thick in most areas, but in part of Area 2 it was up to 45 cm thick and was divided into two subunits. The upper subunit (Stratum 1a) was 20 to 22 cm thick, while the lower subunit (Stratum 1b) was 20 to 23 cm thick. Both consisted of a dark yellowish brown sandy loam that contained a few pea gravels and artifacts. Color was the main distinction between subunits; Stratum 1a was slightly darker than 1b. This distinction was a matter of degree, and there was no clear break between subunits; thus, no individual stratum designations were assigned.

Stratum 2

This unit was a layer of pale brown sandy clay containing 5 percent small gravel inclusions. While cultural materials were occasionally encountered in this layer, they were rare and appeared to be intrusive. This unit was the B horizon of a moderately well developed soil. It ranged between 10 and 43 cm thick, and was missing in the western part of the site.

Stratum 2 occurred directly beneath Stratum 1 in Area 2 and the east part of Area 1, initially suggesting it was associated with that A horizon. As excavation proceeded to the west in Area 1, however, a layer of alluvially deposited sand and gravel (Stratum 9) intruded between those layers, demonstrating that they were not related. The break between Strata 1 and 2 is an erosional unconformity, and those units are evidence of two different soil formation episodes. Stratum 2 was the deepest of the four paleosols identified at the site.

Stratum 3

Underlying Stratum 2, this unit was a 5 to 35-cm-thick layer of light yellowish brown water-deposited sand. It was not laminated, suggesting that it represented a single depositional episode or was reworked. Sands ranged in texture from fine to coarse. Insect or worm burrow casts were common, suggesting that deposits were somewhat disturbed. A few concentrations of coarse sand were also noted. While a few artifacts were found in this unit, they were derived from Stratum 4 through bioturbation.

Stratum 4

This unit was a layer of hard-packed light brownish gray clayish sand containing 1 to 2 percent small gravels. It ranged between 17 and 26 cm thick, and was sealed by Stratum 3. Stratum 4 occurred throughout Areas 1, 2, 5, and 6, but subtle differences led to it being assigned a separate number in Area 2. This unit represented an Archaic occupational zone, and contained abundant cultural materials including chipped and ground stone artifacts, charcoal, fire-cracked rock, and bone. Several hearths were found, as were areas containing clusters of chipped stone artifacts that represent reduction loci. Insect or worm burrow casts were common, suggesting that deposits were somewhat disturbed by bioturbation.

Stratum 5

Stratum 5 was the deepest unit encountered at the site. Underlying the deepest cultural unit (Stratum 4), it was a layer of alluvially deposited light yellowish brown fine sand of undetermined thickness. No laminations were noted, but a few lenses of coarse sand and pea gravels occurred in the areas investigated. While artifacts were recovered from the upper part of this unit, they were rare and had undoubtedly reached that level through bioturbation. Augering showed that this stratum was over 1.5 m thick, and contained no cultural materials below its contact with Stratum 4.

Stratum 6

Stratum 6 was the lowest occupational layer in Area 2, corresponding in stratigraphic location and depth to Stratum 4 elsewhere. It was a 3 to 20-cm-thick layer of compact yellowish brown sand containing 1 to 2 percent small gravels. Insect or worm burrow casts were common, suggesting that deposits were somewhat disturbed by bioturbation. Cultural materials, particularly charcoal, were less abundant than in adjacent areas of Stratum 4. Excavation revealed a break between Strata 4 and 6 in Grids 96N/101 to 102E (Fig. 6.4). While these strata were very similar in texture, Stratum 6 was not as darkly stained as Stratum 4.

Stratum 9

Stratum 9 was a layer of fine light yellowish brown sand containing 1 to 2 percent small gravels. It was of variable

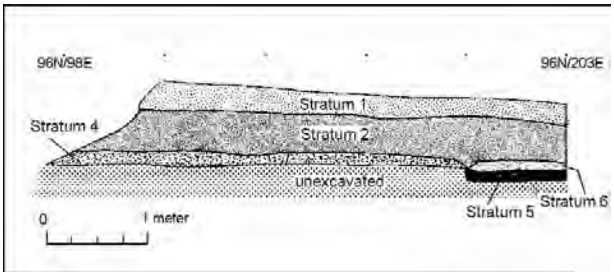

Figure 6.4. Profile of the north wall of Grids 96N/98-102E at the San Ildefonso Springs site, showing the break between Strata 4 and 6.

thickness and did not occur consistently across the site. It was absent in Areas 2 and 5. In Area 1, Stratum 9 occurred at the unconformity between Strata 1 and 2. It ranged between 5 and 50 cm thick, and formed a wedge that thickened to the west. Stratum 9 was a major stratigraphic unit in Area 4, comprising the bulk of deposits below Stratum 1 and measuring over 1 m thick (total thickness was not determined). No cultural materials were found in this unit, and it represents stream deposits.

Stratum 10

This unit was a layer of very pale brown sandy clay containing 5 percent small gravels. It ranged between 2 and 24 cm thick where it occurred, and formed a wedge-shaped intrusion between Strata 3 and 4. While this unit contained a few charcoal flecks and chipped stone artifacts, most of the latter were recovered at its contact with Stratum 4. Stratum 10 was only found in the western part of Area 1, and corresponds to a decrease in the thickness of Stratum 4. At the west edge of Area 1, Stratum 4 was reduced in thickness to only a few centimeters, and was missing from gully exposures further west. This unit may represent the edge of an erosional channel that truncated the deepest cultural deposits.

Stratum 12

This was the uppermost and youngest paleosol. It was only encountered in Area 4, having been eroded from the lower terrace in the eastern part of the site. While this unit was exposed at the edge of the terrace in Area 4, away from the edge it was covered by colluvium (Stratum 13). Stratum 12 was a grayish brown silty sand containing a few small gravels, and was between 23 and 30 cm thick. A dark gray to black stain was noted within this paleosol containing numerous charcoal fragments and a few artifacts. Cultural materials were rare elsewhere in this unit. Like Stratum 1, it was the A horizon of a weakly developed soil that was buried before lower horizons could develop.

Stratum 13

This was a 20 to 70-cm-thick layer of colluvium that covered Stratum 12 in most of Area 4. In general, it was a light pale brown slightly compacted sand. At the far west end of Area 4, a mixture of light brownish gray compact sandy clay and gravelly sand comprised the lower 20 to 30 cm of this unit. Flecks of charcoal were noted throughout, but no concentrations were found. A few lithic artifacts were also recovered, and were probably indicative of sporadic Pueblo use of the area.

Stratum 15

Stratum 15 was a layer of light yellowish brown sandy clay, ranging between 6 and 12 cm thick. Occurring only in the western part of the site, this unit separated the uppermost paleosol (Stratum 12) from the second paleosol (Stratum 16). No cultural materials were found in this layer. This unit may represent the B horizon of the uppermost paleosol.

Stratum 16

This was the second youngest paleosol, and was encountered only in Area 4, having been eroded from the lower terrace in the eastern part of the site. It was a 12 to 18-cm-thick layer of hard-packed yellowish brown sandy clay, and contained no cultural materials. Like most of the paleosols, this unit was the A horizon of a weakly developed soil that was buried before lower horizons could develop.

Stratum 20

This was a 42 to 44-cm-thick layer of alluvially deposited light yellowish brown sand containing some small gravels and large pebbles. Occurring only in Area 4, this unit separated the second paleosol (Stratum 16) from the third paleosol (Stratum 1). No cultural materials were recovered from this layer.

Stratigraphic Summary

None of the excavated areas contained the entire sequence of strata. The upper units were missing from the eastern part of the site and the lower units from the western part. The lowest stratum encountered was a sterile alluvial sand representing an earlier channel of either Totavi Wash or an intermittent tributary of a stream that drains the area north of the site. The current channel of the latter stream runs along the east edge of the site, while the modern channel of Totavi Wash is 50 to 80 m

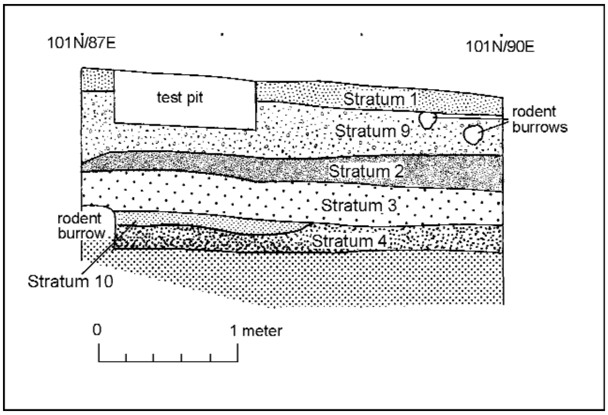

Figure 6.5. Profile of the north wall of Grids 101N/88-90E at the San Ildefonso Springs site, showing the location of Stratum 10 in Area 1.

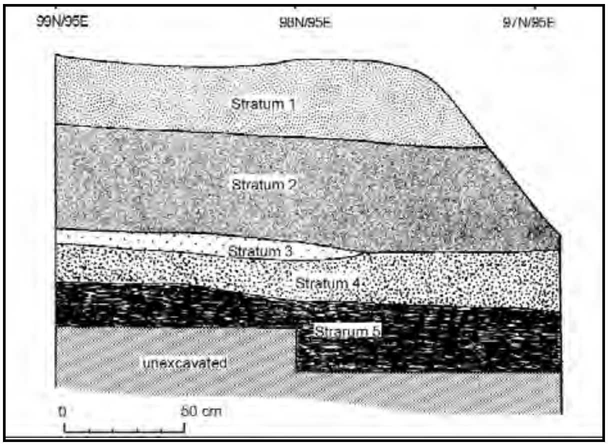

Figure 6.7. Profile of the east wall of Grids 97-99N/95E at the San Ildefonso Springs site, showing the termination of Stratum 3 in Area 1.

to the south.

Strata 4 and 6 were the deepest cultural units. Unlike the other deposits that contained artifacts, these strata did not represent a paleosol. Rather, they were a mixture of cultural materials and sand from the upper levels of Stratum 5. The earliest site occupants camped on alluvially deposited sand, excavating several hearths into that unit. It is unlikely that the thickness of these units (up to 26 cm) suggests a long-term occupation. Instead, they represent a mixing of cultural debris with the underlying sand, both by trampling at the time of occupation and through bioturbation afterward. The condition of bone recovered from these strata suggests they were covered soon after the site was abandoned, and were never again exposed until they were excavated.

As noted earlier, Strata 4 and 6 occurred in the same position in the stratigraphic sequence, and at about the same depths (Fig. 6.4). Thus, while they may represent separate occupational episodes, they probably formed at the same time. Stratum 10 appeared between Strata 3 and 4 at the west end of Area 1 (Fig. 6.5), and truncated Stratum 4 just outside the excavated area. While the top of this unit was relatively level, it thickened into a wedge as it extended eastward, suggesting a plano-convex channel profile. This unit was also found in Area 5 (Fig. 6.6). Stratum 10 probably represents an erosional channel that cut through the site at an angle (northeast-southwest) sometime after the initial occupation.

Similarly, Stratum 3 occurred above Stratum 4 in Areas 1, 5, and 6, but was missing from Area 2. This unit pinched out at the east end of Area 1 (Fig. 6.7) and grew thicker as it extended west. While Stratum 3 may represent a single episode of deposition, it is more likely the remains of a stream channel, possibly the same channel that is represented by Stratum 10.

Thus, one or two stream channels were cut through the site after the earliest cultural materials were deposited. Both channels were scoured into Stratum 4, apparently removing its upper layers in parts of Areas 1, 5, and 6, and truncating it at the west end of Area 1. Following that erosional episode, a relatively well developed soil formed. That soil was represented by a B horizon (Stratum 2), which was unconformably overlain in areas by a second soil (Stratum 1).

Stratum 9 was probably related to the erosional episode that removed the A horizon from Stratum 2. First

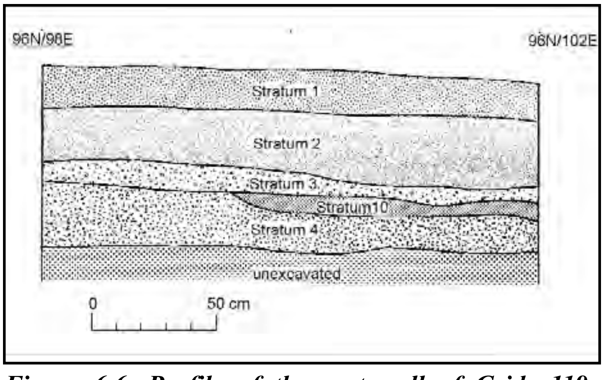

Figure 6.6. Profile of the east wall of Grids 119-120N/98E at the San Ildefonso Springs site, showing the location of Stratum 10 in Area 5.

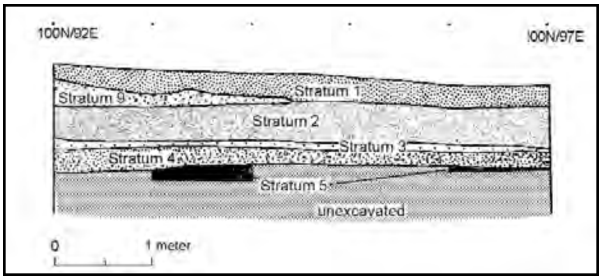

Figure 6.8. Profile of the north wall of Grids 100N/92-97E at the San Ildefonso Springs site, showing the location of Stratum 9 in Area 1.

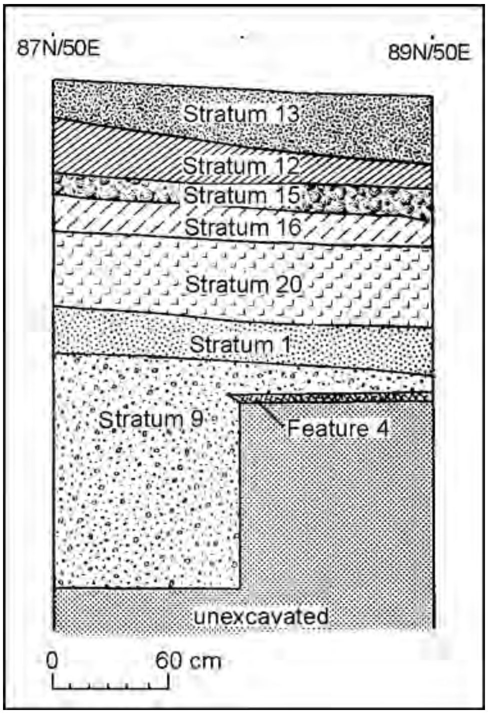

Figure 6.9. Profile of the west wall of Grids 87-89N/50E at the San Ildefonso Springs site, showing the location of Feature 4 in Area 4.

encountered as a thin layer of sand between Strata 1 and 2, Stratum 9 thickened into a wedge-shaped unit as it extended west (Fig. 6.8). As Stratum 9 thickened, Stratum 2 became thinner, indicating that it was partly eroded away. The absence of Strata 2, 3, 4, 5, and 10 in Area 4 seems to be evidence of a wide and relatively deep channel that removed the lowest occupational level and paleosol across much of the site. The presence of Feature 4 within Stratum 9 (Fig. 6.9) at the west end of the site suggests that the stream was intermittent, and may have been used as a camping area between periods of inundation or after that part of the channel was abandoned.

A second paleosol (Stratum 1) overlay Stratum 2 in the far east part of the site, and Stratum 9 across most of the rest of the site. Only an A horizon was present, suggesting a short period of development. Evidence from the western part of the site suggests that Stratum 1 was covered by a layer of alluvial sand (Stratum 20) before lower soil horizons could develop. Though those deposits may still be blanketing part of the east section of the site (Area 3), it is more likely that the thin layer of sand above Stratum 1 in that area was colluvially deposited.

A third paleosol (Stratum 16) overlay Stratum 20 in the west part of the site, and may have developed in the upper levels of that alluvium. Again, only an A horizon was found, indicating that this soil was not fully developed when it was covered by other materials. Stratum 15 was a sandy clay above Stratum 16 that may represent the B horizon of the uppermost paleosol (Stratum 12). If so, that paleosol (Strata 12 and 15) was relatively well developed before being covered by Stratum 13, a thick layer of colluvium.

Feature Descriptions

Ten features were identified during data recovery at the San Ildefonso Springs site, and were associated with two paleosols and the deepest cultural stratum. No features were found in the third (Stratum 16) or first (Stratum 2) paleosols, nor was there any conclusive evidence of artifacts in association with either. Removal of the A horizon by erosion probably accounts for the lack of cultural materials in Stratum 2. This absence in Stratum 16 is more difficult to explain. Either the site was not occupied while that soil was forming, or associated cultural materials occur outside project limits.

One feature was in the upper paleosol (Stratum 12), three were in the second paleosol (Stratum 1), and five were in the lowest occupational level (Stratum 4). The tenth feature was in Stratum 9, an otherwise noncultural unit. Only two types of features were found–charcoal stains and simple hearths. There was no definite evidence of shelters or storage features, though the former may have once been present. This possibility is discussed in more detail later.

Charcoal Stains

Feature 1. A roughly oval charcoal stain was located in the second paleosol (Stratum 1). This feature was partly examined during testing, and was in Area 2 (Grids 97N/103 to 104E). It measured 84-by-70 cm, and averaged 8 cm thick (Fig. 6.10). No evidence of formal construction was found. It was filled with Stratum 7, a very dark grayish brown sandy loam containing numerous small charcoal fragments and no artifacts.

Feature 9. This was an amorphous charcoal stain in the second paleosol (Stratum 1). This feature was in Area 3 (Grids 139 to 141N/106E, 137 to 139N/105E, 137N/104E) and constituted the only part of that zone to be investigated during data recovery. No accurate horizontal dimensions were available, since an unknown amount of this feature was eroded away before excavation began. The remaining portion of the stain measured 5-by-2 m, and was between 7.5 and 17 cm thick. No evidence of formal construction was found. It was filled with Stratum 18, a dark gray sandy loam that contained numerous charcoal fragments and chipped stone artifacts.

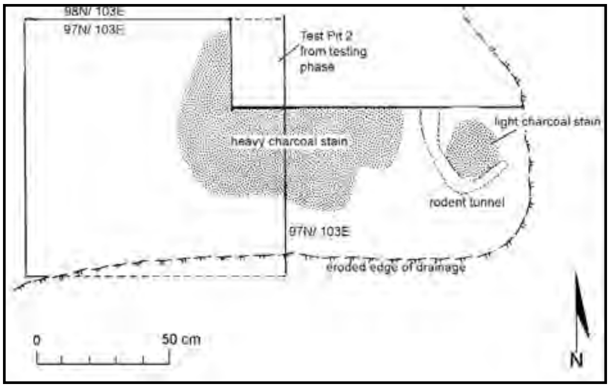

Figure 6.10. Plan of Feature 1 at the San Ildefonso Springs site.

Feature 10. This was an amorphous stain in the upper paleosol (Stratum 12). It was in Area 4 (Grids 81N/42 to 46E, 80N/41 to 46E, 79N/42 to 45E, 78N/42E) and constituted the main locus of excavation in Area 4. No accurate horizontal dimensions were available, since an unknown amount of this feature was eroded away before excavation began. The remaining portion of stain measured 5-by-3.5 m, and ranged between 10 and 15 cm thick. It was filled with a dark gray sandy clay that contained numerous charcoal fragments and chipped stone artifacts.

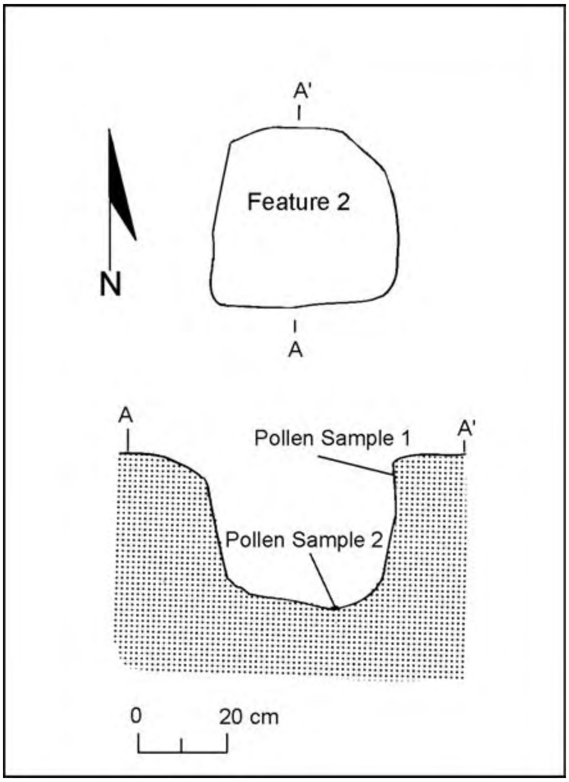

Figure 6.11. Plan and profile of Feature 2 at the San Ildefonso Springs site.

Hearths

Feature 2. This was a small simple hearth in Area 1 (Grid 99N/94E). The top of this feature articulated with the break between Strata 4 and 5. It was apparently dug into Stratum 5 during the earliest occupation of the site. It measured 20 cm in diameter by 17 cm deep (Fig. 6.11). Light oxidation was noted around its rim, but there was no evidence of heavy burning or extended use. It was filled with Stratum 8, a sandy clay containing a large amount of ash, charcoal, chipped stone, and one fragment of ground stone.

Feature 3. Another simple hearth was located eroding out of the second paleosol (Stratum 1) in a gully wall just outside project limits. This hearth was not excavated; investigations were limited to recording the feature and obtaining charcoal and flotation samples. All artifacts noted during sampling were also collected. It measured approximately 1.6 m in diameter by 12 cm deep, and seemed to be shallow and saucer-shaped. It was filled with Stratum 17, a sandy clay containing a large amount of ash, charcoal, chipped stone and bone artifacts, and a few fragments of fire-cracked rock.

Feature 4. This was a simple hearth in Area 4 (Grids 87-88N/51E, 89N/50E). It was entirely within the matrix of Stratum 9, indicating it was built while that unit was being deposited. No exact limits were defined because the feature extended into unexcavated grids, but it was larger than 1 m in diameter, and was 4 cm deep (Fig. 6.9). No oxidation was noted, and there was no evidence of heavy burning or extended use. It was filled with Stratum 19, a charcoal-blackened sand containing numerous chunks of charcoal, bone, chipped and ground stone artifacts, and fire-cracked rock.

Feature 5. This was a simple hearth in Area 5 (Grid 113N/97E). The top of this feature articulated with the break between Strata 4 and 5, and it was apparently dug into Stratum 5 during the earliest occupation of the site (Fig. 6.12). It measured 65-by-55 cm in diameter, and was 14 cm deep. No oxidation was noted, and there was no evidence of heavy burning or extended use. It was filled with Stratum 21, a sandy clay containing numerous charcoal flecks; no artifacts were found in this stratum.

Feature 6. Another simple hearth in Area 5 (Grids 112N/97-98E). The top of this feature articulated with the break between Strata 4 and 5, and it was apparently dug into Stratum 5 during the earliest occupation of the site (Fig. 6.12). It measured 55-by-40 cm in diameter, and was 8 cm deep. No oxidation was noted and there was no evidence of heavy burning or extended use. It was filled with Stratum 22, a sandy clay containing a few small gravels and large amounts of charcoal and ash; no artifacts were found in this stratum.

Figure 6.12. Feature 5 (on left) and Feature 6 (on right) at the San Ildefonso Springs site.

Feature 7. Yet another small simple hearth in Area 5 (Grid 120N/98E). The top of this feature articulated with the break between Strata 4 and 5, and it was apparently dug into Stratum 5 during the earliest occupation of the site. It measured 25-by-19 cm in diameter, and was 11 cm deep (Fig. 6.13). No oxidation was noted, and there was no evidence of heavy burning or extended use. It was filled with Stratum 11, a sandy clay containing large amounts of charcoal and ash; no artifacts were found in this stratum.

Feature 8. This feature was a simple hearth in Area 1 (Grids 99-100N/90-91E). It was not identified as such during excavation; rather, it was recorded as a heavy concentration of charcoal, ash, and artifacts and was thought to represent a dumping episode. Its resemblance to other hearths was only noted after the grids in which it occurred were completely excavated. Thus, no accurate measurements are available, but charcoal and flotation samples were obtained. This feature was about 40 to 50 cm in diameter and 10 to 20 cm deep. No oxidation was noted, and there was no evidence of heavy burning or extended use. It was filled with a sandy clay containing large amounts of charcoal, ash, bone, and chipped stone artifacts.

Discussion of Features

As stated above, two distinct types of features were defined at the San Ildefonso Springs site–amorphous charcoal stains and hearths. There are several possible explanations for the charcoal stains. They could be hearths that were spread over large areas by rodent and insect action, trash disposal loci, or areas beneath hearths that were indurated by charcoal and ash carried downward by water percolating through the soil. However, the latter is unlikely because chunks of charcoal occurred in all three of these features, and artifacts were found in Features 9 and 10 that were too large to have been carried downward by percolation. Seven hearths were also identified, five of which were associated with the earliest occupation, one with an apparent transitory occupation occurring as the stream bed deposits represented by Stratum 9 were being laid down, and one with the second paleosol. Little more can be said about the latter two features, since one was not excavated and the other was not associated with a living surface or occupational zone. However, it is possible to speculate about the hearths associated with the initial occupation.

Of the five hearths associated with Stratum 4, four

Figure 6.13. Feature 7 at the San Ildefonso Springs site.

were only visible at the break with Stratum 5, and the fifth occurred as a heavier than normal concentration of cultural materials. None of these hearths was heavily burned, and this contributed to the difficulties encountered in identifying them. Only one hearth was found within Stratum 4; the others occurred as shallow excavations into Stratum 5. Artifacts and charcoal were scattered throughout Stratum 4, which might suggest a relatively long period of cultural deposition. However, core information (as discussed in Chapter 8, *Analysis of the Chipped Stone Assemblages*) suggests that a limited number of reduction episodes occurred at this location. Rather than reflecting a long depositional history, then, it is likely that these deposits were disturbed by bioturbation. Plenty of evidence for this was noted during excavation, including rodent burrows and insect burrow casts. Thus, materials from this occupation were smeared vertically across 10 to 26 cm.

Much of the charcoal found in Stratum 4 probably came from hearths disturbed by burrowing rodents and insects, or other processes that are no longer identifiable. The upper parts of hearths found at the break between Strata 4 and 5 may also have been smeared by bioturbation, leaving only the bases of those features to be identified during excavation. Thus, none of the dimensions provided above can be taken as complete, and it is possible that more hearths may have existed but were eradicated.

ARTIFACT ANALYSES

James L. Moore and Daisy F. Levine

Chronometrics

The only materials amenable to chronometric analysis from the Archaic occupations at this site were charcoal fragments from features and cultural strata. Ten samples were submitted for analysis, and each was subjected to $^{13}C/^{12}C$ fractionation before being calibrated to account for atmospheric fluctuations of ^{14}C due to sun spot activity (Suess 1986).

Table 6.2 summarizes data from the samples submitted for analysis. Unfortunately, most were wood charcoal fragments, and in no case were we able to determine whether only outer rings were present. The calibration technique used assumes a short life span for dated materials, on the order of twenty years or less. Uncertainties are introduced by the old wood effect when this is not the case. Both minimum and maximum ends of date ranges may be overstated, and in some cases may even be understated. Thus, when wood charcoal of uncertain ori-

TABLE 6.2. INFORMATION ON CHARCOAL SAMPLES FROM THE SAN ILDEFONSO SPRINGS SITE SUBMITTED TO BETA ANALYTIC FOR RADIOCARBON ANALYSIS; GRAMS OF MATERIAL

Charcoal type	Stratum 4 Beta-56746	Feature 1 Beta-56747	Feature 2 Beta-56748	Stratum 4 Beta-56749	Feature 8 Beta-56750	Feature 9 Beta-56751	Feature 5 Beta-56752	Feature 3 Beta-56753	Feature 4 Beta-56754	Feature 6 Beta-56755
Juniper	6.82	0.00	5.30	8.66	2.40	3.90	2.30	1.50	4.51	1.50
Piñon pine	0.00	0.00	0.00	0.00	0.10	0.0	0.0	0.00	2.60	0.00
Ponderosa pine	0.00	0.00	0.00	0.00	0.60	0.00	0.00	0.00	0.00	0.00
Pinus sp.	0.00	0.00	0.00	0.00	0.00	0.50	0.00	2.50	0.00	0.00
Rhus sp.	0.21	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00
Unident. conifer	0.05	0.00	0.00	0.00	0.70	0.00	0.26	1.90	0.84	0.40
Saltbush	0.41	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0.00
Greasewood	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sagebrush	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wolfberry	0.00	0.00	0.00	0.00	0.00	0.01	0.15	0.00	0.00	0.00
Unident. non-conifer	0.02	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Oak	0.00	0.00	0.00	0.00	0.10	0.05	0.00	0.00	2.35	0.00
Populus/Salix	0.03	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00
Box-elder	0.00	0.00	0.00	0.00	0.00	0.14	0.30	0.00	0.00	0.20
Unknown A	0.00	0.00	0.00	0.00	1.80	0.00	0.00	0.00	0.00	0.00
Unknown B	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.30	0.00	0.00

gin is dated, the ranges derived can predate site occupation.

Keeping these potential problems in mind, the results of radiocarbon analysis are shown in Table 6.3. Four samples were associated with the second paleosol, Stratum 1. Beta-56747 was taken from Feature 1, a charcoal stain in Area 2. This sample differed from the others in that it contained mostly shrub wood. The date for this sample was much later than any of the others from the site, and indicates a Developmental or Coalition period Pueblo occupation. This use was evident during excavation when several sherds were found on or near the surface, particularly in Areas 1 and 2. However, our initial impressions were that none of the features were related to that occupation, so this date was surprising.

The other samples associated with the second paleosol suggest a late Archaic occupation between ca. 1150 and 800 B.C. Features 3 and 9 were in the second paleosol, while Feature 4 was directly beneath it in Stratum 9. It is interesting that the latter sample, while stratigraphically deeper than the others, provided the latest date. However, large charcoal fragments were found in Feature 4 while only small scattered fragments were obtained from the others. In addition, all three samples were predominantly juniper charcoal. Juniper is a long-lived tree, and juniper wood can last for a long time on the surface, under good conditions up to several centuries. Thus, a combination of the condition of charcoal in the samples and the old wood effect probably account for this distribution.

Six samples were obtained from Stratum 4, the deepest occupational level (Table 6.3). Four were from feature fill and two were scatter samples collected during excavation of individual grids. Two clusters of dates are visible: Cluster 1 dates ca. 930 to 780 B.C., and Cluster 2 ca. 1430 to 940 B.C. While both ranges overlap the date range for the second paleosol, Cluster 1 dates are actually a bit later than those from Stratum 1. Thus the late cluster seems anomalous, and there may be a problem with these samples. Figure 6.14 illustrates the date ranges for each sample at the first standard deviation. The anomalous dates from Stratum 4 are rather tightly clustered but, again, are in general the latest. Stratigraphically this is impossible; deposits and features from Stratum 4 cannot predate those from Stratum 1.

Since there is only a 67 percent chance that the actual date of the samples falls within the first standard deviation, second standard deviation ranges were plotted and are shown in Figure 6.15. Here there is at least some overlap between the two clusters of dates from Stratum 4, but Cluster 1 still overlaps and basically postdates the samples from Stratum 1. Cluster 1 includes scatter samples from individual grids and a sample from Feature 5. It is likely that rodent and insect burrowing were responsible for scattering charcoal through Stratum 4, and the origin of materials in the general samples that were not obtained from hearths cannot be pinpointed. In addition, field notes indicate that a large rodent burrow ran through Feature 5. Thus, obvious disturbance was present in all three cases, and probably accounts for the anomalous nature of these samples. A T-test on samples from Stratum 4 indicated that they are statistically different at the 95 percent confidence level (T statistic=32.25, chi square=11.10). When a T-test was run for the three samples that were not obviously disturbed, they were statistically similar at the 95 percent confidence level (T statistic=2.77, chi square=5.99). Thus, the late dates from Stratum 4 were eliminated from consideration.

TABLE 6.3. RADIOCARBON SAMPLE INFORMATION AND DATES FROM THE SAN ILDEFONSO SPRINGS SITE

SAMPLE NO.	PROVENIENCE	^{14}C YEARS B.P.	$^{13}C/^{12}C$	^{13}C ADJUSTED AGE	CALIBRATED DATES [1]
Beta-56746	98N/95E Levels 9-10	2,550 ± 70	-21.5 0/00	2,600 ± 70	824-777 B.C.
Beta-56747	Feature 1	810 ± 160	-16.3 0/00	950 ± 160	A.D. 900-1250
Beta-56748	Feature 2	2,920 ± 90	-22.4 0/00	2,970 ± 90	1382-1043 B.C.
Beta-56749	99N/93E Stratum 4	2,660 ± 70	-23.3 0/00	2,690 ± 70	910-805 B.C.
Beta-56750	Feature 8	3,080 ± 80	-24.6 0/00	3,080 ± 80	1434-1263 B.C.
Beta-56751	Feature 9	2,790 ± 70	-23.2 0/00	2,820 ± 70	1058-905 B.C.
Beta-56752	Feature 5	2,640 ± 90	-22.7 0/00	2,680 ± 90	915-799 B.C.
Beta-56753	Feature 3	2,820 ± 80	-23.1 0/00	2,850 ± 80	1154-915 B.C.
Beta-56754	Feature 4	2,700 ± 70	-24.0 0/00	2,720 ± 70	927-813 B.C.
Beta-56755	Feature 6	2,880 ± 110	-22.5 0/00	2,920 ± 110	1310-943 B.C.

[1] Age range at one standard deviation.

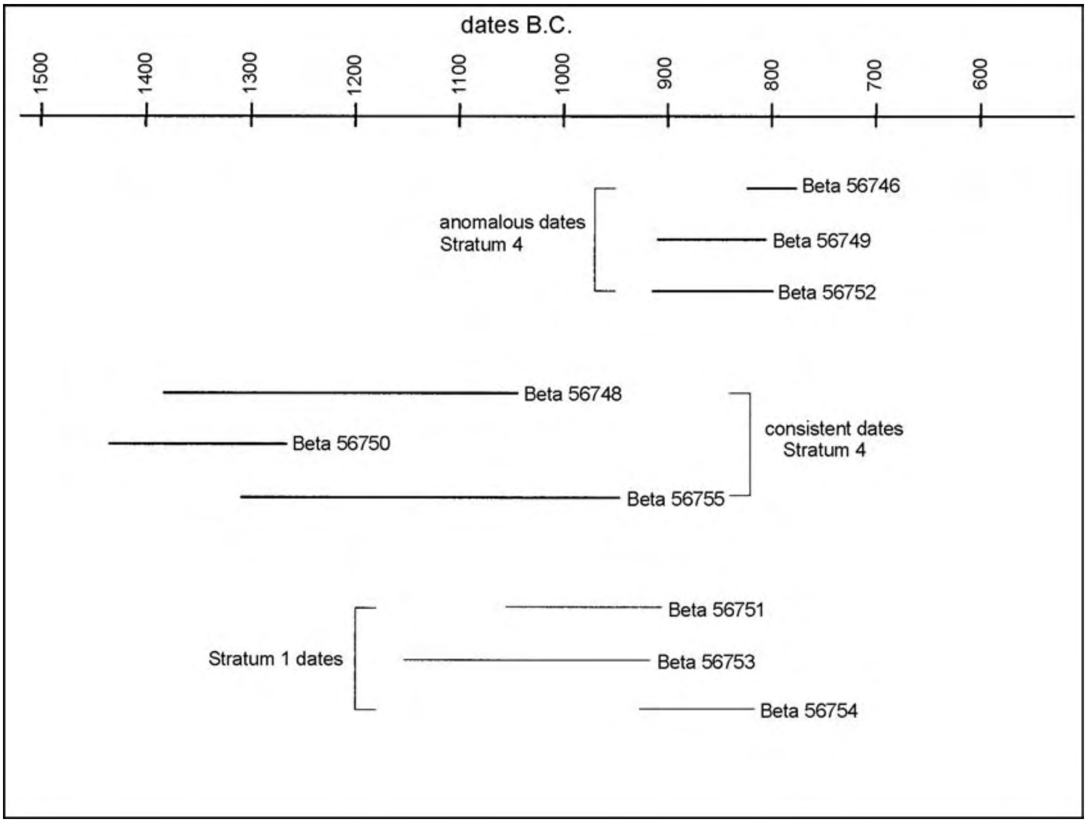

Figure 6.14. ^{14}C date ranges at the first standard deviation for the San Ildefonso Springs site.

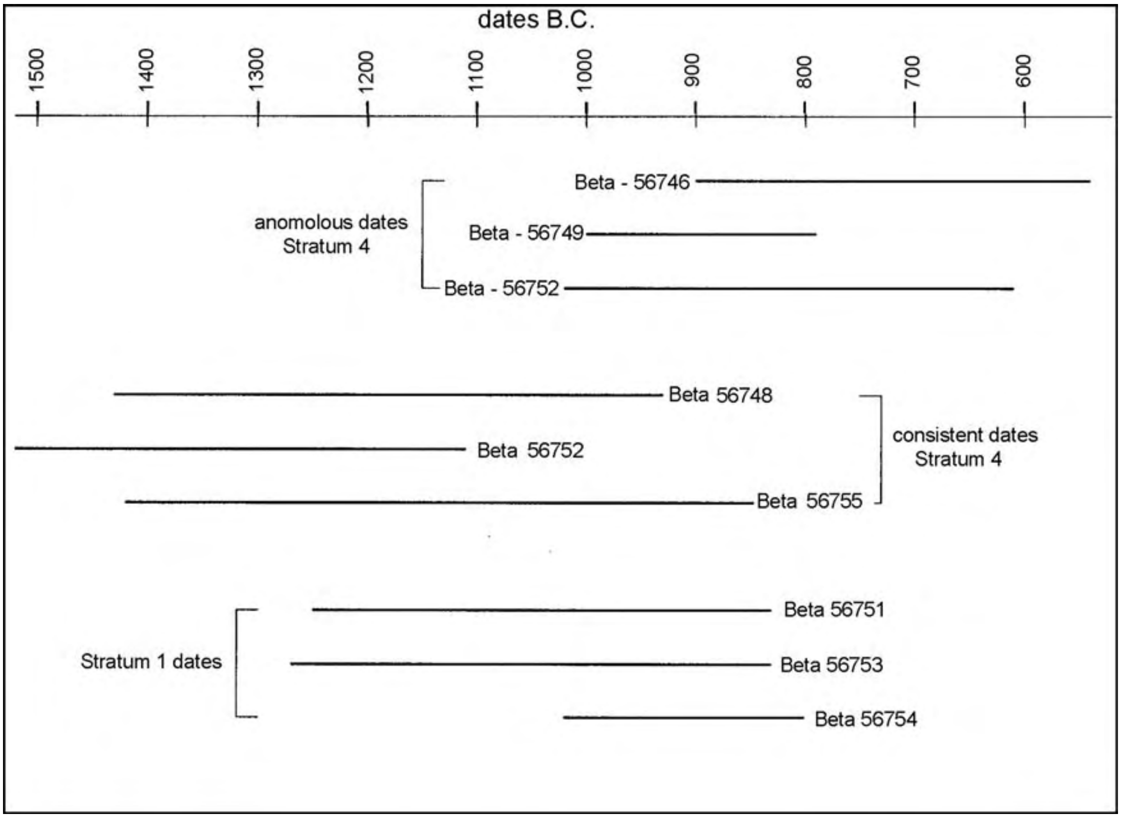

Figure 6.15. ^{14}C date ranges at the second standard deviation for the San Ildefonso Springs site.

TABLE 6.4. AVERAGED RADIOCARBON DATE RANGES FOR THE SAN ILDEFONSO SPRINGS SITE

SAMPLE NOS.	^{14}C DATE B. P.	CALIBRATED INTERCEPTS	FIRST STANDARD DEVIATION RANGE	SECOND STANDARD DEVIATION RANGE
Beta-56746 Beta-56749 Beta-56752	2,792 ± 42.1	971 B.C. 960 B.C. 932 B.C.	1010 to 899 B.C.	1080 to 832 B.C.
Beta-56748 Beta-56750 Beta-56755	3,006 ± 52.5	1293 B.C. 1280 B.C. 1263 B.C.	1375 to 1115 B.C.	1429 to 1053 B.C.
Beta-56748 Beta-56750 Beta-56751 Beta-56752 Beta-56754 Beta-56755	2,782 ± 30.2	970 B.C. 962 B.C. 928 B.C.	1002 to 899 B.C.	1048 to 833 B.C.

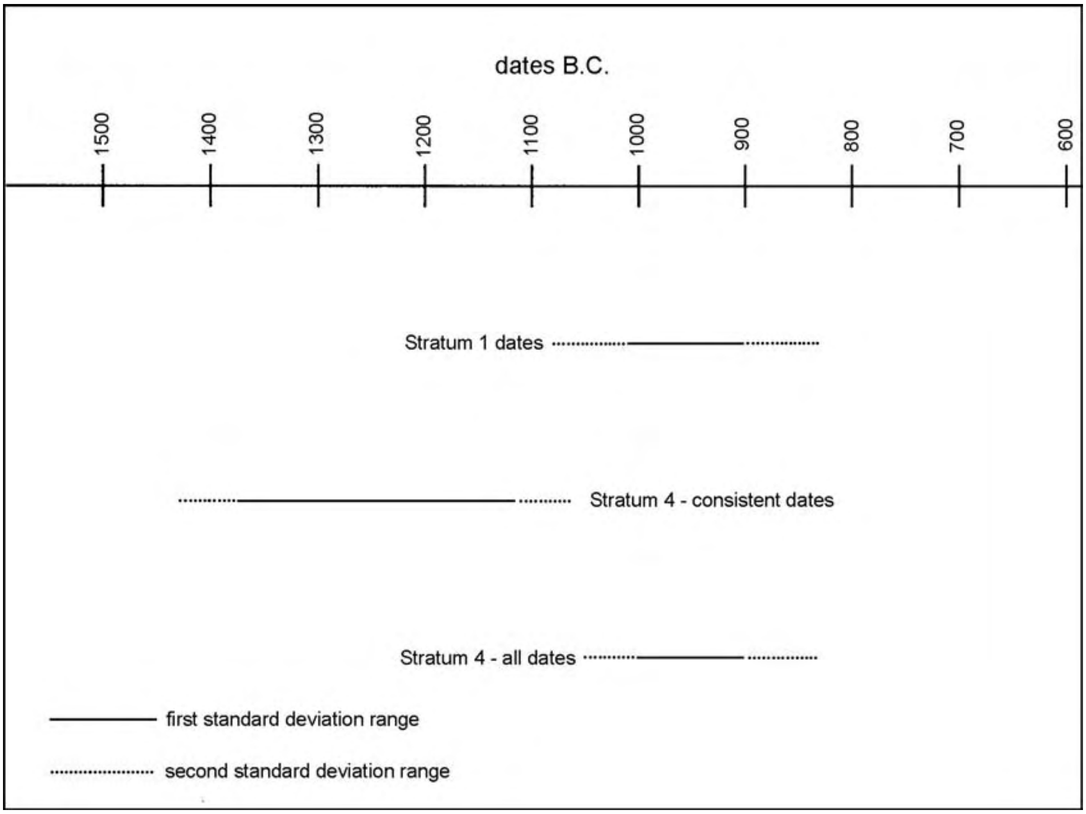

Figure 6.16. Averaged ^{14}C date ranges for the San Ildefonso Springs site.

Assuming that the Archaic occupations of the second paleosol (Stratum 1) and the deepest occupational level (Stratum 4) were single episodes or multiple episodes extending over relatively short time spans, the radiocarbon dates from these strata can be averaged. However, considering the assumptions made, the average dates must be used with caution. Using the University of Washington's radiocarbon calibration program (1987, version 2.0), a series of average date ranges were calculated and are shown in Table 6.4 and Figure 6.16. When the consistent dates from Stratum 4 are averaged and plotted against the Archaic dates from Stratum 1 they assume the correct relationship in terms of site stratigraphy. The average date for Stratum 4 is earlier than the average date for Stratum 1, with a slight overlap at the lower end of the second standard deviation between 1080 and 1048 B.C.

Interestingly, the date derived from averaging all samples from Stratum 4 is almost exactly the same as that for Stratum 1. When only the three anomalous dates from Stratum 4 are averaged they provide a first standard deviation range of 888 to 798 B.C., and a second standard deviation range of 901 to 789 B.C. These dates are significantly later than those derived for Stratum 1, which is higher in the stratigraphic sequence. The anomalous samples are skewing the average date upward for this occupational level in Figure 6.16. Again, this argues that they should be rejected.

Dates from the deepest occupational level and the second paleosol indicate that the occupations of those strata occurred during the late Archaic period. In terms of the Oshara sequence, the dates fall into the Armijo phase. However, considering the possibility that old wood may have skewed the dates, assignment to a specific phase may be out of place, particularly since no temporally diagnostic artifacts were found. Using the calibrated intercepts for the averaged dates from these strata, it can be suggested that these occupations were separated by a period of perhaps 300 years. While it is possible that an early Basketmaker II occupation is indicated for the second paleosol (Stratum 1), Stratum 4 undoubtedly predates that period. A later Pueblo occupation also left behind a feature and artifacts that intruded into the upper levels of Stratum 1. No dates were derived for the other paleosols.

Chipped Stone Artifacts

A total of 7,523 chipped stone artifacts was recovered. They are listed in Table 6.5. The assemblage is dominated by obsidians, which comprise 64 percent of the total. Chert is the next most common class of materials, and makes up 24 percent of the assemblage. With the exception of silicified wood (6.0 percent) and basalt (2.5 percent), other materials comprise less than 2 percent of the assemblage apiece.

Formal tools are rare, comprising only 4.1 percent of the assemblage. Cores are even less common than formal tools, making up only .2 percent of the assemblage. The vast majority of the chipped stone artifacts are debitage related to the manufacture of large, general purpose biface-cores. This is discussed in detail in Chapter 8, *Analysis of the Chipped Stone Assemblages*.

Ground Stone Tools

Fifteen ground stone artifacts were recovered from this site. Table 6.6 illustrates artifact morphology by material type. A variety of materials were used; quartzite and basalt are most common. Two general classes of tools are represented in this small assemblage–pounding tools and

TABLE 6.5. CHIPPED STONE ARTIFACTS FROM THE SAN ILDEFONSO SPRINGS SITE; FREQUENCIES AND ROW PERCENTAGES

MATERIAL TYPE	ANGULAR DEBRIS	CORE FLAKES	BIFACE FLAKES	CORES	UNIFACES	BIFACES	TOTALS
Chert	71 10.4	329 48.0	284 41.5	1 0.2	0 0.0	0 0.0	685 9.1
Pedernal chert	146 13.0	673 59.9	293 26.1	6 0.5	0 0.0	6 0.5	1,124 14.9
Silicified wood	69 15.4	238 53.0	141 31.4	1 0.2	0 0.0	0 0.0	449 6.0
Jemez obsidian	275 5.7	3,159 66.3	1,313 27.6	0 0.0	1 0.02	18 0.4	4,766 63.4
Polvadera obsidian	3 6.7	22 48.9	20 44.4	0 0.0	0 0.0	0 0.0	45 0.6
Igneous undifferentiated	3 25.0	9 75.0	0 0.0	0 0.0	0 0.0	0 0.0	12 0.2
Basalt	17 8.9	103 53.9	68 35.6	1 0.5	0 0.0	2 1.0	191 2.5
Rhyolite	2 28.6	5 71.4	0 0.0	0 0.0	0 0.0	0 0.0	7 0.1
Metamorphic undifferentiated	1 50.0	1 50.0	0 0.0	0 0.0	0 0.0	0 0.0	2 0.0
Quartzite	21 16.9	75 60.5	24 19.4	2 1.6	0 0.0	2 1.6	124 1.6
Quartzitic sandstone	7 5.9	66 55.9	44 37.3	1 0.8	0 0.0	0 0.0	118 1.6
Totals Percent	615 8.2	4,680 62.2	2,187 29.1	12 0.2	1 0.01	28 0.4	7,523 100.0

TABLE 6.6. GROUND STONE ARTIFACT FUNCTION BY MATERIAL TYPE FOR THE SAN ILDEFONSO SPRINGS SITE; FREQUENCIES AND ROW PERCENTAGES

FUNCTION	BASALT	SANDSTONE	QUARTZITIC SANDSTONE	QUARTZITE	RHYOLITE	IGNEOUS UNDIFFERENTIATED	TOTALS
Mano undifferentiated	0 0.0	0 0.0	0 0.0	2 100.0	0 0.0	0 0.0	2 13.3
One-hand mano	0 0.0	0 0.0	0 0.0	2 50.0	1 25.0	1 25.0	4 26.7
Basin metate	2 100.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	2 13.3
Slab metate	1 25.0	1 25.0	2 50.0	0 0.0	0 0.0	0 0.0	4 26.7
Trough metate	1 50.0	0 0.0	1 50.0	0 0.0	0 0.0	0 0.0	2 13.3
Hammerstone	0 0.0	0 0.0	0 0.0	1 100.0	0 0.0	0 0.0	1 6.7
Totals Percent	4 26.7	1 6.7	3 20.0	5 33.3	1 6.7	1 6.7	15 100.0

grinding tools. A hammerstone is the only example of the former category and is an unmodified quartzite cobble. Only battering was present, which occurred during use. This tool was recovered from Stratum 4 in Area 6, and is not considered any further.

Other ground stone tools were used in food preparation. Two trough metate fragments were found on the surface. One slab metate fragment was found in Area 1 and articulated with the upper surface of Stratum 4. Other ground stone tools from Area 1 included two basin metate fragments from Stratum 4, two unidentified mano fragments from Strata 3 and 4, and a one-hand mano fragment from Feature 2. No ground stone tools were recovered from Area 2. Area 3 contained two slab metate fragments, both from Stratum 18 in Feature 9. Three ground stone tools were recovered from Area 4, including a one-hand mano and a slab metate fragment from Stratum 12, and a one-hand mano from Stratum 19 in Feature 4. A one-hand mano was also recovered from Feature 3, outside of our analytical units.

All five manos have convex grinding surface cross sections. Three of the slab metates have flat cross sections and only one has a concave cross section. Both basin metate fragments have deeply concave grinding surfaces, but are otherwise unmodified. The trough metates were from the surface, and are undoubtedly related to the later Pueblo occupation. Two combinations of grinding stones were probably used during the Archaic occupation at this site; one included flat netherstones and (presumably) flat handstones, the other included concave netherstones and convex handstones.

Ceramic Artifacts

There are 36 sherds in this assemblage, mostly Biscuit B bowl body sherds (Table 6.7). In combination with the Biscuit A and Glaze A sherds that were also found here, a temporal range from about A.D. 1325 to 1475 can be suggested. The handful of eighteenth-century Tewa sherds may be eroding from a nearby site.

Ceramics were found on the surface of the site and in subsurface contexts in Areas 1 and 5. Area 5 contained the most sherds (n = 13), though there were no Pueblo

TABLE 6.7. CERAMIC ASSEMBLAGE FROM THE SAN ILDEFONSO SPRINGS SITE

CERAMIC TYPE	FREQUENCY	PERCENT
Undifferentiated Biscuitware	1	2.8
Biscuit A	4	11.1
Biscuit B	22	61.1
Glaze A	3	8.3
Ogapoge Polychrome	1	2.8
Pojoaque Polychrome	1	2.8
Undifferentiated Tewa polychrome	1	2.8
Tewa Black	1	2.8
Plain, unpolished micaceous	2	5.6
Total	36	100.0

features in that zone. Sherds in Area 5 occurred in Strata 1, 4, and 5. Two sherds, an undifferentiated Tewa polychrome and a Tewa Black, were found in Stratum 1 in Area 5. Otherwise, the sherds are all Biscuit wares. Twelve sherds were found in Area 1, both on the surface and in Stratum 1. This zone also contained no Pueblo features. No sherds were found in or around the Pueblo hearth (Feature 1).

Euroamerican Artifacts

A total of 15 Euroamerican artifacts were recovered from the surface of this site. Among then are two sardine cans, one salmon can, one plastic doll shoe, one cutwire framing nail, one milk glass saucer, and three pieces of leached glass. These artifacts suggest an occupational range between the 1930s and 1960s, and represent trash associated with features occurring outside project limits.

Faunal Remains

Most of the 143 pieces of bone recovered at this site (Table 6.8) are highly fragmented, and less than 6 percent of the sample could be identified beyond the class level. Only two specimens of historic taxa were identified–a *Bos taurus* (cow) bone from the surface of the lower terrace, and an *Ovis aries* (sheep) bone from the upper terrace. The surface in both of these areas contained mixed materials from several occupations, including one or more historic uses. These artifacts undoubtedly relate to that late period of occupation. The remaining identifiable bone fragments were classified as Artiodactyla (even-toed hoofed mammals). Large mammal (including artiodactyl) remains dominated this small assemblage (57 percent).

TABLE 6.8. FAUNAL REMAINS FROM THE SAN ILDEFONSO SPRINGS SITE

TAXON	FREQUENCY	PERCENT
Mammal	49	34.3
Small mammal	7	4.9
Medium mammal	4	2.8
Large mammal	74	51.7
Order Artiodactyla (Even-toed hooved mammals)	7	4.9
Bos taurus (Domestic cattle)	1	0.7
Ovis aries (Domestic sheep)	1	0.7
Total	143	100.0

Floral Remains

Two types of samples were analyzed for vegetal remains. Ten charcoal samples were examined before submission for radiocarbon dating to determine the types of fuels used (Table 6.9). Six samples were from Stratum 4, three were from features associated with Stratum 1, and one was from the Pueblo occupation. Tree woods dominated the samples from Stratum 4, and three samples also contained charcoal from shrubs. A scatter sample from Stratum 4 contained squawberry (*Rhus*) and saltbush charcoal; a sample from Feature 4 contained saltbush charcoal, and a sample from Feature 5 contained squawberry and wolfberry charcoal. However, these samples were dominated by tree woods, and shrub woods comprised only small percentages of the materials examined. A similar pattern was exhibited by charcoal from features associated with Stratum 1. Only the sample from Feature 9 contained shrub wood, in this case a minuscule amount of wolfberry charcoal. Feature 1, which dates to the Pueblo occupation, displayed a completely different pattern. Only shrub woods occurred in this sample including saltbush, greasewood, and wolfberry. Thus, it appears that the Late Archaic occupants relied on tree wood for fuel, while the Pueblos mostly used shrub wood.

Flotation samples from seven features were also examined (Table 6.9). These samples were scanned for seeds and other economic plant parts. The scans suggested that a detailed analysis would produce few other data on the vegetal portion of the occupant's diets, so a more detailed analysis was not undertaken. Seeds or other parts of ten economic species were identified, and specimens of five were burned. Since unburned seeds may represent intrusives introduced by rodent or insect disturbance, only burned specimens are considered evidence of economic use. Chenopodium was the most common economic plant found, occurring in four samples from Stratum 4 and two samples from Stratum 1. Stratum 4 samples also contained evidence for the economic use of cactus (*Opuntia*) and probable squawberry seeds. Other economic plant remains recovered from Stratum 1 include purslane (*Portulaca*) and possible squawberry seeds. Corn (*Zea*) was only found in the sample from Feature 1, which dates to the Pueblo occupation. An unknown type of seed was also recovered from this sample. One macrobotanical sample, a burned fragment of piñon shell, was recovered from Stratum 3 and is associated with the earliest occupational level.

Four types of edible seeds and an edible nut were recovered from Archaic samples. Burned specimens suggest that all five were consumed as food. Chenopodium, squawberry, *Portulaca,* piñon, and cactus seeds are

TABLE 6.9. RESULTS OF FLOTATION SCANS FOR FEATURES AT THE SAN ILDEFONSO SPRINGS SITE

Feature Number	Sample	*Chenopodium*	*Amaranthus*	*Portulaca*	*Cleome*	*Mentzelia*	*Euphorbia*	*Opuntia*	*Rhus*[1]	*Zea*	Compositae	Unknown
1	1									†*		†*
	2				†[1]	†						
2	1	†*						†*			†	
3	1	†*										
	2	††							†*			
	3	††*										
	4	†*										
4	1	† †*										
	2								†*			
5	1	††*										
6	1											
8	1	†*							†*			
9	1	†*										
	2	†	†									
	3		†	†††*[2]			†					

† 1 to 10 specimens
†† 10 to 20 specimens
††† 20 to 30 specimens
* specimens are burned (when asterisk is absent, specimens are unburned)
[1] resembles species
[2] some unburned specimens also present

available for consumption in the late summer to fall, suggesting that the site was used at that time of year during at least two Late Archaic occupations. Corn cupules from the Pueblo occupation may also be an indication of fall occupation; however, the possible use of stored foods makes this conclusion tentative. While storage of seeds is also possible for the Archaic occupations, the lack of storage features at the site coupled with the character of those occupations (as discussed in Chapter 13, *An Archaic Workshop Site: LA 65006*) indicates that this is probably not the case.

Pollen Analysis

Fifteen pollen samples were obtained for analysis of the prehistoric environment, and are discussed in detail in Chapter 11, *Analysis of Pollen from the San Ildefonso Springs Site*. To summarize those findings, the pollen analysis suggests a gradual warming and drying trend during the Late Archaic period. A few corn pollen grains were found that may be an indication of early horticulture in this area. However, the paucity of such remains, their association with a noncultural stratum in one case, the lack of burned corn parts in Archaic flotation samples, and the presence of a Pueblo feature at the site that contained corn parts cast doubt on this possibility.

Discussion

At least four periods of occupation were indicated in the part of this site examined during data recovery, and were represented by cultural materials in the deepest occupational level (Strata 4 and 6), two paleosols (Strata 1 and 12), and the site surface. Bracketing dates were obtained for the two earliest and the latest occupation of this part of the site. Strata 4 and 6 represent the first occupation for which remains were recovered. Since these strata represented a mixture of cultural materials and stream-deposited sand, it is unlikely that earlier materials are present. The three dates from Stratum 4 that were considered acceptable suggest an occupation ca. 1429 to 1053 B.C. Though no dates were obtained for Stratum 6, the fact that it is contiguous with and at the same level as Stratum 4 indicates that it dates to the same period. Five features were associated with this occupation (Features 2, 5, 6, 7, and 8), all simple hearths.

Following the initial occupation, this part of the site does not seem to have been used for a considerable period, during which time the area was aggrading. However, at least one period of erosion is indicated by a B soil horizon (Stratum 2), which is unconformably overlain by stream-deposited sand (Stratum 10) and an unassociated A horizon (Stratum 1). Thus, if a cultural occupation was associated with the first paleosol (Stratum 2), all evidence was removed by erosion. The presence of a well-developed B horizon between the deepest occupational level and the next occupation (Stratum 1) suggests that a considerable amount of time passed between these uses. While it has been suggested that these occupations were separated by about 300 years, it is possible (and perhaps likely) that the hiatus was longer, possibly on the order of 500 to 600 years.

The second occupation, represented by Stratum 1, also occurred during the Late Archaic period ca. 1080 to 832 B.C. Three features were associated with this occupation including two hearths (Features 3 and 4) and a large charcoal stain (Feature 9). Feature 4 had a later date than the others but was stratigraphically earlier, occurring just below Stratum 1 and perhaps representing a transitory use of the site. This suggests that old wood may be responsible for the earlier dates from Features 3 and 9. If so, it is likely that Stratum 1 dates to the early Basketmaker II period.

Two later preceramic occupations were represented by paleosols occurring higher in the stratigraphic sequence, Strata 12 and 16. Unfortunately, though one unit contained a large charcoal stain (Feature 10), no dates could be obtained for these strata. However, the lack of sherds in both layers suggests that they, too, were occupied during the Late Archaic period, probably during the Basketmaker II phase.

The latest prehistoric occupation was during the Pueblo period between A.D. 716 and 1375 as suggested by a radiocarbon date from Feature 1. The upper end of this range corresponds to the date provided by ceramics, which suggested a Pueblo occupation ca. A.D. 1325 to 1475. Thus, this part of the site seems to have been used during the early Classic period. A few artifacts also suggest historic use of the site, but since no features related to that use were encountered in the area examined, these materials are not further considered.

The Presence of Possible Structures at the Site

Two general categories of features were defined for the Archaic occupation–simple hearths and charcoal stains. Although no definite evidence of structures was found, the function of the charcoal stains remains undetermined and it is possible that they were the remains of structures. Both of the amorphous stains were in eroded areas. Feature 9 was on a narrow finger jutting out from the edge of the terrace in Area 3, and Feature 10 was at the edge of the upper terrace in Area 4. Thus, it was not possible to define the complete extent of either feature, but at a minimum they measured 5-by-2 and 5-by-3.5 m, respectively.

Late Archaic structures have been found in many areas. Stiger (1986:197-223) discusses much of this information. Eliminating structures that are too late for comparison or lack detailed descriptions, we can summarize three Archaic structures from his discussion. The Kewclaw site in west-central Colorado produced evidence of a roughly circular structure measuring about 4 m in diameter (Cassells 1983; Conner and Langdon 1986). The structure was basin shaped and contained a central hearth and deep pit in the floor with several postholes around the periphery. Two Archaic structures were investigated near Gunnison, Colorado, by Euler and Stiger (1981) and Stiger (1981). Both were roughly circular charcoal stains and measured 3.5 m and 4.2 m in diameter. One structure contained a central hearth and two pits, and they dated 4500 B.C. and 4100 B.C., respectively.

Six Archaic structures were excavated at Abiquiú Reservoir, five at LA 25328 and one at LA 47940 (Cella et al. n.d.). Feature 1 at LA 25328 was a 5-m-diameter charcoal stain that was 0.4 m deep and circular to semicircular in shape. No postholes were found, and the structure was radiocarbon dated 730 ± 60 B.C. (Cella et al. n.d.:12-176). Internal features included two hearths, a pit, and a possible posthole. Feature 2 was a charcoal stain measuring 5.5-by-4.6 m, and contained a hearth, 12 pits, and 2 postholes (Cella et al. n.d.:12-180). This structure was radiocarbon dated 450 ± 90 B.C. A third structure, Feature 3, was encountered under Feature 2 (Cella et al. n.d.:12-186). This structure was an irregular circle measuring 3 m in diameter, was heavily burned, and contained four pits. Feature 11 was a basin-shaped pit structure filled with charcoal-stained soil, and measured 3.25-by-2.3 m (Cella et al. n.d.:12-188 to 12-190). The only internal feature was an unlined pit, and this structure was radiocarbon dated 830 ± 70 B.C. The last structure was roughly circular and basin shaped, measuring 3.1-by-2.9 m, and was partly burned (Cella et al. n.d.:12-192). It contained two pits and was radiocarbon dated to A.D. 180 ± 80. The structure at LA 47940 was roughly oval in shape, measured 3.8-by-2.9 m, and was about 10 cm deep (Cella et al. n.d.:12-503 to 12-507). This structure was filled with charcoal-stained soil and contained four pits.

An oval-shaped Archaic structure measuring 2.7-by-2.5 m was excavated at Casa Denada by the Dolores Archaeological Project (Kane et al. 1988). This structure was 25 to 30 cm deep, was filled with charcoal-stained soil, and contained an internal hearth and pit. Radiocarbon dates suggest an occupation between 2130 and 625 B.C. Sayles (1945) examined Late Archaic structures at Benson 8:3 and Pearce 8:4 in southeast Arizona. These pit structures lacked postholes and formal hearths, but did contain internal pits. Lent (1991) excavated a Late Archaic pithouse near Otowi Bridge. This structure was shallow (.55 m deep) and basin shaped, measuring 2.5-by-2.7 m. Postholes were found along one edge, and the structure was filled with charcoal and ash-stained soil. The occupation of this site was radiocarbon-dated between 540 ± 70 B.C. and A.D. 110 ± 70.

Thirteen Archaic structures have been summarized. Though most appear to have been circular or semicircular in shape, they were quite variable in size and in the types and numbers of internal features they contained. What they appear to have in common is a charcoal and ash-stained fill and a lack of formal walls and floors. In size they vary from 2.5 to 5 m in diameter, and from 10 to 55 cm in depth. Postholes were associated with some, but evidence of the superstructure support system was lacking at most. Internal hearths and pits were common but by no means ubiquitous. In some ways, Features 9 and 10 from the San Ildefonso Springs site resemble Archaic structures found elsewhere. In size they are at the large end of the distribution; they lacked evidence of internal features and support systems, and did not have clearly defined transitions to preoccupational deposits that might have served as floors. Thus, it is impossible to determine whether these features were actually the remains of structures or represent evidence of other activities such as refuse discard, food processing, etc. However, the possibility that they represent the remains of eroded structures cannot be dismissed.

Summary

At least six periods of occupation were defined at the San Ildefonso Springs site. Four represent Archaic uses and include the deepest occupational level (Stratum 4) and three of the four paleosols identified by excavation (Strata 1, 12, and 16). Cultural materials were only recovered from two paleosols within project limits; evidence of occupation at the time that Stratum 16 was forming was only found outside the area of investigation, and no artifacts were recovered from that component. Pottery and Feature 1 found on and just below the surface of the lower terrace were dated to the Classic period of the Pueblo sequence. This suggests that the lower terrace was eroded to approximately the same level as the modern surface at the time of the Pueblo occupation. Thus, surface materials, particularly in the vicinity of Areas 1 and 2, contain a mixture of materials related to a Late Archaic occupation ca. 1080 to 832 B.C. and Pueblo use during the Classic period. A few artifacts from later historic use of the area were recovered within project limits, but no features dating to this later use were found and the main areas of historic occupation were outside project limits.

Thus, four of six occupations can be examined with materials from this site including three Late Archaic and one Classic period Pueblo components. The structure of the artifact assemblages from these occupations is discussed in later sections of this report.

CHAPTER 7. FH SITE (LA 65013)

Joan K. Gaunt

LA 65013 was on an alluvial slope on the north edge of Totavi Wash at an elevation of 1,737 m (5,699 ft), and covered an area of 1,140 sq m. The site was first recorded by Moore and Levine (1987) as a small rubble mound and surface artifact scatter measuring 17-by-15 m. The rubble mound was 3 m in diameter and a maximum of .3 m high (Fig. 7.1). Only one unidentified plain ware sherd and between 100 and 200 chipped stone artifacts were noted on the surface. No testing was conducted at this site since the rubble mound indicated the likely presence of an intact feature. The site was covered by a moderate growth of juniper, which is also common on surrounding hills and terraces. Covering the ground surface was a moderate growth of mixed grasses, snakeweed, and low sage. Cottonwood trees tend to line major drainages, while rabbitbrush commonly occurs along minor drainages.

During excavation, LA 65013 was found to contain the remains of a possible fieldhouse (Structure 1), an extramural hearth (Feature 1), four small pits containing burned or fire-cracked rock (Features 2 through 5), an amorphous depressed area (Feature 6), and a chipped stone and sherd scatter that extended downslope toward Totavi Wash (Fig. 7.2). Since no temporally diagnostic artifacts or features were noted, the site was initially identified as Pueblo of unknown age. However, it was thought that a Classic period date was likely since most Pueblo sites from this area have been dated to that period. As discussed later in this chapter, this was confirmed by ceramic analysis. The scatter of associated artifacts was found to be more extensive than noted during survey, so site measurements were revised to 38 by 30 m. About 58 percent of the site was within project limits, and this area included the structure and all associated features. Only the artifact scatter continued outside project limits.

Excavation Methods

Surface artifacts were collected in 1-by-1-m units around the rubble mound since that area contained the heaviest concentration of cultural materials. The artifact scatter was considerably larger than originally thought, extending downslope for 38 m to the edge of Totavi Wash.

Figure 7.1. Structure 1 at the FH site before excavation.

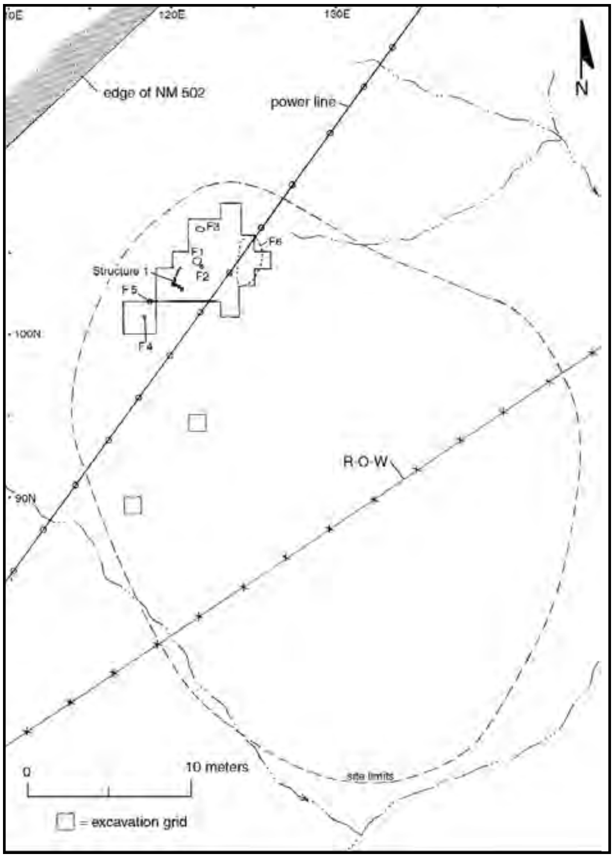

Figure 7.2. Plan view of the FH site. (Pueblo of San Ildefonso land.)

Artifacts found away from the structure were piece-plotted since they were sparsely scattered and not concentrated enough to warrant collection by grid. Only artifacts found within project limits were collected.

Twenty-eight 1-by-1-m grids were excavated in and around the structure to determined whether the distribution of cobbles was patterned, and to recover materials discarded during its occupation. The locations of cobbles were mapped for each level before proceeding with excavation. As cobbles were exposed, the possibility of their being part of an alignment was evaluated. If so, they were left in place. When rubble from a collapsed wall was identified, those materials were removed to expose the next level of excavation.

Soil removed from this area was screened through ¼-inch hardware cloth. Initially, grids were dug in 10-cm vertical levels. As soil strata were defined they were excavated by natural units. A 7-m-long trench was excavated to examine an amorphous depressed area, Feature 6, located about 4 m east of the structure. A 4-by-4-m area southwest of the structure was also surface stripped to search for extramural features.

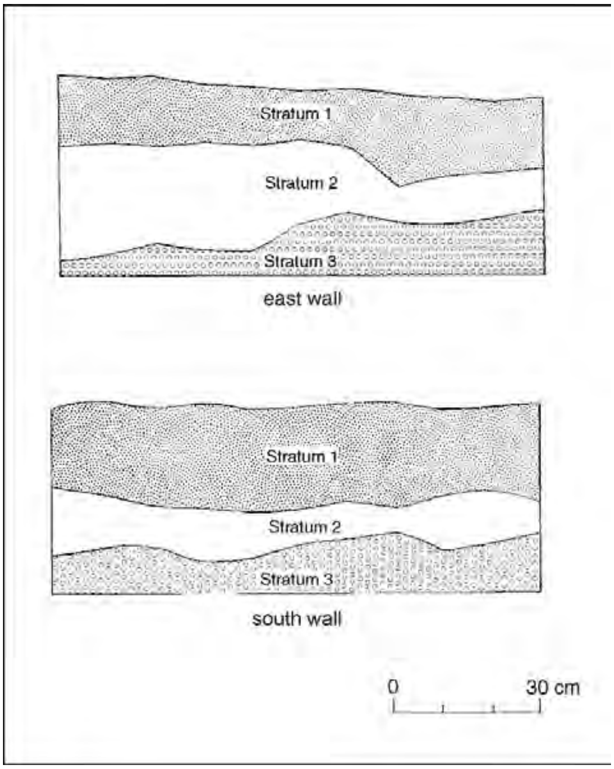

Figure 7.3. Profiles of the east and south walls of Grid 103N/120E at the FH site.

Site Stratigraphy

Three strata were defined at the FH site, with Stratum 1 containing most of the cultural materials that were recovered. These soil units were consistently found across the excavated part of the site, except in features. Figure 7.3 shows representative profiles, illustrating the vertical relationship of these layers.

Stratum 1

This unit was a 2 to 18-cm-thick layer of dark grayish brown silty sand containing some pea gravels. It contained most of artifacts recovered at the site, and all of the features and Structure 1 also occurred within this unit.

Stratum 2

Stratum 2 was a 2 to 5-cm-thick layer of pale brown sandy silt alluvium. It was fairly homogeneous, and contained a small amount of gravel. Several episodes of alluvial deposition were evident in this stratum. A few artifacts were recovered from this layer, but were apparently deposited by bioturbation. Except for these materials, Stratum 2 was sterile.

Stratum 3

This pale brown sandy silt contained a high percentage of large alluvially deposited gravels and no cultural materials. Along with Stratum 2, this layer represents preoccupational valley margin fill. The thickness of this unit was undetermined because excavation generally ended when it was reached.

Stratigraphic Summary

The single layer of soil that contained the bulk of cultural materials at LA 65013 was rather homogeneous and fairly thin. Most of this unit represents sediments deposited on the site by eolian and colluvial processes. Cultural features (including the structural remains) occurred at the base of this unit, and many were excavated down into Stratum 2. Both of the lower soil strata were comprised of materials deposited in this area long before the site was occupied. The top of Stratum 2 probably represents the ground surface at the time of occupation.

Structure 1

Structure 1 was on a shallow southeast-facing slope; its original shape could not be determined from remaining structural elements. A relatively distinct section of wall at the southwest corner of the structure, measuring 0.8 m northeast-southwest by 0.7 m northwest-southeast, was all that remained (Fig. 7.4). The number of scattered cobbles from collapsed walls that were noted during excavation (Fig. 7.5) do not represent all of the material that would have been required to build four solid walls to any great height.

The paucity of building materials suggests that cobbles were either used to build a low foundation wall, or that materials were salvaged for use elsewhere after abandonment. The southwest corner stood only one course high, and articulated with a small section of intact interior floor surface (Fig. 7.6). This area was badly disturbed by rodent activity, so the wall and floor articulation was rather questionable. It should be noted that no

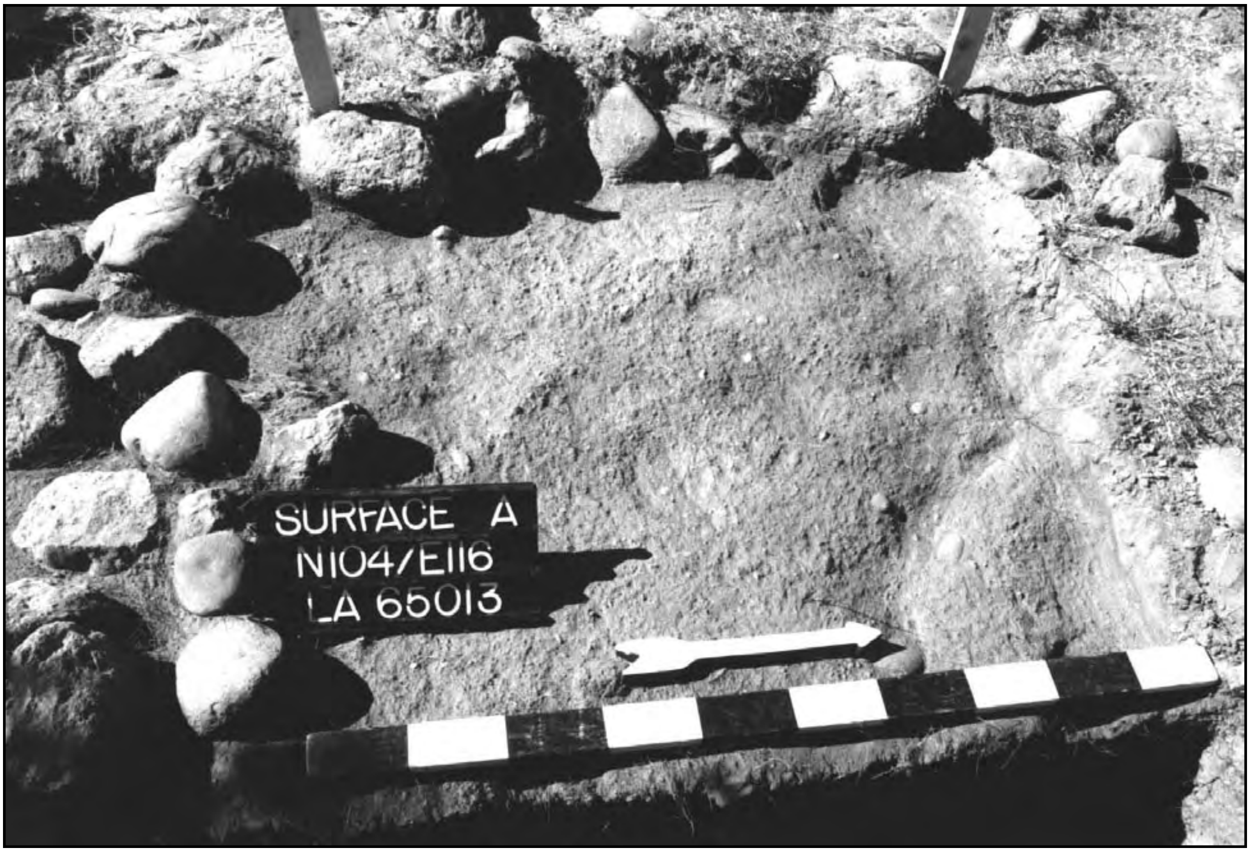

Figure 7.4. Remaining wall alignment in Structure 1 at the FH site, and section of intact floor.

Figure 7.5. Scattered cobbles from collapsed walls at the FH site.

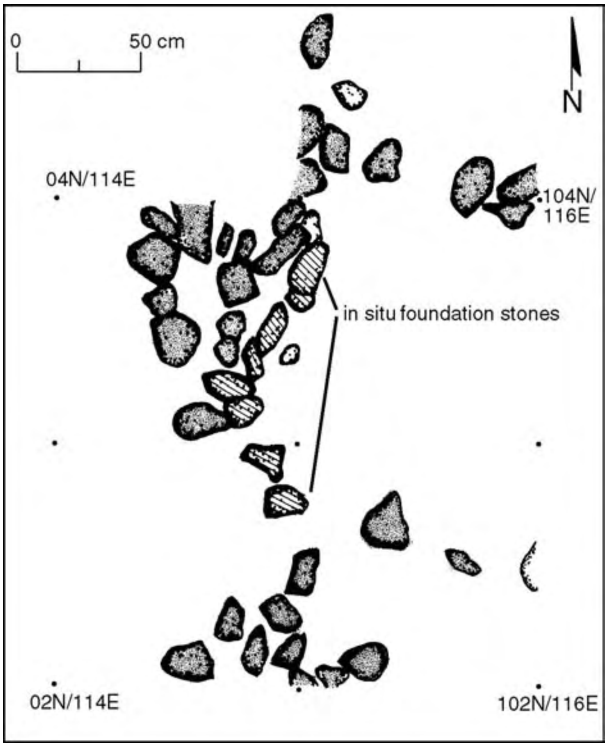

Figure 7.6. Plan view of Structure 1 at the FH site, shaded cobbles are in situ foundation stones.

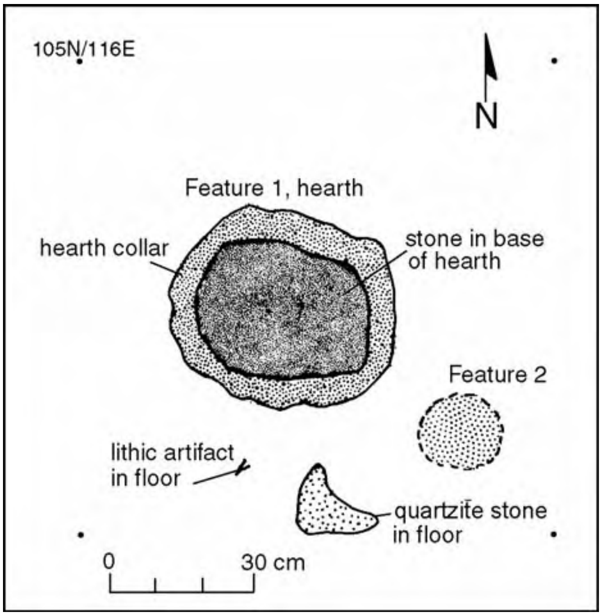

Figure 7.7. Plan of Features 1 and 2 at the FH site.

other building materials like roof casts or wooden wall or roof elements were found.

There was a definite lack of floor features in the structure. The only interior structural element was the section of intact floor in the southwest corner. This was not a prepared surface, but instead appeared to be the result of soil compaction caused by foot traffic. The presence of a very small section of intact floor could indicate one of two things: (1) the structure was used for a short period of time, perhaps one season, so it was not occupied long enough to create (or require) a formal floor; or (2) building materials were removed when the site was abandoned and the structure was left exposed to the elements, causing deterioration of the unprepared floor and remaining wall segments. The highly eroded state of the structure could also be a result of both processes.

Feature 1

Feature 1 was a hearth located 1 m northeast of Structure 1. It measured 41 cm north-south by 47 cm east-west, and the remaining section was about 3 cm deep (Fig. 7.7). A large fire-blackened stone made up most of the floor of this feature, and it was surrounded by a semi-baked collar of sterile soil that was 5 to 7 cm wide. The top of the hearth was heavily eroded before it was buried, leaving only the lower portion intact. A possible use-surface was evident around the hearth, appearing as a slightly compact soil. Embedded in the surface was a chipped stone artifact and a large fragment of tabular quartzite. Insufficient organic materials were available for chronometric sampling.

Feature 2

Feature 2 was a small pit located 45 cm southeast of Feature 1. It measured 18 cm in diameter and was 8 cm deep (Fig. 7.7). This pit was filled with a dark stained soil that contained a few flecks of charcoal. The only associated artifact was a fragment of fire-cracked quartzite found in the center of the feature. While it is possible that this pit served as an ash pit for Feature 1, this is uncertain, and no definite function could be assigned.

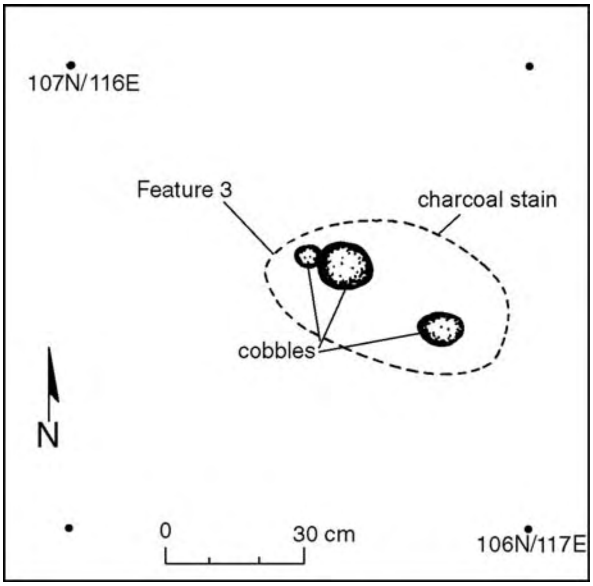

Figure 7.8. Plan of Feature 3 at the FH site.

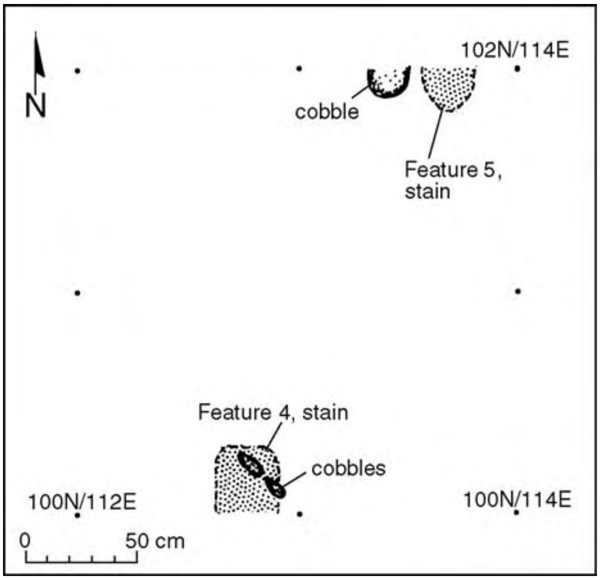

Figure 7.9. Plan of Features 4 and 5 at the FH site.

Feature 3

This feature was 1 m northeast of Feature 1. It consisted of a small charcoal stain that measured 30 cm north-south by 55 cm east-west (Fig. 7.8), and was filled with a dark ashy soil that contained three small burned rocks. The stain was around 2 or 3 cm deep, and no burned surface was encountered, so it is difficult to determine its function. This feature may represent a simple surface hearth with charcoal and ash having been transported down into the soil below it, causing the stain. Conversely, it may simply be a stain resulting from hearth cleaning and the subsequent discard of those materials.

Feature 4

This feature was about 2 m southwest of Structure 1. It was a shallow stain similar to Features 2 and 3, and measured 10 cm north-south by 25 cm east-west (Fig. 7.9). It was filled with a very dark grayish brown soil containing two small upright stones and some charcoal flecks, and was 9 cm deep.

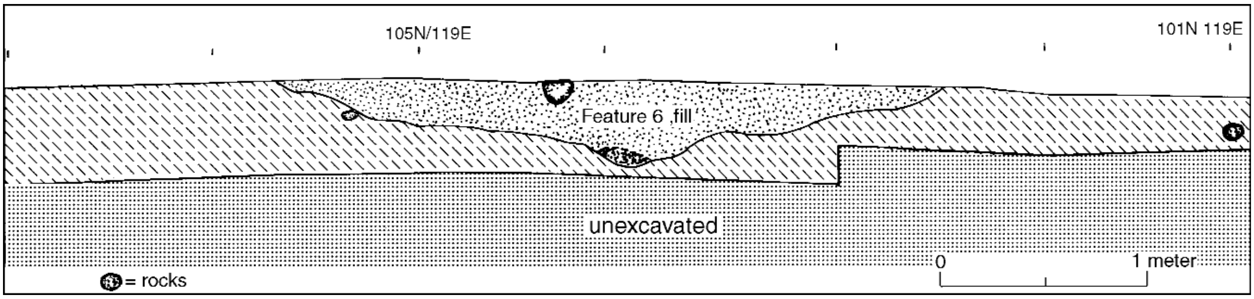

Figure 7.10. Profile of Feature 6 at the FH site.

Feature 5

This feature was located 3 m southwest of Structure 1. It was a shallow stain similar to Features 2 through 4, and measured 15 cm north-south by 14 cm east-west (Fig. 7.9). It was filled with a very dark grayish brown soil containing two small stones and some charcoal flecks, and was 9 cm deep.

Feature 6

This feature was located about 4 m east of Structure 1 (Fig. 7.2). It was a slightly depressed amorphous surface measuring 3.2 m north-south by 1.5 m east-west (Fig. 7.10). This poorly defined surface was badly damaged by bioturbation. It was distinguished in places from over- and underlying alluvial deposits by small areas of compact soil. The depth of this depression ranged from 4 cm

TABLE 7.1. CHIPPED STONE ARTIFACTS FROM THE FH SITE; FREQUENCIES AND ROW PERCENTAGES

Material	Indeterminate	Angular Debris	Core Flake	Biface Flake	Core	Cobble Tool	Biface	Totals
Chert	0 0.0	12 11.5	86 82.7	2 1.9	4 3.8	0 0.0	0 0.0	104 7.5
Pedernal chert	1 0.1	154 16.3	739 78.4	18 1.9	30 3.2	0 0.0	1 0.1	943 67.9
Silicified wood	0 0.0	0 0.0	5 100.0	0 0.0	0 0.0	0 0.0	0 0.0	5 0.4
Jemez obsidian	0 0.0	1 2.4	26 61.9	15 35.7	0 0.0	0 0.0	0 0.0	42 3.0
Polvadera obsidian	0 0.0	0 0.0	5 62.5	3 37.5	0 0.0	0 0.0	0 0.0	8 0.6
Igneous undifferentiated	0 0.0	1 3.1	29 90.6	1 3.1	1 3.1	0 0.0	0 0.0	32 2.3
Basalt	0 0.0	1 4.0	20 80.0	0 0.0	2 8.0	2 8.0	0 0.0	25 1.8
Vesicular basalt	0 0.0	0 0.0	3 75.0	0 0.0	1 25.0	0 0.0	0 0.0	4 0.3
Rhyolite	0 0.0	10 10.3	83 85.6	1 1.0	3 3.1	0 0.0	0 0.0	97 7.0
Siltstone	0 0.0	0 0.0	1 100.0	0 0.0	0 0.0	0 0.0	0 0.0	1 0.1
Quartzite	0 0.0	16 13.3	94 78.3	0 0.0	9 7.5	1 0.8	0 0.0	120 8.6
Quartzitic sandstone	0 0.0	0 0.0	7 100.0	0 0.0	0 0.0	0 0.0	0 0.0	7 0.5
Totals Percent	1 0.1	195 14.0	1,098 79.1	40 2.9	50 3.6	3 0.2	1 0.1	1,388 100.0

along its edges to 40 cm in its center. Its function is unknown, but the depression may have initially served as a borrow area during construction of Structure 1, with subsequent reuse for trash disposal. The latter use was suggested by the presence of a higher concentration of artifacts in the fill of this feature than in other subsurface zones at the site.

Discussion of Features

All six features appeared to be associated with Structure 1. Once Features 3, 4, and 5 were exposed, it became evident that they generally aligned with the remaining west edge of the structure. This alignment may have been coincidental, but it was potentially important in helping to define the architectural pattern of the structure, since these small pits may have held posts used in the construction of a brush superstructure. However, as noted earlier, Feature 3 may represent the remains of a simple surface hearth or material discarded during hearth cleaning rather than the location of a post associated with Structure 1. Indeed, rather than being part of the structure, Features 4 and 5 may have been associated with an extramural lean-to or ramada.

The only definite hearth found at the site, Feature 1, was 1 m northeast of the remaining portion of the structure. While no definite internal features were found, it is possible that Features 1 and 2 were originally within the covered space represented by Structure 1. If so, then the small areas of compact soil found in the remaining southwest corner of the structure and around Feature 1 may be the remnants of an informal floor. Although the function of Feature 6 can not be exactly determined, its proximity to Structure 1 suggests a connection, perhaps first serving as a borrow pit while the structure was being built, with a later conversion to a handy trash midden.

Artifact Analyses

James L. Moore, Daisy F. Levine, and Linda Mick-O'Hara

Chipped Stone Artifacts

A total of 1,388 chipped stone artifacts was recovered from this site. The distribution of material types by artifact morphology is shown in Table 7.1. Cherts dominate the assemblage, making up over 75 percent of the total. Quartzite and rhyolite are next in abundance, comprising 8.6 and 7.0 percent of the assemblage, respectively. Only four formal tools were found: two hammerstones, one chopper, and one early stage biface. However, a larger proportion of the assemblage (4.3 percent) exhibits use as informal tools (Table 7.2). Core flakes were by far the most commonly used informal tools, followed distantly by biface flakes.

Table 7.2. Chipped Stone Informal Tools from the FH Site; Frequencies and Row Percentages

Material	Angular Debris	Core Flake	Biface Flake
Chert	0 0.0	6 85.7	1 14.3
Pedernal chert	1 2.9	32 94.1	1 2.9
Silicified wood	0 0.0	1 100.0	0 0.0
Jemez obsidian	0 0.0	5 62.5	3 37.5
Igneous undifferentiated	0 0.0	3 100.0	0 0.0
Basalt	0 0.0	2 100.0	0 0.0
Rhyolite	0 0.0	3 100.0	0 0.0
Totals Percent	1 1.7	52 89.7	5 8.6

Ceramic Artifacts

There are 82 sherds in this assemblage; 81 were from one or two Sapawe Micaceous Washboard jars. The single exception is a Biscuit A bowl sherd. The character of the pottery assemblage suggests that the site dates to the Rio Grande Classic period, between ca. A.D. 1350 and 1550.

Table 7.3. Faunal Remains from the FH Site

Taxon	Frequency	Percent
Mammal	1	7.7
Small mammal	8	61.5
Large mammal	1	7.7
Sylvilagus audubonii (Desert cottontail)	2	15.4
Ovis/Capra (Sheep/goat)	1	7.7
Total	13	100.0

Faunal Remains

This small Classic period site produced only 13 pieces of bone (Table 7.3). One piece of eroded horn core could be assigned to the combined sheep/goat generic category (*Ovis/Capra*) and two long bones are from one or more cottontail rabbits (*Sylvilagus audubonii*). The other remains could only be generally classified as small and large mammal. Small mammal remains comprise most of the bone from this site and reflect the predominant use of smaller taxa (including cottontail), which could have been taken from fields surrounding this location.

Discussion

LA 65013 represents the remains of a Classic period structure, possibly a fieldhouse, and associated cultural features and deposits. Six features were associated with the structure. As discussed earlier, no definite internal features were present. While it is possible that Features 1 and 2 were at one time within the structure, this could not be determined for certain. Features 4 and 5 were possible postholes that were generally aligned with the west edge of the structure. Also as discussed earlier, this alignment may be coincidental, but it could also represent the location of posts from a brush superstructure or associated lean-to or ramada. While Feature 3 may have had a similar function, it more likely represents the remains of a second hearth. Although the function of the depression, Feature 6, could not be exactly determined, its proximity to the fieldhouse suggests that it is related, perhaps having first served as a borrow pit during construction and later as a trash midden.

LA 65013 was located 2.9 km southwest of Perage (LA 41), an ancestral site to San Ildefonso Pueblo. If LA 65013 was related to the occupation of Perage, its close proximity suggests that it could have been reached on a daily basis when necessary, i.e., when fields or crops needed attention. Most of the sherds recovered were from one or two Sapawe Micaceous Washboard jars (A.D. 1350 to 1550). Such utility ware storage vessels are representative of the types of ceramic artifacts one would expect to find at a fieldhouse. The chipped stone assemblage was characterized by an expedient core-flake trajectory; little formal tool manufacture or use was evident in the assemblage. The general sparseness of artifacts, especially ceramics, suggests that the site did not function as a residence. The (possible) lack of internal features may indicate that it was used during the warm season. If Feature 1 (and possibly Feature 3) was an extramural hearth, it would appear that any cooking was done outside.

The presence of only two probable wall stubs forming a corner may be important. Field structures did not always have four walls and a roof. For example, the Hopi *kishoni* shelter (Mindeleff 1891:218) consists of a simple windbreak. Thus, it is possible that the shelter represented at LA 65013 consisted of only two walls that articulated at a corner and were roofed over for shade. If so, then Feature 1 was almost certainly an extramural hearth. Since no evidence of other walls or a contiguous floor surface were found, such a configuration may be more likely than a four-walled, roofed structure. This may also explain the lack of sufficient materials at the site for such a structure.

PART 3. ARTIFACT ANALYSES

CHAPTER 8. ANALYSIS OF THE CHIPPED STONE ASSEMBLAGES

James L. Moore

The three excavated sites had widely differing dates and contained extensive chipped stone artifact assemblages. The Pedro Sánchez site (LA 65005) and FH site (LA 65013) contained single components. Multiple occupations were evident at the San Ildefonso Springs site (LA 65006), and that assemblage can be divided into at least four components. Several questions were developed in the research orientation for this project (J. Moore 1989), and analysis of the chipped stone assemblages was integral to each question. In general, this analysis was aimed at providing information about reduction, material procurement strategies, and tool production and use. This chapter will address these general topics. While more specific questions concerning the economy and lifestyle of the peoples occupying these sites were developed in the data recovery plan, they are discussed elsewhere.

Two basic reduction strategies have been identified in the prehistoric Southwest. Curated strategies entailed the manufacture of bifaces that served as unspecialized tools and cores, while expedient strategies were based on the removal of flakes from cores for use as informal tools (Kelly 1985, 1988). Technology was related to lifestyle. Curated strategies are usually associated with a high degree of residential mobility, while expedient strategies are typically associated with sedentism. Exceptions to this include highly mobile groups living in areas that contain abundant and widely distributed raw materials or suitable substitutes for stone tools (Parry and Kelly 1987). However, neither of these exceptions applies to the Southwest. Prehistoric Southwestern biface reduction strategies were similar to the blade technologies of Mesoamerica and Western Europe in that they focused on efficient reduction with little waste. While initial preparation of large bifaces was labor intensive and resulted in a fair amount of waste, the finished tool was easily and efficiently reduced.

Curated strategies allowed flintknappers to produce the maximum length of usable edge per biface. By maximizing the return from cores, they were able to reduce the volume of raw material required for the production of informal tools. Large unspecialized bifaces could also be efficiently reduced into specialized forms when needed. This helped lower the amount of weight transported between camps. Neither material waste nor transport cost were important considerations in expedient strategies, flakes were simply struck from cores when needed. Thus, analysis of the reduction strategy used at a site allows us to estimate whether site occupants were residentially mobile or sedentary.

Examination of material sources is critical to discussions of mobility and ties to other regions. Materials were classified as local or exotic depending on how distant their source was from where they were used. In general, materials were considered local if a source was no more than 10 to 15 km distant. This distance is based on ethnographic studies, which suggest that a 20 to 30 km round trip is the maximum distance that hunter-gatherers will walk comfortably in a day (Kelly 1995:133). While more distant regions were undoubtedly also used, this zone represents the area that was most heavily exploited around residential sites.

The array of tools found at a site provides information on how it was used and its position in the settlement system. Unfortunately, most facially flaked tools were usually removed from sites when they were abandoned unless they were lost, broken, or no longer useful. Thus, much of the direct evidence of tool use is gone long before a site is excavated. Expedient tools, on the other hand, were usually discarded after the task for which they were made was completed, and thus remain at their locus of use. By examining the types of facially flaked and expedient tools recovered from a site it is possible to estimate the range of activities that occurred there and provide an approximation of site function.

Component Summaries

Both LA 65005 and LA 65013 contained single components: LA 65005 was used during the Spanish Colonial period and LA 65013 was a Classic period Pueblo fieldhouse. However, LA 65006 contained at least three Late Archaic and one Classic period Pueblo components within project limits. Two of the late Archaic components and the Pueblo occupation were dated; the last component was assigned to the Archaic because it lacked pottery.

The Archaic occupations at LA 65006 occurred at three levels: the deepest occupational level (Strata 4/6), the second paleosol (Stratum 1), and the fourth paleosol (Stratum 12). Each of these units was separated from the others by layers of stream-deposited sand, which also contained some artifacts. However, these materials were not deposited by cultural processes but were moved by bioturbation, and assemblages from those units should be assignable to components. Materials from 16 distinct cores were identified during analysis, and provide data

TABLE 8.1. DESCRIPTIONS OF CORES FROM LA 65006

CORE NO.	DESCRIPTION	NUMBER OF EXAMPLES
1	Fine-grained gray and yellow chert	8
2	Fine-grained light brown and white silicified wood	101
3	Very fine-grained chert, predominantly black with yellow to red mottling in places; occasionally completely red	40
4	Fine-grained chert, reddish-brown with white inclusions ranging up to 3-4 mm in diameter. Occasionally the predominant color ranges to yellow	212
5	Very fine-grained black basalt; glassy	57
6	Fine-grained yellow chert with white inclusions	206
7	Fine-grained brown and white silicified wood. Color is predominantly brown, white occurs as laminar streaks	190
8	Fine-grained light brown and tan silicified wood with black laminar streaks	96
9	Fine-grained brown to light brown silicified wood	104
10	Fine-grained yellow-brown quartzitic sandstone	104
11	Fine-grained pink quartzite	32
12	Medium-grained brown quartzite	2
13	Fine-grained Pedernal chert, mottled yellow, white, black, and red	1
14	Fine-grained black basalt	48
15	Medium-grained light brown and tan chert	54
16	Fine-grained dark brown quartzite	45

that can be used to assign artifacts from noncultural strata to specific components. Debitage from these cores is distinct and can be separated from the more ubiquitous obsidian and Pedernal chert artifacts. Core definitions were based on material color, texture, and distinctive markings. While these cores were not refitted, they seem to represent individual reduction episodes. None of the materials represented by these cores outcrop locally, and most were probably obtained as nodules from gravel deposits along the canyon margin. The distribution of artifacts from these cores should provide information on movement patterns, and may allow us to collapse soil strata into the various components.

Table 8.1 provides descriptions of the cores isolated at LA 65006. The number of artifacts per core ranged from 1 to 212. Six cores have over 100 examples and another six between 40 and 99; only four cores had less than 40 examples each. In order to determine artifact movement patterns, distributional maps were generated (Figs. 8.1-8.8). The distributions of cores represented by less than 40 artifacts and those occurring mostly within a single stratum were not plotted.

Except for Cores 3, 12, and 13 (which are not plotted), all identified cores were reduced in Areas 1 or 6. Twenty-five artifacts from Core 3 were from Feature 9 in Area 3, two were found on the surface, one was from Stratum 3 in Area 1, and one was from Stratum 6 in Area 2. Either more than one core is represented by these artifacts or materials were collected from earlier deposits and reused during later occupations. Only two examples of Core 12 were recovered, both from Stratum 1 in Area 2. Core 13 was represented by a single example from Stratum 13 in Area 4.

Three cores were reduced in Area 6. Most debitage from Core 15 came from Stratum 4 (Fig. 8.1), though a few occurred in Stratum 3. Debitage from Cores 14 and 16 were exclusively recovered from Stratum 4 in Area 6. The ten remaining cores were reduced in Area 1. Most debitage from Core 1 was found in Stratum 4, with a single example recovered from Feature 9 in Area 3. Most debitage from Core 2 was found in Strata 4/6, though a few pieces were carried upward into Strata 10 and 3.

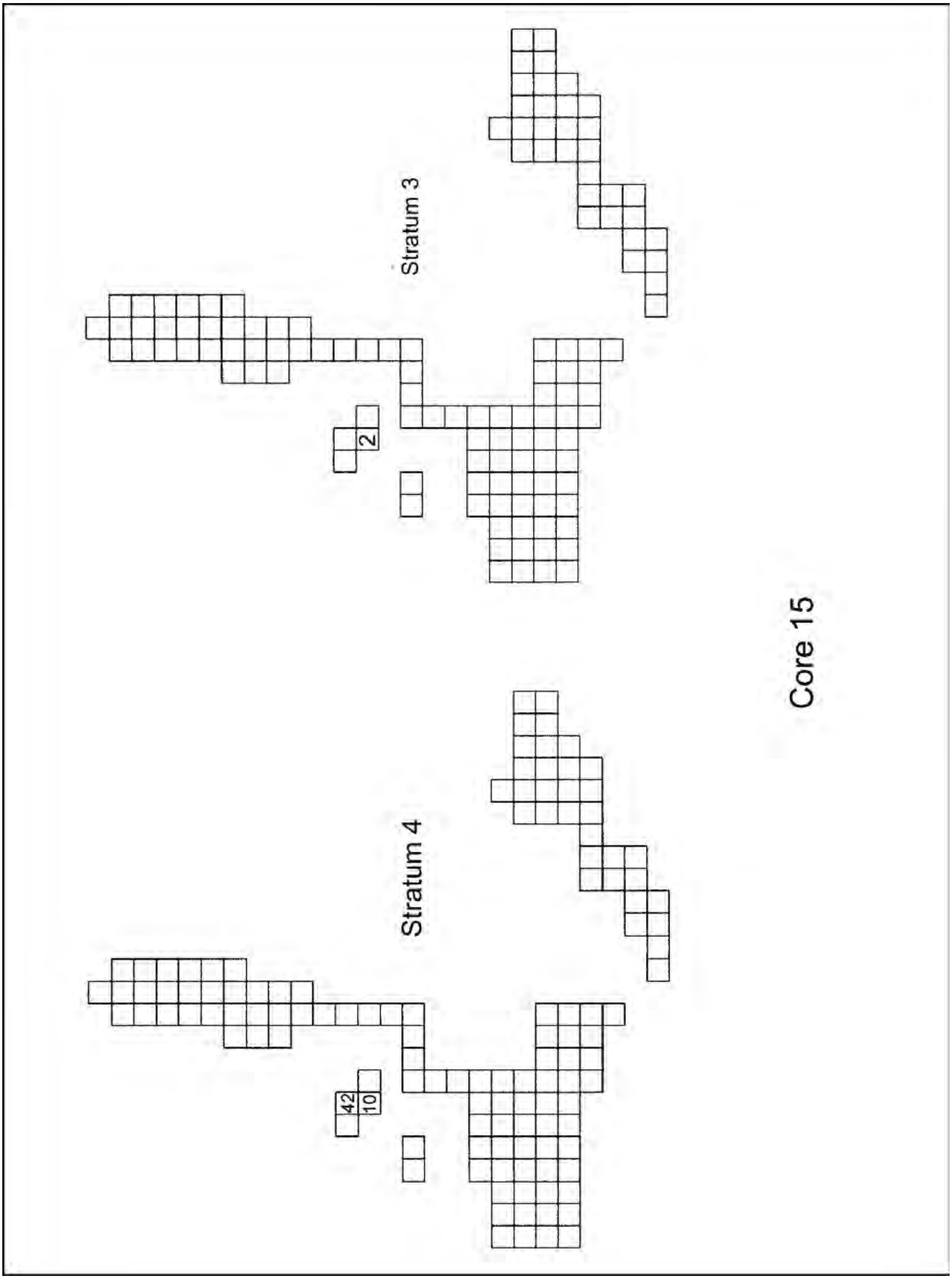

Figure 8.1. Distribution of chipped stone artifacts from Core 15.

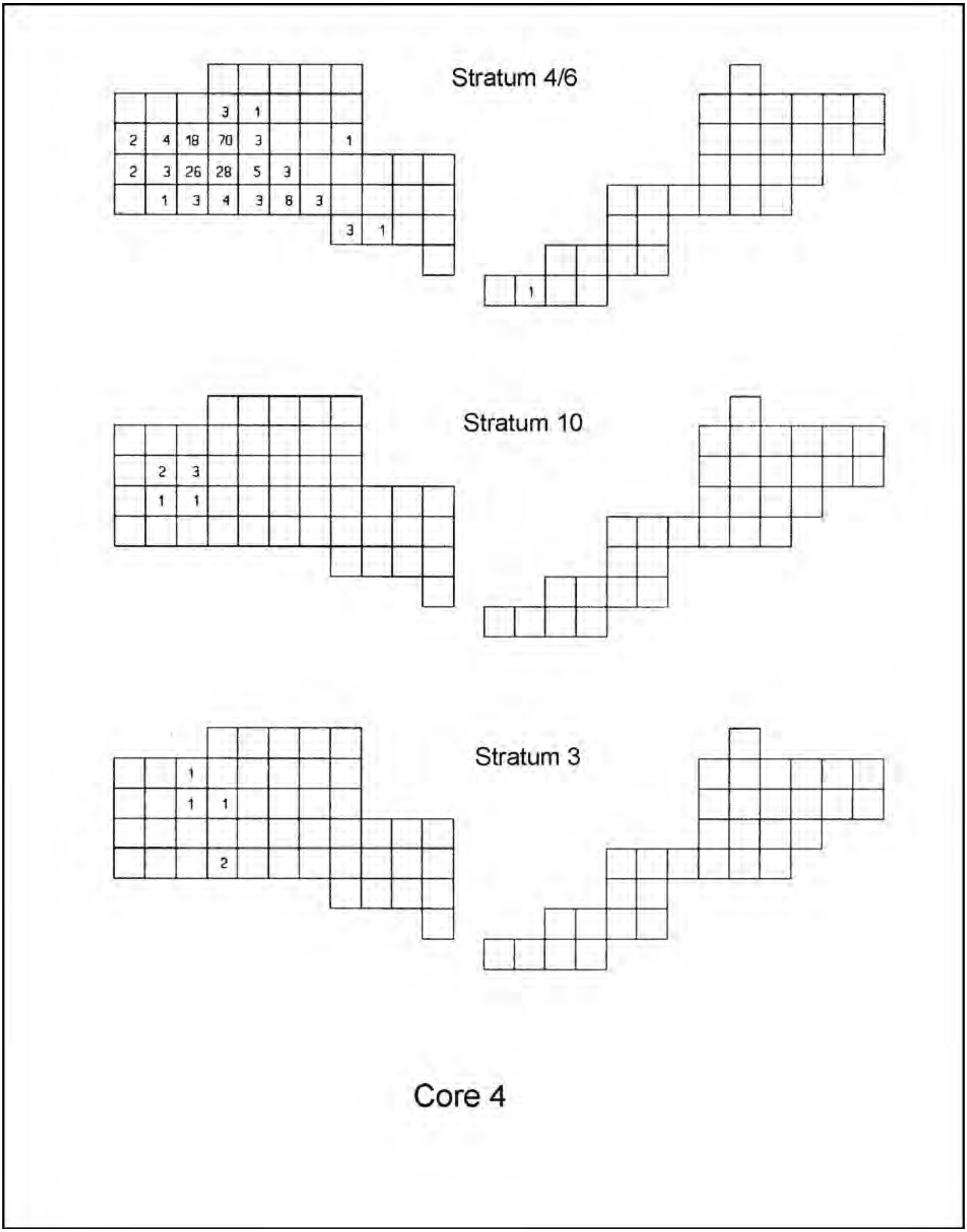

Figure 8.2. Distribution of chipped stone artifacts from Core 4.

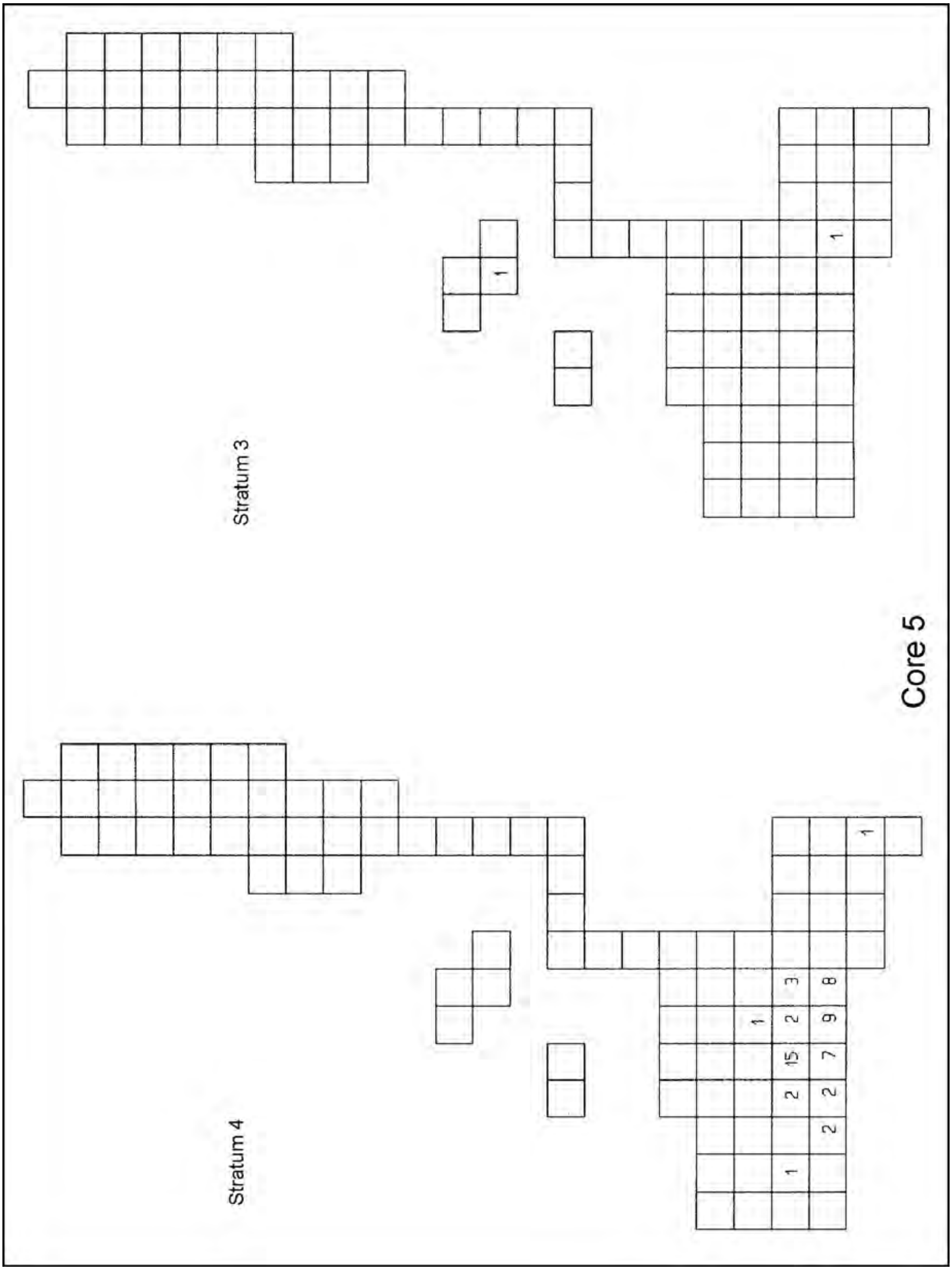

Figure 8.3. Distribution of chipped stone artifacts from Core 5.

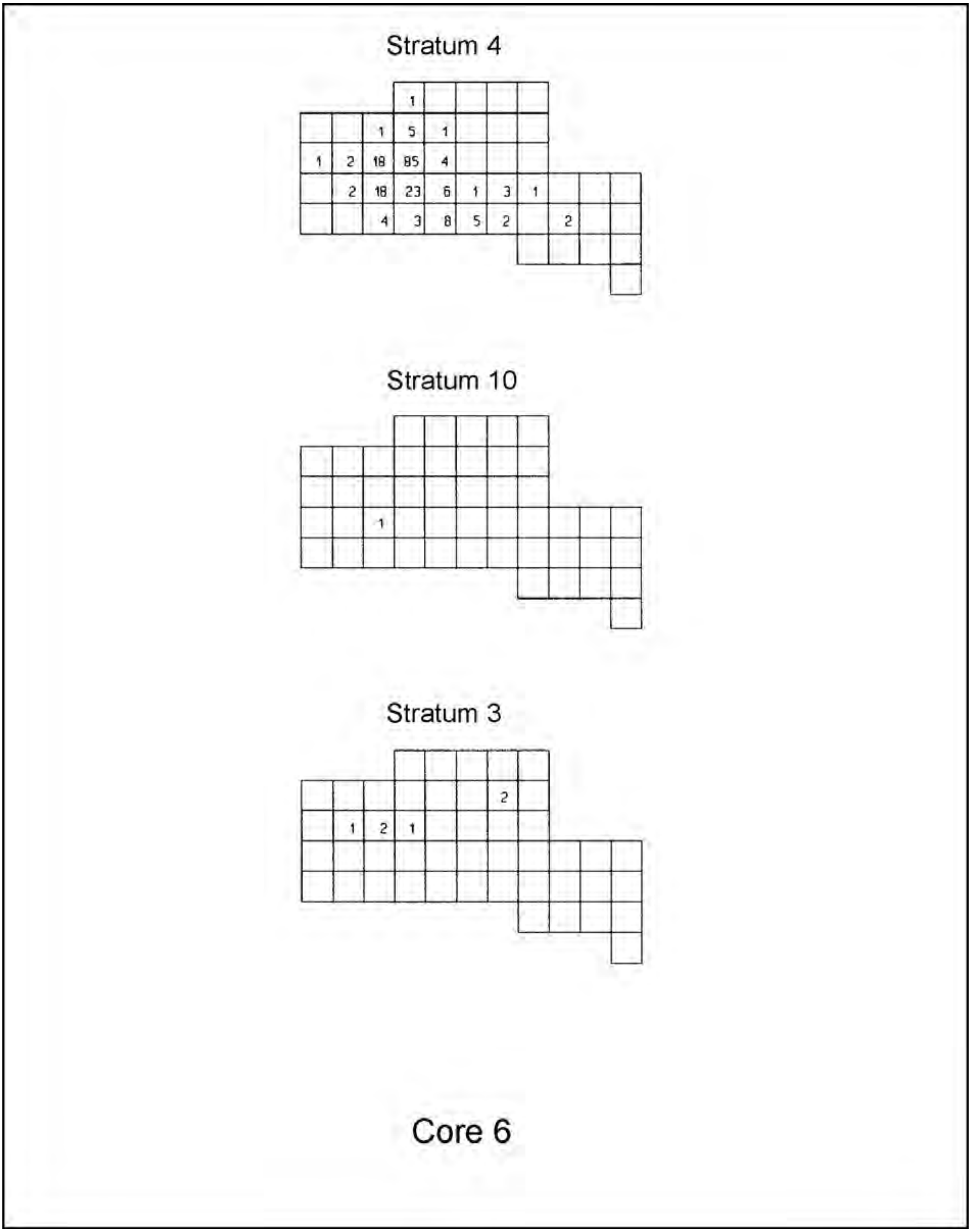

Figure 8.4. Distribution of chipped stone artifacts from Core 6.

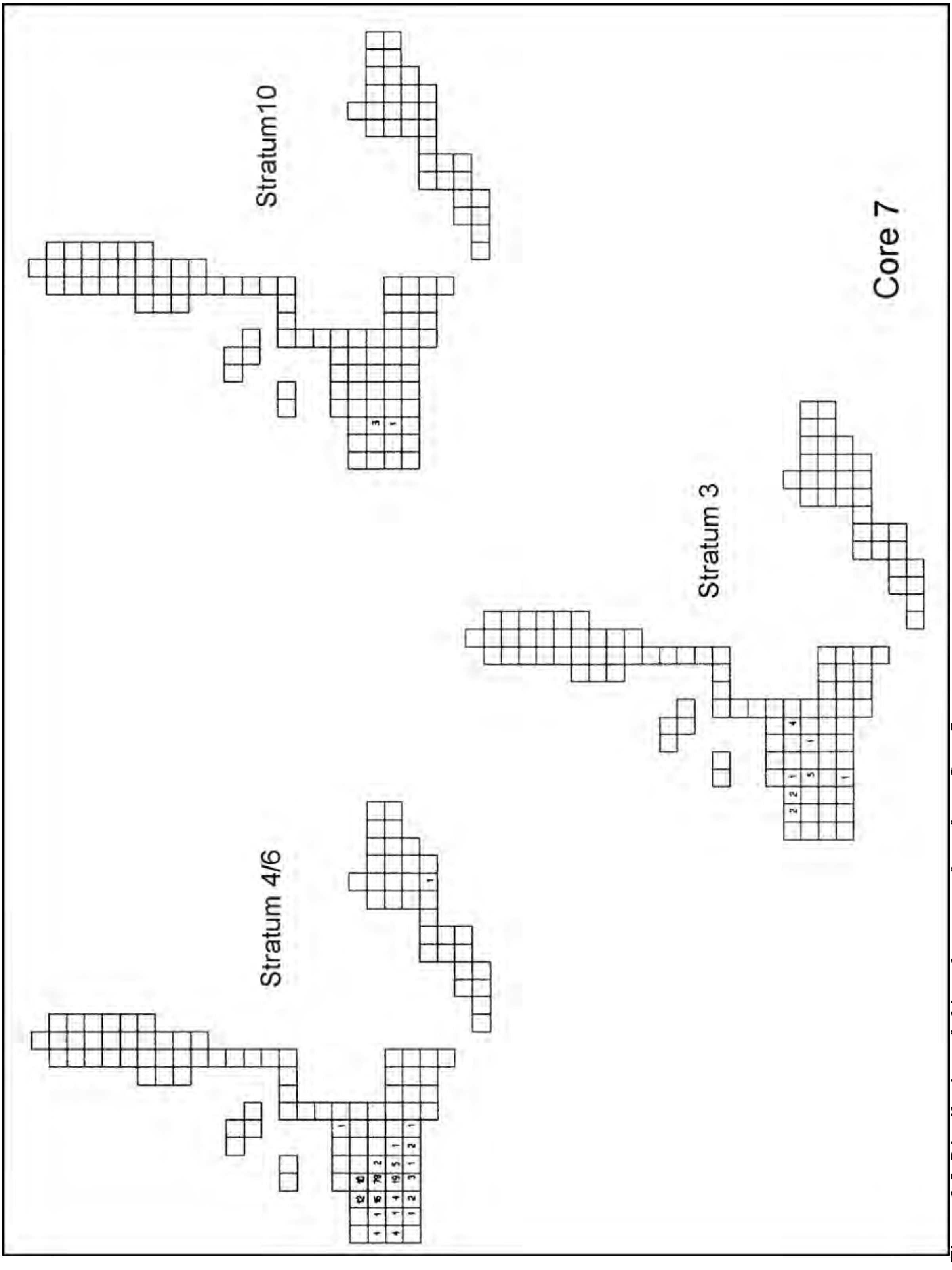

Figure 8.5. Distribution of chipped stone artifacts from Core 7.

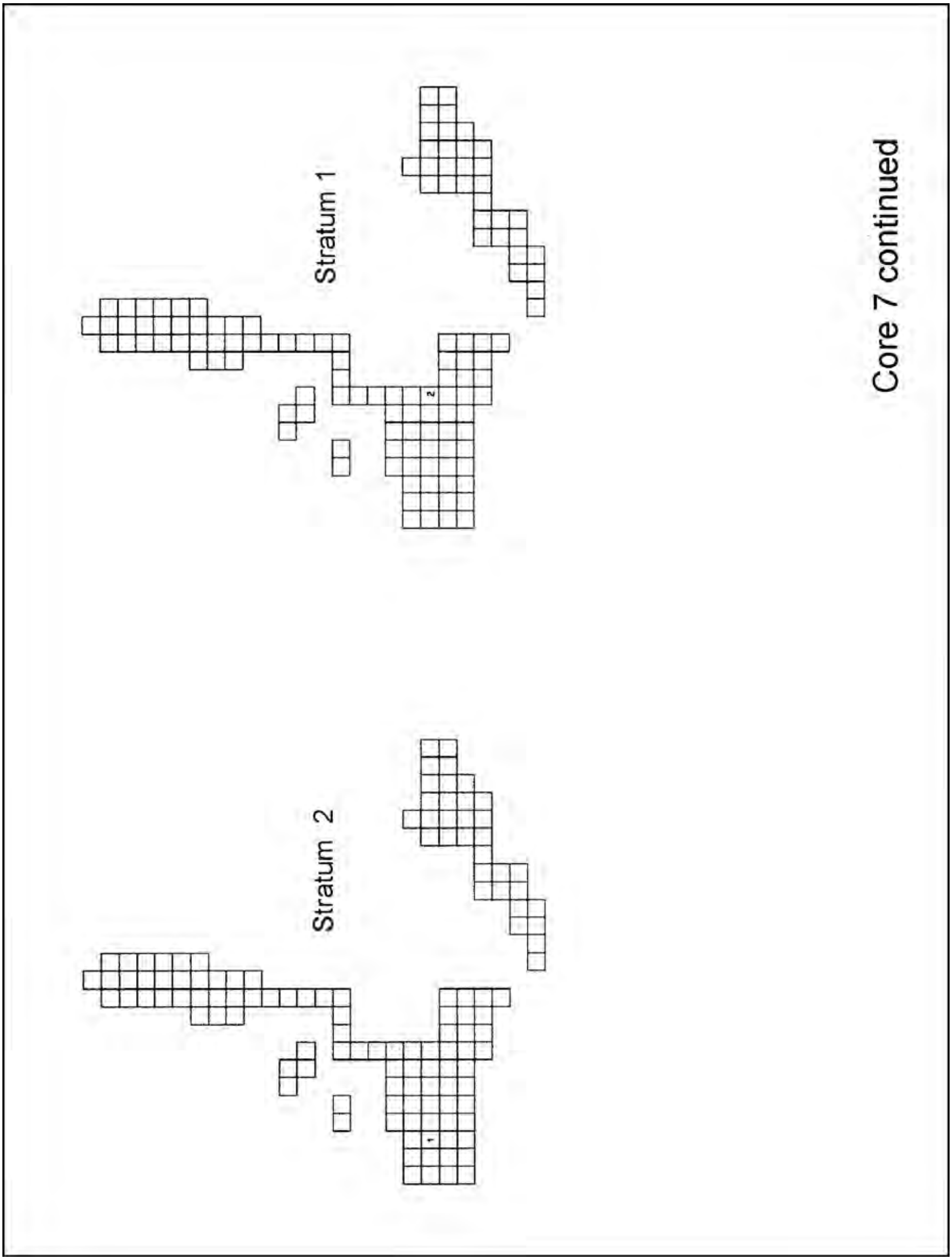

Figure 8.5. Continued.

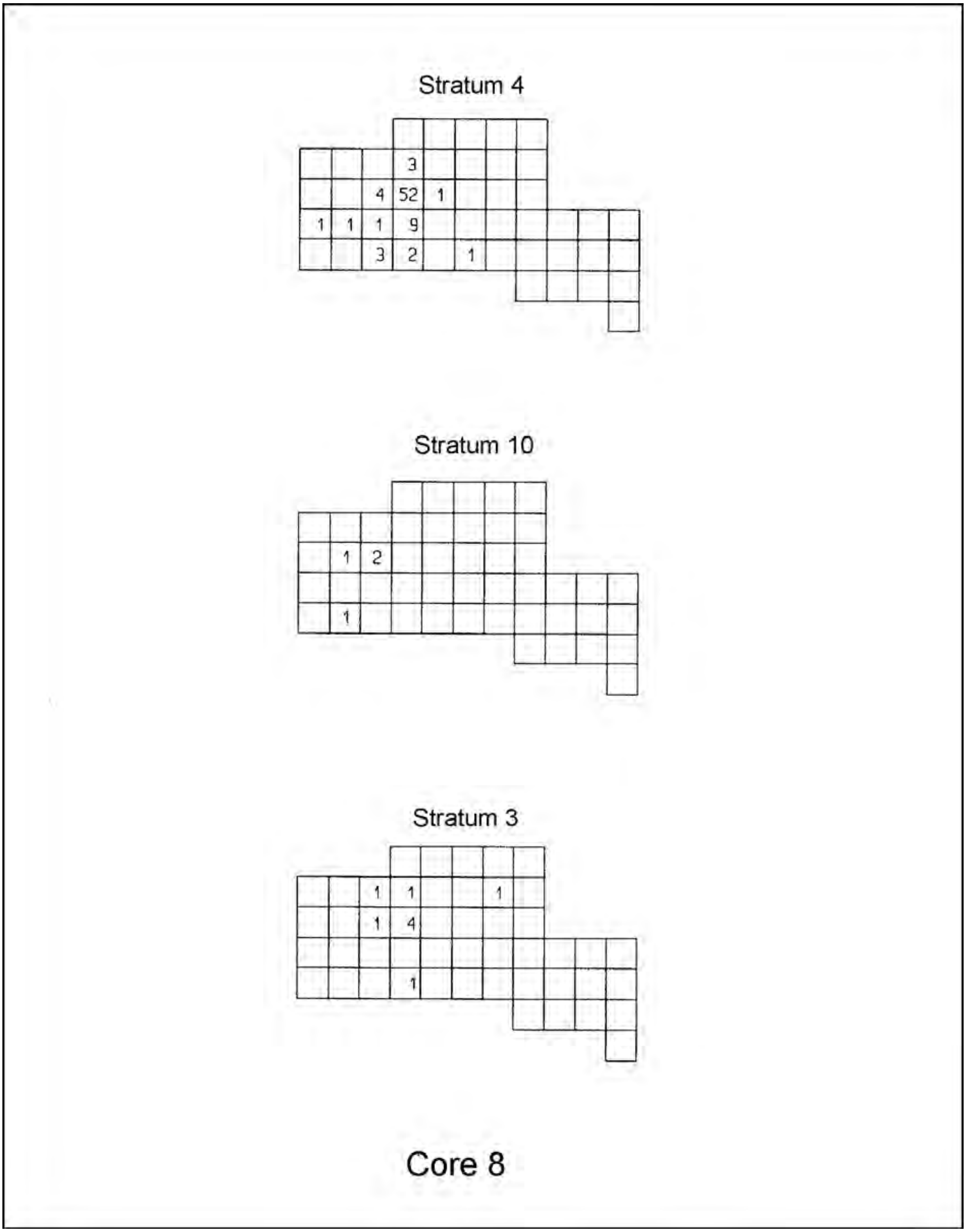

Figure 8.6. Distribution of chipped stone artifacts from Core 8.

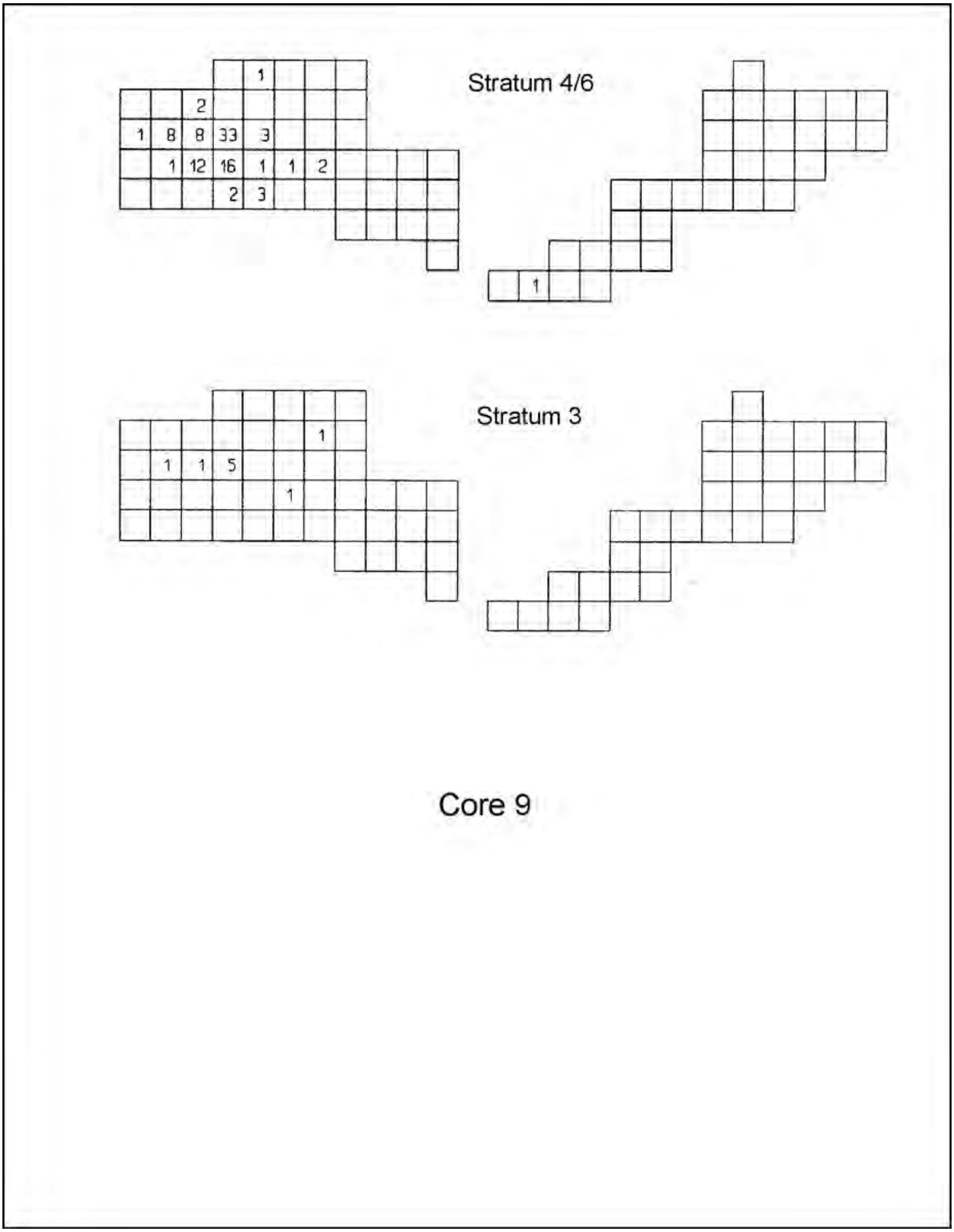

Figure 8.7. Distribution of chipped stone artifacts from Core 9.

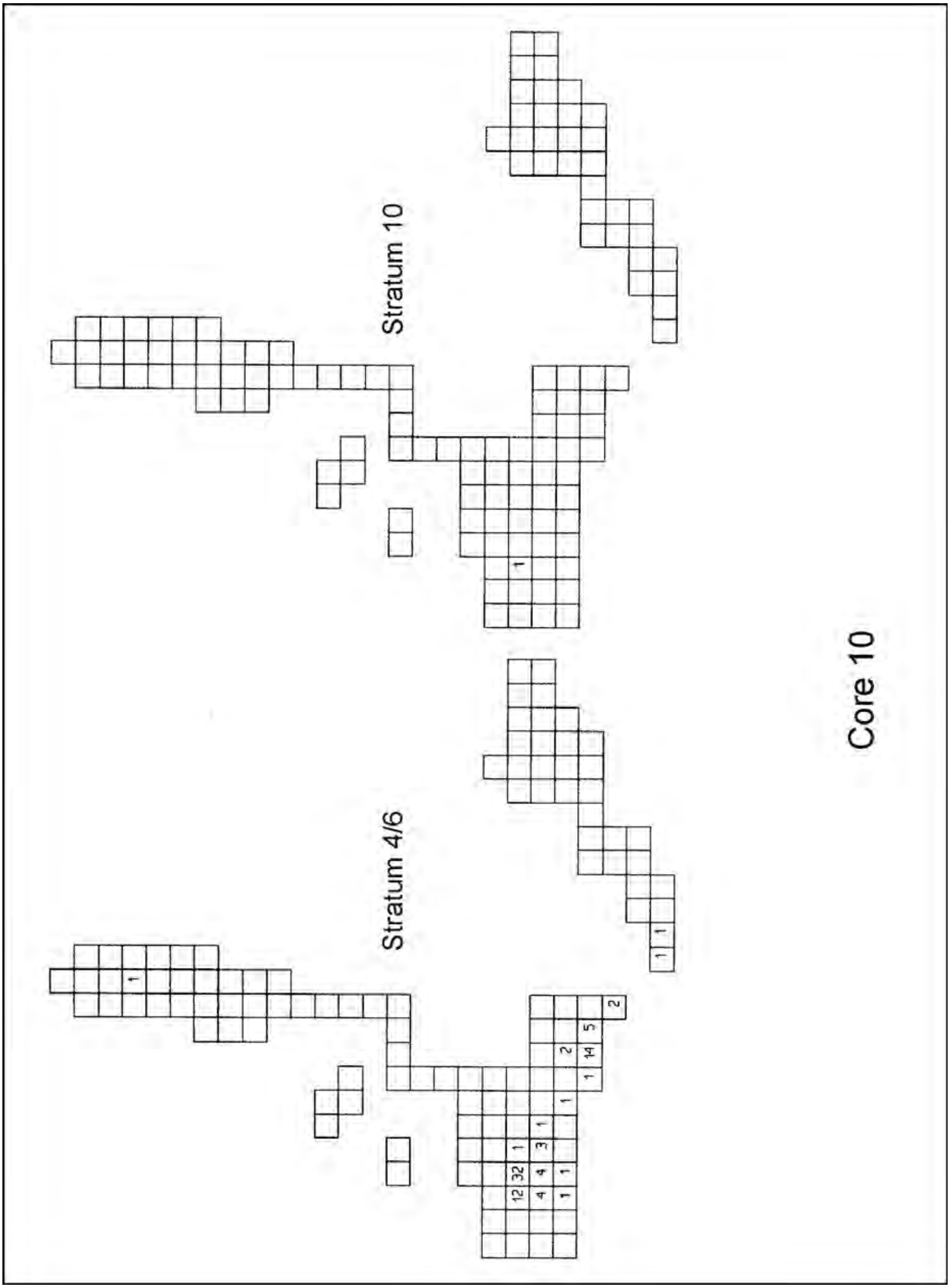

Figure 8.8. Distribution of chipped stone artifacts from Core 10.

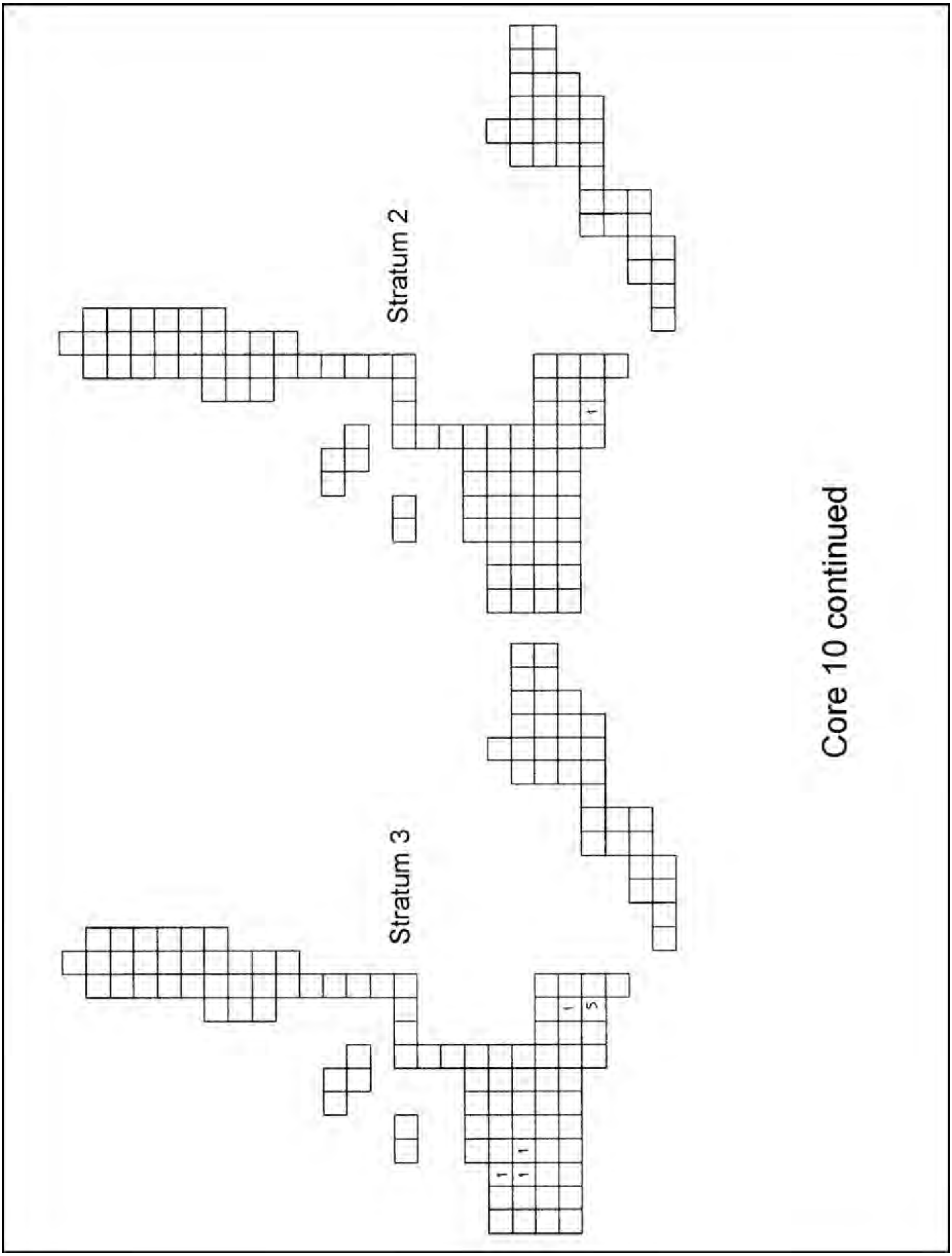

Figure 8.8. Continued.

Core 4 (Fig. 8.2) was similarly distributed, and mostly occurred in Stratum 4, with small numbers found in Strata 10 and 3. Four artifacts from this core were also found in Area 4: one in Stratum 1, two in Stratum 12, and one in Stratum 13. These examples may represent reuse of artifacts produced during earlier occupations.

Artifacts from Core 5 occurred mostly in Stratum 4 (Fig. 8.3), though two were found in Stratum 3 (one each in Areas 1 and 6), and two were from the surface. Nearly all of more than 200 pieces of Core 6 were recovered from Stratum 4 (Fig. 8.4), though some upward movement is indicated by the occurrence of a few examples in Strata 10 and 3. Artifacts from Core 7 had the greatest vertical distribution, and were found in all strata except those predating the earliest occupation (Fig. 8.5). However, reduction again seems to have been centered in Stratum 4, with upward movement represented by occurrences in Strata 10, 3, 2, and 1.

The distribution of materials from Core 8 (Fig. 8.6) was similar to that of Cores 5 and 6, with this material occurring mainly in Stratum 4 but with a few examples moved upward into Strata 10 and 3. Two artifacts from this core were also found in Stratum 12 in Area 4, again suggesting reuse of artifacts produced during an earlier occupation. Core 9 was restricted to two levels (Fig. 8.7): most artifacts from this core were found in Strata 4/6, with a few moved upward into Stratum 3.

While the basic distribution of artifacts from Core 10 resembled that of other cores in Area 1 (Fig. 8.8), there is an important difference. Most artifacts from this core were recovered from Stratum 4, with a few examples moved upward into Strata 10, 3, and the surface. However, where other cores had a unimodal distribution, Core 10 had a bimodal distribution, suggesting two reduction episodes. With four exceptions, materials from Core 11 were recovered from Area 1. Two pieces came from Stratum 6 in Area 2, one was from Stratum 4 in Area 6, and the last was found on the surface.

Upward movement into strata deposited between occupational episodes was a common theme in the distribution of these cores. Most artifacts from identified cores in Area 1 were found in Stratum 4 and appear to have been reduced during that occupation. However, materials from these cores were also moved upward into Strata 10 and 3, probably through bioturbation. Both of these strata were deposited by stream action and represent periods when this part of the site was not in use. Materials from only one of these cores were found in the next cultural level (Stratum 1), and either reached that position through bioturbation or reuse of materials from an earlier occupation. Upward movement to this extent was probably made difficult by Stratum 2, which was very clayish and contained few artifacts except at its boundary with Stratum 1. A few pieces of debitage from cores that occurred primarily in Strata 3, 4, and 10 were also recovered from the surface. While these artifacts may have reached that position through bioturbation, they more likely represent reused materials from earlier occupations.

The distribution of materials from identified cores at LA 65006 suggests that artifacts from several strata represent discrete site occupations and can be combined. Thus, artifacts from the deepest cultural unit (Stratum 4/6) and overlying and underlying noncultural units (Strata 3, 5, and 10) are combined as Component 1. While no artifacts from the identified cores occurred in Stratum 5, that unit is included because materials seemed to have moved downward at its boundary with Stratum 4/6. Component 1 includes Features 2, 5, 6, 7, and 8.

Component 2 combines artifacts from the second cultural unit (Stratum 1), and two underlying noncultural units (Strata 2 and 9). Though no artifacts from the identified cores were found in Stratum 9, its location between Strata 1 and 2 in Area 1 indicates that it should be merged with them. Component 2 also includes Features 3, 4, and 9. Some mixing of materials from the Archaic and Pueblo occupations is expected in this component, particularly in Areas 1 and 2. Strata 12 and 13 are combined as Component 3, which also includes Feature 10. Finally, Component 4 is comprised of materials from the surface and Feature 1, and should contain a mixture of Archaic and Pueblo materials.

Material Selection

Table 8.2 shows the distribution of material types for each component. A total of 9,160 chipped stone artifacts was analyzed for all three sites, with the majority (82.1 percent) from LA 65006. All but the 36 artifacts recovered from auger tests at LA 65006 are included in this analysis. Components 1, 2, and 4 from LA 65006 have similar material distributions. Cherts comprise 20 to 29 percent of these assemblages, and obsidians make up 60 to 75 percent. Other materials occur in varying quantities, though only basalt and quartzite are similarly distributed.

Cherts comprise over 70 percent of the LA 65005 and LA 65013 assemblages, while obsidian makes up only about 4 and 6 percent, respectively. Quartzite is the second most common material at these sites, and igneous materials (basalt, rhyolite, undifferentiated igneous) make up over 11 percent of the LA 65013 assemblage, considerably more than in any of the other components. These assemblages also contain examples of siltstone, massive quartz, and limestone–materials that do not occur at LA 65006.

Component 3 differs considerably from other assemblages at LA 65006, and closely resembles those

Table 8.2. Distribution of Material Types for All Components, Frequencies and Column Percentages

Material Type	LA 65006-1	LA 65006-2	LA 65006-3	LA 65006-4	LA 65005	LA 65013
Chert	590 9.8	37 7.5	12 14.0	44 4.8	18 7.2	104 7.5
Pedernal chert	822 13.7	108 21.9	52 60.5	140 15.4	166 66.7	943 67.9
Silicified wood	438 7.3	7 1.4	3 3.5	1 0.1	14 5.6	5 0.4
Obsidian	3789 63.2	299 60.6	14 16.3	679 74.5	15 6.0	50 3.6
Igneous undifferentiated	8 0.01	2 0.4	1 1.2	1 0.1	5 2.0	32 2.3
Basalt	146 2.4	23 4.7	1 1.2	21 2.3	5 2.0	25 1.8
Vesicular basalt	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	4 0.3
Rhyolite	3 0.01	0 0.0	1 1.2	2 0.2	1 0.4	97 7.0
Siltstone	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	1 0.1
Limestone	0 0.0	0 0.0	0 0.0	0 0.0	1 0.4	0 0.0
Metamorphic undifferentiated	1 0.002	0 0.0	0 0.0	1 0.1	0 0.0	0 0.0
Quartzite	98 1.6	7 1.4	1 1.2	17 1.9	16 6.4	120 8.6
Quartzitic sandstone	102 1.7	10 2.0	1 1.2	5 0.5	4 1.6	7 0.5
Massive quartz	0 0.0	0 0.0	0 0.0	0 0.0	4 1.6	0 0.0
Totals Percent	5997 65.7	493 5.4	86 0.9	911 10.0	249 2.7	1388 15.2

from LA 65005 and LA 65013. Percentages of cherts, undifferentiated igneous rocks, and rhyolite are more similar to those assemblages than to other components from LA 65006. The largest difference between Component 3 and the LA 65005 and LA 65013 assemblages is the much higher percentage of obsidian and lower percentage of quartzite in the former.

Component 4 contains the highest percentage of obsidian, even more than the definite Archaic assemblages (Components 1 and 2). This is suspicious, since Component 4 is thought to be a mixture of Archaic and Pueblo materials. Two methods were used to collect surface materials. Artifacts eroding from the lower terrace edge were collected in arbitrary units, and consisted mainly of materials from Strata 4/6 on the south edge of the site and Stratum 18 on the north edge. These strata contained Archaic materials that are probably skewing the distribution of surface material types. In order to test this, Component 4 was divided into edge collection and general surface collection/Feature 1 (Table 8.3). With the edge collection removed from Component 4, material percentages are closer to those of Components 1 and 2, though the percentage of obsidian is much smaller. Thus, the edge collection seems to be skewing this distribution, since it contains mostly obsidian debris. With this in mind, Component 4 will be broken into two subcomponents for the rest of this discussion. Component 4a contains materials collected around the edge of the site, and is a mixture of artifacts from Components 1 and 2. Component 4b is mixed Archaic and Pueblo materials from the lower terrace surface.

Table 8.3. Material Types by Collection Area for Component 4 on LA 65006, Frequencies and Column Percentages

Material Type	Edge Collection	General Surface Collection and Feature 1
Chert	9 1.7	35 8.9
Pedernal chert	28 5.4	112 28.4
Silicified wood	0 0.0	1 0.3
Obsidian	472 91.5	207 52.4
Igneous undifferentiated	0 0.0	1 0.3
Basalt	4 0.8	17 4.3
Rhyolite	1 0.2	1 0.3
Metamorphic undifferentiated	0 0.0	1 0.3
Quartzite	2 0.4	15 3.8
Quartzitic sandstone	0 0.0	5 1.3
Totals Percent	516 56.6	395 43.4

Material Source: Local Versus Exotic

An examination of material source is critical to a consideration of curated versus expedient technologies. Tools were produced in anticipation of need in curated strategies, while expedient strategies manufactured tools according to immediate need. In essence, these strategies constitute opposite ends of a behavioral continuum (Bamforth 1989). While Kelly (1988) associates curated strategies with mobility, Bamforth (1986) argues they are more closely related to the availability of desirable materials. Preliminary studies during the testing phase suggested that both positions are correct (J. Moore 1993). Archaic assemblages from the study area displayed a differential reduction of local and exotic materials. While local materials were mostly reduced expediently, exotic materials were primarily reduced as bifaces. Pueblo assemblages contained few exotics and little evidence of biface manufacture. It was concluded that Archaic populations reduced exotic materials efficiently because they were desirable and in limited supply. Local materials were expediently reduced because they were easily obtained and plentiful, making conservation unnecessary. Only when moving toward exotic sources were local materials reduced bifacially. Large general purpose bifaces were made in anticipation of future need and to replace exhausted or broken curated tools rather than for immediate use.

Materials are divided into local and exotic categories based on the distance of their source from the study area. Many of the materials found at these sites are available in Los Alamos Canyon. A weakly cemented conglomerate at the base of the Puye Formation contains cobbles and boulders deposited by the ancestral Rio Grande. Examination of materials eroding from this formation showed that it contains Pedernal and other cherts, quartzite, basalt, rhyolite, undifferentiated igneous rocks, and silicified wood. Several prehistoric quarries were examined on the north side of the canyon during survey and testing (Moore and Levine 1987; J. Moore 1993), and were probably used from Archaic through Spanish Colonial times. These quarries are 1.5 to 5 km west of the excavated sites, and reconnaissance during data recovery showed that other exploitable cobble deposits occur atop a high terrace on the south side of Totavi Creek.

Obsidian occurs in none of these deposits, and had to have been imported into the area. Three major obsidian sources are almost equidistant from our sites. Obsidian Ridge is about 25 km northwest of the area, and Cerro del Medio and Polvedera Peak are both about 26 km away. These locations are well beyond the 10 to 15 km limit for local versus exotic sources discussed earlier, and the distances cited above are as the crow flies. Rough, broken terrain separates the study area from these sources, and comparatively long journeys were required to reach them. Thus, obsidian is the only material found that is definitely exotic to the area.

It must be kept in mind that materials were not necessarily obtained from specific locations simply because they outcrop there. Rocks can be transported great distances by water and deposited in gravel terraces along streams. Not only are materials like Jemez obsidian and Pedernal chert available in outcrops, they also occur in terraces flanking streams that drain the regions in which they outcrop, and along the rivers into which those streams flow. This type of distribution complicates discussions of material source. Simply identifying an outcrop does not mean materials were obtained there. The type of cortex on artifacts provides a better indication of origin. Waterworn cortex indicates that a material was obtained from stream deposits away from the location in which it outcrops, while nonwaterworn cortex implies procurement at or near an outcrop. As noted above, Pedernal chert occurs in local gravels, and has waterworn cortex like other materials from those deposits.

TABLE 8.4. CORTEX TYPE BY COMPONENT, FREQUENCIES AND ROW PERCENTAGES

COMPONENT	CORTEX TYPE: WATERWORN	NONWATERWORN	INDETERMINATE	TOTALS
LA 65006-Component 1	176 38.5	227 49.7	53 11.6	456
LA 65006-Component 2	44 46.8	43 45.7	7 7.4	94
LA 65006-Component 3	13 65.0	4 20.0	3 15.0	20
LA 65006-Component 4a	40 55.6	27 37.5	5 6.9	72
LA 65006-Component 4b	53 66.3	24 30.0	3 3.8	80
LA 65005	95 97.9	2 2.1	0 0.0	97
LA 65013	466 81.2	51 8.9	57 9.9	574
Totals Percent	887 63.7	378 27.1	128 9.2	1393

Thus, it can be assumed that Pedernal chert with waterworn cortex was obtained from gravel deposits away from the outcrop, and were probably procured locally in Los Alamos Canyon. Conversely, Pedernal chert with nonwaterworn cortex was undoubtedly obtained at or near the source, and is of exotic origin because it outcrops well beyond our 10 to 15 km range.

Table 8.4 shows the distribution of cortex type by component. There are major differences between distributions for the five components at LA 65006 versus LA 65005 and LA 65013. The two latter assemblages are overwhelmingly dominated by waterworn cortex. Only two artifacts from LA 65005 have nonwaterworn cortex; both are obsidian and may have been obtained from earlier sites. The LA 65013 assemblage contains 51 artifacts with nonwaterworn cortex. They include four materials of igneous origin that were probably available locally; most other artifacts in this category are Pedernal chert or quartzite.

The LA 65006 components contain considerably more artifacts with nonwaterworn cortex. There is a steady decrease in the percentage of materials with nonwaterworn cortex as one ascends through the cultural layers at this site, perhaps suggesting an increasing reliance on local materials over time. Table 8.5 shows percentages of waterworn cortex by material for each component except LA 65005. Obsidian was obtained from outcrops as well as gravel deposits downstream from those outcrops. However, those deposits are also beyond our 10 to 15 km limit and obsidian was considered exotic no matter what type of cortex was present.

Pedernal chert was obtained at or near outcrops in the Chama Valley as well as from local gravels. Debitage from only one Pedernal chert core (Core 15) was identified and traced at LA 65006, and has waterworn cortex. Cortex on materials from three of the other identified cores (Cores 3, 11, and 16) is waterworn, indicating they were probably obtained from local gravels. Materials from five cores (Cores 1, 5, 12, 13, and 14) are noncortical, suggesting they were not obtained locally but were transported to the site as partly reduced cores or debitage.

The origins of the seven other identifiable cores from LA 65006 are more problematic. Both waterworn and nonwaterworn cortex was identified in these cases. There are two possible explanations for this–either multiple cores are indicated or cortex type was misidentified on some artifacts. The distribution of materials from these cores suggests that the former is unlikely, and misclassification is probably responsible. Nonwaterworn cortex dominates the Core 2 assemblage, with only one example of waterworn cortex occurring. The latter was likely misidentified, and this core was probably obtained at or near the outcrop. The opposite is true for Cores 4, 6, 8, and 9. In two cases (Cores 6 and 8) only one example of nonwaterworn cortex was noted, again suggesting misidentification. In the other cases (Cores 4 and 9), two examples each (out of 11 and 6, respectively) are classified as nonwaterworn, and were probably misidentified. Two cores (7 and 10) are more ambiguous, and have

TABLE 8.5. PERCENTAGES OF MATERIALS WITH NONWATERWORN CORTEX BY MATERIAL TYPES FOR EACH COMPONENT EXCEPT LA 65005

MATERIAL	LA 65006 COMPONENT 1	LA 65006 COMPONENT 2	LA 65006 COMPONENT 3	LA 65006 COMPONENT 4A	LA 65006 COMPONENT 4B	LA 65013
Chert	20.6	50.0	33.3	0.0	25.0	12.2
Pedernal chert	23.6	12.5	0.0	16.7	4.3	7.2
Silicified wood	27.8	0.0	0.0	0.0	0.0	0.0
Obsidian	63.3	82.9	75.0	40.0	57.6	20.0
Igneous undifferentiated	0.0	0.0	0.0	0.0	0.0	5.6
Basalt	0.0	0.0	0.0	0.0	0.0	15.8
Vesicular basalt	0.0	0.0	0.0	0.0	0.0	25.0
Rhyolite	0.0	0.0	0.0	0.0	100.0	6.0
Siltstone	0.0	0.0	0.0	0.0	0.0	0.0
Quartzite	14.3	0.0	0.0	0.0	0.0	14.5
Quartzitic sandstone	33.3	20.0	0.0	0.0	33.3	0.0

equal percentages of waterworn and nonwaterworn cortex. Both of these cores also have high percentages of indeterminate cortex, and it is possible that they were stream transported but had not moved far from their original sources, creating battering over only part of their surfaces.

Obsidian is the only exotic material at LA 65005, and comprises 6 percent of that assemblage. Probable exotic materials at LA 65006 include obsidian, Pedernal chert with nonwaterworn cortex, and artifacts from Cores 1, 2, 5, 12, 13, and 14. Probable exotics comprise 66.1 percent of Component 1, 61.9 percent of Component 2, 18.6 percent of Component 3, 91.7 percent of Component 4a, and 52.7 percent of Component 4b.

About half of the artifacts with nonwaterworn cortex at LA 65013 are Pedernal chert, 3 percent are obsidian, nearly 20 percent are quartzite, and 15 percent are igneous materials. The two former categories are definitely of nonlocal origin, while the latter two were probably available locally. Exotic materials (obsidian and Pedernal chert with nonwaterworn cortex) comprise only 5.4 percent of this assemblage.

High percentages of exotic materials might be expected in hunter-gatherer assemblages, but should not occur in sedentary farming assemblages. Thus, percentages of exotic materials for six of seven components are in line with our expectations, considering proposed occupational dates and types. Components 1, 2, 3, and 4a represent mobile Archaic occupations and contain high percentages of exotics, though the percentage for Component 3 is much lower than any of the others. Component 4b and the assemblages from LA 65005 and LA 65013 are thought to represent mixed Archaic/Pueblo, Spanish Colonial, and Pueblo occupations, respectively. However, Component 4b contains very high percentages of exotics, which is not in line with this expectation. This suggests that mostly Archaic materials may be represented in that component.

Material Texture

Different materials are suited to different tasks (Chapman 1977). For example, while obsidian is eminently suited to the production of cutting tools because it is easily flaked and possesses very sharp edges, it is too fragile to be used for heavy-duty chopping. Conversely, while basalt and quartzite have duller edges and are less efficient as cutting tools, these materials are well suited to heavy-duty use like chopping because they are dense and resist shattering. The suitability of materials for specific tasks also varies according to texture. Fine-grained materials possess sharper edges than coarse materials, and are more amenable to the manufacture of formal tools because they are easily and predictably flaked. For example, fine-grained basalt produces nearly as good a cutting edge as obsidian or chert, while coarse-grained basalt may only be suitable for chopping or battering. Thus, the texture of materials selected for reduction can provide an indication of the uses to which they were put.

Table 8.6 illustrates textures for each material by site component. It should be noted that obsidian is glassy by definition, and no other materials are assigned to that category. Most other materials are dominated by fine-grained textures. This information is summarized by component in Table 8.7. Glassy and fine-grained materials comprise between 95.5 and 99.3 percent of all components at LA 65006, while they make up 87.5 and 87.7 percent of the LA 65005 and LA 65013 assemblages, respectively. Materials with these textures are suited to the production of formal tools and possess sharp cutting edges. LA 65005 and LA 65013 contain higher percentages of materials with textures that are better suited for use in tasks requiring durable edges.

Material textures for facially flaked tools and tool-making debris are listed by component in Table 8.8. Tool-making debris includes biface, resharpening, and notching flakes; facially flaked tools are whole and unifaces and bifaces are fragmentary. Glassy and fine-grained materials were overwhelmingly selected for the manufacture of facially flaked tools in all seven components. Medium-grained materials were used to produce facially flaked tools in three components, and no flaked tools were made from coarse-grained materials. Only debitage was recovered from the manufacture of tools made from medium-grained materials, and includes Pedernal chert, silicified wood, quartzitic sandstone, basalt, and rhyolite.

The importance of workability in the selection of materials for tool manufacture becomes obvious when tool function is examined. Cryptocrystalline materials are suited to formal tool manufacture because they flake predictably and equally well in all directions, and are amenable to pressure flaking. These qualities are rarely possessed by noncryptocrystalline materials. High-quality materials like chert, obsidian, and silicified wood are cryptocrystalline, as are fine-grained basalt, rhyolite, quartzite, and quartzitic sandstone. One uniface and 26 bifaces were recovered from LA 65006; all are high-quality glassy or fine-grained chert, obsidian, basalt, and quartzite. Only two formal tools were found at LA 65005–a biface and a cobble tool; the former is fine-grained chert and the latter is medium-grained quartzite. Formal tools from LA 65013 include a fine-grained chert biface and three cobble tools, two of medium-grained basalt and one of medium-grained quartzite. Facially flaked tools from these sites are made from cryptocrystalline materials, while cobble tools are made from noncryptocrystalline materials. High-quality materials were used to produce tools that required careful shaping, while lower quality materials were used to make tools that required less shaping. Fine-grained and glassy cryptocrystalline materials were used to make tools that required sharp working edges, while medium-grained noncryptocrystalline materials were used to make tools that required durable edges.

Table 8.9 shows material type by texture for informally used tools at all three sites (except for strike-a-light flints at LA 65005). Glassy and fine-grained materials were overwhelmingly selected for informal tool use; only 3 of 240 informal tools were made from medium-grained materials. This suggests that the tasks for which these tools were used required sharp rather then durable edges; this is tested in a later section.

Reduction Strategy

There are two basic aspects to the reduction process, strategy and technique. Both are related to how a material is flaked. While reduction strategy is mostly a mental process, reduction technique is physical. As discussed earlier, two basic reduction strategies are defined in the Southwest–curated and expedient. The strategy used to reduce a specific nodule was dependent on several factors including material availability, nodule size, and mobility. When desirable materials were rare or difficult to access they could be reduced in a way that maximized return. Conversely, when suitable materials were locally abundant they could be expediently reduced, with no attempt being made to conserve or maximize return. Nodule size was sometimes an important factor in reduction strategy, though it is not taken into account by this study. When materials occur as small nodules, expedient reduction may be the only option; it may be impossible to more efficiently reduce them. Finally, mobility must be taken into account. Mobile peoples often require tool kits that are generalized and easily transported. In the Southwest, this need was often fulfilled by large general purpose bifaces used as unspecialized tools, cores, and preforms. Large bifaces were efficient tools because waste material was removed during manufacture and they could be flaked in a way that maximized the amount of useable edge produced. However, the initial production of these tools was inefficient, and a large amount of waste was usually generated during manufacture.

Reduction technique refers to the physical methods used to remove material from a core or tool. Two techniques were used in the Southwest–percussion and pressure. Percussion flaking involves the striking of a core or tool with a hammer to remove flakes. Both hard and soft hammers can be used, and flakes produced by these methods can often be distinguished from one another. Pressure flaking involves the use of a tool to press flakes off the edge of an artifact. In general, hard hammers were used for core reduction, while soft hammers and pressure flaking were used to make tools. However, use of these techniques often overlapped, and hard hammers were sometimes used for initial tool manufacture while soft

Table 8.6. Material Texture by Material Type for All Components, Frequencies and Row Percentages

Material	LA 65006 Component 1				LA 65006 Component 2				LA 65006 Component 3				LA 65006 Component 4a			
	G	F	M	C	G	F	M	C	G	F	M	C	G	F	M	C
Chert	0 0.0	585 99.2	4 0.7	1 0.2	0 0.0	36 97.3	1 2.7	0 0.0	0 0.0	12 100.0	0 0.0	0 0.0	0 0.0	9 100.0	0 0.0	0 0.0
Pedernal chert	0 0.0	766 93.2	56 6.8	0 0.0	0 0.0	108 100.0	0 0.0	0 0.0	0 0.0	52 100.0	0 0.0	0 0.0	0 0.0	28 100.0	0 0.0	0 0.0
Silicified wood	0 0.0	324 74.0	114 26.0	0 0.0	0 0.0	4 57.1	3 42.9	0 0.0	0 0.0	3 100.0	0 0.0	0 0.0	0 0.0	1 100.0	0 0.0	0 0.0
Obsidian	3,789 100.0	0 0.0	0 0.0	0 0.0	299 100.0	0 0.0	0 0.0	0 0.0	14 100.0	0 0.0	0 0.0	0 0.0	472 100.0	0 0.0	0 0.0	0 0.0
Igneous undifferentiated	0 0.0	3 37.5	3 37.5	2 25.0	0 0.0	1 50.0	1 50.0	0 0.0	0 0.0	1 100.0	0 0.0	0 0.0	0 0.0	0 0.0	1 100.0	0 0.0
Basalt	0 0.0	90 61.6	54 37.0	2 1.4	0 0.0	13 56.5	10 43.5	0 0.0	0 0.0	1 100.0	0 0.0	0 0.0	0 0.0	2 50.0	2 50.0	0 0.0
Vesicular basalt	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0
Rhyolite	0 0.0	1 33.3	2 66.7	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	1 100.0	0 0.0	1 50.0	1 50.0	0 0.0
Metamorphic undifferentiated	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	1 100.0
Quartzite	0 0.0	88 89.8	4 4.1	6 6.1	0 0.0	4 57.1	3 42.9	0 0.0	0 0.0	0 0.0	1 100.0	0 0.0	0 0.0	0 0.0	2 100.0	0 0.0
Quartzitic sandstone	0 0.0	92 90.2	10 9.8	0 0.0	0 0.0	6 60.0	4 40.0	0 0.0	0 0.0	1 100.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0
Massive quartz	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0

TABLE 8.6. CONTINUED.

MATERIAL	LA 65006 COMPONENT 4B				LA 65005				LA 65013			
	G	F	M	C	G	F	M	C	G	F	M	C
Chert	0 0.0	35 100.0	0 0.0	0 0.0	0 0.0	16 88.9	2 11.1	0 0.0	0 0.0	104 100.0	0 0.0	0 0.0
Pedernal chert	0 0.0	112 100.0	0 0.0	0 0.0	0 0.0	164 98.8	2 1.2	0 0.0	0 0.0	942 99.9	1 0.1	0 0.0
Silicified wood	0 0.0	1 100.0	0 0.0	0 0.0	0 0.0	14 100.0	0 0.0	0 0.0	0 0.0	5 100.0	0 0.0	0 0.0
Obsidian	207 100.0	0 0.0	0 0.0	0 0.0	15 100.0	0 0.0	0 0.0	0 0.0	50 100.0	0 0.0	0 0.0	0 0.0
Igneous undifferentiated	0 0.0	0 0.0	1 100.0	0 0.0	0 0.0	1 20.0	4 80.0	0 0.0	0 0.0	20 62.5	12 37.5	0 0.0
Basalt	0 0.0	13 76.5	4 23.5	0 0.0	0 0.0	0 0.0	4 80.0	1 20.0	0 0.0	12 48.0	13 52.0	0 0.0
Vesicular basalt	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	1 25.0	3 75.0	0 0.0
Rhyolite	0 0.0	0 0.0	1 100.0	0 0.0	0 0.0	0 0.0	0 0.0	1 100.0	0 0.0	32 33.0	65 67.0	0 0.0
Metamorphic undifferentiated	0 0.0	0 0.0	0 0.0	1 100.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0
Siltstone	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	1 100.0	0 0.0	0 0.0
Quartzite	0 0.0	6 40.0	8 53.3	1 6.7	0 0.0	3 18.8	8 50.0	5 31.3	0 0.0	47 39.2	71 59.2	2 1.7
Quartzitic sandstone	0 0.0	3 60.0	2 40.0	0 0.0	0 0.0	4 100.0	0 0.0	0 0.0	0 0.0	5 71.4	1 14.3	1 14.3
Massive quartz	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	1 25.0	3 75.0	0 0.0	0 0.0	0 0.0	0 0.0

(G = glassy, F = fine-grained, M = medium-grained, C = coarse-grained)

Table 8.7. Comparison of Material Texture Percentages for All Components, Frequencies, and Column Percentages

Material Texture	LA 65006 Component 1	LA 65006 Component 2	LA 65006 Component 3	LA 65006 Component 4a	LA 65006 Component 4b	LA 65005	LA 65013
Glassy	63.2	60.6	16.3	91.5	52.4	6.0	3.6
Fine	32.5	34.9	81.4	7.8	43.0	81.5	84.2
Medium	4.1	4.5	1.2	0.8	4.1	8.4	12.0
Coarse	0.2	0.0	1.2	0.0	0.5	4.0	0.2

Table 8.8. Material Textures for Facially Flaked Tools and Tool Making Debris for All Components

Component	Glassy	Fine	Medium	Totals
LA 65006 Component 1	1169 60.1	725 37.3	52 2.7	1946
LA 65006 Component 2	63 63.6	35 35.4	1 1.0	99
LA 65006 Component 3	4 23.5	13 76.5	0 0.0	17
LA 65006 Component 4a	72 88.9	9 11.1	0 0.0	81
LA 65006 Component 4b	43 59.7	29 40.3	0 0.0	81
LA 65005	1 20.0	4 80.0	0 0.0	5
LA 65013	18 43.9	22 53.7	1 2.4	41

hammers were occasionally used to reduce cores.

The removal of flakes from a core or tool can be facilitated by modifying platforms to prevent crushing or shattering. The edge of a platform is usually sharp and fragile; modification by abrasion increases that angle and strengthens the edge so it can better withstand the force used to remove flakes. Platform modification was most common during tool manufacture, though core platforms were sometimes also modified.

This discussion is mostly concerned with the reduction strategies used at our sites. Only a few observations are made concerning reduction technology, since that was not a focus of analysis. Several attributes are examined to help determine whether reduction strategies focused on the use of curated large bifaces or expedient core-flake reduction. However, it must be remembered that these strategies were not mutually exclusive. Mobile hunter-gatherers used both curated and expedient strategies, and while sedentary farmers relied on an expedient strategy, large bifaces continued to be made and used, though they declined in importance.

Several attributes of debitage, cores, and formal tools can contribute information on reduction strategy. Debitage are important indicators because they are rarely curated and often constitute the only remaining evidence of reduction on sites from which formal tools and cores were removed at the time of abandonment. When they occur, the types and conditions of cores and formal tools can also be important indicators of reduction strategy. The approach used by this study is complicated because the chipped stone reduction process is itself complex. Our approach is typological because it is possible to use certain characteristics to determine whether a flake was removed from a core or tool.

The Debitage Assemblage

Eight debitage assemblage attributes were selected as indicative of reduction strategy. They include percentages of noncortical debitage, biface flakes, and modified platforms; flake to angular debris ratio, flake breakage patterns, platform lipping, presence of opposing dorsal scars, and flake to core ratio. Though only the percentage of biface flakes in an assemblage is directly related to reduction strategy, when combined with the other attributes, a clearer picture of the strategy used at a site can be derived. Unfortunately, baseline data against which these results can be measured are rare. Thus, many of our expectations are preliminary and will require modification as more data become available. However, it is possible to predict what purely expedient or curated debitage assemblages will look like, and to compare our results to those expectations. This should allow us to determine whether a certain strategy or combination of strategies was used in a component.

Curated and Expedient Debitage Assemblages Modeled. Debitage assemblages reflecting a purely expedient reduction strategy should contain different percentages of noncortical debitage than those produced by a purely curated strategy. Cortex is the weathered outer rind on nodules. It is often brittle and chalky and does not flake with the ease or predictability of unweath-

TABLE 8.9. MATERIAL TYPES AND TEXTURES USED FOR INFORMAL TOOLS AT ALL SITES

	LA 65005		LA 65006		LA 65013	
MATERIALS	FINE & GLASSY	MEDIUM	FINE & GLASSY	MEDIUM	FINE & GLASSY	MEDIUM
Chert	2 100.0	0 0.0	9 100.0	0 0.0	7 100.0	0 0.0
Pedernal chert	1 100.0	0 0.0	12 100.0	0 0.0	34 100.0	0 0.0
Silicified wood	0 0.0	0 0.0	1 100.0	0 0.0	1 100.0	0 0.0
Obsidian	3 10.0	0 0.0	151 100.0	0 0.0	8 100.0	0 0.0
Igneous undifferentiated	0 0.0	0 0.0	0 0.0	0 0.0	1 33.3	2 66.7
Basalt	0 0.0	0 0.0	2 100.0	0 0.0	2 100.0	0 0.0
Rhyolite	0 0.0	0 0.0	0 0.0	0 0.0	3 100.0	0 0.0
Quartzite	0 0.0	1 100.0	0 0.0	0 0.0	0 0.0	0 0.0
Totals Percent	6 85.0	1 15.0	175 100.0	0 0.0	56 96.0	2 4.0

ered material. This can cause problems during tool manufacture, so cortex is removed during the early stages of tool production. As noted earlier, the manufacture of large bifaces is rather wasteful of material, and quite a number of flakes must be removed before the proper shape is achieved. These flakes must be carefully struck, and are generally smaller and thinner than those removed from cores. Thus, large numbers of interior flakes lacking cortical surfaces are removed during biface manufacture. It is not as necessary to remove cortex from cores used to produce informal tools. This suggests that assemblages reflecting a curated strategy should contain smaller percentages of cortical debitage than those generated by expedient core reduction.

The presence of biface flakes is good evidence that formal tools were produced at a site, though it is often difficult to determine number or type. As discussed in *Field and Analytical Methods* in Chapter 4, flake type was defined by a polythetic set of conditions. Flakes fulfilling at least 70 percent of those conditions were considered biface flakes, while those that did not were core flakes.

Biface flake length is indicative of the size of the tool being made. The presence of biface flakes measuring 15 to 20 mm or more in length suggest that large bifaces were reduced at a site. However, the opposite is not necessarily true when only small biface flakes are found. While the presence of small biface flakes may suggest that small specialized tools were made, the possibility that they are debris from retouching large biface edges must also be considered. Large percentages of biface flakes suggest that tool production was an important activity. When those flakes are large in size, it is likely that large bifaces were manufactured or used, and this in turn suggests a curated reduction strategy. While the lack of large biface flakes is not definite proof of an expedient strategy, it suggests that reduction was not focused on the manufacture of curated tools.

Though platform modification is used by the polythetic set to help assign flakes to core or manufacturing categories, it can also be used as an independent indicator of reduction strategy. This is because the polythetic set only identifies ideal examples of flakes removed during tool production. Many flakes produced during the initial shaping and thinning of a tool are difficult or impossible to distinguish from core flakes. However, even at this stage platforms were usually modified to facilitate removal. While core platforms were also modified on occasion, it occurred less commonly than during tool manufacture because the same degree of control over flake size and shape were unnecessary unless a core was being systematically reduced. Since this rarely occurred in the Southwest, it is likely that a large percentage of modified platforms indicates tool manufacture, while the opposite denotes core reduction. When there is a high percentage of modified platforms but few definite biface flakes, early tool manufacture may be indicated.

Since tool manufacture is generally more controlled than core reduction, fewer pieces of angular debris are produced. This suggests that a high ratio of flakes to angular debris should be indicative of tool manufacture, while a low flake to angular debris ratio suggests core reduction. Unfortunately, this is a bit simplistic because the production of angular debris is also dependent on the type of material being worked, the technique used to remove flakes, and the amount of force applied. Brittle materials shatter more often than elastic materials, and hard hammer percussion tends to produce more recoverable pieces of angular debris than do soft hammer percussion or pressure flaking. The use of excessive force can also cause materials to shatter. Even so, as reduction proceeds the ratio of flakes to angular debris should increase, and late stage core reduction as well as tool manufacture should produce a high ratio.

Flake breakage patterns are also indicative of reduction strategy. Experimental data presented in a later section suggest there are differences in fracture patterns between flakes struck from cores and those removed from tools. Though reduction techniques are more controlled during tool manufacture, flake breakage increases because debitage becomes thinner as reduction proceeds. Thus, there should be more broken flakes in an assemblage related to tool manufacture than in one derived from core reduction. However, trampling, erosional movement, and other post-reduction impacts can cause considerable breakage and must also be taken into account.

Much flake breakage is by secondary compression, in which outward bending during removal causes flakes to snap (Sollberger 1986). Certain characteristics of the broken ends of flake fragments can be used to determine whether breakage was caused by this sort of bending. When a step or hinge fracture occurs at the proximal end of distal or medial fragments they are classified as broken during manufacture. Characteristics diagnostic of manufacturing breakage on proximal fragments include "pieces à languette" (Sollberger 1986:102), negative hinge scars, positive hinges curving up into small negative step fractures on the ventral surface, and step fractures on the dorsal rather than ventral surface (Fig. 8.9). Breakage by processes other than secondary compression seems to result in snap fractures. This pattern is common on debitage that has been broken by natural processes like trampling or erosional movement, but snap fractures also occur during flake removal. Core reduction tends to cause a high percentage of snap fractures, while biface reduction results in a high percentage of manufacturing breaks. However, since snap fractures can also be evidence of post-reduction damage, this is perhaps the weakest of the attributes used to examine reduction strategy.

The presence of platform lipping is indicative of reduction technology, and is only marginally related to strategy. Platform lipping is usually evidence of pressure flaking or soft-hammer percussion, though it can sometimes occur on flakes removed by hard hammers (Crabtree 1972). The former techniques were usually used to manufacture tools, but they could also be used in core reduction. Thus, a high percentage of lipped platforms suggests that soft hammer percussion or pressure flaking were used. In turn, this suggests that tool manufacture rather than core reduction was the focus of reduction activities at a site. Other data are necessary to corroborate this conclusion, however, and as an independent indicator of reduction strategy this attribute has limited utility.

The pattern of scars on the dorsal surface of a flake left by earlier removals can also aid in estimating reduction strategy. Since bifacial reduction removes material from opposing surfaces and edges, flakes often contain evidence of previous removals from the opposite edge. In other words, flake scars that originate beyond the distal end of a flake and run toward its proximal end. These are opposing scars, and indicate the reduction of a surface from opposite edges. Opposing dorsal scars are indicative of biface manufacture, but can also occur when cores are reduced bidirectionally (Laumbach 1980:858). Thus, like platform lipping, this attribute is not directly indicative of tool manufacture, but can help in estimating the reduction strategy used.

The ratio of flakes to cores on a site is another potential indicator of reduction strategy, though there are some problems with this attribute. As the importance of tool manufacture increases, so should the ratio between flakes and cores. The opposite should be true of assemblages in which expedient core reduction dominated; in that case the ratio between flakes and cores should be relatively low. A potential problem, of course, is that cores were often transported to another location if still useable, while debris from their reduction was left behind. This would inflate the ratio, and suggest that tool manufacture rather than core reduction occurred. In addition, the systematic reduction of cores also produces high flake to core ratios. As an independent predictor of reduction strategy, this attribute has little utility.

Of the debitage assemblage attributes examined by this study, few are accurate independent indicators of reduction strategy. However, when combined they should allow us to fairly accurately determine how materials were reduced at a site. A purely curated debitage assemblage should contain very high percentages of noncortical debitage, biface flakes, modified platforms, manufacturing breaks, lipped platforms, and flakes with

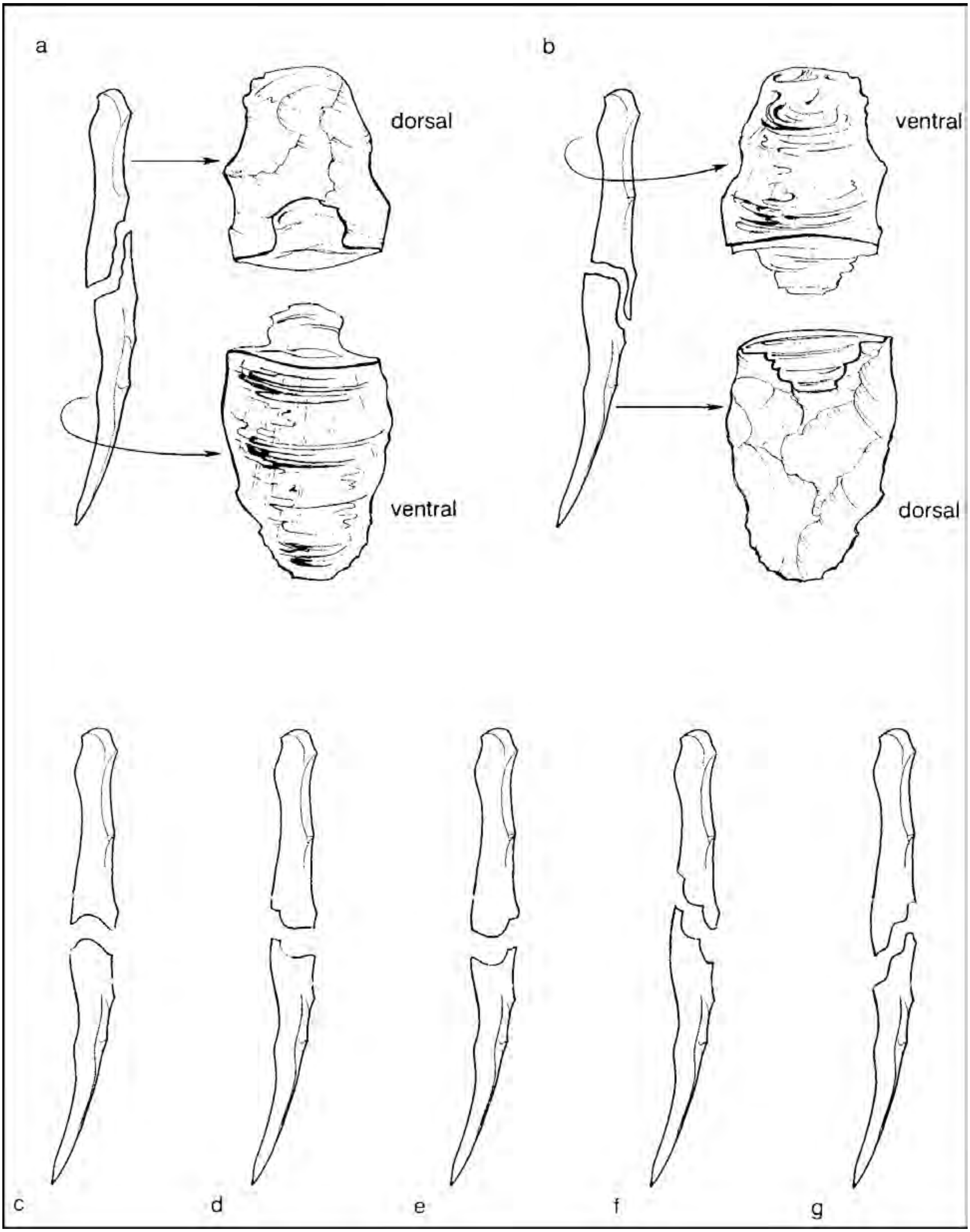

Figure 8.9. Manufacturing breakage patterns on flakes: (a-b) pieces à languette, adapted from Sollberger (1986:102); (c) negative proximal hinge, positive distal hinge; (d) positive proximal hinge with small step off ventral surface, negative distal hinge; (e) positive proximal hinge, negative distal hinge; (f) proximal step, distal step off dorsal surface; (g) reverse proximal step, distal step off ventral surface. Note that proximal fragments of (e) and (f) resemble natural core terminations and would usually be defined as such.

opposing dorsal scars. In addition, they should have high flake to angular debris and flake to core ratios. Purely expedient debitage assemblages should contain comparatively low percentages of noncortical debitage, and very low percentages of biface flakes, modified platforms, manufacturing breaks, lipped platforms, and flakes with opposing dorsal scars. They should also have low flake to angular debris and flake to core ratios. Unfortunately, "pure" assemblages are rare, and most can be expected to combine tool manufacture and core reduction.

Dorsal Cortex and Reduction Stage. While cortex has been discussed in the context of material source, its relation to reduction stage remains to be considered. Cortical surfaces are rarely suitable for flaking or tool use. Further, the outer sections of nodules that were transported by water often contain microcracks created by cobbles striking against one another, producing a zone with unpredictable flaking characteristics. Because the outer rind flakes differently than nodule interiors and may be flawed, cortical surfaces are typically removed and discarded. In general, flakes have progressively less dorsal cortex as reduction proceeds. Thus, cortex can be used to examine reduction stages in an assemblage; the early stages are characterized by high percentages of flakes with lots of dorsal cortex, while the opposite suggests later reduction stages.

Reduction can be divided into two stages: core reduction and tool manufacture. Flakes are removed for use or further modification during core reduction. *Primary* core reduction includes initial core platform preparation and removal of the cortical surface. *Secondary* core reduction is the removal of flakes from core interiors. This difference is rarely as obvious as the definitions make it seem. Both processes often occur simultaneously, and rarely is all cortex removed before secondary reduction begins. In essence, they represent opposite ends of a continuum, and it is difficult to determine where one stops and the other begins. In this analysis, primary core flakes are those with 50 percent or more of their dorsal surfaces covered by cortex, and secondary core flakes are those with less than 50 percent dorsal cortex. These distinctions can provide data on the condition of cores reduced at a site. For example, a lack of primary flakes suggests that initial reduction occurred elsewhere, while the presence of few secondary flakes may indicate that cores were carried elsewhere for further reduction. Tool manufacture refers to the purposeful modification of debitage into particular forms. Primary core flakes represent the early stages of reduction, while secondary core flakes and biface flakes represent the later stages.

Table 8.10 contains dorsal cortex information for all components. Three categories are shown: 0 percent, 1 to 49 percent, and 50 to 100 percent; the first two represent the later stages of reduction, while the latter represents the early stage. Each assemblage is dominated by debitage lacking cortex, suggesting that the later stages of reduction dominated. However, there are major differences between LA 65006 and the other sites. All components from LA 65006 contain small percentages of primary core reduction debitage. Component 1 has by far the smallest percentage of primary debitage, while those from the other components are larger but are still less than half the percentages for LA 65005 and LA 65013. The LA 65006 assemblages also contain higher percentages of debitage lacking dorsal cortex than the other sites. Thus, while it appears that the later stages of reduction dominated all components, there are important differences between sites.

TABLE 8.10. DORSAL CORTEX DATA FOR ALL DEBITAGE BY COMPONENT, FREQUENCIES AND ROW PERCENTAGES

COMPONENT	0%	1-49%	50-100%
LA 65005	161 66.8	45 18.7	35 14.5
LA 65006 Component 1	5,576 93.3	297 5.0	102 1.7
LA 65006 Component 2	405 82.7	56 11.4	29 5.9
LA 65005 Component 3	67 79.8	13 15.5	4 4.8
LA 65006 Component 4a	451 87.9	45 8.8	17 3.3
LA 65006 Component 4b	315 82.0	42 10.9	27 7.0
LA 65013	972 72.9	198 14.8	164 12.3

By combining intentional removals (flakes) and shatter (angular debris) this pattern may have been somewhat obscured; thus, only flakes are included in Table 8.11. While the later reduction stages still dominate, there are rather important changes in percentages when angular debris is removed. This is particularly true of the LA 65005 and LA 65013 assemblages, in which the percentage of primary debitage increases, and the percentage of debitage lacking cortex decreases. While there is a slight increase in the percentage of primary debitage in one assemblage from LA 65006, there are decreases in three and one remains the same. Again, the largest percentage of primary flakes from LA 65006 is less than half the values for LA 65005 and LA 65013, and there are much higher percentages of flakes lacking cortex in the former assemblages.

Table 8.12 shows dorsal cortex percentages for flakes by material source. Overall, there is no real pattern to the distribution of cortical and noncortical flakes

TABLE 8.11. DORSAL CORTEX DATA FOR FLAKES BY COMPONENT, FREQUENCIES AND ROW PERCENTAGES

COMPONENT	0%	1-49%	50-100%
LA 65005	95 65.5	23 15.9	27 18.6
LA 65006 Component 1	5,128 93.1	287 5.2	92 1.7
LA 65006 Component 2	355 82.0	50 11.5	28 6.5
LA 65006 Component 3	61 83.6	10 13.7	2 2.7
LA 65006 Component 4a	422 88.1	42 8.8	15 3.1
LA 65006 Component 4b	284 82.3	39 11.3	22 6.4
LA 65013	781 68.6	197 17.3	160 14.1

between these categories. Both material classes were brought onto the sites as unreduced or partly reduced cores. Removal of flakes from core interiors or tools may account for relatively small percentages of cortical flakes from LA 65006 in general, and Component 1 in particular.

The flake population from each component is divided into core and manufacturing categories by dorsal cortex percentages in Table 8.13. Small percentages of cortical biface flakes occur in three components, while there are large to moderate percentages of cortical core flakes in all assemblages. Cortical data indicate there was little variation in the state in which materials were brought onto these sites. While there are notable differences between components, within assemblages, percentages of cortical and noncortical debitage are similar enough to suggest that local and exotic materials were brought to sites in similar states. Differences in the distribution of cortical and noncortical flakes seem related to reduction strategy.

Flake assemblages for each component are broken into reduction stages in Table 8.14. Again, while primary flakes occur in each component, they are comparatively rare at LA 65006. Secondary core flakes dominate all assemblages. Biface flakes make up large percentages of all assemblages from LA 65006, but are rare at LA 65005 and LA 65013. Thus, the lower percentages of cortical flakes noted for all components at LA 65006 may be related to the prevalence of tool manufacture at that site. The other assemblages are dominated by core reduction, and consequently contain higher percentages of cortical flakes.

TABLE 8.12. DORSAL CORTEX PERCENTAGES FOR LOCAL AND EXOTIC MATERIALS IN THE FLAKE ASSEMBLAGES, ROW PERCENTAGES

COMPONENT	MATERIALS	0%	1-49%	50-100%
LA 65005	Exotic	62.5	25.0	12.5
	Local	65.7	15.3	19.0
LA 65006 Component 1	Exotic	92.3	6.0	1.6
	Local	94.8	3.4	1.7
LA 65006 Component 2	Exotic	85.2	10.6	4.2
	Local	75.8	13.4	10.7
LA 65006 Component 3	Exotic	78.6	14.3	7.1
	Local	84.7	13.6	1.7
LA 65006 Component 4a	Exotic	87.6	9.0	3.4
	Local	94.4	5.6	0.0
LA 65006 Component 4b	Exotic	83.8	12.6	3.7
	Local	80.5	9.7	9.7
LA 65013	Exotic	67.1	24.7	8.2
	Local	68.7	16.8	14.5

Table 8.13. Dorsal Cortex Percentages by Flake Type for Each Component, Row Percentages

Component	Flake Type	0%	1-49%	50-100%
LA 65005	Core flakes	64.5	16.3	19.1
	Biface flakes	100.0	0.0	0.0
LA 65006 Component 1	Core flakes	91.4	6.3	2.3
	Biface flakes	96.3	3.1	0.6
LA 65006 Component 2	Core flakes	78.3	13.4	8.3
	Biface flakes	94.8	5.2	0.0
LA 65006 Component 3	Core flakes	79.3	17.2	3.4
	Biface flakes	100.0	0.0	0.0
LA 65006 Component 4a	Core flakes	86.8	9.8	3.5
	Biface flakes	94.9	3.8	1.3
LA 65006 Component 4b	Core flakes	78.8	13.3	7.9
	Biface flakes	97.0	3.0	0.0
LA 65013	Core flakes	67.9	17.6	14.6
	Biface flakes	90.0	10.0	0.0

Table 8.14. Frequencies and Percentages of Flakes Assigned to Each Reduction Stage for All Components

Component	Primary Flakes	Secondary Flakes	Biface Flakes	Totals
LA 65005	27 18.6	114 78.6	4 2.8	145
LA 65006 Component 1	81 1.5	3498 63.5	1928 35.0	5507
LA 65006 Component 2	28 6.5	308 71.1	97 22.4	433
LA 65006 Component 3	2 2.7	56 76.7	15 20.5	73
LA 65006 Component 4a	14 2.9	386 80.6	79 16.5	479
LA 65006 Component 4b	22 6.4	256 74.2	67 19.4	345
LA 65013	160 14.1	938 82.4	40 3.5	1138

Flake Platforms. Platforms are remnants of core or tool edges that were struck to remove flakes. Various types of platforms can be distinguished, providing information about the condition of the artifact from which the flake was removed as well as reduction technology. Cortical platforms are usually evidence of early stage core reduction, particularly when dorsal cortex is also present. Single-facet platforms can occur at any time during reduction, but are most often associated with flakes removed from cores. Multifacet platforms are evidence of previous removals along an edge; they occur on both core and biface flakes, and suggest that the parent artifact was subjected to a considerable amount of earlier reduction.

Platforms were often modified to facilitate flake removal. Two types of modification were used–retouch and abrasion. While abrasion occurs on all types of platforms, retouch is considered a distinct platform type. Thus, abrasion can occur on single-facet and multifacet platforms, but retouch cannot. Both modifications result from rubbing an abrader across an edge. Movement perpendicular to an edge removes microflakes and retouches as well as abrades it. Movement parallel to an edge produces abrasion. These processes increase the platform angle, strengthening it and reducing the risk of shattering. Stronger platforms also increase control over the shape and length of flakes removed from a core or tool.

In many instances, flake platform types could not be defined. The most common reason was breakage, with the proximal portion (which includes the platform) being absent. Two other processes also obscured platforms during reduction. A platform that is unmodified or poorly prepared will sometimes crush when force is applied; crushing can also occur when excessive force is used. While the point of impact is often still visible on a crushed platform, its original form is impossible to define. Platforms can also collapse when force is applied. Collapsed platforms detach separately from flakes, leaving a scar on the dorsal or ventral surface; occasionally a small part of the platform is preserved on one or both sides of the scar. While these remnants are usually too small to allow definition of the original platform type, they show where impact occurred and indicate that while the platform is missing, flake dimensions are complete. Platforms can also be damaged by use or impact from natural processes; these were simply recorded as obscured.

The array of platforms from all components is shown in Table 8.15. Though abraded cortical platforms were identified in four assemblages, cortical surfaces usually require no modification during reduction. It is likely that these examples were battered during water transport and only resemble abrasion, and are not further considered a separate category. With this in mind, the assemblages can be divided into two groups. When compared with LA 65005 and LA 65013, the LA 65006 assemblages generally contain smaller percentages of cortical, single facet, multifacet, and crushed platforms, and larger percentages of modified single and multifacet platforms, abraded and unabraded retouched platforms, platforms that were abraded but the original form could not otherwise be defined, and platforms that collapsed or broke during reduction.

These platform types are combined into three categories in Table 8.16. The unmodified category includes cortical, single-facet, and multifacet platforms. The modified category includes all abraded (except cortical) and retouched platforms, while the obscured category includes flakes with missing or damaged platforms. Modified platforms are common in all assemblages from LA 65006, and are uncommon in the LA 65005 and LA 65013 assemblages. It is interesting that the components containing the smallest percentages of modified platforms also contain the smallest percentages of obscured platforms, while the opposite is true of those that contain high percentages of modified platforms. This may be related to reduction strategy, with flakes growing progressively thinner and more prone to fracture during tool manufacture.

The relatively large numbers of obscured platforms in all assemblages may be concealing patterning in platform treatment. In order to examine this possibility, obscured platforms were dropped and Table 8.17 was generated. About half or more of the unobscured platforms from all LA 65006 components are modified, while only small percentages from LA 65005 and LA 65013 were similarly treated. As discussed earlier, platform modification helps prevent edge shattering and increases control over the size and shape of flakes.

While core platforms are sometimes modified, this usually occurs during systematic reduction. Blade manufacture is an example of this, and blade core platforms are carefully prepared to control reduction and produce flakes of uniform shape and size. However, evidence of this type of modification tends to occur in a different location on core flakes than on biface flakes. Platform modification is usually evidenced on the dorsal surface of core flakes just below the platform, while it occurs on biface flake platforms. Biface edges tend to have very acute angles that will often shatter unless the angle of the edge is increased and strengthened by modification. Core platforms are usually much closer to a right angle, and increasing the platform angle by similar types of modification will usually make it more difficult to remove flakes. Much core platform modification takes the form of removal of overhangs that would otherwise shatter and make further removals from an edge difficult or impossible. Evidence of such platform cleaning occurs on the dorsal surfaces of flakes that are subsequently struck from that edge. Thus, the types of platform modification recorded by this analysis will usually be related to tool manufacture rather than core reduction. Assemblages with large percentages of biface flakes also contain large percentages of modified platforms. Conversely, assemblages with low percentages of biface flakes contain few modified platforms.

During testing at nine sites along NM 502 there appeared to be a differential reduction of local versus exotic materials, particularly at Archaic sites (J. Moore 1993). In order to further test this idea, platform data were divided into local and exotic material categories and are shown in Table 8.18. Although exotic materials comprise larger percentages of the LA 65006 assemblages than do those from LA 65005 and LA 65013, in

Table 8.15. Platform Types by Site Component, Frequencies and Row Percentages

Site	Cortical	Cortical & Abraded	Single Facet	Single Facet & Abraded	Multi-facet	Multifacet & Abraded	Retouched	Retouched & Abraded	Abraded
LA 65006 Com. 1	42	4	420	154	207	290	37	311	410
	0.8	0.1	7.6	2.8	3.8	5.3	0.7	5.6	7.4
LA 65006 Com. 2	14	0	37	12	24	32	7	25	33
	3.2	0.0	8.5	2.8	5.5	7.4	0.9	5.8	7.6
LA 65006 Com. 3	6	0	7	4	5	5	0	5	5
	8.2	0.0	9.6	5.5	6.8	6.8	0.0	6.8	6.8
LA 65006 Com. 4a	7	2	14	16	12	34	0	27	43
	1.5	0.4	2.9	3.3	2.5	7.1	0.0	5.6	9.0
LA 65006 Com. 4b	11	0	52	25	21	19	3	17	17
	3.2	0.0	15.1	7.2	6.1	5.5	0.9	4.9	4.9
LA 65005	15	0	37	1	24	0	1	1	1
	10.3	0.0	25.5	0.7	16.6	0.0	0.7	0.7	0.7
LA 65013	208	9	278	25	130	8	5	8	32
	18.2	0.8	24.4	2.2	11.4	0.7	0.4	0.7	2.8

Site	Collapsed	Crushed	Absent	Absent BIM	Obscured	Totals
LA 65006 Com. 1	707	150	891	1885	5	5513
	12.8	2.7	16.2	34.2	0.1	
LA 65006 Com. 2	67	9	64	112	0	433
	15.5	2.1	14.8	25.9	0.0	
LA 65006 Com. 3	11	3	5	17	0	73
	15.1	4.1	6.8	23.3	0.0	
LA 65006 Com. 4a	67	11	91	148	0	479
	14.0	3.8	19.0	30.9	0.0	
LA 65006 Com. 4b	57	14	35	73	1	345
	16.5	4.1	10.1	21.2	0.3	
LA 65005	14	9	15	23	4	145
	9.7	6.2	10.3	15.9	2.8	
LA 65013	69	83	159	125	2	1141
	6.0	7.3	13.9	11.0	0.2	

Com = component; BIM = Broken in manufacture.

TABLE 8.16. PLATFORM CATEGORIES FOR EACH COMPONENT, FREQUENCIES AND ROW PERCENTAGES

COMPONENT	UNMODIFIED	MODIFIED	OBSCURED	TOTALS
LA 65005	76 52.4	4 2.8	65 44.8	145
LA 65006 Component 1	671 12.2	1202 21.8	3634 66.0	5507
LA 65006 Component 2	75 17.3	106 24.5	252 58.2	433
LA 65006 Component 3	18 24.7	19 26.0	36 49.3	73
LA 65006 Component 4a	35 7.3	120 25.1	325 67.7	480
LA 65006 Component 4b	84 24.3	81 23.5	180 52.2	345
LA 65013	622 54.7	78 6.9	437 38.4	1137

TABLE 8.17. UNMODIFIED AND MODIFIED PLATFORM CATEGORIES FOR FLAKES AND FLAKE FRAGMENTS WITH UNOBSCURED PLATFORMS BY COMPONENT, FREQUENCIES AND ROW PERCENTAGES

COMPONENT	UNMODIFIED	MODIFIED	TOTALS
LA 65005	76 95.0	4 5.0	80
LA 65006 Component 1	671 35.8	1202 64.2	1873
LA 65006 Component 2	75 41.4	106 58.6	181
LA 65006 Component 3	18 48.6	19 51.4	37
LA 65006 Component 4a	35 22.6	120 77.4	155
LA 65006 Component 4b	84 50.9	81 49.1	165
LA 65013	622 88.9	78 11.1	700

TABLE 8.18. PLATFORM CATEGORIES FOR FLAKES AND FLAKE FRAGMENTS WITH UNOBSCURED PLATFORMS BY COMPONENT AND MATERIAL SOURCE, FREQUENCIES AND ROW PERCENTAGES

COMPONENT	MATERIAL SOURCE	UNMODIFIED	MODIFIED	TOTALS
LA 65005	Exotic	2 66.7	1 33.3	3 3.8
	Local	74 96.1	3 3.9	77 96.3
LA 65006 Component 1	Exotic	285 24.5	877 75.5	1162 62.0
	Local	386 54.3	325 45.7	711 38.0
LA 65006 Component 2	Exotic	22 26.5	61 73.5	83 60.1
	Local	40 72.7	15 27.3	55 39.9
LA 65006 Component 3	Exotic	3 10.3	26 89.7	29 36.3
	Local	28 54.9	23 45.1	51 63.8
LA 65006 Component 4a	Exotic	27 20.1	107 79.9	134 86.5
	Local	8 38.1	13 61.9	21 13.5
LA 65006 Component 4b	Exotic	28 36.8	48 63.2	76 42.2
	Local	56 62.9	48 37.1	104 57.8
LA 65013	Exotic	19 54.3	16 45.7	35 5.0
	Local	603 90.7	62 9.3	665 95.0

TABLE 8.19. CHIPPED STONE ASSEMBLAGE ATTRIBUTES FOR ALL COMPONENTS

COMPONENT	MATERIAL SOURCE	FLAKE/ANGULAR DEBRIS RATIO	BROKEN FLAKES	PROXIMAL FRAGMENTS	DISTAL FRAGMENTS
	Overall	1.51	42.1	19	34
LA 65005	Local	1.54	39.7	15	31
	Exotic	1.14	77.7	4	3
	Overall	11.77	67.2	889	1951
LA 65006 Component 1	Local	6.90	64.7	261	603
	Exotic	17.35	68.4	628	1348
	Overall	7.60	59.4	73	126
LA 65006 Component 2	Local	4.10	49.7	18	41
	Exotic	13.50	64.4	55	85
	Overall	6.68	49.3	12	16
LA 65006 Component 3	Local	6.56	42.4	6	13
	Exotic	7.00	78.6	6	3
	Overall	14.55	69.8	92	169
LA 65006 Component 4a	Local	7.20	55.5	7	11
	Exotic	15.86	70.9	85	158
	Overall	8.85	51.0	67	78
LA 65006 Component 4b	Local	6.42	39.0	19	30
	Exotic	12.73	60.7	48	48
	Overall	5.84	38.8	150	220
LA 65013	Local	5.49	37.8	137	208
	Exotic	73.10	53.4	13	12

all cases percentages of exotic flakes with modified platforms are significantly higher than those for local materials. For LA 65005 this may be more a result of sample size than reduction strategy, since there are only three flakes of exotic materials with platforms represented in that assemblage. However, these data suggest that there was more expedient reduction of local materials in all components at LA 65006, while exotic materials were more commonly used for tool manufacture. A similar conclusion could be made for LA 65013.

Debitage Type and Condition. Table 8.19 shows flake to angular debris ratios and numbers of proximal and distal flake fragments for all components. Overall, flake to angular debris ratios are highest for the assemblages from LA 65006 and lowest for LA 65005. The very low ratio for LA 65005 suggests that core reduction dominated at that site, and little if any tool manufacture occurred. The overall assemblage ratios for LA 65006 are rather high, and suggest that tool manufacture dominated in those components, with the possible exception of Component 3. The moderately high overall ratio for LA 65013 is ambiguous, and either suggests a combination of core reduction and tool manufacture, or systematic core reduction.

In comparison with Pueblo assemblages from the Taos area (J. Moore 1994), the overall flake to angular debris ratio for LA 65005 is significantly lower, and the ratio for LA 65013 is at the upper end of the Taos area range (2.42 to 5.83). However, it is interesting that the highest flake to angular debris ratio for the Taos sites (5.83) came from deposits at a probable field structure, similar in function to LA 65013. The flake to angular debris ratio for residential sites in that study ranged between 2.42 and 3.12, indicating more shattering during reduction. The reason for this variation is undetermined, but may be because a more systematic reduction strategy was used at limited occupation sites due to a less certain supply of raw materials.

Some interesting trends appear when assemblages are divided into local and exotic materials. While there is little difference between these ratios for LA 65005, there are significant differences in the other assemblages. Except for Component 3, flake to angular debris ratios for local materials from LA 65006 are significantly smaller than those for exotic materials. Local and exotic materials seem to have been differentially reduced in these assemblages, with more exotic materials used for tool manufacture and local materials more commonly reduced as cores. Flake to angular debris ratios for local materials in the LA 65013 and Component 3 assemblages are similar to the overall ratios; however, the same ratio for exotic materials at LA 65013 was much higher than any from LA 65006. Only one piece of exotic angular debris was recovered from this site versus 73 flakes. The lack of angular debris suggests that exotic materials may not have been reduced there; rather, they might have been transported from the main residential site, or scavenged from earlier sites. Flake to angular debris ratios are similar for both material classes in the Component 3 assemblage.

While only about 40 percent of the flakes from LA 65005 and LA 65013 are broken, around 50 percent or more of the flakes in the LA 65006 assemblages are broken. With the exception of Components 3 and 4b, over 57 percent of the flakes from components at LA 65006 are broken. This suggests a difference between assemblages, and may indicate that tool manufacture dominated in at least three and possibly all five components at LA 65006, while reduction focused on core reduction at the other sites. Larger percentages of exotic flakes are broken in each case, again suggesting that more exotic materials were selected for tool manufacture. However, these conclusions will only hold true if breakage occurred during removal; if breakage was due to post-removal impact, the patterns are essentially meaningless.

Equivalent numbers of distal and proximal fragments in an assemblage suggests post-reduction breakage by trampling or other natural processes. If distal fragments significantly outnumber proximal fragments, much of the breakage probably occurred during reduction. This situation arises because our analytical scheme identifies whole flakes as artifacts with platforms and natural terminations. While some breaks attributable to secondary compression can be identified on proximal fragments, other types are indistinguishable from natural terminations on whole flakes. Thus, many artifacts classified as whole flakes with hinge or step terminations may actually be the proximal ends of broken flakes. In addition, observations made during experimental flintknapping suggest that proximal ends often shatter during reduction, leaving only medial or distal fragments. The number of proximal and distal fragments from each site is shown in Table 8.19. Overall, distal fragments outnumber proximal fragments in all cases. With the exception of Component 3, the ratio ranges between 1.5:1 and 2.2:1; the ratio of distal to proximal fragments for Component 3 is 1.3:1.

It is difficult to make sense of the breakage patterns when flakes are divided into local and exotic materials. This may be because of sample error; in six cases there are less than 50 examples, and two others contain fewer exotics than 100. For this reason, broken flakes are not

TABLE 8.20. FLAKE BREAKAGE PATTERNS FOR ALL COMPONENTS; PROXIMAL, MEDIAL, AND DISTAL FRAGMENTS ONLY

	Proximal Fragments		Medial Fragments		Distal Fragments		Totals	
Component	Snap Fracture	BIM	Snap Fracture	BIM	Snap Fracture	BIM	Snap Fracture	BIM
LA 65005	47.4	52.6	0.0	100.0	41.2	58.8	41.8	58.2
LA 65006 Component 1	39.2	60.8	20.7	79.3	32.3	67.7	31.7	68.3
LA 65006 Component 2	44.8	55.2	80.0	20.0	37.3	62.7	42.8	57.2
LA 65006 Component 3	41.5	58.3	0.0	0.0	31.3	68.8	35.7	64.3
LA 65006 Component 4a	48.3	49.7	25.4	74.6	40.8	59.2	42.1	57.9
LA 65006 Component 4b	54.0	46.0	28.6	71.4	29.5	70.5	38.5	61.5
LA 65013	69.6	30.4	50.9	49.1	56.6	43.4	60.4	39.6

Obscured platforms and terminations eliminated
BIM= Broken in manufacture

divided into local and exotic categories in the remainder of this discussion.

Table 8.20 shows flake breakage pattern data for each component, and separates manufacturing breaks from snap fractures. While snap fractures occur during reduction, there is no way to separate them from breaks caused by post-reduction damage; thus, it is impossible to determine the cause of most snap fractures. In general, manufacturing breaks dominate in three assemblages from LA 65006 (Components 1, 3, and 4b). Snap fractures dominate only in the LA 65013 assemblage. While manufacturing breaks outnumber snap fractures in the other assemblages, the differences are not large.

In order to examine flake breakage patterns in more detail, broken flakes were recovered during core reduction and tool manufacture experiments, and breaks on those fragments were studied. Four obsidian nodules (three Jemez obsidian and one Mexican obsidian) were reduced using a small basalt hammerstone in the core flake breakage experiment. Only broken flakes were kept for study; flakes that shattered completely were not retained. Several specimens that fractured into pieces that would normally be identified as whole flakes and angular debris was also eliminated as unsuitable for this study. A total of 48 fragments from 25 flakes were recovered including 20 proximal, 3 medial, and 25 distal. Step or hinge fractures indicative of manufacturing breakage occurred in 18 cases (37.5 percent), and snap fractures were found in 30 (62.5 percent).

Numerous bifaces reduced over a long period of time provided data for the biface flake breakage study. As with the core flake experiment, only obsidian was used and included varieties from the Jemez Mountains and unidentified Mexican sources. Again, only broken flakes were retained, and fragments from 62 flakes were examined. Nearly half (n = 28, 45.2 percent) are represented by distal fragments only–the proximal ends shattered. A total of 103 fragments were available for study including 30 proximal, 9 medial, and 64 distal portions. Since medial fragments have two broken ends, 112 individual breaks were examined. Step or hinge fractures indicative of manufacturing breakage occurred in 82 cases (73.2 percent), and snap fractures in 29 (25.9 percent); in 1 case (.9 percent) the type of break could not be defined.

Though hardly scientific, these results suggest that while both manufacturing and snap fractures occur during core reduction and tool manufacture, there are differences in distributions. Core reduction tends to produce considerably more snap fractures than manufacturing breaks, while tool manufacture produces the opposite pattern. The high percentage of snap fractures in the LA 65013 assemblage essentially replicates experimental data for core flake breakage, suggesting that post-reduction impact may be negligible. Similarly, Components 1, 3, and 4b essentially replicate experimental data for biface flake breakage, suggesting that fragmenting during reduction may be responsible for most of that breakage.

Two conclusions can be drawn from these experiments. First, there is a difference in breakage patterns between core reduction and tool manufacture; core reduction produces a high percentage of snap fractures, while tool production results in a high percentage of manufacturing breaks. Second, when flakes break during tool manufacture, there is a rather high likelihood that the proximal end will shatter beyond recognition. While this also occurred during core reduction, it did not happen as often. Assemblages with large percentages of broken flakes and manufacturing breaks seem related to tool production. Those containing smaller numbers of broken flakes with high percentages of snap fractures appear to be related to core reduction.

Platform Lipping and Dorsal Scar Orientation. Platform lipping and dorsal scar orientation data are shown in Table 8.21; only whole flakes and proximal fragments are included. Overall, large percentages of lipped platforms occur in all assemblages except LA 65005. This suggests that soft-hammer percussion was predominantly used to reduce six of the seven components.

When the assemblages are separated into local and exotic materials, some inconsistent variation is visible. While platform lipping seems much more common on exotic materials at LA 65005, this is due to sample error; there are only four exotic artifacts in that assemblage. There are few differences between local and exotic materials in five assemblages including Components 1, 2, 3, 4b, and LA 65013. Platform lipping is much more common on local materials in the Component 4a assemblage, suggesting slightly more soft-hammer percussion and hence tool manufacture using local materials.

Three assemblages contain small overall percentages of flakes with opposing dorsal scars–LA 65005, Component 3 and LA 65013. Comparatively large percentages occur in the other four assemblages. When the assemblages are divided into local and exotic categories, some interesting differences are visible. Discounting LA 65005, which contains few exotics, opposing dorsal scars are more common on exotic materials. In some cases, the difference between these categories is considerable. This suggests that more exotic materials were reduced bifacially than were local materials.

Flakes to Cores and Large Bifaces. Frequencies and percentages of flakes, cores, and large bifaces are shown in Table 8.22. Only whole flakes and proximal fragments are considered, providing a minimum number of individual removals. Cores comprise over 5 percent of

TABLE 8.21. PERCENTAGES OF PLATFORM LIPPING AND DORSAL SCAR PATTERNS FOR ALL COMPONENTS

		Platform Lipping		Dorsal scarring		
Component	Material Source	Present	Absent	Absent	Opposing Scars	Indeterminate
LA 65005	Overall	5.2	94.8	95.8	4.2	0.0
	Local	4.3	95.7	95.5	4.4	0.0
	Exotic	25.0	75.0	100.0	0.0	0.0
LA 65006 Component 1	Overall	53.5	46.5	81.0	19.0	0.1
	Local	53.5	46.5	93.3	6.7	0.0
	Exotic	53.5	46.5	75.1	24.8	0.1
LA 65006 Component 2	Overall	43.0	57.0	85.3	14.5	0.2
	Local	42.9	57.1	91.0	8.3	0.7
	Exotic	43.1	56.9	82.4	17.6	0.0
LA 65006 Component 3	Overall	43.2	56.8	94.5	5.5	0.0
	Local	42.9	57.1	94.9	5.1	0.0
	Exotic	44.4	55.6	92.9	7.1	0.0
LA 65006 Component 4a	Overall	50.7	49.3	73.3	26.7	0.0
	Local	63.6	36.4	87.0	13.0	0.0
	Exotic	49.2	50.8	71.8	28.2	0.0
LA 65006 Component 4b	Overall	47.2	52.8	83.5	15.2	1.3
	Local	43.4	56.6	89.8	9.3	0.9
	Exotic	50.9	49.1	78.0	20.3	1.6
LA 65013	Overall	43.9	56.1	94.2	4.2	1.6
	Local	44.0	56.0	95.3	3.0	1.7
	Exotic	42.9	57.1	76.6	23.4	0.0

the LA 65005 and LA 65013 assemblages. Except for Component 4b, they make up less than 1 percent of all assemblages from LA 65006. Large bifaces occur in all assemblages except for LA 65005. However, they comprise .6 percent or more of each assemblage from LA 65006, and only .1 percent of the LA 65013 assemblage. When the proportion of flakes to cores is considered, except for Components 3 and 4b, the LA 65006 assemblages have very high ratios (over 237:1), while ratios for LA 65005 and LA 65013 are low (around 17:1). No cores were recovered from Component 3.

This assemblage is divided into local and exotic material categories in Table 8.23. In addition, core flake to core and biface flake to large biface ratios are provided. Even though many of the core flakes from LA 65006 may relate to early stage biface manufacture, this table provides some interesting information. With the exception of LA 65013, there are no exotic cores. A single Pedernal chert core with nonwaterworn cortex is in that assemblage. There are no obsidian cores in any of our assemblages, indicating that this material was either carried onto the sites as flakes or was completely reduced into debitage. Local material core flake to core ratios range from a low of 14.7 to a high of 100.3. The highest ratios may evidence early stage biface reduction rather than core reduction.

The lack of bifaces in several assemblages illustrates a problem with the use of biface flake to large biface ratios. While cores were often abandoned where they were reduced, bifaces were rarely left at the location where they were made unless they were broken. With bifaces far more likely than cores to be transported to another location, this ratio is unreliable. This explains the extreme variation between local and exotic biface flake

TABLE 8.22. FREQUENCIES AND ROW PERCENTAGES OF WHOLE AND PROXIMAL FLAKE FRAGMENTS, CORES, AND LARGE GENERALIZED BIFACES FOR EACH COMPONENT

COMPONENT	WHOLE AND PROXIMAL FLAKE FRAGMENTS	CORES	FLAKES/ CORES	BIFACES
LA 65005	103 94.5	6 5.5	17.2	0 0.0
LA 65006 Component 1	2713 99.3	4 0.1	678.3	17 0.6
LA 65006 Component 2	250 98.8	1 0.4	250.0	2 0.8
LA 65006 Component 3	49 96.1	0 0.0	--	2 3.9
LA 65006 Component 4a	237 98.8	1 0.4	237.0	2 0.8
LA 65006 Component 4b	236 96.7	6 2.5	39.3	2 0.8
LA 65013	847 94.3	50 5.6	16.9	1 0.1

TABLE 8.23. FREQUENCIES AND ROW PERCENTAGES OF WHOLE AND PROXIMAL CORE FLAKE AND BIFACE FLAKE FRAGMENTS, CORES, AND LARGE GENERALIZED BIFACES FOR EACH COMPONENT

COMPONENT	SOURCE	CORE FLAKES	CORES	CORE FLAKES/ CORES	BIFACE FLAKES	LARGE BIFACES	BIFACE FLAKES/BIFACE CORES
LA 65005	Local	97	6	15.8	3	0	--
	Exotic	4	0	--	1	0	--
LA 65006 Component 1	Local	401	4	100.3	474	3	158.0
	Exotic	945	0	--	894	14	63.9
LA 65006 Component 2	Local	67	1	67.0	27	2	13.5
	Exotic	109	0	--	47	0	--
LA 65006 Component 3	Local	32	0	--	8	2	4.0
	Exotic	5	0	--	4	0	--
LA 65006 Component 4a	Local	15	1	15.0	8	1	8.0
	Exotic	159	0	--	55	1	55.0
LA 65006 Component 4b	Local	88	6	14.7	25	1	25.0
	Exotic	88	0	--	35	1	35.0
LA 65013	Local	780	49	15.9	20	1	20.0
	Exotic	34	1	34.0	13	0	--

to large biface ratios in Table 8.23. Because of the apparent unreliability of this measure, it is not further considered.

Summary. The eight debitage assemblage attributes examined as indicators of reduction strategy are summarized in Table 8.24. Some are better predictors than others, but when combined they provide a good indication of the reduction strategies used in these components. Overwhelming evidence for biface reduction in all LA 65006 assemblages except for Component 3 suggests that tool manufacture was a major activity in those assemblages. Biface manufacture probably also dominated in Component 3, though three of the indicators are indeterminate and one suggests core reduction. Core reduction seems to have dominated the LA 65005 and LA 65013 assemblages. However, it must be remembered that core and tool reduction were combined in most prehistoric assemblages. This is evident in the LA 65005 and LA 65013 assemblages, where a few flakes removed during tool manufacture were identified, but most were derived from core reduction. Thus, this analysis has only determined the strategies on which reduction focused.

Four of the assemblage attributes are rather inaccurate indicators of reduction strategy. While the percentage of noncortical debitage helped suggest basic reduction strategy, conclusions based on this attribute are tentative because factors other than reduction strategy can affect it. When raw materials are directly procured from an outcrop there may be no cortex present. A systematic reduction of cores can also produce a large proportion of noncortical debitage. Percentage of manufacturing breaks may be useful as corroborative data, but is not an accurate indicator of reduction strategy when used alone. Platform lipping provides information on reduction technology, which can be used to infer reduction strategy. Unfortunately, it is not an accurate independent indicator because reduction technologies are not restricted to specific strategies. Finally, flake to core ratios can be used to assess reduction strategy, but the possibility that cores were curated renders conclusions derived from this attribute alone suspect.

The four remaining attributes are more dependable indicators of reduction strategy, though there are also problems inherent in their use. The percentage of flakes classified as biface flakes by the polythetic set of variables provides information on the relative amount of tool manufacture that occurred in an assemblage. Unfortunately, that model only identifies ideal biface flakes, and debitage produced during the early stages of tool manufacture may be classified as core flakes. The percentage of modified platforms in an assemblage is another good indicator of the amount of tool manufacture. However, use of this attribute must be tempered with the knowledge that core platforms were also sometimes modified, particularly when they were systematically reduced. High flake to angular debris ratios are generally good indicators of tool production, while low ratios are indicators of uncontrolled core reduction. Again, however, the ratio of flakes to angular debris may be relatively high when cores are systematically reduced. Finally, high percentages of flakes with opposing dorsal

TABLE 8.24. SUMMARY OF REDUCTION STRATEGY INDICATORS

ATTRIBUTE	LA 65005	LA 65006 COMPONENT 1	LA 65006 COMPONENT 2	LA 65006 COMPONENT 3	LA 65006 COMPONENT 4A	LA 65006 COMPONENT 4B	LA 65013
% Noncortical debitage	Core	Biface	Biface	Indet.	Biface	Biface	Core
% Biface flakes	Core	Biface	Biface	Biface	Biface	Biface	Core
% Modified platforms	Core	Biface	Biface	Biface	Biface	Biface	Core
Flake/angular debris ratio	Core	Biface	Biface	Indet.	Biface	Biface	Indet.
% Manufacture breaks	Indet.	Biface	Indet.	Biface	Indet.	Biface	Core
Platform lipping	Core	Biface	Biface	Biface	Biface	Biface	Biface
Dorsal scarring	Core	Biface	Biface	Core	Biface	Biface	Core
Flake/core ratio	Core	Biface	Biface	Indet.	Biface	Indet.	Core
Reduction strategy	Core	Biface	Biface	Indet.	Biface	Biface	Core

indet = indeterminate

scars may be a good indicator of tool manufacture, again remembering that certain types of core production can produce similar scar patterns.

The use of any one of these indicators alone provides questionable results. However, when they are combined and used to corroborate one another an analyst can be relatively certain they have identified the main reduction strategy used. In general, it appears that biface reduction dominated in most of the assemblages from LA 65006, while core reduction was the main strategy used at LA 65005 and LA 65013. While this analysis is inconclusive for Component 3, it is tentatively suggested that biface reduction dominated in that assemblage as well.

Some evidence of differential reduction of local and exotic materials is visible in the LA 65006 assemblages. Overall, local and exotic materials seem to have differed little in the state in which they were brought onto that site. Once on-site, however, the reduction strategy applied to them varied. When only biface flakes are considered, percentages suggest that exotic materials were more often reduced as bifaces in three cases (Components 1, 2, and 4a). Platform modification occurred much more frequently on exotic materials in all cases. Flake to angular debris ratios are much higher for exotic materials except for Component 3. Percentages of broken flakes also suggest there was a difference in how exotic and local materials were reduced. While platform lipping information suggests that exotic materials were more frequently reduced by soft-hammer percussion in two cases and local materials in one, opposing dorsal scars are more common on exotics in all cases. Finally, the complete lack of exotic cores suggests that little if any core reduction of those materials occurred on-site, or that those materials were completely reduced, leaving no large unused pieces behind.

Cores and Large Bifaces

The types and states of cores and large bifaces at a site can provide corroborative information concerning reduction strategy. Table 8.25 shows the number of cores and large bifaces by artifact morphology for each component. Except for a single large biface at LA 65013, that artifact class is restricted to components from LA 65006. While cores occur in all but one component, they are most common in the LA 65013 assemblage. In general, this distribution suggests that both expedient core reduction and curated biface reduction strategies were used in six of the seven components. Over half of the cores (58.8 percent) have flakes removed from more than two platforms and are classified as multidirectional. Bidirectional cores comprise the next largest category (13.2 percent), followed by unidirectional cores and test-

TABLE 8.25. NUMBER OF CORES AND LARGE BIFACES BY ARTIFACT MORPHOLOGY FOR EACH COMPONENT

Artifact Morphology	LA 65005	LA 65006 Component 1	LA 65006 Component 2	LA 65006 Component 3	LA 65006 Component 4a	LA 65006 Component 4b	LA 65013
Tested cobble	0	0	0	0	0	1	7
Undifferentiated core	0	1	0	0	0	1	0
Unidirectional core	0	1	0	0	0	0	7
Bidirectional core	0	0	0	0	0	0	9
Multidirectional core	6	2	1	0	1	4	26
Pyramidal core	0	0	0	0	0	0	1
Undifferentiated biface	0	1	0	0	1	0	0
Early stage biface	0	10	0	1	1	0	1
Middle stage biface	0	5	2	1	0	2	0
Late stage biface	0	1	0	0	0	0	0

ed cobbles (11.8 percent each). Two cores could not be classified (2.9 percent), and one is pyramidal in shape (1.5 percent). Half of the large biface population are early stage tools, with middle stage tools comprising 38.4 percent of the population. Two large bifaces (7.7 percent) could not be classified, and only one (3.9 percent) is a late stage tool.

Table 8.26 shows the distribution of material types by core types for each site. Overall, Pedernal chert is the most common material used for cores, with 39 examples occurring. Quartzite (n = 11) is next most common, followed by other cherts (n = 8), basalt (n = 4), and rhyolite (n = 3). Silicified wood, undifferentiated igneous, and quartzitic sandstone are represented by one example each.

The amount of reduction performed on a core can be measured by two variables, the amount of cortex remaining and core mass. Table 8.27 illustrates percentages of remaining cortex by type for the core assemblage; 20 cores have no cortex and are not included. Overall, most cores with waterworn cortex appear to have had at least 50 percent of their cortical surfaces removed by flaking. Most cores with nonwaterworn or indeterminate cortex had little of their cortical surfaces removed. However, it should be noted that only about 8 percent of the cores with cortical surfaces fall into the latter two classes.

All six cores from LA 65005 are multidirectional; two have no cortex and four have 60 percent or more of their waterworn cortical surfaces removed. Considering the type of cortex found on cores and the materials represented it is likely that all were obtained from local gravel deposits.

A total of twelve cores were found in four components at LA 65006. Component 1 contained four cores including two multidirectional, one unidirectional, and one undifferentiated. The multidirectional cores all lack cortex; about 40 percent of the unidirectional core surface and 80 percent of the undifferentiated core surface are cortical. The former is waterworn, while the cortical type of the latter was unidentified. One multidirectional core with 30 percent of its surface covered by indeterminate cortex was found in Component 2. Component 4a contained one multidirectional core with waterworn cortex. Cores from Component 4b include four multidirectional, one undifferentiated, and one tested cobble. Only two of the multidirectional cores have cortex remaining; in both cases it is waterworn. Both the indeterminate core and the tested cobble lack cortex. In the latter case, the core type may have been miscoded or it was a large piece of angular debris with a flake struck from it sometime after initial reduction. All of the cores recovered from LA 65006 were probably obtained from local gravel deposits, including those with indeterminate cortex.

The 50 cores found at LA 65013 include 26 multidirectional, 9 bidirectional, 7 unidirectional, 1 pyramidal, and 7 tested cobbles. Eleven have no cortex remaining, and include the pyramidal core, 6 multidirectional cores, and 4 unidirectional cores. Waterworn cortex occurs on 18 multidirectional, 7 bidirectional, 3 unidirectional cores, and all 7 tested cobbles. One multidirectional core has nonwaterworn cortex, and the cortex type on another is undetermined. At least half the cortical surface was removed from all multidirectional cores, all but 1 of the bidirectional cores, and 4 of 7 unidirectional cores. Cortex occurs on all tested cobbles, and at least 50 percent was removed in 5 of 7 cases. With the exception of 1 Pedernal chert specimen, cortex type on these cores suggests procurement from local gravels. The Pedernal chert core with nonwaterworn cortex was obtained at or near its source, and is the only definitely exotic core found at any of our sites. Three core types might be evidence of systematic reduction to maximize flake production and include the pyramidal, unidirectional, and bidirectional categories. Cortical data suggest that this may be the case for the pyramidal core and 5 of 7 unidirectional cores. However, only a third of the bidirectional cores have 20 percent or less of their surfaces covered by cortex, suggesting that this category was not reduced to the same extent as were the others. In fact, a higher percentage of multidirectional cores have 20 percent or less of their surfaces covered by cortex (42 percent).

Core morphology by mass in cubic centimeters (cu cm) is shown in Table 8.28. Over half of the cores were reduced to under 100 cu cm, and only four are larger than 500 cu cm. Surprisingly, the pyramidal core is larger than most others. It may have been abandoned before it was completely reduced, or its shape precluded further reduction. However, this artifact was heavily reduced, and no longer retains any cortical surface. The undifferentiated cores tend to be the smallest, averaging only 27.8 cu cm in size. However, they have the second highest average of cortex at 40 percent. Only the tested cobble category has a higher average for cortex at 47.5 percent. They also have the second smallest average size at 125.3 cu cm. Thus, the two smallest morphological categories also have the most cortical coverage. This suggests that these categories (tested cobbles and undifferentiated cores) probably began as smaller nodules than was the case with the other core categories.

There is a progression in size from unidirectional (211.7 cu cm) to bidirectional (170.9 cu cm) to multidirectional (142.8 cu cm) cores, suggesting that the former represents the least amount of reduction and the latter the most. Unfortunately, this is not supported by cortical data; unidirectional cores have the smallest average cortex coverage at 26.3 percent, multidirectional cores have the second smallest at 25 percent, and bidirectional cores the largest at 31.1 percent.

Table 8.26. Core Morphology by Material Type for Each Component

Component	Core Type	Chert	Pedernal Chert	Silicified Wood	Basalt	Rhyolite	Undifferentiated Igneous	Quartzite	Quartzitic Sandstone
LA 65005	Multidirectional	3	3	0	0	0	0	0	0
LA 65006 Component 1	Undifferentiated	0	1	0	0	0	0	0	0
	Unidirectional	0	1	0	0	0	0	0	0
	Multidirectional	0	1	1	0	0	0	0	0
LA 65006 Component 2	Multidirectional	0	1	0	0	0	0	0	0
LA 65006 Component 4a	Tested cobble	0	0	0	0	0	0	0	0
	Multidirectional	0	1	0	0	0	0	0	0
LA 65006 Component 4b	Tested cobble	0	0	0	0	0	0	1	0
	Undifferentiated	1	0	0	0	0	0	0	0
	Multidirectional	0	1	0	1	0	0	1	1
LA 65013	Tested cobble	1	1	0	0	1	0	4	0
	Unidirectional	1	5	0	1	0	0	0	0
	Bidirectional	1	3	0	2	1	0	2	0
	Multidirectional	1	21	0	0	1	0	3	0
	Pyramidal	0	0	0	0	0	1	0	0

TABLE 8.27. CORE MORPHOLOGY BY CORTEX FOR EACH CORTEX TYPE

CORTEX TYPE	CORE TYPE	10%	20%	30%	40%	50%	60%	70%	80%	90%	TOTAL
Waterworn	Tested cobble	0	0	2	1	1	0	1	2	0	7
		0.0	0.0	28.6	14.3	14.3	0.0	14.3	28.6	0.0	15.9
	Unidirectional core	1	0	0	1	0	1	0	0	1	4
		25.0	0.0	0.0	25.0	0.0	25.0	0.0	0.0	25.0	9.1
	Bidirectional core	0	1	1	3	1	1	0	0	0	7
		0.0	14.3	14.3	42.9	14.3	14.3	0.0	0.0	0.0	15.9
	Multidirectional core	3	4	7	5	6	1	0	0	0	26
		11.1	15.4	26.9	19.2	23.1	3.8	0.0	0.0	0.0	59.1
	Totals	4	5	10	10	8	3	1	2	1	44
	Percent	9.1	11.4	22.7	22.7	18.2	6.8	2.3	4.5	2.3	
Nonwaterworn	Multidirectional core	0	0	0	0	0	0	0	1	0	1
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	100.0
	Totals	0	0	0	0	0	0	0	1	0	1
	Percent	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	
Indeterminate	Undifferentiated core	0	0	0	0	0	0	0	1	0	1
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	33.3
	Multidirectional core	1	0	0	0	0	0	0	1	0	2
		50.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	66.7
	Totals	1	0	0	0	0	0	0	2	0	3
	Percent	33.3	0.0	0.0	0.0	0.0	0.0	0.0	66.7	0.0	

TABLE 8.28. CORE MORPHOLOGY BY MASS, FREQUENCIES AND ROW PERCENTAGES

CORE MORPHOLOGY	1-99	100-199	200-299	300-399	400-499	600-699	800-899	1000-1099	TOTALS
Tested cobble	5	2	0	0	0	1	0	0	8
	62.5	25.0	0.0	0.0	0.0	12.5	0.0	0.0	11.8
Undifferentiated	2	0	0	0	0	0	0	0	2
	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9
Unidirectional	3	2	2	0	0	0	1	0	8
	37.5	25.0	25.0	0.0	0.0	0.0	12.5	0.0	11.8
Bidirectional	4	3	1	0	1	0	0	0	9
	44.4	33.3	11.1	0.0	11.1	0.0	0.0	0.0	13.2
Multidirectional	24	10	1	2	1	0	1	1	40
	58.5	25.0	2.5	5.0	2.5	0.0	2.5	2.5	58.8
Pyramidal	0	0	0	1	0	0	0	0	1
	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	1.5
Totals	38	17	4	3	2	1	2	1	68
Percent	55.9	25.0	5.9	4.4	2.9	1.5	2.9	1.5	

Measurements are in cubic centimeters

In general, as cores get smaller they also have less cortical surface, although there is quite a bit of variation. For example, bidirectional cores between 1 and 99 cu cm in size average 12.5 percent cortical coverage, those between 100 and 199 cu cm average 50 percent cortical coverage, and those larger than 200 cu cm in size average 40 percent cortical coverage. Thus, the amount of cortex remaining on a core is not directly related to artifact size, but to the size of the original nodule. Similarly, core size is not directly related to the extent of reduction or number of platforms.

To summarize core information, most nodules used for cores appear to have been procured from local sources. A single pyramidal core is included in the assemblage, and is the only good evidence for systematic core reduction. Other core types are more indicative of expedient reduction. Interestingly, the only core that suggests systematic reduction is from the Pueblo assemblage at LA 65013; none were recovered from the Archaic site (LA 65006), where they were expected.

Whole or fragmentary large bifaces were recovered from two sites: LA 65006 (n = 25), and LA 65013 (n = 1). In addition to the general analysis attributes, breakage patterns were also recorded to provide information on when and how bifaces were fractured. With one exception, breakage pattern descriptions were adapted from Johnson (1979) and Rondeau (1981). Johnson (1979:25-26) defined two general break categories: direct fractures that originate at the point where force is applied, and indirect fractures that occur away from the area being worked.

Four types of direct break were identified: hinge fractures, reverse fractures, perverse fractures, and impact fractures. The hinge category also includes step fractures, and causes biface rejection when several hinges or steps in a restricted area make further attempts at thinning impossible. A second type of break is the reverse fracture, which is caused by a ". . . bifacial thinning flake which begins normally but curves back through the body of the biface to remove the bifacial edge opposite the point of origin" (Johnson 1979:25). A type of reverse fracture occurs with some frequency in the present study, and is assigned a separate classification. This is the edge bite, which consists of a portion of a biface edge broken out by an improperly aimed blow. Perverse fractures were originally described by Crabtree (1972:82) and occur ". . . when the fracture plane twists on the axis of rotation corresponding with the direction

TABLE 8.29. LARGE BIFACE DATA

Site	Large Biface Type	Portion	Material	No. of Examples	Break Pattern
LA 65006	Early stage	Whole	Obsidian	1	Abandoned because of thickness and stepping
		Base-midsection	Quartzite	1	Lateral snap
		Midsection	Pedernal chert	1	Reverse fracture & lateral snap
		Edge	Obsidian	5	Edge bite (reverse fracture)
			Quartzite	1	Edge bite (reverse fracture)
		Unidentified fragment	Obsidian	2	Lateral snap
				1	Perverse fracture
			Pedernal chert	1	Broke at flaw
	Middle stage	Base	Obsidian	1	Reverse fracture
		Tip	Basalt	1	Lateral snap
				1	Incipient fracture plane
		Tip and edge	Obsidian	1	Snap fracture
		Unidentified fragment	Pedernal chert	2	Lateral snap
				1	Reverse fracture
				1	Flaw-thermal treatment [1]
			Obsidian	1	Manufacturing break [2]
				1	Lateral break at flaw
	Late stage	Tip	Obsidian	1	Lateral snap
	Undifferentiated	Edge	Obsidian	1	Edge bite (reverse fracture)
LA 65013	Early stage	Midsection	Pedernal chert	1	Lateral snap (?)

[1] Biface broke at an undetached heat spall.
[2] Undifferentiated manufacturing break; artifact was hit with a pick during excavation, partially obscuring break pattern.

of force" (Johnson 1979:25). This causes a truncation of the biface. The fourth type is the impact fracture, which is caused by impact of the tool with a hard material, and consists of "longitudinally oriented flake scars derived from the distal end of the blade . . ." Impact fractures can occur during manufacture or use; the latter pattern generally pertains to projectile points.

Five types of indirect fracture were defined: lateral snaps, incipient fracture planes, crenated fractures, pot lid fractures, and haft snaps. Lateral snaps are transverse breaks that bisect the biface in a relatively straight line, usually resembling a gentle S-shaped curve (Johnson 1979:25). This type of break is also called end shock, and occurs when a thinning blow is struck at the end of a biface which exceeds the elastic qualities of the material, causing the tool to fracture in the middle. Rondeau (1981) notes that lateral snaps also occur with edge blows, and would thus be classified as direct fractures. This is confirmed by experimental work conducted by the author, in which lateral snaps caused by edge blows were the main cause of biface failure. Bedding planes within a material can also cause indirect fractures; this type of break is classified as incipient fracture plane. Two types of breaks result from improper heat treatment. A crenated fracture ". . . forms a sinuous line across the face of the artifact giving the appearance of having been cut with a jigsaw" (Johnson 1979:25-26). This type of fracture lacks the characteristics of mechanically induced breaks, and occurs when an artifact is heated too rapidly, causing it to craze. The second type of thermal break is caused by pot lid fracturing, and may be the result of an accidental application of heat. Finally, haft snaps are transverse breaks across the proximal portion of a hafted biface, and are caused by usage.

Table 8.29 shows the fracture types identified on bifaces from LA 65006 and LA 65013. Six of the types identified by Johnson (1979) and Rondeau (1981) occur in these assemblages, only crenated fractures and use-related breaks (impact fracture and haft snap) are missing. Reverse fractures are the most common type of break; ten examples of this type were noted, seven of which are edge bites. Lateral snaps are the second most common type, and occur on nine artifacts. One biface was abandoned because step fractures prevented it from being thinned, and there is one example each of the incipient fracture plane and perverse fracture types. A general manufacturing break was assigned to one biface, which was shattered during excavation. Fragments of this tool showed evidence of a break that occurred during production, but further breakage during excavation precluded an accurate identification of the fracture type. A break induced by improper heat treatment was noted on one biface, which appears to have fractured at an undetached heat spall and should be classified as a pot lid fracture. Breaks that did not fall into the above categories were noted on three artifacts. Two bifaces broke when flaws were encountered. This type of fracture could easily be combined with the incipient fracture plane category. Finally, a single example of a simple snap fracture was noted. This type is undiagnostic, and can occur during manufacture or when a tool is dropped or stepped on.

The most interesting aspect of this analysis is that all of the bifaces are broken and only one fragment has an undiagnostic break; 24 of 25 fragments from LA 65006 and the single example from LA 65013 were definitely broken during manufacture. Over half of the breaks (n = 14, 53.9 percent) occurred during early-stage tool manufacture, and most of the rest (n = 10, 38.5 percent) broke during middle-stage manufacture. The latter category includes the single snap fracture. Only one biface broke during late-stage manufacture, and the production stage could not be identified in one case. These data strongly support the conclusion that a considerable amount of biface manufacture occurred at LA 65006, and suggest that at least some occurred at LA 65013.

Only four material types are represented among the broken bifaces including obsidian (15 examples), Pedernal chert (7 examples), quartzite (2 examples), and basalt (2 examples). Material textures are either glassy (obsidian) or fine-grained (Pedernal chert, quartzite, basalt), and visible flaws were noted in only three cases–two obsidian and one Pedernal chert. Sixteen bifaces were made from exotic materials, and the materials from which nine were made were obtained locally.

While cores were dominated by locally obtained materials, nearly two-thirds of the bifaces were made from exotic materials. These data tend to support the idea of differential reduction of local and exotic materials, with the former primarily being reduced expediently and the latter dominating the curated tool category. However, several bifaces were made from materials obtained locally, showing that local materials were also used to produce curated tools when suitable for that purpose. Most biface breakage at LA 65006 appears to have occurred during the early and middle stages of reduction, and very few tools broke during late stage reduction. This is probably because few bifaces were formed into finished tools at this site, and most left as large generalized bifaces.

Summary of Reduction Strategy Information

While several debitage assemblage attributes were used to determine the dominant reduction strategy at each site, the various components have not been discussed in detail. In this section, reduction in each component is discussed, and evidence for the use of various strategies is reviewed.

LA 65005. This assemblage has the lowest percentage of noncortical debitage and flake to angular debris ratio. Only four biface flakes (3.9 percent) were identified, and few flakes have modified platforms or opposing dorsal scars. There is no overlap between these attributes; flakes with modified platforms do not have opposing dorsal scars. Whole biface flakes average 22.04 mm in length, suggesting they were removed from large bifaces similar to those produced at LA 65006. The mean length of whole core flakes is 31.3 mm. Only a small percentage of platforms are lipped, suggesting that hard-hammer reduction dominated. The combination of a relatively low percentage of noncortical debitage, very low flake to angular debris ratio, and few biface flakes, modified platforms, or flakes with opposing dorsal scars suggests that core reduction dominated and that little, if any, formal tool manufacture occurred. Only a few large biface flakes were found and, while possible that they were produced on-site, they more likely represent artifacts collected at an Archaic site. LA 65006 is only about 75 m away, and was probably the source of these artifacts.

Core data support the conclusion that this assemblage was dominated by expedient core-flake reduction. No systematically reduced cores were found; only multidirectional cores (n = 6) were recovered. No whole or fragmentary large bifaces were found. Coupled with little (if any) evidence for on-site biface manufacture, it is likely that few or no formal tools were produced at this site.

LA 65006 Component 1. This assemblage contains the highest percentage of noncortical debitage and biface flakes, and has the second highest percentage of modified platforms and flakes broken during manufacture. Whole core flakes average 21.3 mm long, while biface flakes average 20.9 mm long. Either the cores and bifaces reduced in this component were nearly the same size, or the whole flakes represent the same basic population. Considering the high percentages of flakes with modified platforms and opposing dorsal scars, it is likely that much of the core flake population originated during the early stages of biface manufacture. Data from debitage removed from identifiable cores also support this possibility, with 13 of 14 identified cores represented by both core and biface flakes. A high percentage of lipped platforms suggests that reduction was primarily accomplished by soft-hammer percussion. These data in addition to the large average length for biface flakes suggest that large bifaces were manufactured in this component. There is some evidence for core reduction as well, but it seems to have been a minor activity.

Core and biface data support these conclusions. There are 4 cores and 17 large bifaces in this assemblage. All of the cores are made from local materials; 2 are multidirectional and have no cortical surfaces, suggesting extensive expedient reduction. The morphology of 1 core was unidentified, but since 80 percent of its surface is covered by cortex it was not reduced to any appreciable extent. The final core is unidirectional; 40 percent of its surface is covered by cortex, so it was probably discarded before being exhausted. In general, these artifacts indicate that some expedient core reduction occurred in this component.

Of the 17 large biface fragments, 16 were broken during manufacture and only 1 possesses an undiagnostic break. Ten biface fragments were broken during the early stage of manufacture, five during the middle stage, and only 1 during the late stage; the manufacturing stage of the last biface was undetermined. Breakage seems to have decreased as reduction progressed, with less breakage occurring during the middle and late stages. Fourteen bifaces were made from exotic materials, and only three were made from locally obtained materials.

The presence of both cores and large bifaces indicate that expedient reduction as well as the manufacture of curated artifacts occurred in this component. The relative paucity of cores when compared to the number of large biface fragments is interesting and supports the conclusion that large biface manufacture dominated reduction activities. While all of the cores are of locally obtained materials, most of the large biface fragments are made from exotic materials, supporting the idea that there was a differential reduction of local versus exotic materials. While local materials were used in expedient core reduction as well as large biface manufacture, exotics seem to have been almost exclusively used for the latter.

LA 65006 Component 2. This assemblage contains the second lowest flake to angular debris ratio and the lowest percentages of noncortical debitage and flakes broken during manufacture for the site. Percentages of biface flakes and modified platforms are moderate. Mean whole core flake lengths are the largest for the site, averaging 31.5 mm versus 24.7 mm for biface flakes. Opposing dorsal scars occur on 24.3 percent of biface flakes (whole and proximal fragments) and only 9.1 percent of core flakes. Materials from six identified cores were found, but except for debitage from Cores 3 and 12, most seem to have moved upward from lower deposits. Core 3 is represented by both core and biface flakes, suggesting that this material represents early stage biface reduction. Only a core flake and a piece of angular debris from Core 12 were found, tentatively suggesting that this material was reduced as a core. A relatively high percentage of lipped platforms suggests that reduction was mostly accomplished by soft-hammer percussion. These data suggest that, while quite a bit of large biface manufacture occurred in this component, core reduction was also important.

Core and large biface data add little to these conclusions. This component contains one core and two large bifaces, all of Pedernal chert. The core was locally procured, and no sourcing information was available for the bifaces. The core is multidirectional, suggesting expedient reduction. Both large bifaces broke during the middle stage of manufacture, one at a flaw caused by improper heat treatment. All of these artifacts seem to have been reduced in this component, indicating that both expedient core-flake reduction and the manufacture of large curated bifaces occurred.

LA 65006 Component 3. This assemblage has the third highest percentage of biface flakes at LA 65006, but it also has the lowest flake to angular debris ratio and percentage of manufacturing breaks. Percentages of modified platforms and noncortical debitage are moderate. Mean whole core flake lengths are the second largest for the site, averaging 28.5 mm versus 29.0 mm for biface flakes. This component has the smallest overall percentage of flakes with opposing dorsal scars, which occur on 8.3 percent of the biface flakes and 8.1 percent of the core flakes. A rather high percentage of lipped platforms suggests that reduction was primarily accomplished by soft-hammer percussion. These data suggest that the manufacture of large bifaces occurred in this component. However, several attributes such as the relatively low flake to angular debris ratio and percentages of modified platforms and noncortical debitage suggest that core reduction may have dominated.

This assemblage contains no cores and only two large bifaces. Both biface fragments were broken during manufacture, one each during the early and middle stages. Neither is of demonstrably exotic origin, so it is likely that these materials were obtained locally. While these data support the conclusion that large biface manufacture occurred in this component, they provide no evidence for expedient core reduction.

LA 65006 Component 4a. This assemblage has the lowest percentage of biface flakes and the highest percentage of modified platforms at LA 65006. The flake to angular debris ratio and percentage of noncortical debitage are the second highest for the site. Mean whole core flake length is 21.7 mm, as opposed to 25.9 mm for biface flakes. This is the only case where the mean length of biface flakes is appreciably greater than core flakes. Opposing dorsal scars occur on 24.1 percent of core flakes and 39.2 percent of biface flakes. A high percentage of lipped platforms suggests that reduction was mainly accomplished by soft-hammer percussion. Most of these attributes suggest that tool manufacture was important in this component. A moderate percentage of biface flakes coupled with a high overall percentage of modified platforms, relatively high percentages of opposing scars on both core and biface flakes, and a high flake to angular debris ratio suggest that late stage reduction dominated. The large average size of biface flakes, particularly in comparison with core flakes, suggests that large bifaces were manufactured, and much of the debitage seems to have been removed during the early stage of manufacture when the difference between core and biface flakes is not clear-cut. It is also likely that a fair amount of core reduction occurred, though it was probably a minor aspect of the reduction strategy.

Core and biface data partly support these conclusions. This component contains a multidirectional core and two large biface fragments; all appear to have been made from local materials, though this is certain only for the core. Both bifaces were broken during manufacture, one in the early stage and the other in the middle stage. Thus, both expedient core-flake reduction and large biface manufacture are reflected by this small part of the assemblage.

Component 4a contains a mixture of materials collected from erosional exposures at the edge of the lower terrace at LA 65006. Most of this assemblage was collected along the south edge of the terrace and seems to have eroded out of Strata 4/6, accounting for the close resemblance between the assemblages from Components 1 and 4a.

LA 65006 Component 4b. This assemblage has the lowest percentage of modified platforms at LA 65006, and comparatively low flake to angular debris ratio and percentage of biface flakes. The percentage of noncortical debitage is the second lowest for the site. Mean whole core flake length is 31.1 mm, while whole biface flakes average 24.1 mm long. The large average size of biface flakes indicates that large bifaces were manufactured. Opposing dorsal scars occur on 16.8 percent of core flakes, and 13.4 percent of biface flakes. A high percentage of lipped platforms suggests that reduction was mostly accomplished by soft-hammer percussion. With the possible exception of Component 3, the low percentage of biface flakes, modified platforms, and opposing dorsal scars coupled with a relatively low flake to angular debris ratio suggest that expedient core reduction was more prevalent in this assemblage. Conversely, while there is evidence for large biface manufacture, it was less important than in other assemblages from this site, again perhaps except for Component 3.

Core and biface data partly support these conclusions. This assemblage contains six cores and two large bifaces. The cores mostly suggest expedient reduction: four are multidirectional, one is unidentifiable, and one is a tested cobble. Both biface fragments were broken in manufacture, one during the early stage and the other during the middle stage. Thus, both expedient core-flake reduction and the manufacture of large bifaces for curation are reflected in this small part of the assemblage.

LA 65013. This assemblage has the second lowest percentage of noncortical debitage and flake to angular debris ratio. Few biface flakes (3.9 percent) were recovered, platforms are modified on a fairly low percentage of flakes, and opposing dorsal scars are rare. The mean length of whole core flakes is 32.1 mm, and whole biface flakes average 28.9 mm long. A high percentage of lipped platforms suggests that reduction was mostly accomplished by soft-hammer percussion. High percentages of core flakes and unmodified flake platforms coupled with the relative rarity of opposing dorsal scars, a low percentage of noncortical debitage, and a moderate flake to angular debris ratio suggest that core reduction dominated. The length of the few biface flakes recovered suggest that large bifaces were also reduced.

Core and biface data support these conclusions. While 50 cores were recovered, there was only one large biface in this assemblage. Over half of the cores (n = 26, 52 percent) are multidirectional and suggest expedient reduction. Ten are bidirectional or pyramidal in shape, and may indicate some systematic reduction to produce the maximum number of useable flakes. The single biface was broken during early-stage manufacture and is very thick and crude. These data indicate that expedient core-flake reduction dominated. While much of that activity was aimed at maximizing the number of flakes removed from cores, it remained expedient in nature. Very little evidence for the manufacture of large bifaces was found.

Tool Use

While some aspects of the tool assemblages have been discussed, specifics concerning their use have not yet been addressed. An examination of tool use patterns will provide information that, along with other types of data, can be used to determine component functions. Tool assemblages are broken into two categories–informal and formal tools. Informal tools are debitage that were used without modification. Very conservative standards were applied when defining edge damage as evidence of use. This was necessary because trampling and erosional movement can cause damage that might be mistaken for cultural use. Only when scar patterns are consistent along an edge and the edge margin is regular (no extreme scoops or projections) are artifacts categorized as informal tools. In general, these tools exhibit little modification of shape or edge angle. Strike-a-light flints are an exception to this. Discussed in detail later, shapes and edge angles of these artifacts were often greatly altered, but because these modifications resulted from use rather than purposeful shaping, strike-a-light flints are classified as informal tools.

Formal tools are debitage that was purposely altered to produce a specific shape or edge angle. Flaking patterns are unifacial or bifacial, and artifacts are classified as early-, middle-, and late-stage tools based on the extent of flaking and edge condition. Early-stage tools have an irregular outline and widely and variably spaced flake scars that often do not extend completely across surfaces. Middle-stage tools have a semiregular outline and closely or semiregularly spaced flake scars that sometimes extend completely across surfaces. Late-stage tools have a regular outline and closely or regularly spaced flake scars that usually extend completely across surfaces. While these categories may reflect manufacturing stages, this is not always true. For example, flaking is often confined to margins on one or more surfaces of many small prehistoric projectile points, suggesting the early or middle stage of manufacture, even though they are finished tools. Thus, tools can not be judged as finished or unfinished on the basis of morphology alone.

Informal Tools

A total of 285 informal tools were identified including 240 pieces of utilized or retouched debitage and 45 strike-a-light flints. While the latter only occur at LA 65005, utilized or retouched debitage were recovered from every component (Table 8.30). Slightly more than 79 percent of the informal tools are utilized debitage, while retouched debitage (sometimes also utilized) make up 4.6 percent of the total. By far the most informal tools (n = 138, 48.4 percent) were found in Component 1, which is not surprising since this assemblage contains 82.1 percent of the chipped stone artifacts analyzed. However, it is interesting that a larger percentage of the informal tool assemblage was not also recovered from this component. Proportionally, there seems to have been less informal tool use in Component 1. Informal tools make up only 2.3 percent of that assemblage as compared to 20.9 percent for LA 65005, 3.9 percent for Component 2, 3.5 percent for Component 3, and 4.4 percent for LA 65013. The assemblages that contain smaller percentages are Components 4a (1.4 percent) and 4b (2.1 percent). These assemblages contain nearly all of the surface artifacts from LA 65006, and very conservative standards were used to assign a cultural origin to edge damage on those materials. Thus, these percentages may be related to analytical procedure rather than cultural processes.

The informal tool assemblage from LA 65005 can be divided into two categories–utilized-retouched debitage and strike-a-light flints. The former are discussed with the informal tools from other components. The latter consists of debitage used in combination with steel strike-a-lights *(chispas)* in historic fire-making kits. Only chert materials, including Pedernal, other cherts, and sili-

TABLE 8.30. FREQUENCIES OF INFORMAL TOOLS FOR EACH COMPONENT

COMPONENT	UTILIZED DEBITAGE	RETOUCHED DEBITAGE	RETOUCHED AND UTILIZED DEBITAGE	STRIKE-A-LIGHT FLINTS
LA 65005	5	1	1	45
LA 65006 Component 1	132	3	3	0
LA 65006 Component 2	18	0	1	0
LA 65006 Component 3	1	1	1	0
LA 65006 Component 4a	6	1	0	0
LA 65006 Component 4b	7	1	0	0
LA 65013	58	0	0	0
Totals	227	7	6	45
Percent	79.7	2.5	2.1	15.8

cified woods, were used for this purpose. Strike-a-light flints were recognized by their distinct wear patterns, and in many cases by metal adhesions that occur as rusted lumps of metal fused to the stone (J. Moore 1992). These artifacts are common on Spanish sites, and are an excellent indicator of Historic period occupation. While strike-a-light flints often resemble spokeshaves or scrapers in shape, their distinct wear patterns demonstrate that they were used for a totally different purpose. Since strike-a-light flints comprise a large percentage of this assemblage (18.1 percent), fire-making appears to have been one of the major activities for which chipped stone artifacts were used at LA 65005. In the remainder of this discussion, the term informal tool refers only to utilized and retouched debitage.

Of 240 informal tools, multiple use edges were noted on only ten artifacts. Two edges were used on eight artifacts including five core flakes and a biface flake from LA 65013, a core flake from Component 3, and a piece of angular debris from LA 65005. Three edges were used on two artifacts including a biface flake from LA 65013 and a core flake from LA 65005. Overall, core flakes were overwhelmingly selected for use and comprise 72.2 percent of the informal tools. Biface flakes were next in popularity, making up 25.2 percent of the assemblage. Angular debris was rarely used, and comprises only 2.6 percent. While utilized biface flakes occur in all components except LA 65005, they are most common in Component 1, where 47 biface flakes make up 35 percent of the informal tools. Except for LA 65013, very small numbers of informal tools occurred in the other assemblages. Only 7 percent of the informal tools from that site are biface flakes.

Wear patterns for all informal tool edges are shown in Table 8.31. Six basic wear patterns were found including utilization, retouch, battering, rotary, abrasion, and rounding. Utilized edges exhibit unidirectional or bidirectional attrition scars less than 2 mm long, while scars on retouched edges are more than 2 mm long. While the term "retouch" might seem to suggest the intentional alteration of an edge, both of these patterns result from use rather than purposeful flaking. Rotary wear occurs on projections and combines attrition and rounding on opposing edges. Battered edges were crushed and shattered from contact with hard materials. Abrasion occurs when edges are ground against a hard material, and has a slightly pitted appearance. Rounding is an extreme form of abrasion that is often accompanied by polish.

Unidirectional utilization is the most common wear pattern, and was found on nearly 62 percent of the informal tools. Unidirectional utilization and abrasion is next in abundance at over 14 percent, followed by abrasion at nearly 9 percent, and unidirectional retouch and utilization at nearly 7 percent. Other types of wear are rather uncommon, comprising around 3 percent or less apiece. Glassy and fine-grained materials were overwhelmingly selected for use, and only 3 of 240 informal tools do not fall into these categories. This suggests that most informal tools were used for tasks that involved cutting or scraping. The distribution of wear patterns on edges is shown in Table 8.32. Again, core flake edges were overwhelmingly selected for use. Biface flake edges make up a significant percentage of the assemblage, while very few angular debris edges were used.

The types of scars that occur along a utilized edge vary with the way in which a tool was used as well as the material it was used on. Experiments by Vaughan (1985:20) showed that use in a longitudinal direction (cutting) caused mostly bidirectional scarring (65 percent of specimens), though a significant number of specimens were scarred on only one surface (17 percent of specimens). Transverse use (scraping or whittling) pro-

TABLE 8.31. WEAR PATTERN TYPES FOR UTILIZED/RETOUCHED DEBITAGE EDGES IN ALL COMPONENTS

WEAR PATTERN	LA 65005	LA 65006 COM. 1	LA 65006 COM. 2	LA 65006 COM. 3	LA 65006 COM. 4A	LA 65006 COM. 4B	LA 65013	TOTALS
Unidirectional utilization	6 60.0	90 64.7	11 57.9	1 25.0	1 14.3	3 37.5	46 69.7	157 61.8
Bidirectional utilization	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	1 1.5	1 0.4
Unidirectional retouch	1 10.0	3 2.2	0 0.0	1 25.0	0 0.0	0 0.0	1 1.5	6 2.4
Rounding	1 10.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	1 0.4
Unidirectional utilization and rounding	0 0.0	6 4.3	1 5.3	0 0.0	0 0.0	0 0.0	1 1.5	8 3.2
Unidirectional retouch and rounding	0 0.0	0 0.0	1 5.3	0 0.0	0 0.0	0 0.0	0 0.0	1 0.4
Bidirectional retouch and rounding	0 0.0	1 0.7	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	1 0.4
Bidirectional retouch and abrasion	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	1 1.5	1 0.4
Rotary	0 0.0	1 0.7	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	1 0.4
Unidirectional retouch and utilization	2 20.0	7 5.0	1 5.3	0 0.0	0 0.0	1 25.0	6 9.1	17 6.7
Bidirectional retouch and battering	0 0.0	0 0.0	0 0.0	1 25.0	0 0.0	0 0.0	0 0.0	1 0.4
Abrasion	0 0.0	19 13.7	0 0.0	2 50.0	1 14.3	2 25.0	2 3.0	22 8.7
Unidirectional utilization and abrasion	0 0.0	16 11.4	5 26.3	0 0.0	5 71.4	2 25.0	8 12.1	36 14.2

Com. = Component

duced bidirectional scarring in 46 percent of his experiments, and unidirectional scarring in 54 percent. Thus, it is difficult to assign a specific function to these patterns. Similarly, rounding occurred when flakes were used in both longitudinal and transverse directions (Vaughan 1985:26). While retouch may represent an attempt to resharpen an edge dulled by use, this is unlikely in most cases. Most informal tools were probably discarded when they became dull, and a new flake was struck as a replacement because that required less effort than resharpening a dulled edge.

Material hardness, both of the object being processed and the tool, can be important factors in scarring. Vaughan's (1985:22) experiments showed that consistent scarring was almost always the result of contact with a hard material. However, nearly half of the edges used on hard materials and 80 percent of those used on medium-hard materials were not consistently scarred. These results are similar to those derived in experiments by Schutt (1980), who found that consistent edge scarring occurred only when hard materials were contacted. Scarring also varies with the type of material used as a tool. Fragile materials like obsidian scar more easily than tough materials like chert and basalt. Further, scars are easier to define on glassy and fine-grained materials than they are on medium- or coarse-grained rocks.

Though numerous wear patterns were identified, it is difficult to assign most to specific functions. The only exception is rotary wear, which is evidence that a tool was used for drilling. The presence of obvious signs of wear suggests that other tools were used to cut or scrape hard or medium-hard materials such as wood, bone, or antler. Since the suitability of edges for certain tasks is partly determined by their sharpness, wear patterns are

Table 8.32. Wear Pattern by Debitage Morphology, Edge Frequencies and Row Percentages

Wear Pattern	Angular Debris	Core Flakes	Biface Flakes	Totals
Unidirectional utilization	2 1.3	122 77.7	33 21.0	157 63.1
Bidirectional utilization	0 0.0	1 100.0	0 0.0	1 0.4
Unidirectional retouch	0 0.0	5 83.3	1 16.7	6 2.4
Rounding	0 0.0	1 100.0	0 0.0	1 0.4
Unidirectional utilization and rounding	1 12.5	3 37.5	4 50.0	8 3.2
Unidirectional retouch and rounding	0 0.0	1 100.0	0 0.0	1 0.4
Bidirectional retouch and rounding	0 0.0	1 100.0	0 0.0	1 0.4
Bidirectional retouch and abrasion	0 0.0	0 0.0	1 100.0	1 0.4
Rotary	0 0.0	1 100.0	0 0.0	1 0.4
Unidirectional retouch and utilization	3 21.4	6 42.9	5 35.7	14 5.6
Bidirectional retouch and battering	0 0.0	1 100.0	0 0.0	1 0.4
Abrasion	1 4.5	10 45.5	11 50.0	22 8.8
Unidirectional utilization and abrasion	0 0.0	27 77.1	8 22.9	35 14.1
Totals Percent	7 2.8	179 71.9	63 25.3	249 100.0

grouped by edge angles in Table 8.33. Most edges used in Schutt's (1980) experiments that measured over 40 degrees were found to be poorly suited for cutting. Thus, we assume that edge angles smaller than 40 degrees were best for longitudinal use (cutting), while those larger than 40 degrees were better for transverse use (scraping). A small majority of the informal tool edges have angles of less than 40 degrees. Some wear patterns occur only on steeper edges, including unidirectional retouch and rounding, bidirectional retouch and abrasion, and bidirectional retouch and battering. Wear types occurring only or dominantly on sharper edges include bidirectional utilization, bidirectional retouch, rounding, unidirectional utilization and rounding, rotary, and abrasion. The remaining wear patterns occur in similar percentages on both shallow and steep edges.

Table 8.33. Wear Patterns for All Utilized/Retouched Edges by Edge Angle, Frequencies and Row Percentages

Wear Pattern	1-40 Degrees	>40 Degrees	Total
Unidirectional utilization	90 57.3	67 42.7	157 62.1
Bidirectional utilization	1 100.0	0 0.0	1 0.4
Unidirectional retouch	4 66.7	2 33.3	6 2.4
Rounding	1 100.0	0 0.0	1 0.4
Unidirectional utilization and rounding	5 62.5	3 37.5	8 3.2
Unidirectional retouch and rounding	0 0.0	1 100.0	1 0.4
Bidirectional retouch and rounding	1 100.0	0 0.0	1 0.4
Bidirectional retouch and abrasion	0 0.0	1 100.0	1 0.4
Rotary	1 100.0	0 0.0	1 0.4
Unidirectional retouch and utilization	6 42.9	8 57.1	14 5.6
Bidirectional retouch and battering	0 0.0	1 100.0	1 0.4
Abrasion	15 68.2	7 31.8	22 8.7
Unidirectional utilization and abrasion	15 42.8	20 57.1	35 14.1
Totals Percent	139 55.8	110 44.2	249 100.0

Using the experimental criteria cited above, it is likely that most of the informal tools were used to scrape or cut relatively hard materials. Unfortunately, since processing of soft materials rarely creates visible scarring, and use on medium-hard and hard materials does not always result in consistent scarring, it is likely that only a small part of the informal tool assemblage was identified. Thus, while we can conclude that informal tools were used at our sites, it is impossible to determine how many pieces of debitage actually functioned in that capacity.

Formal Tools

A total of 38 formal tools were recovered from all com-

TABLE 8.34. FORMAL TOOLS FOR ALL COMPONENTS

TOOL TYPE	LA 65005	LA 65006 COM. 1	LA 65006 COM. 2	LA 65006 COM. 3	LA 65006 COM. 4A	LA 65006 COM. 4B	LA 65013	TOTALS
Choppers	1	0	0	0	0	0	1	2
Spokeshaves	0	0	0	0	0	0	1	1
Denticulates	0	1	0	0	0	0	0	1
Chopper-hammerstones	0	0	0	0	0	0	2	2
Gunflints	1	0	0	0	0	0	0	1
Scrapers	0	2	0	0	0	0	0	2
Large bifaces	0	17	1	3	2	2	1	26
Projectile point preforms	0	0	0	0	0	1	0	1
Projectile points	0	0	0	0	0	2	0	2
Totals	2	20	1	3	2	5	5	38

Com. = Component

ponents (Table 8.34). Of the formal tool assemblage, 26 specimens are large biface fragments and have already been discussed. Only 12 other formal chipped stone tools were found. Since so few formal chipped stone tools were recovered they are discussed individually.

Two formal chipped stone tools were found at LA 65005, a chopper and a possible gunflint. The chopper is made from a medium-grained quartzite cobble procured from local gravels. There is a considerable amount of battering on the only utilized edge of the possible gunflint, which resembles the wear observed on gunflints from other sites in New Mexico. There also appears to be some marginal bifacial flaking along the working edge, again similar to other Spanish-style gunflints. However, it is possible that this tool was actually a strike-a-light flint. The flaking is marginal, and could have been caused by use as well as purposeful shaping. In addition, there are metal adhesions along the working edge. Such adhesions often occur on the edges of strike-a-light flints (J. Moore 1992), but the author has not yet found any on the edges of definite gunflints. Thus, the identification of this artifact as a gunflint must be considered tentative. It was made from a Pedernal chert flake, the source of which could not be determined.

Only three formal tools other than large bifaces were recovered from Component 1 including two scrapers and a denticulate. Both scrapers were made from core flakes, one obsidian and the other Pedernal chert. The obsidian tool is an end scraper, with a steeply angled working edge of 53 degrees. The Pedernal chert tool has four working edges. Three exhibit unidirectional retouch and wear with angles of 57, 44, and 95 degrees. The fourth exhibits unidirectional wear and abrasion along a working edge with an angle of 31 degrees. Retouch is more extensive on the obsidian scraper than on the Pedernal chert tool. In the latter case, short retouch scars are confined to the working edges rather than extending partly across surfaces. While this artifact appears to have been purposely flaked along one edge, wear patterns on the other edges suggest informal use. The denticulate is fragmentary, and was made from a Pedernal chert core flake. Unidirectional retouch was used to produce a serrated edge; only four teeth remain on the recovered fragment.

No formal tools other than large bifaces were found in Components 2, 3, and 4a. Three tools were found in the Component 4b assemblage including two projectile point fragments and a projectile point preform, all obsidian. The projectile point fragments consist of a base and a midsection, both impossible to identify with confidence. The base may be part of a late Archaic type such as Armijo or En Medio, but too little remains to allow a more accurate determination. The midsection is unidentifiable. The preform is extensively flaked on its dorsal surface, but the ventral surface was only marginally retouched before the artifact was lost or abandoned. It is tear-drop shaped, with relatively straight edges and a convex base. This form would have been suitable for the production of a late Archaic dart point such as the Armijo or En Medio forms.

Four formal tools other than large bifaces were recovered from LA 65013 including one spokeshave, one chopper, and two chopper-hammerstones. The spokeshave is made from an obsidian core flake, and has unidirectional utilization and abrasion on an edge measuring 43 degrees. The chopper is made from a locally procured quartzite split cobble. One edge was bifacially flaked to produce a cutting edge with an angle of 80 degrees, and sharp edges at the opposite end were abraded to prevent injury during use. Two artifacts were used as both choppers and hammerstones. Both were made from locally procured basalt cobbles, and have bifacially flaked chopper edges with angles of 70 and 83 degrees. At least one surface of each is battered, and was used as a hammerstone.

Summary and Conclusions

The chipped stone artifact assemblages from three sites were examined by this analysis. LA 65005 was a Spanish Colonial period site that contained a relatively extensive collection of chipped stone artifacts. LA 65006 was a late Archaic and Classic period Pueblo site divided into four components. The last site, LA 65013, was a Classic period Pueblo fieldhouse.

Although this analysis treated all four components of LA 65006 equally, it must be remembered that Components 4a and 4b contain mostly surface materials from disturbed contexts. Besides being affected by sheetwash and grazing, many artifacts in these assemblages were exposed and transported by gullies. A separate occupation is certainly not indicated for Component 4a. This assemblage contains materials found eroding from the edge of the lower terrace at LA 65006, and mostly includes materials related to the earliest occupation of the site (Component 1). However, since these materials were exposed in erosional cuts and had lost their provenience, and because some mixing with later materials was suspected, they were considered a separate assemblage. Likewise, Component 4b contains surface materials from the lower terrace as well as the few chipped stone artifacts recovered from Feature 1, which was radiocarbon dated to the Classic period. These materials were considered to be a mixture of late Archaic artifacts eroding out of Stratum 1, which was exposed over most of the lower terrace surface, and Pueblo materials deposited at a much later date.

In both cases our caution concerning these components seems justified. Component 4a rather closely resembles Component 1, as discussed earlier. However, there are differences between these assemblages that might be indicative of some mixing of materials from disparate occupations. This certainly seems to be the case with Component 4b, which contains the least evidence for tool manufacture and the most evidence of core reduction of any assemblage from this site, with the possible exception of Component 3. While Component 4b probably contains a mixture of Archaic and Pueblo materials that cannot be differentiated, the same is not true of Component 3. It is likely that this assemblage represents a late Archaic use.

Three components from LA 65006 represent relatively intact and undisturbed assemblages. Component 1, of late Archaic date, was the most extensive and best preserved. Most of the artifacts recovered from LA 65006 were from this component, as were most of the features and other classes of artifacts (except for ceramics). Component 2 was a smaller late Archaic assemblage that seemed relatively undisturbed, though there may have been some contamination by a later Pueblo occupation. Component 3 contained the smallest assemblage and was undated.

With the exception of percentage of flakes displaying manufacturing breaks, all of the debitage assemblage attributes used to estimate the main reduction strategy suggested that an expedient core-flake reduction strategy was used at LA 65005. Only four biface flakes were recovered, and probably represent materials scavenged from earlier sites. In particular, LA 65006 is only about 75 m away and contains a considerable amount of biface manufacturing debris. Thus, it is likely that little formal tool manufacture occurred at this site. Most of the materials found at LA 65005 were procured locally. Obsidian is the only demonstrably exotic material, and comprises 6 percent of the chipped stone assemblage. While predominantly fine-grained and glassy materials were used, a significant number of artifacts are medium- or coarse-grained. The LA 65005 chipped stone assemblage contains numerous informal tools, but few formal tools. Most of the informal tools are strike-a-light flints, which were apparently discarded when no longer useable in fire-making kits. The presence of several pieces of utilized or retouched debitage indicates that informal tools were used for other purposes as well. While our analysis was not geared toward providing specific tool-use information, the wear patterns and range of edge angles found on these tools suggest use for both cutting and scraping. One of the formal tools is a possible gunflint, which would have been used in a weapon system if our identification is correct. The second is a chopper, which was probably used to process vegetal materials.

The three relatively intact assemblages from LA 65006 were probably all late Archaic in age (although a later date is possible for Component 3). All of the debitage assemblage indicators suggest that a curated strategy dominated chipped stone reduction in Component 1. The presence of numerous fragments of large, mostly early- and middle-stage bifaces, as well as the large average length of whole biface flakes suggests that reduction focused on production of large, general-purpose bifaces. The relatively high proportion of biface flakes in this assemblage combined with a very high percentage of modified platforms suggests that quite a bit of early-stage manufacture probably occurred here, producing debitage that was difficult to distinguish from core flakes. Core reduction was also evident in the assemblage, and some data suggest a differential reduction of local and exotic materials. While local materials were used for both expedient and curated reduction, exotic materials were mostly used to produce curated tools. Most of the artifacts included in Component 4a are probably also related to this assemblage. By far the majority of the artifacts included in that collection were recovered along the edges of Areas 1 and 2, and seemed to be eroding out of Strata 4/6. The debitage assemblage indicators suggest that a curated strategy dominated this assemblage as well, except for percentage of manufacturing breaks, which is inconclusive. While a smaller percentage of biface flakes was found in this assemblage than in Component 1, the percentage of modified platforms was much higher. Thus, this assemblage may reflect even more early stage biface manufacture than Component 1.

Both of these assemblages contain large percentages of nonlocally procured materials, with exotics comprising 66.1 percent of the Component 1 and 91.7 percent of the Component 4a assemblages. Materials selected for reduction were dominantly glassy and fine-grained; coarser materials make up only 4.3 percent of the Component 1 and .8 percent of the Component 4a assemblages. Proportionately few formal or informal tools were recovered from these components. Only 2.3 percent of the Component 1 and 1.4 percent of the Component 4a debitage assemblages were used as informal tools. Large biface fragments were the most numerous formal tools. With the exception of a single example in Component 1, all formal tools were broken during manufacture and presumably discarded at that time. Other than two scrapers and a denticulate from Component 1, no other types of formal tools were found in these assemblages. Thus, tool manufacture rather than use seems to have been the focus of reduction during the initial late Archaic occupation of LA 65006.

Component 2 contains artifacts from Stratum 1 and related soil units and features. Only artifacts from subsurface contexts were included in this assemblage; artifacts from the surface of the terrace and Feature 1 comprise Component 4b. In many ways, Component 2 is very similar to Components 1 and 4a. Except for percentage of manufacturing breaks, all debitage assemblage indicators suggest that a curated strategy dominated reduction in this component. While only a single middle-stage biface fragment was found, the long average length of whole biface flakes suggests that reduction focused on the manufacture of large general-purpose bifaces. A moderately high percentage of biface flakes coupled with a high percentage of modified platforms suggests that initial as well as the later stages of biface reduction occurred here. Exotic materials comprise 61.9 percent of this assemblage, and glassy and fine-grained materials dominate; no coarse-grained materials were recovered and only 5.3 percent of the assemblage is medium-grained. Proportionately, few formal or informal tools were found. Only 3.9 percent of the debitage assemblage was used as informal tools, and two large bifaces were the only formal tools recovered. As was the case with the earlier component, tool manufacture rather than use appears to have been the focus of reduction activities in this assemblage.

Component 3 contains artifacts from Stratum 12 and related soil units. In many ways, this assemblage is similar to those left by earlier occupations, but there are several important differences. Three of the debitage assemblage indicators were inconclusive, while one suggested core reduction. The four remaining indicators suggested biface reduction. The presence of two bifaces broken in manufacture, one early stage and one middle stage, in addition to a large average length for biface flakes suggests that reduction was at least partly focused on the manufacture of large bifaces. The presence of large percentages of biface flakes and modified platforms suggest that both the initial and later stages of biface reduction occurred here. This assemblage contains the lowest percentage of exotic materials at LA 65006, though at 18.6 percent it is still high when compared to the other sites (LA 65005 and LA 65013). Although exotics are rarer in this component, glassy and fine-grained materials are even more common, with coarser materials comprising only 2.3 percent of the assemblage. This component also contains a comparatively high percentage of informal tools. However, like all but Component 1, the only formal tools are fragments of large bifaces that were broken and discarded during manufacture. While tool manufacture may have been the focus of reduction activities in this component, considerable evidence of expedient core-flake reduction was also found.

As noted several times during this discussion, Component 4b consists of materials collected from the surface of the lower terrace and chipped stone artifacts from Feature 1. As such, a mixture of late Archaic and Classic period Pueblo assemblages was expected. This assemblage contains more of a mixture of materials generated during core and tool manufacture than was evident in other assemblages from this site. While the presence of two middle stage bifaces and a large average length for whole biface flakes suggest that large bifaces were manufactured, the presence of several cores, a moderate percentage of biface flakes, and a rather low percentage of modified platforms (for this site) suggest that quite a bit of core reduction also occurred. Exotic materials comprise 52.7 percent of this assemblage, which is the second smallest amount for the site. However, like the other components, glassy and fine-grained materials dominate, with only 4.6 percent of the assemblage comprised of coarser-grained materials. Only 2.1 percent of the debitage was used as informal tools. Five formal tools were found; in addition to two large biface fragments, a projectile point preform and two projectile point fragments were recovered. A mixed assemblage seems likely, as this component seems neither wholly Archaic nor Pueblo when compared to most of the other components. Materials exposed by the erosion of Stratum 1 probably became mixed with later artifacts deposited on top of the lower terrace by Pueblo occupants, creating a jumble of assemblages that cannot be separated. However, considerable evidence for large biface production suggests that this assemblage is dominated by Archaic materials, with an unknown amount of contamination from the Pueblo occupation.

Like LA 65005, core reduction appears to have dominated at LA 65013. Some evidence of biface manufacture was also found, but it appears to have been a minor activity. However, the configuration of several cores, a moderately high flake to angular debris ratio, and the predominance of lipped platforms suggest the occurrence of some systematic core reduction to maximize the number of flakes produced. For the most part, however, debitage assemblage indicators suggest that expedient core-flake reduction dominated. Materials were mostly procured from local sources; exotics comprise only 5.4 percent of the assemblage. Materials are mostly glassy and fine-grained, but coarser materials make up 12.2 percent of the assemblage, which is the second highest proportion (after LA 65005). Informal tools make up 4.4 percent of the debitage, and several formal tools were recovered including a chopper, a spokeshave, and two chopper-hammerstones in addition to a large biface fragment.

Distinct differences can be seen between the unmixed Archaic assemblages and those created by later occupations. Where the Archaic occupations focused on the manufacture of formal chipped stone tools from exotic and local materials, later occupations were more oriented toward the expedient reduction of local materials. Some informal tool use was noted in each assemblage, but because of the conservative standards used to assign debitage to this category, it is likely that only a small percentage of the informal tools were actually identified. Thus, the presence of informal tools in these assemblages (other than strike-a-light flints) simply means that debitage was used, not that such a usage was restricted to a certain percentage of the assemblage. The percentages derived by this analysis may indicate that informal tool use was more common in some components than others, but this is tentative.

To summarize, the manufacture of large general-purpose bifaces was the main focus of reduction in at least two of the three unmixed Archaic assemblages from LA 65006. While other maintenance and production activities are suggested by the presence of formal tools other than large bifaces, their production and use seem incidental to large biface manufacture. Little evidence of formal tool manufacture was seen in the later assemblages from LA 65005 and LA 65013. Instead, reduction in those components focused on the expedient production of flakes from cores, presumably for use as informal tools. Other than a possible gunflint from LA 65005 and a spokeshave and biface from LA 65013, formal tools from these components are large and durable, and were used in pounding or chopping activities. All formal tools from the Archaic components at LA 65006 functioned in cutting or scraping tasks. Thus, different ranges of activities in addition to different reduction strategies are indicated for the Archaic versus the later assemblages.

CHAPTER 9. ANALYSIS AND INTERPRETATION OF CERAMICS FROM THE PEDRO SÁNCHEZ SITE

Daisy F. Levine

The total assemblage from LA 65005 consists of 2,373 sherds, 25.6 percent of which were sampled and analyzed in detail. The sampled assemblage consists of 607 sherds, mostly of historic Tewa manufacture, and initially were thought to represent a seventeenth-century occupation. There are also 25 prehistoric sherds, with a temporal range between the fourteenth and sixteenth centuries. Table 9.1 lists wares, frequencies, and percentages for the sample assemblage.

There were many innovations in ceramic styles and production techniques after the arrival of Spanish colonists in 1598. These include pottery *comales,* soup plates, ring-base (or footed) vessels, fiber-tempered pottery, mold-made vessels, mica-slipped utility wares, and new decorative styles (Warren 1979:235). Polished black and red wares, and polychromes, differentiated from Sankawi Black-on-cream by the addition of red to designs, also appeared (Schaafsma 1979:137). Mexican Indians were often members of Spanish Colonial households, and these changes have been attributed to Mesoamerican influence. Innovations first appeared at seventeenth-century Spanish sites, such as Las Majadas near Cochiti, and apparently continued into the next two centuries. Hemispherical bowls came into use during the eighteenth century, replacing the traditional shouldered style, and soup plates were common. During the nineteenth century there was a general trend toward uniformity in vessel form and a decrease in decorated vessels (Warren 1979).

Table 9.1. The Pedro Sánchez Site Ceramic Assemblage

Ware	Frequency	Percent
Tewa decorated wares	228	33.6
Utility wares	186	30.6
Tewa plain wares	161	26.5
Prehistoric wares	25	4.1
Glaze wares	6	1.0
Puname polychromes	1	0.2
Total	607	100.0

Decorated Wares and Plain Wares

Tewa Decorated Wares

The historic Tewa polychrome series is believed to be derived from Sankawi Black-on-cream (Harlow 1973:24-28; Mera 1939:11; Schaafsma 1979:137; D. Snow 1982:261; Wendorf and Reed 1955:156). This series is characterized by designs in black matte carbon paint, red and white slips, and tuff temper. It is found in the Tewa region; Santa Fe seems to be a dividing line, with the manufacture and distribution of matte-paint wares occurring to the north and glaze wares to the south. Sankawi Black-on-cream (A.D. 1550 to 1650) is an intermediate type between the Biscuit Wares and Tewa Polychrome. Manufacture of Sankawi Black-on-cream centered on the Pajarito Plateau, where it is abundant at several large villages including Tsirege, Sankawi, Potsuwi'i, and Puye.

Vessel form is the most distinctive feature distinguishing Sankawi Black-on-cream from Biscuit Wares. The upper body "spare tire" bulge first appeared on Sankawi Black-on-cream, and this is where most of the painted decoration is found. Rims are slightly flared, and there is no clear differentiation between vessel body and neck, as there is on the preceding Biscuit B jars. Jar bases are always concave, for carrying on the head. Bowl forms are gently rounded, and rims are flat (Harlow 1973:26).

Design style also changed from Biscuit B to Sankawi Black-on-cream. Sankawi designs were less formally laid out, and vessels were less extensively decorated, giving a more open and less busy appearance (Harlow 1973:26). Thinner lines were used in designs than in earlier types. As mentioned above, designs were mostly confined to the band defined by the spare tire bulge; however, some designs also occur in a band just below the lip, and sometimes on the lower part of the body. Occasionally red was added to the inside of jar rims or as a minor decorative element, which may be a precursor to the development of Tewa Polychrome (D. Snow 1982:261).

Harlow (1973:28) describes Sakona Black-on-tan and Sakona Polychrome as the next types in the sequence (Sakona Polychrome is Sakona Black-on-tan with the addition of a red slip on the underbody or rim top). The style and form description is very similar to that of Tewa Polychrome. A distinctive characteristic of Sakona

Polychrome noted by Harlow is the decoration of bowl interiors, while Tewa Polychrome is red slipped or unslipped on bowl interiors. Another characteristic is the use of multiple framing lines, while Tewa Polychrome generally has single framing lines. However, during analysis, these attributes were not always sufficient to warrant separating these types. There were bowl sherds that were decorated on the interior but were not large enough to have any framing lines present. To call all of these sherds Sakona Polychrome is to deny that any variation exists within Tewa Polychrome. It seems that whole, or at least partial, vessels are necessary to distinguish between these types. Indeed, as discussed in Chapter 12, *Spanish Adaptations to the New Mexican Frontier: LA 65005*, Batkin (1987, 1991) rejects the Sakona types and feels they reflect errors made during initial definition of Tewa Polychrome.

Tewa Polychrome (A.D. 1650 to 1730, Harlow 1973:77; A.D. 1675 to 1720, Warren 1979:237) is the first distinct type on which the addition of a red slip appears, beginning with the Tewa polychrome sequence in the mid-seventeenth century. The influence for this addition was probably from the Rio Grande glaze ware tradition to the south, as there was considerable contact with the manufacturers of those wares. Tewa polychrome vessels were found in increasing quantities in the lower Rio Grande during the mid-seventeenth century, possibly as a result of decreasing local ceramic production (the Indian population no longer had access to the high-quality lead needed for glazes at this time) and individual preference by Spanish colonists (D. Snow 1982:262).

Before proceeding further, a source of possible confusion should be clarified–that is the difference between Tewa polychrome (small p) and Tewa Polychrome (capital P). The former refers to a ceramic series manufactured from the early Spanish Colonial period to the present day. The latter is a specific type in the series.

Spanish influence is seen in Tewa vessels, particularly in regard to form. Tewa Polychrome soup plates, candlesticks, and footed vessels are found at seventeenth-century sites. Hemispherical bowls, also considered a Spanish form, are found later, beginning in the early eighteenth century. This form first appeared in Ogapoge Polychrome.

Treatment of slip provides distinctive attributes for identifying Tewa Polychrome. Both red and white slips were applied to different areas of the buff-colored vessel body. The red slip was always applied before the white, so that the white overlaps the red at their juncture. This technique contrasts with later Tewa types (post-1750) in which the red overlaps the white. Another characteristic is that red slip is liberally used in Tewa Polychrome. Vessel underbodies were red slipped almost down to the basal support area, and the upper parts of jars were also covered with red slip. Use of red slip was much curtailed in later types. Harlow (1973:29) also considers fine crazing of the white slip to be typical of Tewa Polychrome, though this characteristic was not evident in our analysis because of the high degree of erosion present in the assemblage.

Tewa Polychrome jars have a white band around the spare-tire mid-body on which fine-line designs are applied in black carbon paint. Lines can be straight or curvilinear. Curvilinear designs are derived from Sankawi Black-on-cream and possibly from Hopi and Zuni sources (D. Snow 1982). Jars are red slipped above and below the design band to within two-thirds of the distance to the base of the vessel; the last third of the lower section is polished over the buff paste.

Bowl upper bodies are concave or straight, and meet the underbody at a sharp keel. Mera (1939:11) believed this form was borrowed from a Middle Rio Grande source. The design is painted on the upper body exterior, which is white slipped, while the underbody is red slipped (Harlow 1973). Underbody slipping is the same as on jars; thus, the lower third is polished but unslipped. The interior is polished and may or may not be slipped. Bowls are more common than jars in this type. Soup plates were also made, though not in great numbers. The decoration is found on the flat rim of soup plates rather than on the interior.

Many Tewa Polychrome sherds from LA 65005 do not conform to the attributes defined by Harlow. Our assemblage contains decorated portions of jar sherds representing the juncture of upper or lower body and the decorated mid-body band (Fig. 9.1). This point should

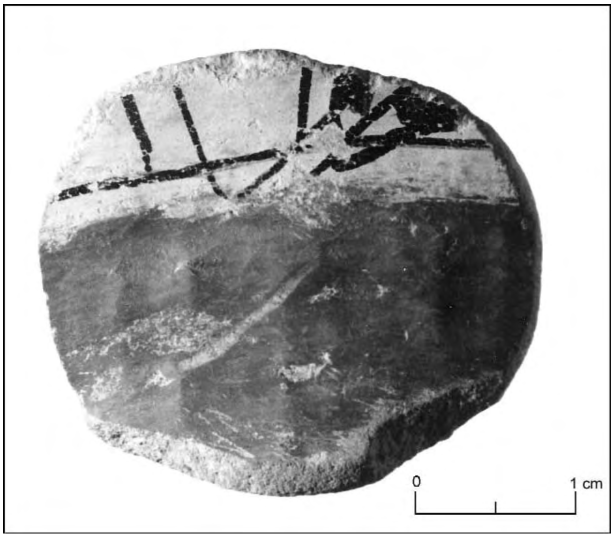

Figure 9.1. Tewa Polychrome jar sherd that has been worked, showing the juncture between the decorated mid-body band and the upper section of the red-slipped underbody. Note the lack of a "spare-tire" bulge.

have been the beginning of a spare-tire bulge, but in many cases was not. Instead, there was a gradual curve between the red-slipped portion and the white-slipped portion. There are also bowl sherds decorated on the interior, which by definition are Sakona Polychrome, not Tewa Polychrome. Classifying all of these sherds as Sakona Polychrome based on this single attribute is not reasonable, particularly when design elements more closely resemble Tewa Polychrome (although there is some overlap in designs between the two types). Therefore, some revision may be necessary in the Tewa Polychrome definition. Our sample of identifiable sherds is not large enough, and our sherds are too small to warrant revising the definition at this point. Future analysis, though, should closely observe these attributes.

Carbon-on-red wares are as yet not well defined. The only formally named types are Powhoge Black-on-red and San Ildefonso Black-on-red. Powhoge Black-on-red is closely related to Powhoge Polychrome, and dates from around A.D. 1880 to 1900. San Ildefonso Black-on-red dates from 1880 to 1930 (Harlow 1973:78,173). However, black carbon-on-red sherds were found at LA 65005 (Table 9.2), as well as at the Torreon site (LA 6178), which dates to the early 1700s. Warren (1979:237) assigns a beginning date of A.D. 1680 to what she calls "Tewa Black-on-red." This is an appropriate designation, as black-on-red apparently first appears in association with Tewa Polychrome.

Pojoaque Polychrome (A.D. 1720 to 1760) is considered an intermediate type between Tewa and Ogapoge Polychrome. In form and design layout, it resembles Tewa Polychrome. However, the designs are bolder, and the vessel base has only a red band of slip, a characteristic seen in succeeding types.

Ogapoge Polychrome (A.D. 1720 to 1760) is the next type in the Tewa series, and is predominantly distinguished from earlier types by the addition of red paint to design elements. Design elements are also different from those used in earlier types, which were dominated by lines and dots. Feather motifs were favored in Ogapoge Polychrome, the tips of which are often filled with red. These designs are reminiscent of Hopi-Zuni-Acoma styles (Harlow 1973:30). The use of red slip is greatly reduced in comparison to earlier types; jar upper bodies are white, and red slip is restricted to a narrow band just below the lowest framing line.

Ten sherds from LA 65005 have red in the design but cannot be classified as Ogapoge Polychrome. Design elements on these sherds are geometric, such as checkerboards with filled in red squares outlined heavily in black (Fig. 9.2). Most of these sherds are from the same vessel, and the ceramic type is unknown. Red in the design generally indicates Ogapoge Polychrome, but the geometric design is not an Ogapoge style. Only one sherd, the base of a footed vessel, is definitely Ogapoge Polychrome (Figs. 9.3 and 9.4). This is puzzling, since ring-based vessels are mostly confined to the seventeenth century, but Ogapoge Polychrome is an eighteenth-century type.

TABLE 9.2. DECORATED CERAMIC ASSEMBLAGE FROM THE PEDRO SÁNCHEZ SITE

CERAMIC TYPE	COUNT	PERCENTAGE
Puname polychromes	1	0.4
San Juan Red-on-tan	1	0.4
Carbon-on-cream (historic)	1	0.4
Sakona Polychrome (?)	7	3.1
Tewa Polychrome	18	7.9
Pojoaque Polychrome	5	2.2
Tewa/Pojoaque Polychrome	9	3.9
Unknown, with red design	10	4.4
Ogapoge Polychrome	1	0.4
Powhoge Polychrome (?)	1	0.4
Black-on-red	4	1.8
Undifferentiated Tewa polychrome	169	73.8
Indeterminate Red-on-buff	2	0.9
Total	229	100.0

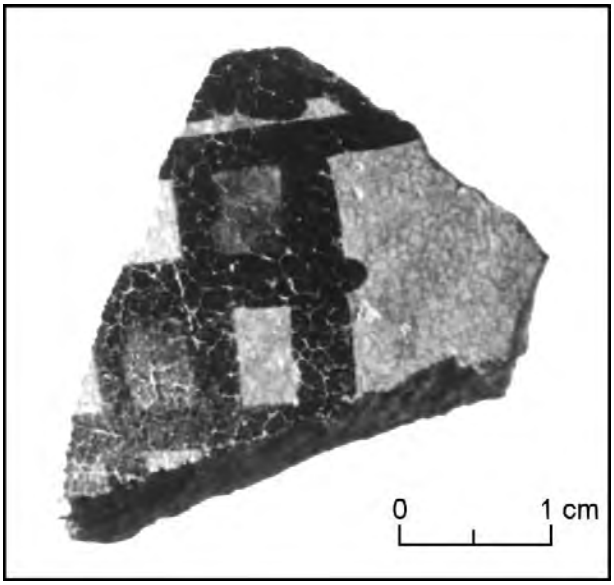

Figure 9.2. Possible Tewa Polychrome sherd illustrating a checkerboard design with red fill.

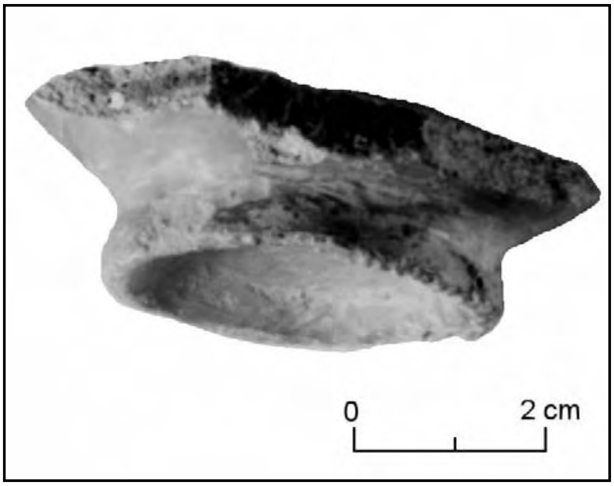

Figure 9.3. Edge view of a sherd from an Ogapoge Polychrome ring-based vessel.

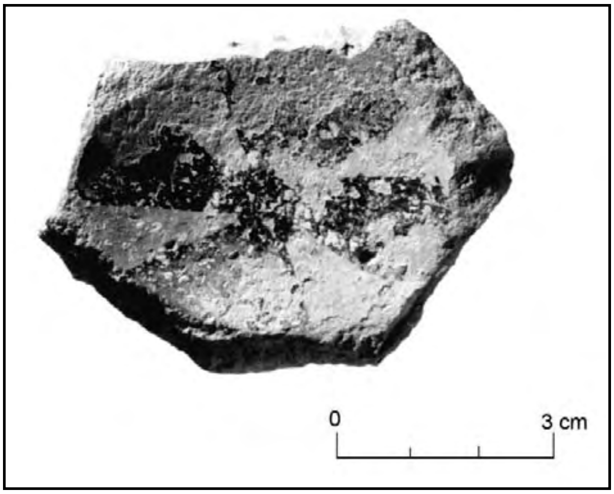

Figure 9.4. Enlargement of decorated interior of the Ogapoge Polychrome ring-based vessel sherd showing a cruciform design with arms painted black (left and right) and red (upper and lower).

Powhoge Polychrome (A.D. 1760 to 1850) is characterized by bold, heavy, geometric designs. Decoration consists of black carbon paint over a white slip, and red paint is no longer used in design elements. Vessel forms include globular jars and more rounded bowls than preceding types. The use of red slip is restricted as it was on Ogapoge Polychrome. Only one possible Powhoge Polychrome sherd was found at LA 65005.

Non-Tewa Decorated Wares

The only non-Tewa decorated wares found at LA 65005 were Puname Polychrome, which first appeared around A.D. 1680 and were manufactured until some time after 1750. They are characterized by a brick-orange slip, have designs in mineral paint, and are tempered with basalt (Zia) or large rounded sand grains (Santa Ana). Only one sherd of Puname Polychrome was included in the analyzed sample, and six were in the total assemblage.

Tewa Plain Wares

Tewa Red (named Posuge Red by Mera in 1939) first appeared at about the same time as Tewa Polychrome. This type has a highly polished red slip over the exterior of a vessel, extending from the rim to two-thirds of the way down to the base, and is characterized by jars with flaring rims. Mera suggested a Middle Rio Grande or southern influence for this type. Snow and Warren (1973) suggest that it may be genetically related to Salinas Red as well as Glaze F forms. Salinas Red, a seventeenth-century Middle Rio Grande ware, is basically an unpainted glaze ware, which occurred abundantly at Abo and was described by Toulouse (1949). Lacking whole vessels or rims, sherds of Posuge Red are difficult to distinguish from red-slipped portions of polychrome or San Juan Red-on-tan vessels. Therefore, the name Tewa Red is used to denote these sherds in our assemblage.

Tewa Red was the most common plain ware at LA 65005, comprising 45.3 percent of the sampled plain ware assemblage (Table 9.3), 44.3 percent of the total plain ware assemblage, and 21.4 percent of the total ceramic assemblage. The only other common plain ware type is Tewa buff/brown (22.8 percent of the total site assemblage), which is indicative of either basal or eroded portions of polychromes or red wares; some may be misfired red wares.

Table 9.3. Plain Ware Assemblage from the Pedro Sánchez Site

Ceramic Type	Count	Percentage
Tewa Black	8	5.0
Tewa Gray	18	11.2
Tewa Red	73	45.3
Tewa Buff/Brown	59	36.7
Buff/brown, historic undifferentiated	3	1.9
Total	161	100.1

Tewa Black Ware, originally called Kapo Black by Mera (1939:15) after the Tewa name for Santa Clara, is basically a smudged Tewa Red. Jars are more common than bowls and forms resemble those of Tewa Polychrome. Black wares are very rare at Pueblo Revolt period sites, and did not become popular until the early eighteenth century (Harlow 1973:40; Mera 1939:15). During the Pueblo Revolt period occupation of the Palace of the Governors, black wares formed only a minimal percentage of the assemblage (Seifert 1979:56).

Harlow's (1973:40) beginning date of A.D. 1720 for this type was based on a comparison of the slipped portion of black ware vessels and Tewa polychromes. The slip on Tewa/Kapo Black extends down the body of the vessel to the level that marks the bottom of the red band on polychrome vessels. Since the transition from over-all basal red slip to a simple band of red slip occurred around 1720, Harlow considers this to be an appropriate beginning date for black wares. The main vessel form used for black wares changed around 1760, and since form is a critical attribute of Kapo Black, 1760 is cited as an ending date. However, black wares continue to be made to the present day, and the designation of Kapo Black is limited to whole vessels that conform to Mera's criteria.

A similar type was named Kapo Gray by Mera. This type is almost identical to Tewa Black except in the color of the vessel. Mera (1939:14) believed that the dark gray shade was the result of "inexperience in the handling of an unfamiliar process." Harlow (1973:40) suggests that these are simply polished unslipped black wares. Seifert (1979:56) disagrees, asserting that Kapo Gray is a slipped but incompletely fired black ware. The Tewa Gray from LA 65005 appears to fit this description, as most of it was slipped.

Origins of the Tewa Plain Wares

Hurt and Dick (1946:309) believe that these plain wares do not resemble either prehistoric or historic Pueblo pottery, and since no transitional forms had been found, they suggest that this style was introduced by Spanish missionaries from Mexico or by Mexican Indians who came with them. They feel that once the new ceramic styles were introduced to the Spanish-American settlers in New Mexico, they began to manufacture their own pottery.

The exact source for these pottery types in Mexico is unknown. However, there are strong resemblances between historic black wares and prehistoric wares found on the Rio Balsas in Mexico (Hurt and Dick 1946:309). Wendorf and Reed (1955:156) also believe these types were introduced from Mexico, stating that "…this seems to be the most plausible explanation, since the strongest appearance of these types was in the area first colonized, and since essentially similar pottery was made in southern Mexico."

Mera (1939) figured that black wares first appeared at the end of the seventeenth century, since polished black sherds are rarely found at pre-Pueblo Revolt sites, but he believed that this treatment was merely a new and refined version of a method used prehistorically. Smudged bowl interiors occurred more or less continuously along the Lower and Middle Rio Grande from before the twelfth century until the beginning of the eighteenth century. It might simply have been the result of a natural progression that bowl exteriors were eventually smudged as well.

Sources of the Tewa Wares from LA 65005

Most of the Tewa sherds in our sample, both plain and decorated wares, have tiny flecks of mica in their paste, indicating that a naturally micaceous clay was used. In discussing the later Powhoge Polychrome, Harlow (1973:33) observes that the size of mica flecks in the paste could be used to distinguish the village of manufacture. Large flakes (at least 1 mm across) indicated Námbe; a less micaceous paste indicated Tesuque or San Ildefonso. San Ildefonso, being furthest from the mountains, was expected to have less mica in the paste. This fits with our assemblage, since it often was not possible to macroscopically see the mica.

Olinger (1988) sorted Tewa sherds by area of manufacture using x-ray fluorescence. In the process, certain attributes, such as presence and size of mica in the paste, became apparent. Cuyamungue Pueblo, abandoned around A.D. 1700, was a major manufacturing center for Tewa Polychrome. Mica is not common in the paste of vessels from that village, with only a few flecks of gold-colored mica being visible. Visually, the paste resembles that of pottery from Pojaque Pueblo, but the chemical signature of the two villages is different (Olinger 1988:20). Olinger also found that San Ildefonso pottery had very fine temper containing little mica. Both San Juan and Santa Clara pueblos were known for plain ware production; San Juan was a center for tan and red wares, and Santa Clara for black wares. Santa Clara pottery has little or no mica in the paste. The surface of red wares from San Juan sparkles, and this quality is often attributed to the presence of mica. However, Olinger has found that it is actually caused by a smooth finish over a paste containing abundant ash temper.

Recent thought has been that Spanish colonists obtained most of their pottery from the pueblos nearest them. However, data from LA 20000, a seventeenth-century Spanish Colonial site near La Cienega, suggests that this is not always true. X-ray fluorescence was performed on a sample of glaze ware and polychrome sherds from that site. The results point to several areas of manufacture (Thomas et al. 1992:32). Glaze wares came from at least three different pueblos to the south, east, and southwest of the site. Matte-paint wares, though comprising only 15 percent of the total assemblage, originated in four Tewa pueblos to the north. Consequently, while it is natural to assume that the inhabitants of LA 65005 obtained their pottery from San Ildefonso based on its proximity and the low amount of mica in most of the pottery, x-ray fluorescence or petrographic analysis could pin down a more definite source or sources of manufacture. Unfortunately, we were unable to conduct either of these analyses, so this question remains unresolved.

Dating the Tewa Series Ceramics at LA 65005

Tewa Polychrome is almost always found in association with Tewa Red. During excavations at the Palace of the Governors, Seifert (1979:55-56) found that both of these types were common in seventeenth-century deposits, and Tewa Red comprised more than a quarter of the total assemblage. Mera (1939) noted that Tewa Polychrome and Posuge Red were popular during the Pueblo Revolt period occupation of Black Mesa. A combined high proportion of these types was believed to reflect the Pueblo Revolt period occupation of the Palace of the Governors. Later polychromes comprised less than 1 percent of the Palace of the Governors assemblage. At Kotyiti Pueblo, a Pueblo Revolt period site near present-day Cochiti Pueblo, intrusives from the Tewa region to the north included Tewa Polychrome, Tewa Red, and some Kapo Black. The ceramic assemblage was otherwise comprised of Glaze F and Salinas Red, both seventeenth-century types in the Middle Rio Grande (Warren 1979:239). Tewa Red is also common at Spanish Colonial homesteads and missions dating to the seventeenth century.

Polychrome frequencies at LA 65005 were difficult to determine since there were many undifferentiated decorated sherds that were too small or eroded to identify. Tewa Polychrome is the most common identifiable type in the decorated sherd assemblage (Table 9.2), but only 18 sherds were assigned to this category. If these are combined with those assigned to the Sakona Polychrome (n=7) and Tewa/Pojoaque Polychrome (n=9) categories, they still comprise only 5.6 percent of the sampled assemblage. In contrast, polychromes comprise 10.2 percent of the overall assemblage.

If the 169 sherds of "undifferentiated Tewa polychrome" belong to this category (combined Tewa, Sakona, and Tewa/Pojoaque Polychrome), it represents 33.4 percent of the sampled assemblage. If a more conservative half of these sherds are combined with that category, it still comprises 19.5 percent of the sample population.

While red wares comprise almost a quarter of the total assemblage, black wares are rare and make up only 3.8 percent of the total assemblage. Gray wares were not differentiated during the rough sort of the assemblage, but they make up only 3.0 percent of the sampled assemblage. Tewa Polychrome is the most common identifiable decorated type, and may comprise a large percentage of the total assemblage from this site. Thus, the plain and decorated wares in the LA 65005 assemblage seem to conform to the pattern seen at seventeenth-century Spanish Colonial sites.

Utility Wares

Three varieties of micaceous wares occur in the Northern Rio Grande. These are (1) those tempered with mica or mica schist, (2) those with a mica slip and a nonmicaceous temper, and (3) those made from residual clays containing mica flakes. Problems often arise when trying to distinguish residual clays from a paste that has had micaceous rock added to it.

There is a long-standing micaceous pottery-making tradition among the Pueblos in the Rio Grande region. Micaceous pottery first appeared in the Northern Rio Grande around A.D. 1300. These early types, Cordova and Cundiyo Micaceous, were ribbed and smeared-indented utility wares, and were associated with Wiyo Black-on-gray (Mera 1935). Sapawe Micaceous Washboard followed, and was found on Biscuit Ware sites dating between A.D. 1450 and 1600. These three types were tempered with crushed rock containing mica. Potsui'i Gray and Potsui'i Incised are mica-slipped wares, tempered with vitric tuff. They date between A.D. 1475 or 1500 and 1600 (Warren 1981).

Between A.D. 1400 and 1600 in the Middle Rio Grande the predominant utility ware was Rio Grande Micaceous, tempered with quartz-mica-schist (Mera 1935). This type has also been referred to as Blind Indented Corrugated. Another type, Faint Striated Utility Ware, was described at Pecos Pueblo by Kidder (1936). It is characterized by fine-grained micaceous sandstone temper, with minute flecks of mica on the exterior surfaces of jars.

D. Snow (1982:267) suggests that historic utility wares represent an aggregate of local and nonlocal prehistoric attributes. In the Chama Valley, Potsui'i Incised (A.D. 1450 to 1550) may have inspired attributes that characterize later historic Tewa utility types. These include the application of a micaceous slip or wash and exterior polish or burnishing. By the mid-seventeenth century, Tewa utility ware had a thick exterior micaceous slip, interior smudging and polish, and sometimes a micaceous paste, either as an addition or as a result of naturally occurring mica in the clay.

Vadito Micaceous was made from A.D. 1600 until the twentieth century, and was produced at Picurís and Námbe Pueblos. San Ildefonso Pueblo made micaceous pottery in the early twentieth century (Guthe 1925:22), and it is likely that they were also making it in the seventeenth century, as was Námbe and possibly other Tewa pueblos. Guthe (1925) documented clay sources, known in the 1920s as "Apache clay." This was a micaceous clay to which no temper was added. Vadito Micaceous is a culinary ware made from nonmicaceous clay with a prominent micaceous slip, consisting of a serecite mica-rich clay over a rough surface (Dick 1965:42-43, 143; F. Ellis 1964:35). Dick (1965:142) described the temper of Vadito Micaceous from Picurís as coarse quarzitic and arkosic (feldspar rich) sand, mica (sometimes as a natural constituent of the clay), and occasional pieces of gravel up to 10 mm in diameter. Most jar interiors have smoothed and smudged surfaces and are often polished.

Schaafsma (1979:144) found that arkosic sand was not a dominant temper in pottery from the Cerrito site near Abiquiú, and interpreted this lack as suggesting Tewa rather than Picurís manufacture. Another difference he noted was in temper size; where Dick described the temper as coarse, Schaafsma found it to be mostly medium. Ollas with everted rims were common at Picurís and Cerrito; bowls were rare, and had parallel sides. Vessels were thinly slipped, bowls on both surfaces, ollas on the exterior. The interiors of all jars and ollas have smoothed and smudged surfaces, and an interior polish was common at Cerrito. At Picurís, however, vessel interiors were only occasionally polished (Dick 1965:43).

The LA 65005 assemblage is similar to that from the Cerrito site. Arkosic sand is rare, temper is mostly medium, and jar interiors are smudged and often polished (38.1 percent of the Vadito sherds had polished interiors). Temper is generally undifferentiated sand (69.1 percent). Other tempering materials include quartz, mica schist, a combination of sand and tuff, and various combinations of the above. Everted rims with round cross sections are common. Slightly more than half of the sampled utility ware assemblage was Vadito Micaceous (Table 9.4).

A utility ware that is nearly identical to Vadito Micaceous, except for the absence of a micaceous slip, also occurs. This is probably Vadito Micaceous from which the slip has eroded. Mera observed that smudged and polished interiors were common in Rio Grande sand-tempered utility wares. These sherds had no exterior surface treatment characteristic of earlier types, such as smearing, indenting, washboard, or ribbing. In the seventeenth-century deposits from La Fonda, Wiseman (1988:8-12) found both Vadito Micaceous and a nonmicaceous plain ware. The nonmicaceous ware was so similar to Vadito that he called it Vadito Plain. Based on the similarities observed between these types by various researchers and noted in the LA 65005 assemblage, this is a reasonable designation. This was the second most common type of utility ware found at LA 65005 (Table 9.4).

Peñasco Micaceous was also made from about A.D. 1600 to the present. This culinary ware is manufactured from micaceous clay or has a micaceous temper added, with or without a mica slip. Peñasco Micaceous was described by Dick (1965) at Picurís. The clay contains biotite mica and grains of quartzitic sand. Vessels are usually unslipped, although a biotite micaceous slip does occur. This type is rare at LA 65005, but does appear in small numbers (Table 9.4).

Utility wares generally form a large percentage of Spanish Colonial assemblages. At the Palace of the Governors, micaceous utility wares were the most common type found (Seifert 1979:57). At LA 65005 utility wares comprise 38.4 percent of the total assemblage. In comparison, utility wares (both micaceous and nonmicaceous) make up 28.4 percent of the Las Majadas, 52.1 percent of the Cochiti Springs site, 46.1 percent of the Signal site, and 20.8 percent of the La Fonda assemblages (Alexander 1971; Bussey and Honea 1971; D. Snow 1973; Wiseman 1988). These are all seventeenth-century Spanish Colonial sites in northern New Mexico.

Table 9.4. Utility Ware Assemblage from the Pedro Sánchez Site

Ceramic Type	Count	Percentage
Vadito Micaceous	97	52.1
Plain, unpolished	76	40.9
Peñasco Micaceous	7	3.8
Plain, polished, mica-slipped	6	3.2
Total	186	100.0

Prehistoric Wares

There are 25 Northern Rio Grande prehistoric sherds and 6 glaze ware sherds in the LA 65005 assemblage (Table 9.5). Half of the identifiable Northern Rio Grande prehistoric sherds are Kwahe'e Black-on-white (A.D. 1125 to 1200). Other types include Wiyo Black-on-white, Biscuit A, and Biscuit B. These types are all precursors to the historic Tewa polychrome series.

Several glaze ware sherds were also recovered, and represent imports from villages to the south of Santa Fe. The identifiable glaze wares are all prehistoric; half represent Glaze C vessels dating between A.D. 1450 and 1490 (Table 9.6). No Glaze F, a seventeenth-century type, was found at LA 65005. The intrusive glaze ware sherds are contemporary with a Biscuit B assemblage rather than the historic occupation.

TABLE 9.5. PREHISTORIC WHITE WARE ASSEMBLAGE FROM THE PEDRO SÁNCHEZ SITE

CERAMIC TYPE	FREQUENCY	PERCENTAGE
Mineral-on-white, undifferentiated	1	4.0
Carbon-on-white, undifferentiated	1	4.0
Kwahe'e Black-on-white	13	52.0
Wiyo Black-on-white	1	4.0
Biscuit A	1	4.0
Biscuit B	5	20.0
Prehistoric, unknown	3	12.0
Total	25	100.0

TABLE 9.6. GLAZE WARE ASSEMBLAGE FROM THE PEDRO SÁNCHEZ SITE

CERAMIC TYPE	FREQUENCY	PERCENTAGE
Glaze-on-red	3	50.0
Glaze-on-yellow and red matte (Espinoso G/p?)	1	16.7
Espinoso G/p (Glaze C)	2	33.3
Total	6	100.0

VESSEL FORMS

Soup plates, also known as flange bowls, were an innovation at seventeenth-century sites. This form is thought to have a European or Spanish derivation, though it also occurred prehistorically in Mesoamerica (Warren 1979:238). Both plain wares and decorated types were made in this style. Comparing soup plate frequencies at several sites in the Cochiti area, Snow and Warren (1973:28) found that while only 8 percent of the ceramic assemblage at one seventeenth-century site was made up of soup plate sherds, the assemblages of two nearby sites dating to the same period contained 40 and 70 percent soup plate rims. They suggest that a low percentage of soup plates may be an indication of a Pueblo Indian rather than Spanish occupation (Snow and Warren 1973:28). Eleven soup plate sherds were found at LA 65005; six were decorated and five were plain. Decorated types were Tewa Polychrome and undifferentiated Tewa polychromes. Within the plain wares, three were Vadito Plain, one was Vadito Micaceous, and one was Tewa Buff.

Another seventeenth-century innovation was the ring base or footed vessel. A portion of one footed vessel of Ogapoge Polychrome was found at LA 65005. According to C. Snow (pers. comm. 1992), this form is an imitation of a Chinese porcelain chocolate cup. Footed vessels arrived with the Spanish in 1598, and are found almost exclusively at pre-Pueblo Revolt period sites. Fragments of footed vessels were found at seventeenth-century Spanish sites in the Cochiti area, the seventeenth-century mission at Abo, and in pre-Pueblo Revolt period storage pits at the Palace of the Governors.

It is often difficult to distinguish between Tewa polychrome series jar and bowl sherds, since both forms are decorated on the exterior. Our counts may therefore not be completely accurate. When there was any doubt, sherds were classified as “indeterminate form.” Jar sherds (26.7 percent) are more abundant than bowl sherds (15.0 percent) in the sample assemblage, though there is a high frequency of indeterminate bowl or jar sherds (28.8 percent). Eliminating indeterminate vessel forms, the plain wares are dominated by jars (81.8 percent), as are the utility wares (90.2 percent). Vessel forms are distributed differently in the decorated ware category, with 57.1 percent bowls and only 36.5 percent jars. The rest of the decorated wares are soup plates (4.8 percent) and keeled bowls (1.6 percent).

WORKED SHERDS

Seven worked sherds were found at LA 65005, and are mostly round or oval disks and a spindle whorl. They include two Tewa Polychrome sherds, two undifferentiated Tewa Polychrome sherds, one undecorated Puname Polychrome sherd, one Biscuit A sherd, and one plain unpolished utility ware sherd. Numerous spindle whorls were found at Las Majadas (Warren 1979:239). Worked sherds were common at the Palace of the Governors, where disks and rectangles were the most common forms. Disks were both perforated and unperforated, with the perforated specimens probably being used as spindle whorls, drill weights, or pendants. The unperforated specimens were probably blanks, unfinished pieces, or gaming pieces (Seifert 1979:84).

SUMMARY

Using traditional dates and comparisons with other Spanish Colonial sites in New Mexico, the historic ceramic assemblage from LA 65005 suggests a seventeenth-century occupation. It is not possible to determine whether this occupation occurred before or during the Pueblo Revolt period because of the limitations of our assemblage and the overlap of traits in those periods. The paucity of eighteenth-century decorated wares, such as

Ogapoge and Powhoge polychromes, a small amount of Tewa Black Ware, and a high frequency of Tewa Red Ware should place the assemblage solidly in the seventeenth century. The low number of soup plate rims may be indicative of occupation during the Pueblo Revolt period or by Pueblo Indians, but this is speculative.

However, the accuracy of many of the dates assigned to Tewa Polychrome series ceramics is questionable. Few Spanish Colonial sites have been accurately documented and dated, so good comparative data are rare. For example, Seifert (1979) assumes that the deposits encountered at the Palace of the Governors represent materials from before or during the Pueblo Revolt period occupation of that structure. However, documentary proof of that association is lacking, and no good absolute dates were obtained from those deposits. So, did they actually date to the assumed period, or could they represent significantly earlier or later uses of the Palace? The validity of dates assigned to Spanish Colonial period Tewa polychromes is discussed in Chapter 12, *Spanish Adaptations to the New Mexican Frontier: LA 65005*, and a much different view is presented.

CHAPTER 10. IDENTIFICATION AND ANALYSIS OF THE FAUNAL REMAINS FROM LA 65005, LA 65006, AND LA 65013

Linda S. Mick-O'Hara

Faunal remains were recovered from all three project sites. The sites included a Spanish Colonial residence (LA 65005), an Archaic camp (LA 65006), and a Pueblo fieldhouse (LA 65013). These sites produced small but intriguing faunal samples. Most of the faunal remains recovered during the project came from Feature 1 at the Pedro Sánchez site, but the evaluation of each sample provides evidence for a diversity in faunal resource use through time in the San Ildefonso area.

Faunal remains recovered from the Classic period FH site were minimal (n = 13) and represent materials from the fieldhouse mixed with historic surface refuse. Bone recovered from the Late Archaic San Ildefonso Springs site (n = 143) was highly fragmented, resulting in a small number of identifiable elements, but the distribution of these materials was of considerable aid in assessing activity areas around features at the site. The animal remains recovered from the midden at the Pedro Sánchez site illustrate the selection, processing, and use of predominantly domestic animals by site occupants, and provide data on butchering techniques and discard patterns relevant to this historic occupation.

The Pedro Sánchez Site (LA 65005)

Excavations undertaken in Feature 1 at this Spanish Colonial site resulted in the recovery of 365 pieces of bone. Added to this sample were 52 specimens recovered from a single grid excavated into Feature 1 during the testing phase. Most of the bone recovered was from domestic species introduced by the Spanish to the area, though a few local wild species were also identified. These two small assemblages were remarkably similar, and the taxa identified in the testing sample essentially predicted the contents of the excavation sample, including the few wild taxa that were encountered. Table 10.1 presents identified taxa by frequency (NISP) and percent for the combined testing and excavation samples.

Of the 417 pieces of bone recovered during testing and excavation at LA 65005, 345 pieces (82.7 percent) were so badly fragmented that they could be identified only as mammal or bird. All mammal remains were further divided into small, medium, and large categories when possible. The 72 remaining bone fragments were more specifically assigned to one order, one family, two combined genera, one genus, and seven species. These categories are included in Table 10.1.

Table 10.1. Summary of Faunal Taxa Identified in Testing and Excavation Samples from the Pedro Sánchez Site

Taxon	Frequency	Percent
Mammal	50	12.0
Small mammal	16	3.8
Medium mammal	78	18.7
Large mammal	199	47.7
Sylvilagus audubonii (Desert cottontail)	2	0.5
Canis familiaris (Domestic dog)	2	0.5
Order Artiodactyla (Even-toed hooved mammals)	22	5.3
Odocoileus sp. (Deer)	2	0.5
Bos/bison (Cattle or bison)	2	0.5
Family Bovidae (Cattle, bison, sheep or goat)	5	1.2
Bos taurus (Cattle)	10	2.4
Ovis/Capra (Sheep/goat)	16	3.8
Ovis aries (Domestic sheep)	4	1.0
Sus scrofa (Domestic swine)	1	0.2
Equus caballus (Horse)	2	0.5
Aves (Bird)	2	0.5
Meleagris gallopavo (Turkey)	4	1.0
Total	417	100.0

All but three of the identified species are domesticated animals, most of which were introduced by the Spanish. The nondomestic species *Sylvilagus audubonii* (desert cottontail) and *Odocoileus* sp. (deer) were common in the wild throughout the greater Southwest during the Spanish Colonial period, but occur only incidentally in this assemblage. In fact, cottontail was only found in the upper levels of excavation and may be contaminants from more recent use of the area. This possibility is supported by the fact that several pieces of undifferentiated large mammal long bones from the surface exhibited rotary saw cuts, indicating a more recent historic origin. Thus, other fragments of bone recovered from the surface may also be evidence of more recent historic trash disposal at this location.

Only one domestic species that was not introduced by the Spanish was found. The turkey was domesticated prehistorically in the New World, and it was introduced to the Spanish by the native inhabitants of Mesoamerica. The few turkey (*Meleagris gallopavo*) long bone fragments that were identified could have been from either wild or domestic animals hunted nearby or acquired from a nearby pueblo.

Both the fragmented and more specifically identifiable parts of the sample were dominated by large mammal bone, which comprises 63.1 percent of the overall sample. Since 62.5 percent of the identifiable large mammal bone was from domesticated species and only 3.1 percent was from demonstrably wild species, it is likely that domestic species played a primary role in the subsistence strategy used at this site. Indeed, it is also likely that the overall sample of large mammal bone was similarly dominated by domesticated species. Mandibular molars from one or two deer were the only demonstrably wild specimens in the large mammal category.

Faunal data from other Spanish Colonial sites in the Southwest indicate that domestic species clearly dominate those assemblages (Bertram 1990; Olsen 1974). In towns such as Santa Fe, domestic animals replaced all but incidental use of wild species during the Spanish Colonial period (Mick-O'Hara 1990, 1992; Rippel-Erickson 1989). A few wild species were also identified in the assemblage from Feature 1. Crass and Wallsmith (1992) suggest that if wild species were hunted, it was in proportion to their availability in the environment. This does not seem to have been the case at LA 65005 or other Spanish Colonial sites in the Southwest. Spanish colonization routinely brought a dramatic shift in the subsistence regimen. Domesticated mammals became the dominant meat source over local wild game.

Most of the large mammal bone in this assemblage falls within the order Artiodactyla and includes domestic species such as cattle, sheep, goat, and swine. Only a few specimens could be assigned to each of these species, but fragments assigned to the order Artiodactyla and the large and medium mammal categories are most likely also from these domestic species.

Bone elements in this assemblage are from a mixture of low and high meat utility segments. Low meat utility elements have little edible meat overlying bone mass (e.g., metapodials), while high meat utility elements have moderate to large amounts of edible muscle mass in association (Binford 1978a, 1981). A partial scapula and innominate identified as domestic sheep would be a prime example of a high meat utility element, while cranial fragments and phalanges identified as cattle would be examples of low meat utility elements. The presence of both high and low meat utility elements in Feature 1 suggests that these animals were killed and butchered at the site and not brought in as carcass segments (Lyman 1979). The amount of highly fragmented generally identifiable bone in all categories indicates that the animals butchered there were used as intensively as possible.

Both cattle and sheep/goat remains contribute significantly to this assemblage while other species are represented by only a few fragments. Swine at this site, as at many others in the Southwest, was probably only an occasional food item, and is represented by a single ramus. Horse, which is represented by second and third phalanges, and dog, which is represented by a partial femur and scapula, were probably not used as food and instead most likely represent chance deaths of mammals kept by site residents for other purposes.

The nondomestic taxa identified at LA 65005 suggest some use of wild animal resources from the general site area. As mentioned earlier, the cottontail remains were recovered from surface and near-surface contexts, so their exact association with the Spanish Colonial deposits is unknown given that more recent trash was encountered on the surface of the site. Deer, however, was probably an occasional part of the diet and was most likely hunted on an encounter basis from the surrounding area. The few turkey remains found could also be evidence of a similar encounter strategy, if they represent wild birds. Unfortunately, we were not able to determine this.

Excavation at LA 65005 identified seven strata, two of which were associated with cultural remains. Two other strata contained cultural materials intrusive from those units. Table 10.2 presents faunal taxa data by stratum. Most of the bone from these units was found in Strata 1 and 2, though a fair amount was also recovered from one of the noncultural levels (Stratum 4). The occurrence of turkey in Stratum 1 suggests that it was an occasional food source, as was deer, which was recovered from Stratum 2. These remains suggest similar animal usage throughout the use-life of this midden. A low incidence of burned bone may indicate that most hearth cleaning refuse was deposited elsewhere.

Most of the bone from Stratum 1 reflects both the use and reduction of the medium and large domestic mammals identified in the sample. The use of axe butchering to reduce the carcasses of these animals

TABLE 10.2. FAUNAL TAXA IDENTIFIED IN STRATA CONTAINING CULTURAL MATERIALS AT THE PEDRO SÁNCHEZ SITE

Taxon	Stratum 1	Stratum 2	Stratum 3	Stratum 4
Mammal	22	13	1	
Small mammal	3	9		2
Medium mammal	37	8	1	1
Large mammal	51	31	1	20
Canis familiaris (Domestic dog)	1			
Order Artiodactyla (Even-toed hooved mammals)	2	11		3
Odocoileus sp. (Deer)		2		
Bos/bison (Cattle or bison)	1	1		
Bos taurus (Cattle)		3		1
Ovis/Capra (Sheep/goat)	9	3		1
Sus scrofa (Domestic swine)				1
Equus caballus (Horse)	1			
Aves (Bird)				1
Meleagris gallopavo (Turkey)	4			
Totals	131	82	3	30

would result in numerous small bone fragments that are only generally identifiable. Huelsbeck (1991:63-64) suggests that mutton and beef were important meat staples in the western United States during colonization and the early historic period, and may have been more commonly butchered and used in the winter months when meat would not spoil as quickly as it would during the warm season. Turkey may also have been used mostly in winter months for the same reason (Huelsbeck 1991:64). The main use of these species during the winter is conjectural at this point, but makes for an interesting scenario. If the primary butchering of cattle and sheep took place in the fall, an occasional use of pork and turkey during the winter might have provided welcome variation in the diet.

Taphonomic Considerations

Butchering marks were rare in this assemblage, but the bone, overall, was extremely reduced. The high degree of fragmentation and the fact that most specimens could be identified as long bone fragments suggests that most cut marks and other signs of butchering may have been obliterated as long bones continued to be reduced. The splintering of long bones is always more dramatic in axe-butchered assemblages, but the elements recovered here are probably the result of deliberate reduction for the production of bone grease, the use of bone marrow, or both (Binford 1978a).

The only sawn long bone specimens from this site were found on the surface. It is interesting to note differences between Anglo and Hispanic butchering practices in the western United States. Lyman (1977) illustrates typical Anglo saw butchering from Fort Walla Walla, which was established in Washington in 1903. He identified very regular sawn sections from forelimbs, hind limbs, and the axial skeletons of cattle at that site. This butchering practice varies markedly from that used during the Spanish Colonial occupation at LA 65005, where elements were reduced and fragmented to the extent that they were often not identifiable to a specific level. The use of axe butchering results in far fewer identifiable element sections than does saw butchery.

Environmental alterations to bone occurred sporadically in the sample. Weathering was noted on 48 percent of the assemblage, which suggests that part of the midden was exposed to the elements for some time before it was buried, or was periodically re-exposed by sheet wash. If weathering was purely a result of exposure since the time of discard, an assessment of the length of exposure could be made by grading the stages of weathering present (Behrensmeyer 1978; G. Miller 1975). However, recent studies indicate that degree of weathering cannot be correlated with the amount of time bone elements were exposed to weathering agents unless those agents and the microenvironment are well understood (Lyman and Fox 1989). Since we do not have the requisite degree of control over these factors, such an attempt cannot be made. We can only say that weathering took place after these items were discarded, and it is most likely the result of repeated exposure to the elements and dissolution by groundwater activity. Canids, as well as sheet wash, could also have helped re-expose bone, but since only four fragments showed any evidence of carnivore impact, this is unlikely.

Burning was sporadic throughout the sample; 76 bone fragments (18.2 percent) exhibited evidence of thermal alteration. Of those bones with surface indications of burning, 41 (11.2 percent) showed only slight thermal alteration in the form of tanning or mottling of the cordical tissue. The remaining 35 pieces of altered bone exhibited some blackening to calcining from direct contact with fire. These pieces may have been secondary deposits from hearth cleaning activities, and the presence of ash and charcoal encountered in the midden suggest that such refuse was part of those deposits.

Discussion

This faunal assemblage, though small and highly fragmented, provides insight into species used by the Spanish residents of the Pedro Sánchez site. Standard domestic animals such as sheep, cattle, goats, and swine that were introduced to the Americas by the Spanish (Reitz 1992; Wing and Brown 1979) are the primary contributors to this assemblage. The occasional use of nondomestics such as deer and (perhaps) cottontail along with an occasional turkey has been noted at other Spanish Colonial sites, especially in rural or mission settings (Bertram 1990; Olsen 1974). The faunal remains recovered from LA 65005 seem typical of Spanish Colonial sites investigated thus far in the Southwest. It is the preferential use of some domestic species over others in this area that is of interest.

Reitz (1992) has suggested that the domestic animals introduced by the Spanish during their colonization of the Americas fared better in some settings than in others. This success was then reflected in the success of the colonies themselves. She also suggests that introduced domestic species adapted more quickly and more successfully to environments that were similar to those from which they had originally come. Since both sheep and goats were previously adapted to the semiarid environments of Andalucia in Spain, the Canary Islands, etc., their success in the Southwest would have been a product of this adaptation. Cattle were also successful for similar reasons, but could not survive as well on some of the sparse landscapes where sheep thrived.

The San Ildefonso Springs Site (LA 65006)

Excavations at LA 65006 resulted in the recovery of 143 pieces of bone from all components (Table 10.3). Most of the bone (134 fragments, 93.7 percent of the sample) was highly fragmented and could only be classified as mammal. When possible, these specimens were further classified as small, medium, or large mammals. The remaining bones were assigned to one order and two species, but the species identifications are of domestic animals from the historic occupation; those species are *Bos taurus* (cow) and *Ovis aries* (sheep). Domestic cow is represented by the glenoid fossa portion of a right scapula, and a partial left femur was assigned to domestic sheep; both elements exhibit saw cuts. Since these specimens were saw cut rather than axe butchered, it is unlikely that they are related to occupation of the nearby Pedro Sánchez site. These specimens are probably related to other historic materials at LA 65006, which suggest a transitory historic occupation dating sometime between the 1930s and 1960s.

Seven bone fragments were assigned to the order Artiodactyla (even-toed hoofed mammals). When combined with fragments that were simply identified as large mammal, this category comprises 56.6 percent of the faunal remains from the site. The dominance of large mammal remains suggests that hunting was an important activity at LA 65006, but the degree of fragmentation indicates that each individual was intensively used, and that only a small number of individuals were procured during the various occupations (Mick-O'Hara 1987).

Table 10.3. Summary of Faunal Taxa Identified from Excavation at the San Ildefonso Springs Site

Taxon	Frequency	Percent
Mammal	49	34.3
Small mammal	7	4.9
Medium mammal	4	2.8
Large mammal	74	51.7
Order Artiodactyla (Even-toed hooved mammals)	7	4.9
Bos taurus (Domestic cattle)	1	0.7
Ovis aries (Domestic sheep)	1	0.7
Total	143	100.0

Component and Distributional Analysis

The distribution of faunal materials is shown by component in Table 10.4. Components 1 and 2 reflect Late Archaic occupations. Most artifacts in Component 3 are of similar date, but there was some evidence that materials from later occupations were mixed with them. Component 4 primarily consists of surface materials from the lower terrace, and represents a mixture of Archaic, Pueblo, and probably historic materials. Because of small assemblages and potential mixing, the two latter components are not discussed in detail. Fortunately, an interesting distribution of Archaic faunal remains was found in Components 1 and 2.

The remains from Component 1 were mostly found in and around Features 2 and 8 (both hearths) in the south part of the site, and Feature 7 (also a hearth) in the north part of the site. Figure 13.23 illustrates these concentrations. Most faunal materials were found southeast of these hearths or between Features 2 and 8. In general, the distribution of chipped stone debris (in *An Archaic Workshop Site: LA 65006,* Chapter 13) complements that seen in the faunal remains. Large mammal and artio-

Table 10.4. Taxonomic Frequencies for Identified Components at the San Ildefonso Springs Site

Taxon	Comp. 1	Comp. 2	Comp. 3	Comp. 4
Mammal	19	25		5
Small mammal	5	2		
Medium mammal	1	3		
Large mammal	32	38	2	2
Order Artiodactyla (Even-toed hooved mammals)	3	4		
Bos taurus (Cattle)				1
Ovis aries (Domestic sheep)			1	
Total	60	72	3	8

dactyl bone (Fig. 13.24) cluster around Features 2 and 8, as do small mammal remains (Fig. 13.25). The most highly fragmented remains that could only be classified as mammal are distributed differently, and concentrate around Feature 7. Thus, while the patterning of faunal discard is similar in both of these areas, the treatment of bone varied. Heavy fragmentation of faunal remains associated with Feature 7 suggests that the recovery of bone grease and marrow was probably a more important consideration in that area.

Faunal remains generally occur to the southeast of hearths. If site occupants dined around hearths, bone debris would tend to be discarded away from the seating area (Binford 1978a), and both seating and discard zones would change relative to wind direction (Binford 1980). This suggests that site occupants tended to be seated to the north or northwest of hearths during meal times, while the distribution of lithic debris suggests movement around hearths. Only 35 percent of the faunal remains from this component show any evidence of thermal alteration. All but one of those fragments were tanned or mottled from cooking, rather than heavily burned. This suggests that bone was generally not discarded into active fires, but was tossed into areas of less active use near hearths. Stiger (1986) found similar patterning at Late Archaic sites near Gunnerson, Colorado.

Component 2 was more areally restricted than Component 1, and contained only two hearths, Features 3 and 4. While a small area was excavated adjacent to and outside of Feature 4, all materials related to Feature 3 were obtained from soil samples taken from that hearth. Again faunal remains were highly fragmented, and only 38.0 percent showed some tanning as a result of cooking, and no specimens evidenced burning from direct contact with an active fire. Since most of the specimens from this component were obtained from hearth fill, it is likely that they were either discarded after the cooking fire was out or while it was dying. An unaltered fragment of antler was also found in this component, and may suggest that some bone was returned to the site for use in tool production. The overall fragmentation of bone from Component 2 also suggests an intensive use of animals similar to that seen in Component 1.

Taphonomic Considerations

As mentioned earlier, only about 38.0 percent of the faunal assemblage exhibited evidence of thermal alteration. This generally took the form of tanning of compact tissue, which occurs when meat is cooked on the bone. Only two elements in the assemblage exhibited evidence of weathering. This suggests that these materials were covered rather quickly after discard and were not reexposed prior to excavation (Lyman and Fox 1989). The highly fragmented nature of the bone assemblage and the relative absence of articular ends indicates that all game processed at the site was reduced as much as possible (Todd and Rapson 1988).

Discussion

Large mammal hunting seems to have been an important activity during the Archaic occupations at LA 65006. The faunal remains recovered from this site were fragmented to such a degree that few bones could be identified beyond the class level. The heavily fragmented bone and low occurrence of articular ends indicates that individuals were intensively used. Only a few individuals seem to be represented, which may suggest that the length of occupation was short.

The fauna recovered from LA 51912, a nearby Late Archaic pit structure (Lent 1991), also demonstrated a dependence on larger species. While the degree of fragmentation was not discussed for the faunal remains from that site, from the level of identification possible in that assemblage, it was probably high there as well. Sample sizes and the level of identification (and probably fragmentation) were similar for both sites, and it is likely that they represent similar faunal exploitation patterns.

Most faunal remains from LA 65006 were either found in or to the southeast of hearths. This pattern in combination with the distribution of chipped stone artifacts (see *An Archaic Workshop Site: LA 65006,* Chapter 13) suggest a use of space reminiscent of that found in other ethnographic and archaeological hunter-gatherer studies (Binford 1978a, 1981; Stiger 1986).

The FH Site (LA 65013)

Excavations at LA 65013 produced only 13 pieces of bone, all of which were recovered from around Features

Table 10.5. Summary of Faunal Taxa Identified from Excavation at the FH Site

Taxon	Frequency	Percent
Mammal	1	7.7
Small mammal	8	61.5
Large mammal	1	7.7
Sylvilagus audubonii (Desert cottontail)	2	15.4
Ovis/Capra (Sheep/goat)	1	7.7
Total	13	100.0

1 and 2 to the northeast of Structure 1. Table 10.5 summarizes these remains. Most (10 fragments) of the bone recovered could only be classified as mammal, and in some instances as small or large mammal. Only 3 specimens could be identified to the specific level. One was a piece of sheep or goat horn core that was found on the surface and most likely represents a recent historic contribution to the site. Two fragments of *Sylvilagus audubonii* (desert cottontail) bone were probably associated with the Pueblo occupation. This species is represented by a femur and an innominate fragment found in the area between Features 1 and 2.

Small mammal remains comprise most of the more generally identifiable sample (80.0 percent). This is partly supported by the few cottontail rabbit bones that were identified. While the size of this sample was so small that several sources of bias could be influencing our results, there was clearly a dependence on small mammals. The use of small animals drawn by agricultural fields has been studied ethnographically by Linares (1976), and seems to be a pattern of exploitation used by the Hopi (Bradfield 1971), Zuni (Cushing 1920), and others in the greater Southwest.

Summary

Temporally and behaviorally the three sites investigated by this project present a diverse picture of the use of this area. The faunal samples provide information on behavioral issues and can be used to complement the analysis of other artifact classes. They can also be contrasted to allow us to compare a variety of subsistence and occupational foci that used the same general area.

The Spanish Colonial assemblage from LA 65005 contained mostly domestic taxa, although there was also evidence of a small, perhaps incidental, use of wild species. This appears to be typical of Spanish sites; however, while still dominated by domestic taxa, a Territorial period site in the Abiquiú area contained a comparatively high percentage of wild animals (Moore et al. n.d.). Examination of bone fragments from the Pedro Sánchez site suggests that only axe butchering was done there. Along with the presence of both low and high meat utility elements, the character of this assemblage suggests that sheep/goats and cattle tended to be butchered and used at the site rather than obtained as cuts from elsewhere.

The faunal remains recovered from LA 65006 produced only general taxonomic information, but provide important distributional data in connection with other artifact types. Both large and small mammal remains were distributed around hearth areas. Such a distribution suggests that game was processed, used, and discarded near those features. Because those areas were not cleared of rubbish, it is likely that the occupations at this site tended to be short in duration and any reoccupations probably established new hearths and processing areas.

The small assemblage recovered from LA 65013 is also highly fragmented. Small mammals, especially cottontail, were the primary taxa used at this site. The relative paucity of faunal remains suggests this site was occupied for only a short period of time and that its occupants did not hunt extensively while living here.

CHAPTER 11. ANALYSIS OF POLLEN FROM THE SAN ILDEFONSO SPRINGS SITE

Richard G. Holloway

LA 65006, the San Ildefonso Springs site, is a multicomponent site containing Archaic camps, a Classic period ceramic and lithic scatter, as well as historic features. The site is located on a low terrace above the valley bottom and has been eroded by several gullies. Several superimposed paleosols were noted in gully exposures and these generally contained the Archaic deposits.

Fifteen samples were taken from the paleosols and adjacent strata and sent for analysis to the Castetter Laboratory for Ethnobotanical Studies at the University of New Mexico. The samples selected were intended for paleoenvironmental rather than archaeobotanical interpretation. In addition, off-site samples of the three paleosols were taken as controls for the strata sampled within the confines of the archaeological site.

The samples were collected from two excavation areas. In Grids 87-89N/50E, Strata 1 and 9 were at the bottom of the sample profile. The other area, Grids 101N/88-90E, contained Strata 1 and 9 at the top of the profile. Based on the presence of both strata (1 and 9) as markers, the various layers could be arranged stratigraphically. In both the results and discussion sections, the data are presented stratigraphically based on the composite profile.

Results

The following samples are presented and discussed in descending order, starting with the modern ground surface. Table 11.1 contains scientific and common plant names, while Table 11.2 contains data on raw pollen counts. Soil units are discussed in the order in which they occurred in stratigraphic columns.

Surface

Sample CLES 92157 was a surface control sample collected from the west end of the site. This assemblage was dominated by *Pinus* pollen (4,186 grains/g). A small quantity of *Juniperus* pollen was also present, with the remainder of the assemblage comprised of typical desert scrub constituents such as Poaceae, Cheno-am, *Artemisia,* and Asteraceae.

Table 11.1. Index of Scientific and Common Plant Names

Scientific Name	Common Name
Amaranthus	Pigweed
Artemisia	Sagebrush
Asteraceae ls.	Pollen morphological category
Asteraceae hs.	Pollen morphological category
Brassicaceae	Mustard Family
Cactaceae	Cactus Family
Cheno-am	Pollen morphological category
Cylindropuntia	Cholla Cactus
Ephedra	Mormon Tea
Erigonum	Buckwheat
Fabaceae	Bean Family
Indeterminate	Unidentifiable
Juniperus	Juniper
Lactuca	Lettuce
Liguliflorae	Cichoriae tribe, Composites
Lycopodium	Clubmoss
Malvaceae	Cotton Family
Nyctaginaceae	Desert 4 O'Clock Family
Onagraceae	Evening Primrose Family
Pinus	Pine
Platyopuntia	Prickly Pear Cactus
Poaceae	Grass Family
Quercus	Oak
Rosaceae	Rose Family
Solanaceae	Tobacco Family
Sphaeralcea	Globe Mallow
Taraxacum	Dandelion
Ulmus	Elm
Zea mays	Corn

Table 11.2. Raw Pollen Counts, San Ildefonso Springs Site

Pollen Type	Control CLES 92157	Stratum 13 CLES 92155	Stratum 12 CLES 92158	Stratum 12 CLES 92174[1]	Stratum 15 CLES 92162	Stratum 16 CLES 92165	Stratum 16 CLES-92176[1]	Stratum 20 CLES 92160
Pinus	145	19	32	73	7	15	18	0
Juniperus	4	0	2	0	2	1	1	0
Quercus	0	0	0	0	1	0	0	0
Ulmus	0	1	0	0	0	0	0	0
Rosaceae	0	0	0	0	0	0	0	0
Onagraceae	0	0	79	0	0	0	0	0
Solanaceae	0	0	0	0	0	0	2	0
Nyctaginaceae	0	0	***1***	***1***	0	0	0	0
Brassicaceae	0	0	0	0	0	0	0	0
Malvaceae	0	0	0	0	0	0	0	0
Fabaceae	0	0	0	0	0	0	0	0
Erigonum	0	0	***1***	0	0	0	0	0
Poaceae	7	0	20	15	0	2	20	0
Cheno-am	22	25	30	63	8	28	100	0
Cheno a. f.	0	1	0	0	0	0	0	0
Asteraceae-high spine	10	3	2	15	1	3	12	0
Asteraceae-low spine	10	4	14	6	0	0	9	0
Artemisia	2	1	4	0	0	2	1	0
Liguliflorae	0	0	1	0	0	0	0	0
Platyopuntia	0	0	0	0	0	0	0	0
Cylindropuntia	0	0	***3***	***4***	0	***1***	0	0
Cactaceae	0	0	0	0	0	0	0	0
Ephedra	0	0	0	0	0	0	1	0
Unknown	0	0	1	0	0	0	0	0

Table 11.2. Continued.

Pollen Type	Control CLES 92157	Stratum 13 CLES 92155	Stratum 12 CLES 92158	Stratum 12 CLES 92174[1]	Stratum 15 CLES 92162	Stratum 16 CLES 92165	Stratum 16 CLES-92176[1]	Stratum 20 CLES 92160
Indeterminate	12	18	28	28	6	10	41	0
Sphaeralcea	0	0	0	0	0	0	0	0
Zea mays	0	0	0	0	0	0	0	0
% indeterminate	.06	0.25	0.13	0.14	0.24	0.16	0.20	ERR
marker	50	180	70	136	102	66	183	53
magnification	20	20	20	20	20	20	20	20
transects	6	4	13	19	6	7	14	12
pollen sum	212	72	218	205	25	62	205	0
weight (g)	5.1	25.1	25	30.1	25	25	31.2	25
total transects	25	25	26	28	26	28	28	28
marker/slide	208	1125	140	200	442	264	366	124

Samples from paleosols were obtained from on-site and off-site columns for comparative purposes.
[1] Sample taken off-site
Bold italic numbers: grains observed in scan of slide

TABLE 11.2. CONTINUED.

POLLEN TYPE	STRATUM 1 CLES 92159	STRATUM 1 CLES 92173[1]	STRATUM 9 CLES 92163	STRATUM 2 CLES 92161	STRATUM 3 CLES 92156	STRATUM 10 CLES 92175	STRATUM 4 CLES 92164
Pinus	28	66	7	4	7	4	35
Juniperus	1	4	1	2	0	3	5
Quercus	0	3	0	0	0	0	1
Ulmus	0	0	0	0	0	0	0
Rosaceae	0	0	0	0	0	0	0
Onagraceae	0	0	0	***1***	0	0	0
Solanaceae	0	0	0	0	0	0	0
Nyctaginaceae	0	0	0	0	0	0	0
Brassicaceae	0	0	0	0	0	0	0
Malvaceae	0	0	0	0	0	0	0
Fabaceae	0	0	0	0	0	0	0
Erigonum	0	0	0	0	0	0	0
Poaceae	3	16	3	0	0	8	10
Cheno-am	10	79	6	41	9	27	112
Cheno a. f.	0	2	1	0	0	0	0
Asteraceae-high spine	4	9	0	5	0	4	6
Asteraceae-low spine	0	6	0	0	1	0	8
Artemisia	2	4	0	0	0	3	0
Liguliflorae	0	0	0	0	0	0	0
Platyopuntia	0	0	0	0	0	0	0
Cylindropuntia	0	***1***	0	0	0	0	0
Cactaceae	0	***1***	0	0	0	***1***	0
Ephedra	0	1	0	0	0	0	1
Unknown	0	1	0	0	0	0	0
Indeterminate	15	13	3	18	5	20	40
Sphaeralcea	0	0	0	0	0	0	0
Zea mays	0	0	0	0	0	***1***	0
% indeterminate	0.24	0.06	0.14	0.25	0.23	0.29	0.18
marker	51	100	120	173	144	179	137
magnification	20	20	20	20	20	20	20
transects	7	4	4	5	6	3	6
pollen sum	63	206	21	71	22	70	218
weight (g)	25	26.8	25	25	25.1	23.4	25
total transects	25	25	22	25	27	25	27
marker/slide	182	625	660	865	648	1492	617

Bold numbers: grains observed in scan of slide.

Stratum 13

This stratum was a colluvial deposit post-dating the youngest paleosol. This sample (CLES 92155) did not produce a statistically valid pollen sum. The pollen concentration values of *Pinus,* Cheno-am, and Asteraceae were extremely low with a corresponding high percentage (25 percent) of indeterminate pollen. Due to conditions of preservation, pollen counting on this sample was terminated. A scan of the uncounted portion of the slide revealed no grains of cultigen pollen.

Stratum 12

This was the youngest and topmost paleosol. Sample CLES 92158 was taken from within the confines of the site. This assemblage was unique in that the dominant pollen type was Onagraceae. *Pinus* and Cheno-am were higher than in Stratum 13, but still fairly low. Traces of Nyctaginaceae and *Eriogonum* pollen were also found. An additional sample from this stratum (CLES 92174) was taken off-site. While the total concentration values are somewhat lower than from CLES 92158, this appears to be due to the absence of Onagraceae pollen. Concentration values of *Pinus* and Cheno-am appear similar. Nyctaginaceae and *Cylindropuntia* pollen, while much lower, are both still present. A number of other taxa have dropped out, however, including *Eriogonum, Artemisia,* and Liguliflorae.

Stratum 15

This stratum was a layer of light yellowish brown sandy clay which separated the upper paleosol (Stratum 12) from the second paleosol (Stratum 16). This pollen assemblage (CLES 92162) was not well preserved. The dominant taxon was Cheno-am (114 grains/g). *Pinus, Juniperus,* and *Quercus* pollen were present but in low concentration values.

Stratum 16

This stratum was the middle paleosol and was identified as the A horizon of a weakly developed soil buried prior to the formation of lower horizons. It contained no cultural materials. The pollen assemblage (CLES 92165) was dominated by Cheno-am and *Pinus* pollen. Traces of *Juniperus, Artemisia,* and *Cylindropuntia* were also present, and indeterminate pollen was high (220 grains/g). The pollen concentration values were quite low from this sample. The assemblage appeared to be very deteriorated, based on examination of the grains. The pollen types recovered were all those which are extremely resistant to deterioration. Because of this, pollen counting was terminated. A second sample (CLES 92176) was taken from this same stratum but away from the archaeological materials. The dominant taxa such as Cheno-am and indeterminate pollen yielded virtually identical pollen concentration values. This off-site sample contained traces of Solanaceae, Asteraceae, and *Ephedra* pollen. *Pinus, Juniperus,* and *Artemisia* pollen, while present, were much lower than in sample 419.

Stratum 20

This stratum was an alluvial deposit of light yellowish brown sand that separated the middle paleosol (Stratum 16) from the oldest paleosol (Stratum 1). No pollen was present in this sample (CLES 92160).

Stratum 1

Stratum 1 was the oldest paleosol sampled (CLES 92159). It was composed of a light brownish gray fine sandy loam with some gravel inclusions. Cultural materials occurred throughout the unit. This assemblage was dominated by *Pinus,* and secondarily by indeterminate type pollen (426 grains/g). Cheno-am pollen was low (284 grains/g) and high spine Asteraceae and *Artemisia* were both present. Again, an off-site sample (CLES 92173) from the same stratum was taken and this assemblage was clearly dominated by Cheno-am pollen (1,068 grains/g). A few Cheno-am anther fragments were identified, and both high and low spine Asteraceae and *Artemisia* were present. Small quantities of *Juniperus* and *Quercus* pollen were recovered, as were small amounts of *Cylindropuntia,* other members of the Cactaceae family, and *Ephedra* pollen.

Stratum 9

This stratum was a layer of fine light yellowish brown sand. No cultural materials were recovered from this unit and it was thought to represent stream channel deposits. The pollen assemblage was severely deteriorated (CLES 92163). Traces of Cheno-am, Poaceae, *Pinus, Juniperus,* and indeterminate pollen were the only taxa recovered and the total pollen concentration values were extremely low. Based on these data and because these were stream channel deposits which are notorious for their lack of pollen, counting was terminated.

Stratum 2

Stratum 2 was a layer of pale brown sandy clay that represented the B horizon of a moderately well developed soil profile. The pollen assemblage (CLES 92161) was dominated by Cheno-am and indeterminate pollen with only traces of a few other taxa.

Stratum 3

Stratum 3 was a layer of light yellowish brown water-deposited sand. Its appearance suggested a single depositional event. The assemblage (CLES 92156) contained very little pollen and was clearly dominated by indeterminate types.

Stratum 10

This stratum was a layer of very pale brown sandy clay representing the edge of an erosional channel that truncated the deepest cultural deposits. The sample from this unit (CLES 92175) was dominated by Cheno-am and indeterminate pollen. There were also traces of Asteraceae, Poaceae, *Pinus,* and *Juniperus*. A single grain of *Zea mays* pollen was identified in the scan of the slide.

Stratum 4

This was a layer of light brownish gray clayish sand that represented the main Archaic occupation zone and contained abundant artifacts. The sample from this stratum (CLES 92164) was clearly dominated by Cheno-am pollen, with *Pinus* and small quantities of *Juniperus* and *Quercus* pollen also occurring. *Ephedra* and Asteraceae pollen were also present.

Discussion

A statistically valid count of 200 grains/sample was attempted for each stratum. However, due to the state of preservation of many samples, this was not possible. If the proportion of indeterminate pollen was greater than 25 percent *and* the estimated pollen concentration value was less than 1,000 grains/g, counting was terminated. Counting did not terminate until a minimum of 50 marker grains were counted. Using these data, a fairly reliable estimate of pollen concentration was tabulated using the formula explained earlier (see Chapter 3, *Field and Analytical Methods*). During this preliminary tabulation, records were kept on the number of transects examined in order to reach the estimate. Further examination of the remainder of the slide was conducted to look for pollen from cultigens. Unfortunately, none were found.

Using a modification of Dean's (1992) technique to estimate pollen abundance of selected target taxa, averages were computed for the number of marker grains/transect of the rows actually counted. The number of marker grains present was estimated by multiplying this number by the total number of transects on the slide. Assuming that a cultigen pollen grain would be the next pollen grain encountered on a second slide, and applying these numbers to the formula above, a minimum concentration value for the selected taxon was obtained. These data are presented in Table 11.3. This indicates that if the target taxa are present in the sample, they are present in less than the minimum concentration value. Only 2 of the 15 samples would have had pollen present in quantities greater than 10 grains/g (10 and 12 grains/g respectively). Of the 13 remaining samples, only 4 contained minimum concentration values between 5 and 8. Thus 9 of the 15 samples would have had a minimum concentration value of 3 grains/g or less. These values were sufficient to suggest that no further examination of grains would be profitable.

In order to extract paleoenvironmental information from these data, Principal Components Analysis (PCA) was performed on the raw pollen count data set, and the results are presented in Table 11.4. According to these results, 85 percent of the observed variation is accounted for by the first two components. The eigenvector analysis suggests that these two components are controlled by the interaction of *Pinus* and Cheno-am pollen types.

When the first principal component is plotted against trends in several taxa (Fig. 11.1), the importance of the paleosols becomes more evident. The three paleosols, the cultural component (Stratum 4), and the surface control sample all reveal positive loadings of the component scores, whereas the intermediate strata contain negative loadings. None of the *Pinus* concentrations (except the surface) are large enough to conclude that *Pinus* was a member of the local community. Rather, these figures indicate that *Pinus* pollen was deposited as the result of long-distance transport.

Figure 11.2 is a graphic representation of pollen concentration values for several selected taxa. All three paleosols show slight increases in Poaceae, Cheno-am, and the Asteraceae pollen types. This is similar to the environment present today. The general trend of the pollen profiles is toward increased abundance of these taxa toward the surface. This indicates a process of drying and possibly reduced moisture conditions on a very gradual plane. This trend was interrupted at least three times when conditions stabilized for sufficient periods of time to at least initiate soil formation. This results in the greater abundance (at present) of both low and high spine composites, along with Cheno-am and Poaceae groups. Although more irregular, this same trend is observable with the *Cylindropuntia* group as well.

Two samples were collected from each paleosol location, one within the site boundary and one from off-site. The pollen assemblages from each pair of samples correspond closely to one another (Figs. 11.1 and 11.2) but are sufficiently different from adjacent, nonpaleosol

Table 11.3. Concentration Values, Pollen Samples from the San Ildefonso Springs Site

Pollen Type	Control CLES 92157	Stratum 13 CLES 92155	Stratum 12 CLES 92158	Stratum 12 CLES 92174[1]	Stratum 15 CLES 92162	Stratum 16 CLES 92165	Stratum 16 CLES 92176[1]	Stratum 20 CLES 92160
Pinus	4,186	152	663	646	99	329	114	0
Juniperus	115	0	41	0	28	22	6	0
Quercus	0	0	0	0	14	0	0	0
Ulmus	0	8	0	0	0	0	0	0
Rosaceae	0	0	0	0	0	0	0	0
Onagraceae	0	0	1,636	0	0	0	0	0
Solanaceae	0	0	0	0	0	0	13	0
Nyctaginaceae	0	0	***10***	***6***	0	0	0	0
Brassicaceae	0	0	0	0	0	0	0	0
Malvaceae	0	0	0	0	0	0	0	0
Fabaceae	0	0	0	0	0	0	0	0
Erigonum	0	0	***21***	0	0	0	0	0
Poaceae	202	0	414	133	0	44	127	0
Cheno-am	635	200	621	558	114	615	635	0
Cheno a. f.	0	8	0	0	0	0	0	0
Asteraceae-high spine	289	24	41	133	14	66	76	0
Asteraceae-low spine	289	32	290	53	0	0	57	0
Artemisia	58	8	83	0	0	44	6	0
Liguliflorae	0	0	21	0	0	0	0	0
Platyopuntia	0	0	0	0	0	0	0	0
Cylindropuntia	0	0	***31***	***24***	0	***5***	0	0
Cactaceae	0	0	0	0	0	0	0	0
Ephedra	0	0	0	0	0	0	6	0
unknown	0	0	21	0	0	0	0	0

TABLE 11.3. CONTINUED.

POLLEN TYPE	CONTROL CLES 92157	STRATUM 13 CLES 92155	STRATUM 12 CLES 92158	STRATUM 12 CLES 92174[1]	STRATUM 15 CLES 92162	STRATUM 16 CLES 92165	STRATUM 16 CLES 92176[1]	STRATUM 20 CLES 92160
indeterminate	346	144	580	248	85	220	260	0
Sphaeralcea	0	0	0	0	0	0	0	0
Zea mays	0	0	0	0	0	0	0	0
marker	50	180	70	136	102	66	183	53
magnification	20	20	20	20	20	20	20	20
transects	6	4	13	19	6	7	14	12
pollen sum	212	72	218	205	25	62	205	0
concentration	6,120	577	4,462	1,800	355	1,345	1,301	0
weight (gms)	25.1	25.1	25	30.1	25	25	31.2	25
average marker/transect	8.33	45.00	5.38	7.16	17.00	9.43	13.07	4.42
total transects examined	25	25	26	28	26	28	28	28
estimated # marker/slide	208.33	1,125.00	140.00	200.42	442.00	264.00	366.00	123.67
minimum concentration	7	1	10	6	3	5	3	12

[1] Sample taken off-site

Samples from paleosols were obtained from on-site and off-site columns for comparative purposes.

TABLE 11.3. CONTINUED.

POLLEN TYPE	STRATUM 1 CLES 92159	STRATUM 1 CLES 92173[1]	STRATUM 9 CLES 92163	STRATUM 2 CLES 92161	STRATUM 3 CLES 92156	STRATUM 10 CLES 92175	STRATUM 4 CLES 92164
Pinus	796	892	85	34	70	35	370
Juniperus	28	54	12	17	0	26	53
Quercus	0	41	0	0	0	0	11
Ulmus	0	0	0	0	0	0	0
Rosaceae	0	0	0	0	0	0	0
Onagraceae	0	0	0	***2***	0	0	0
Solanaceae	0	0	0	0	0	0	0
Nyctaginaceae	0	0	0	0	0	0	0
Brassicaceae	0	0	0	0	0	0	0
Malvaceae	0	0	0	0	0	0	0
Fabaceae	0	0	0	0	0	0	0
Erigonum	0	0	0	0	0	0	0
Poaceae	85	216	36	0	0	69	106
Cheno-am	284	1,068	72	343	90	234	1,185
Cheno a.f.	0	27	12	0	0	0	0
Asteraceae-h.s.	114	122	0	42	0	35	63
Asteraceae-l.s.	0	81	0	0	10	0	85
Artemisia	57	54	0	0	0	26	0
Liguliflorae	0	0	0	0	0	0	0
Platyopuntia	0	0	0	0	0	0	0
Cylindropuntia	0	***2***	0	0	0	0	0
Cactaceae	0	***2***	0	0	0	***1***	0
Ephedra	0	14	0	0	0	0	11
unknown	0	14	0	0	0	0	0
indeterminate	426	176	36	151	50	173	423
Sphaeralcea	0	0	0	0	0	0	0
Zea mays	0	0	0	0	0	1	0
marker	51	100	120	173	144	179	137
magnification	20	20	20	20	20	20	20
transects	7	4	4	5	6	3	6
pollen sum	63	206	21	71	22	71	218
concentration	1,790	2,762	254	588	221	599	2,306
weight (g)	25	26.8	25	25	25.1	23.4	25
average # marker/transect	7.29	25.00	30.00	34.60	24.00	59.67	22.83
total transects examined	25	25	22	25	27	25	27
estimated marker/slide	182.14	625.00	660.00	865.00	648.00	1491.67	616.50
minimum concentration	8	2	2	2	2	1	2

Bold italic numbers: Concentration calculated on basis of total slide.

TABLE 11.4. RESULTS OF PRINCIPAL COMPONENTS ANALYSIS ON RAW POLLEN COUNT DATA SET

CENTERED COVARIANCE MATRIX

AXIS	EIGENVALUE	PERCENT OF TOTAL	CUMULATIVE PERCENT
1	1,777.619	52.29	52.29
2	1,114.703	32.79	85.08
3	451.759	13.29	98.37
4	31.349	0.92	99.29
5	14.269	0.42	99.71
6	2.187	0.06	99.78
7	2.061	0.06	99.84
8	1.738	0.05	99.89
9	1.440	0.04	99.93
10	0.935	0.03	99.96
11	0.544	0.02	99.97
12	0.352	0.01	99.98
13	0.199	5.8E-0003	99.99
14	0.124	3.6E-0003	99.99
15	0.067	2.0E-0003	99.99
16	0.067	2.0E-0003	100.00
17	0.065	1.9E-0003	100.00
18	0.038	1.1E-0003	100.00
19	4.8E-0004	1.4E-0005	100.00
20	2.0E-0005	6.0E-0007	100.00

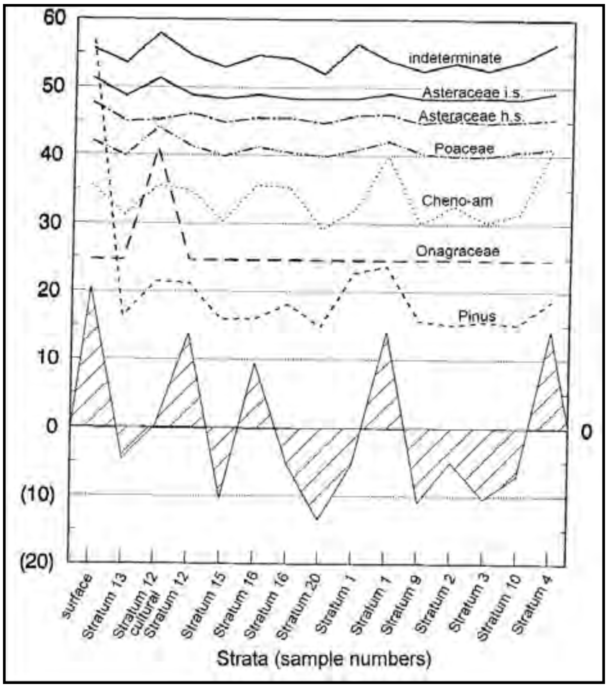

Figure 11.1. Comparison of principal components analysis and selected pollen taxa from the San Ildefonso Springs site.

Table 11.4. Continued.

Eigenvectors (Component Loadings)							
Plot		Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6
Pinus	A	0.75434	-0.64837	-0.02516	0.01325	-0.06087	-0.05005
Juniperus	B	0.02215	0.00365	-0.00141	-0.00373	-0.00370	0.00032
Quercus	C	0.00700	0.00538	-0.00058	-0.00198	-0.00155	0.00043
Ulmus	D	0	0	0	0	0	0
Onagraceae	E	0.00194	-0.01999	0.95691	-0.14357	-0.16077	0.12796
Solanaceae	F	0.00064	0.00774	-0.00059	-0.00189	-0.00106	0.00053
Nyctaginaceae	G	-0.00002	-0.00019	0.01121	-0.00168	-0.00188	0.00150
Erigonum	H	-0.00003	-0.00021	0.01212	-0.00182	-0.00203	0.00162
Poaceae	I	0.11972	0.07239	0.17432	-0.12177	0.91075	-0.32350
Cheno-am	J	0.60696	0.72020	-0.06683	-0.28337	-0.15280	0.03187
Cheno a. f.	K	0	0	0	0	0	0
Asteraceae-high spine	L	0.09379	0.01110	-0.04211	0.15849	0.34276	0.92016
Asteraceae-low spine	M	0.08225	0.00386	0.13134	-0.03848	-0.00405	0.00948
Artemisia	N	0.00929	-0.00642	0.03551	-0.00620	-0.00044	0.00154
Liguliflorae	O	0.00014	0.00035	0.01207	-0.00217	-0.000088	0.0004
Cylindropuntia	P	0.00983	-0.00034	0.03106	-0.00702	-0.00048	0.00168
Cactacea	Q	0	0	0	0	0	0
Ephedra	R	0.00585	0.00810	-0.00085	-0.00291	-0.00031	0.00065
Unknown	S	0.00014	0.00033	0.01142	-0.00205	-0.0000083	0.00040
Indeterminate	T	0.17862	0.23439	0.16443	0.92593	-0.00992	-0.16930

assemblages. An anomaly occurs with Stratum 12 (upper paleosol). In the assemblage taken from the site, the assemblage is clearly dominated by Onagraceae pollen. Members of this family are large-grained and insect-pollinated (entomophilous). Thus, it is unusual to find this type of pollen concentration for members of this family. There are several possible interpretations of the extraordinarily high and abnormal concentration values recorded. First, there is the possibility that it is the result of field contamination. However, several samples from the same column were taken at the same time and no others exhibit this phenomenon. Secondly, it could be the result of laboratory contamination. Again, eight samples were processed together during the extraction procedure, and only two contained Onagraceae pollen. The other sample contained a concentration value of 1 grain/g. If laboratory contamination were a problem, more than one sample would be expected to show evidence of it. Third, it may represent a natural deposit of flowers from this family. While this would be somewhat extraordinary, it is likely because there is no evidence of contamination.

Traces of Nyctaginaceae pollen were also present in both samples from this paleosol. It would appear that these taxa may have been introduced by cultural activity, although there is no concrete evidence to support this interpretation.

A single grain of *Zea mays* was recovered during the scan analysis of the slide from Stratum 10 and was present in very low concentration values of 1 grain/g. This is the only documented presence of *Zea mays* pollen in these samples. This suggests that corn was present in the area by the Late Archaic period. However, no inferences concerning whether it was brought in or grown locally can be drawn on the basis of a single grain. It is possible that since Stratum 4 immediately underlies Stratum 10, corn pollen was a contaminant from that unit, but this cannot be demonstrated with any certainty. An intensive scan of the sample from Stratum 4 was conducted subsequent to the environmental analysis to test this idea (Holloway 1993). The pollen concentration value for *Zea*

TABLE 11.4. CONTINUED.

PRINCIPAL COMPONENT SCORES

PLOT	AXIS 1	AXIS 2	AXIS 3	AXIS 4	AXIS 5	AXIS 6	AXIS 7	AXIS 8	AXIS 9	AXIS 10	AXIS 11	AXIS 12
437	20.59192	-23.03421	-1.92316	0.64814	-0.51928	-0.35417	0.31546	0.23190	-0.07101	-0.30610	-0.10975	-0.07127
408	-4.59499	-0.41162	-1.33170	1.45811	-0.94245	-0.04702	0.65078	-0.35913	0.02469	-0.06418	-0.05379	0.19599
415	0.21720	-1.10659	20.49405	-0.24188	-0.01707	0.12505	-0.00768	0.09831	-0.00809	0.00044	-0.07331	-0.07127
ec-12	13.76616	-1.49908	-1.27341	1.23945	1.34810	0.76298	-0.34632	-0.75582	-0.42312	0.82092	-0.17403	-0.07127
410	-10.47167	-2.36107	-1.60300	-0.31097	-0.20235	0.00954	0.03412	0.30787	-0.20160	-0.01075	0.26235	-0.07127
ec-16	9.45096	16.06467	-0.64875	1.14244	1.63565	0.06188	0.67485	-0.45388	-0.02561	-0.21905	-0.23703	-0.07127
419	-5.30958	0.39156	-1.73976	-0.79147	-0.48877	0.21191	-0.40672	-0.08757	0.30465	0.20720	-0.05759	-0.07127
412	-13.50587	-3.07014	-1.66455	-1.25453	0.16492	0.06029	0.26208	-0.15898	-0.18152	0.01417	0.01887	-0.07127
428	-5.31547	-4.99019	-1.25891	1.86680	0.35670	-0.18252	-0.33980	-0.05390	0.27020	-0.05718	-0.02155	-0.07127
ec-1	14.14886	1.85944	-2.04628	-4.00322	0.53725	0.11051	-0.48671	0.26933	0.65948	0.00416	0.59513	0.46325
429	-10.87619	-2.88130	-1.54756	-1.04037	0.52730	-0.37726	0.04050	0.05154	-0.20678	-0.01283	0.00060	0.19599
430	-5.05154	5.26749	-1.43402	0.28039	-1.20911	0.80558	-0.45911	0.15766	-0.20712	-0.06438	-0.08473	-0.07127
431	-10.37399	-2.23655	-1.61755	-0.68429	-0.33083	-0.18037	0.28454	-0.23097	-0.20332	-0.01363	-0.00704	-0.07127
432	-6.98335	2.85101	-0.93975	1.56529	1.25460	-0.37465	-0.27806	0.49193	0.59104	-0.04935	-0.05098	-0.07127
433	14.30754	15.15657	-1.46566	0.12611	-2.11465	-0.63174	0.06205	0.49173	-0.32188	-0.24944	-0.00716	-0.07127

TABLE 11.4. CONTINUED.

PRINCIPAL COMPONENT SCORES

PLOT		AXIS 13	AXIS 14	AXIS 15	AXIS 16	AXIS 17	AXIS 18	AXIS 19	AXIS 20
437	A	0.12920	-0.03563	-0.01704	-0.01782	-0.00745	0.01281	0.01185	0.00229
408	B	-0.02844	-0.03563	-0.01913	0.24944	-0.01665	-0.02038	0.00221	0.00003
415	C	-0.01563	-0.03563	0.00104	-0.01782	-0.00272	-0.02911	0.00181	0.00008
ec_12	D	-0.03028	-0.03563	0.24901	-0.01782	-0.02026	-0.11949	-0.00125	0.00096
410	E	-0.01237	-0.03563	-0.01933	-0.01782	-0.01577	0.02464	0.00317	-0.00018
ec_16	F	0.37201	-0.03563	-0.01915	-0.01782	-0.03243	0.03165	-0.01452	0.00001
419	G	-0.03847	-0.03563	-0.01920	-0.01782	-0.01689	-0.02962	0.00207	-0.00004
412	H	-0.00637	-0.03563	-0.01945	-0.01782	-0.01638	0.04540	0.00253	-0.00031
428	I	0.00963	-0.03563	-0.01898	-0.01782	-0.01498	0.02266	0.00399	0.00019
ec_1	J	-0.06747	0.23163	-0.01835	-0.01782	0.24422	0.10265	-0.00449	0.00087
429	K	-0.00845	-0.03563	-0.01933	-0.01782	-0.01750	0.02960	0.00134	-0.00018
430	L	-0.07523	-0.03563	-0.02251	-0.01782	-0.02009	-0.06782	-0.00142	-0.00362
431	M	-0.01412	-0.03563	-0.01933	-0.01782	-0.01634	0.02202	0.00256	-0.00018
432	N	-0.04934	0.23163	-0.01938	-0.01782	-0.02149	-0.03125	-0.00289	-0.00024
433	O	-0.16467	-0.03563	-0.01886	-0.01782	-0.02526	0.00625	-0.00696	0.00032

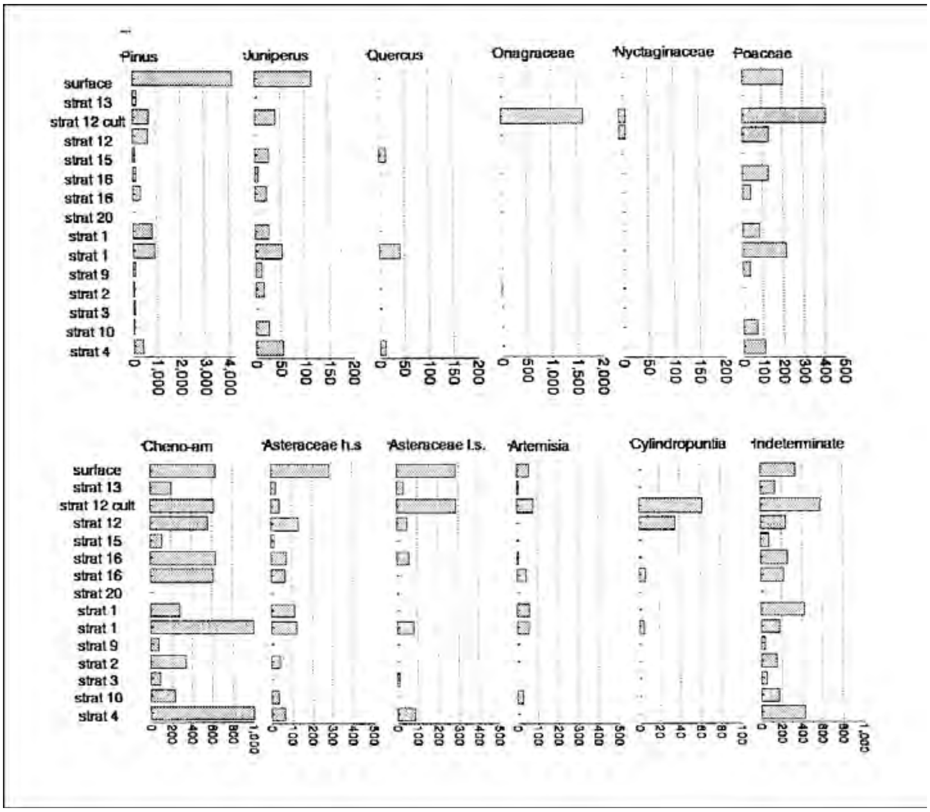

Figure 11.2. Pollen concentration values for several selected taxa from the San Ildefonso Springs site.

mays from that cultural stratum is also very low (1 grain/g) and is the same as the calculated concentration value for the adjacent Stratum 10. Thus, it is possible that the corn pollen in Stratum 10 was derived from Stratum 4. However, the mechanics of sediment transport suggest that pollen derived in one stratum and mixed with another would have lower concentration values in the destination stratum than in the source stratum. This is due to the process of sediment mixing. This was not the case. In both samples the pollen concentration values were low (1 grain/g), and it is equally likely that the single grain occurrence in each sample is the result of either long-distance transport or a similar contamination event.

Conclusions

Unfortunately, most of the samples were very poorly preserved and did not contain sufficient pollen to analyze. Analysis indicated that if cultigen pollen was present in these samples it was in extremely low concentrations. In general, the trends of the pollen taxa revealed a gradual warming and drying. This general trend was interrupted at several intervals, allowing the development of soils. A trace of corn pollen was recovered from an Archaic cultural level, suggesting use during the Late Archaic occupation. However, it was not possible to determine whether the presence of corn pollen was due to cultural use or noncultural contamination.

PART 4. DISCUSSION AND INTERPRETATIONS

CHAPTER 12. SPANISH ADAPTATIONS TO THE NEW MEXICAN FRONTIER: LA 65005

James L. Moore

Frontiers

In preparing for data recovery at LA 65005 it was assumed that this site represented a Spanish Colonial intrusion onto San Ildefonso Pueblo lands (J. Moore 1989). In general, our study was aimed at recovering information that would shed light on the veracity of this assumption, and help determine how its occupation related to developments on the New Mexico frontier. Billington (1963) views the frontier as both a place and an economic process. As a place the frontier is:

> a geographic region adjacent to the unsettled portions of the continent in which a low man-land ratio and unusually abundant, unexploited, natural resources provide an exceptional opportunity for social and economic betterment to the small-propertied individual (Billington 1963:25).

By this definition, movement onto a frontier is an economic process where individuals who lack wealth seek a chance to improve their economic situation. A frontier is also:

> the process through which the socioeconomic-political experiences and standards of individuals were altered by an environment where a low man-land ratio and the presence of untapped natural resources provided an unusual opportunity for individual self-advancement (Billington 1963:25).

Again, this definition views the frontier as an economic process. Movement into a new environment caused changes in social, economic, and political systems, but these changes were usually minor, varying with the settlers' backgrounds.

In his discussion of frontiers and boundaries, Kristof (1959:272) notes that: ". . . the frontier has, and always had, also a strategic meaning–the defensive line which keeps enemies out–and in this depends on support from the hinterland." Frontiers are also areas of integration, representing a transition from one way of life to another, where traits from both are assimilated (Kristof 1959:273). In reviewing historic sites in Cochiti Reservoir, C. Snow (1979:217) notes that:

> In such a frontier situation, adaptive responses are as frequently effected by the indigenous cultures in the area as by the newly arrived groups. This often produces a frontier culture that is a combination of both parent groups but which develops on its own.

As a place, New Mexico was a frontier that provided a chance for economic advancement while serving as a defensive buffer for the inner provinces. As a process, the New Mexican frontier was a place where the traditional lifestyles of New Spain and both Pueblo and nomadic Indians overlapped, producing a culture that was neither wholly one nor the other, but an amalgam of both.

The degree of acculturation probably varied with individual wealth, the amount of interaction with other groups, and cultural biases. Rich individuals, particularly those of high social status, would be less likely to adopt the trappings of another culture, and more likely to try to preserve what they viewed as a traditional lifestyle. Poor people may have had no choice; partial assimilation of another lifestyle may have been necessary for survival. Such trends are demonstrated in the Spanish Colonial remains at St. Augustine, Florida (Deagan 1983). There, the proportion of native to European ceramics decreased as economic status rose. Among the European wares the proportion of British trade ceramics to Spanish majolica and earthenware also decreased as economic status rose. Thus, access to the more desirable and traditional commodities improved with economic status, and they were selected over other available merchandise.

Interaction was undoubtedly conditioned by wealth and proximity. Wealthy individuals had fewer reasons to interact with the native population than poor individuals–they could always hire others to act as go-betweens. Finally, cultural bias can lead people to accept or reject specific aspects of another lifestyle–traits seen as superior or adaptive might be assimilated, while those viewed as inferior are rejected.

The Frontier as a Dynamic Process

Though New Mexico was a frontier to New Spain, when viewed as a discrete spatial entity it was also comprised of hinterland and frontier (as defined by Kristof 1959).

The hinterland was the core area in and around Santa Fe where most of the population and wealth were concentrated. The frontier was the zone that surrounded the core area and, to some extent, protected it. The frontier represented a chance for economic advancement, and was settled by people who were willing to leave the relative safety of the core in search of land or wealth.

Because of the nature of expansion, frontiers are spatially and temporally impermanent (Lewis 1977:153). They change over time when events that occurred in the center of an occupied region are repeated on its periphery as the region expands outward (Lewis 1977:153). As frontiers become settled, chances for economic advancement decrease–unclaimed land becomes scarce and the best agricultural and pastoral areas are already occupied. New settlers begin to press beyond what had been the frontier in search of economic opportunity. A new frontier is formed, and the previous frontier becomes part of the hinterland.

This process is illustrated by the development of the Chama Valley (Quintana and Snow 1980). The first settlements in that area were small scattered homesteads. Rather than community grants, the earliest settlers built on individual allotments and may have used the valley on a seasonal basis for livestock grazing. Occupancy became year-round as the region developed; more substantial houses were built and multifamily plazas began to appear. This was a rapid process–the first individual grant was approved in 1724 and the first community grant in 1734 (Carrillo n.d.; Quintana and Snow 1980). Conflict with Indians kept the frontier from successfully expanding much further outward until late in the Spanish Colonial period. Initially, Abiquiú was on the periphery of the frontier settlement zone. Then herders and later farmers pushed beyond that village to develop lands to the north and west. Abiquiú stopped serving as an outpost and became a local supply center.

Thus, the location of the New Mexican frontier was variable, changing over time as new areas on the fringe of the Spanish-occupied zone were settled or abandoned. During the first period of colonization the entire province was a frontier. Later, a hinterland developed and expanded as the frontier was pushed outward by those seeking economic improvement. The lack of support from New Spain hindered this process, and caused it to proceed slowly and to suffer continual setbacks.

A Model of Frontier Acculturation

Frontier acculturation can be examined at two levels. At a general level New Mexico was part of the frontier and the Spanish inhabitants became partly acculturated to the indigenous way of life. At a local level New Mexico itself consisted of frontier and hinterland, and the degree of assimilation must have varied according to location–people on the local frontier probably made more concessions to the native way of life than did inhabitants of the core area. The model developed for examining LA 65005 was adapted from research at sites occupied between the Spanish Colonial and American Territorial periods in the Chama Valley near Abiquiú (Moore et al. n.d.). Succinctly stated, that model is:

> Access to manufactured goods and the distribution of wealth help condition the assimilation of native technology by disparate parts of a colonizing group.

On a general level this means the assimilation of part or all of a native technology to improve chances of group survival. At a specific level there will be variation in the extent to which different communities of the colonizing group adopt native technologies, depending on degree of access to manufactured goods. If LA 65005 was on the frontier it should contain much evidence of acculturation to native technologies. If it was in the core area it should reflect a lesser degree of acculturation to native technologies.

Two factors limited access to manufactured goods: wealth and proximity to the center of distribution. Since Santa Fe was the economic center of the province, nearby settlements had easier access to manufactured goods than did distant villages. This pattern may have been conditioned by wealth, with rich land owners in distant villages having better access to manufactured goods than poor villagers living near the source. However, since Santa Fe was the center of government, commerce, and society during the Spanish Colonial period, most of the wealth was also concentrated there and in surrounding settlements. Relatively cheap and common manufactured items should occur throughout the province, but rarer and more expensive goods should occur more commonly in and around Santa Fe. If the distribution pattern of Spanish goods follows that found at St. Augustine (Deagan 1983), such commodities were desirable as indicators of social status, and their proportions in assemblages should increase with wealth.

Documentary Evidence for a Spanish Occupation at LA 65005

Documentary evidence indicates that the area containing LA 65005 was part of two different Spanish land grants in the first half of the eighteenth century. The history of this site is closely tied to three families–the land was granted to two, and a third was related to both families and resided nearby.

The Roybal Family

Ignacio de Roybal y Torrado was a native of the Spanish village of Caldas de Reyes, located a few miles south of Compostela in Galicia (Chávez 1992:273). Roybal was 21 years old when he came to New Mexico as a soldier of the Reconquest in 1693 (Chávez 1992:273-275). In 1694 he married Francisca Gómez Robledo, a New Mexico native who had survived the Pueblo Revolt of 1680 (Chávez 1992:37). She may be the Francisca Lucía who was residing with Sargento Mayor Bartolomé Gómez Robledo in the El Paso census of 1692 to 1693 (Kessell et al. 1995:40). If so, she was his niece, and was probably living with Bartolomé because her father, Andrés Gómez Robledo, was killed during the defense of Santa Fe in 1680 (Chávez 1992:37).

By 1708 Roybal was alcalde of Santa Fe, and within 10 years of his arrival in the province he had attained the military rank of alférez (Ebright 1994:250). During his long life (he died in 1756 at about 84 years) he served as High Sheriff of the Inquisition and was a member of the Confraternity of La Conquistadora (Chávez 1992:275). In addition to his political power, Roybal also had substantial land holdings and a prominent social position, and became a person of great wealth (Ebright 1994:250-251).

Roybal received grants at Santa Fe and Jacona; the latter is discussed in detail by Hall (1987) as an example of the legal labyrinth resulting from Spanish encroachments on Pueblo lands and varying interpretations of laws during the Spanish Colonial, Mexican Territorial, and American Territorial periods. The Jacona Grant was made in 1702 (Jenkins 1972), its legality was challenged in 1703, and by 1986 was still essentially unresolved (Hall 1987). While interesting, that dispute is ancillary to this discussion. However, Roybal also held a grant in the San Ildefonso area for a short period of time, and that grant included the area in which LA 65005 is situated.

The Roybal Grant adjacent to San Ildefonso was made by Governor Diego de Vargas on 4 March 1704, and on 16 September 1704 the Pueblo of San Ildefonso filed suit against Roybal, accusing him of encroaching on their lands (SANM I 1704). Roybal described his grant as follows:

> I, the Ensign, Ygnacio de Roibal, a resident of this kingdom of New Mexico, appear before your excellency in the best form the law will allow and which may be favorable to me, and state: That I register in due form some lands for raising cattle, sheep and horses, on the other side of the Rio del Norte between lands of the pueblo of Santa Clara and the channel of the river, towards the lower part, with its entrances and exits. The boundaries thereof are: On the east, said Rio del Norte; on the west, the Sierra. (SANM I 1704:4)

In another statement, Roybal related that:

> . . . I have a grant of an uninhabited place opposite the pueblo of San Yldefonso, on the other side of the Rio del Norte. . . . (SANM I 1704:6)

Thus, while its boundaries were poorly demarcated on paper, it is certain that Roybal's grant was on the west side of the Rio Grande opposite San Ildefonso Pueblo. This is the approximate location of the project area, and LA 65005 falls within these vague boundaries. Unfortunately, nowhere does Roybal or any of the other persons that made statements in this case mention whether he built a house on the property. However, a structure was built by San Ildefonso on the west side of the river in an attempt to solidify its claim to the land. As Roybal states:

> Moreover, because you have commanded me by a decree which the Alcalde Mayor, Xptoval de Arellano, made known to me, together with the petition which Alfonso Rael de Aguilar is making and has made in the name of the Indians of San Yldefonso, whom your Excellency may examine, I inquire and ask your Excellency what motive they can have in asking for more work than that which they have in serving the priest who administers to them, who, during the busiest time, when they should be cultivating their fields, orders and obliges them to make adobes and a house in order to establish a ranch on my said sitio, where said Indians do not expect to have profit, only that each week eight or ten Indians go to take care of said ranch and house. . . . (SANM I 1704:7)

Thus, a ranch house was built on the west side of the Rio Grande by Indians from San Ildefonso, and may have been occupied part-time in an attempt to establish a better claim to the disputed property. A location for this structure is alluded to in a later petition written by San Ildefonso's protector, Alfonso Rael de Aguilar on 28 September 1704:

> Therefore, and on account of what belongs to us, we ask and request that your Excellency be pleased to order that the customary measurements be made without injury to us. The landmark is beyond the place where we erected a room and torreon (tower), and which is the boundary line of the lands which belong to this pueblo. (SANM I 1704:12-13)

This request was written after Lieutenant Governor Hurtado made his decision in favor of San Ildefonso on 25 September 1704. The reason for this second petition is unclear. It is possible that they suspected the possibility of double-dealing on the part of the Spanish, and were trying to persuade the Governor to grant them their entire league. This scenario suggests that LA 65005 could be the ranch built by San Ildefonso on the instructions of their priest, since the site is about three-quarters of a league west of the village, and is thus short of the west boundary of the pueblo as the petition says it should be. However, it is also possible that the San Ildefonsans were simply anxious to settle the lawsuit and were reinforcing their earlier petition because they had not yet received notice of Hurtado's decision. In this case, the continual references concerning the village's interest in reacquiring their traditional farmlands may have been the primary motivation, and they or their protector were afraid that justice might not be served.

The suit was settled by Lieutenant Governor Juan Paez Hurtado on 25 September 1704, and Alcalde Mayor Xptobal de Arellano was ordered to:

> … measure one league for them to each point of the compass, designating landmarks to them; and (I order) that the grant of said Ensign Ygnacio Roybal shall be understood hereafter as being from said landmarks, with the understanding that if the measurements which he may make should include the cultivated lands of Mathias Madrid, then the said grant shall be understood to be from the boundaries of said Mathias Madrid up to their pueblo. (SANM I 1704:10)

Upon receiving Hurtado's decision, Arellano states that he:

> . . . proceeded with the execution of the said decree, measuring and placing landmarks on the land one league to the north, one-half league to the south, one-half league to the west, and another half league to the east because there was no farming land on which to mark out the league in every direction, which is what the natives say they are asking for and not woods, hills, nor even that which cannot be sown and cultivated, leaving the rest of the land to be asked for where it should be to their use. (SANM I 1704:11)

This shortening of the grant league was done in spite of Hurtado's order, which assigned them a full league in every direction (SANM I 1704:10).

Roybal was in possession of the grant for less than seven months, losing the eastern part of it in Hurtado's decision. Since he declined to accompany Alcalde Arellano during the measuring of the Pueblo league, Jenkins (1972:120) suggests that he lost his claim to the rest of the grant as well. The fact that there is no mention of a house built by him while the ranch constructed by San Ildefonso is alluded to by more than one document suggests that he never got around to building a formal structure on the property. Indeed, a house was probably not necessary when the grant was established because Roybal's home at his Jacona Grant was nearby.

The location of the ranch house and torreon built by San Ildefonso remains unresolved. If the Pueblo was only interested in acquiring title to farmlands, LA 65005 is probably not that site. However, it is possible that their request was misinterpreted, either mistakenly or intentionally, and the village was actually interested in recovering the entire grant to which they were legally entitled. If so, the ranch and torreon may have been closer to the location of LA 65005. There may have been some collusion between Roybal and Arellano, allowing him to use or retain part of the original grant. But since there is no further mention of Roybal's grant in this area, this is unlikely.

An interesting side-line to this story is discussed by Jenkins (1972). No documentary references to the traditional Pueblo league have been found before the Pueblo Revolt of 1680. Instead, the Spanish government seems to have recognized the right of Pueblos to all lands that were effectively used and occupied by their members (Jenkins 1972:114). Only after the Reconquest is the word "league" used in reference to Pueblo lands, and the settlement of San Ildefonso's petition against Roybal seems to have been the first case in which the Pueblo league was applied (Jenkins 1972:120).

The Luján Family

Mathías Luján was born at San Cristóbal in the Santa Cruz de la Cañada district, and fled south with his family during the Pueblo Revolt of 1680 (Chávez 1992:63). He is listed with his family of eight in the refugee rolls of 1680 to 1681, which included his wife, Francisca Romero, their children, and an unspecified number of brothers-in-law (Chávez 1992:63). The Luján family is also mentioned in Vargas's census of the El Paso District in December of 1692 to January of 1693, and this time included no brothers-in-law (Kessell et al. 1995:60). The children of Matías and Francisca listed in this census were (ages in parentheses): Catalina (18), Antonia (16), María (13), Felipe (11), Juana (8), Juan (6), Pascual (5), Miguel (2), and Manuela (1).

The Luján family returned to New Mexico with Vargas in 1693. Two members of this family are of particular interest to this discussion–María and Juana. María married Pedro Sánchez de Iñigo after returning to New Mexico; this relationship is discussed in more detail below. Juana, described by Chávez (1992:213) as "the author of a unique family," is of more immediate interest.

Juana Luján had three illegitimate children–Francisco, Juan, and Luisa. Chávez (1992:187) suggests that her children were born at Guadalupe del Paso while Juana was a refugee from New Mexico. However, since Juana was listed as 8 years old in the census of 1692 to 1693 (Kessell et al. 1995:60), this is virtually impossible. The children were sometimes called Luján, but more often were referred to as Gómez del Castillo, which is interesting because no family of this name is known in New Mexico either before or during this time (Chávez 1992:187). Both sons and their families are listed with the latter surname in the 1750 census of Santa Cruz de la Cañada (Olmstead 1981:24).

Chávez (1992:187) has speculated that Juana's children were fathered by either Antonio or Bartolomé Gómez Robledo. These men were first cousins, and Chávez (1992) thinks that the mother of one of them may have been a member of the López del Castillo family. However, more recent research conducted by José Antonio Esquibel (pers. comm. 1998) indicates that this is unlikely. Apparently, no males of the Goméz Robledo family returned to New Mexico after the Reconquest (Chávez 1992:187), and since Juana was far too young to have had a child by 1693 (much less three) it is highly unlikely that either of these gentlemen was the father of her children.

Esquibel (pers. comm. 1998) provides considerable new data concerning Juana Luján, and at the same time introduces a small mystery. Records from the early eighteenth century appear to contain two contemporary Juana Lujáns with very similar backgrounds. The Juana Luján we have been discussing was born ca. 1684, probably at the pueblo of La Ysleta in the El Paso District, where her family was listed as residing in the census of 1692 to 1693 (Kessell et al. 1995:60). The Luján family lived in Santa Fe for a while after the Reconquest, and are listed as residents of that town in censuses taken in 1694, 1695, and 1696. Juana's mother, Francisca Romero, is enumerated as a widowed resident of Santa Cruz in a census of 1706. Juana's first son appears to have been born around 1700, when she was about 16 years old.

Most of our information concerning the second Juana Luján is furnished by documents associated with a lawsuit (José Antonio Esquibel, pers. comm. 1998; AASF 1702). This Juana stated she was 16 years old in 1702, suggesting she was born in 1685 or 1686, very close to the birth date of the other Juana. Her father was also named Matías Luján, but her mother's name is given as Francisca de Salazar. Like the other Juana, her parents lived in Santa Fe after the Reconquest, remaining there until 1702 when they apparently moved to the jurisdiction of Santa Cruz. The second Juana also had an illegitimate son, born in 1701. Esquibel (pers. comm. 1998) suggests that the correspondences between these two women are a little too close, and that perhaps they were the same person. The biggest discrepancy between the stories is the name given to the mother, who Esquibel suggests may actually have been named Francisca Romero de Salazar. With this discrepancy accounted for, the stories are almost exactly the same. Perhaps most significantly, the second Juana disappears from the records after the lawsuit, while the first continues to appear in contemporary documents.

If Esquibel is correct, several pieces of missing information can be filled in. The lawsuit filed by Juana Luján in 1702 (AASF 1702) was against a young soldier in the Presidial garrison named Buenaventura de Esquibel, who was an español from Mexico City and was apparently from a moderately important family. Juana charged that while she and her cousin Ana Luján were cooks at the Santa Fe Presidio she had become engaged to Esquibel and later bore him a son. In the meantime, pressure to make a better marriage was apparently brought to bear on Esquibel by his family, and he had become engaged to another woman. Juana sued, and after a lengthy investigation was awarded 200 pesos in damages. This may have been some (if not all) of the money she later used to acquire land in the Rio Arriba.

Some of the testimony in Luján's lawsuit was provided by three of her cousins. From these relations, Esquibel (pers. comm. 1998) suggests that her paternal grandparents were Juan Luis Luján and Isabel López del Castillo. This provides a more feasible origin for the del Castillo surname taken by her children. Where the Gómez part of their name came from is unknown, but it is possible that it was also taken from an ancestor. Interestingly, this may provide a distant tie to the Gómez Roblado family, since the mother of either Bartolomé or Antonio Gómez Robledo may also have been a member of the López del Castillo family, as mentioned earlier. This is potentially important because Ignacio de Roybal's wife was a Gómez Robledo, and a first cousin to both of these men (Chávez 1992:187). Thus, she and Juana may have been very distant cousins, which could help account for the close ties between the families. In any case, Chávez notes that the Luján family was very close to the Roybal-Gómez Robledo family. Whether this was because they lived near one another or there was a familial connection remains uncertain.

Baptismal records indicate that the Luján family had a presence in the San Ildefonso area by 1701 (Esquibel, pers. comm. 1998). Mathías Luján and Francisca Romero began appearing as godparents to children from San Ildefonso Pueblo by this date, and Juana began fulfilling the same role by 1703. In the latter case, she was listed as godmother to several children from both San Ildefonso and Santa Clara pueblos (Esquibel, pers. comm. 1998).

Juana began accumulating land in the San Ildefonso area before April of 1713. On April 27 of that year she bought land from Diego Martín, which was adjacent to property she had earlier purchased from his father, Domingo Martín (SANM I 1713). This parcel was in the jurisdiction of Santa Cruz de la Cañada, apparently near Santa Clara since one of the boundaries was given as lands belonging to the convent of that village (SANM I 1713:1). Interestingly, Pedro Sánchez (de) Iñigo served as a witness to this transaction (SANM I 1713:1). About a year later Juana purchased land near San Ildefonso from Mathías Madrid (16 July 1714). This was apparently the Mathías Madrid mentioned in San Ildefonso's lawsuit against Ignacio de Roybal (SANM I 1704), whose grant was made on 26 January 1702. Ahlborn (1990:326) notes that the original grant was of dubious legality, and that it was bordered by San Ildefonso Pueblo lands and Ignacio de Roybal's grant. Rather than the land lost in 1704, this was Roybal's Jacona Grant (Hall 1987:80).

Juana married Francisco Martín on 20 April 1732 (AASF 1732), by which time her children were adults and she had acquired substantial holdings. By the time of her death in 1763, she had amassed an estate worth nearly 6,000 pesos (Ahlborn 1990). Pedro Ignacio Sánchez was named in her will, and was probably the grandson of Pedro Sánchez de Iñigo. In 1763, Juana Luján's heirs were named in a lawsuit brought against Spanish settlers encroaching on Pueblo land by Phelipe Tafoya on behalf of San Ildefonso. The parcel mentioned in the suit was the land Juana had purchased from Mathías Madrid in 1714, and this suit is discussed in detail later.

Sánchez Family

Three siblings–Francisca, Jacinto, and Pedro Sánchez de Iñigo–were born in New Mexico and escaped the Pueblo Revolt of 1680. Their mother appears to have been named Ana or Juana López, but the name of their father is unknown (Chávez 1992:279). Pedro was the youngest of the three, and Francisca and Jacinto were much older than he. Francisca married Captain Juan García de Noriega in May of 1681, and they had four children by 1692 (Chávez 1992, n.d.:1695; Kessell and Hendricks 1992:249; Salazar 1992). Her husband was the son of Alonso de García de Noriega, lieutenant general of the Rio Abajo and alcalde major of Sandia at the time of the Pueblo Revolt of 1680 (Hendricks 1993). In the census of 1692 to 1693, García de Noriega is listed as *alguacil mayor* of the *cabildo* (Kessell et al. 1995:37), and later in 1693 he is the *alcalde ordinario* of El Paso. While García de Noriega participated in Vargas's first expedition in 1692, he and his family remained in the El Paso area and did not participate in the resettling of New Mexico (Kessell and Hendricks 1992:249).

Jacinto was born in the Rio Abajo around 1662 or 1664, and was married to Ysabel Jiron with two children–José, age one-and-a-half, and Juana, age four–in the census of 1692 to 1693 (Chávez n.d.:1696; Kessell et al. 1995:45; Salazar 1992). Ysabel died in 1695 or 1696 and Jacinto married María Rodarte de Castro Xabalera, a native of Sombrerete, in the same year (Chávez n.d.:1696; Hendricks 1993; Kessell et al. 1998:565). He received a grant opposite Cochiti in 1703, and was *alcalde mayor* of Santa Cruz de la Cañada by 1713 (Hendricks 1993). The family relocated to the Rio Abajo around 1715, and Jacinto and María both died in 1734 (Chávez 1992:280; Hendricks 1993).

Pedro was born around 1672 or 1673 (Chávez n.d.:1691), and was a resident of Nuestra Señora de Guadalupe del Paso in Vargas's census of 1692 (Salazar 1992). That document also lists a María de Tapia as his wife, which may be a clerical error since nowhere else is she mentioned in connection with Pedro. He may have served as a soldier before the Reconquest; Chávez (1992) suggests he might have been a "Pedro López de Yñíguez" who was a soldier at Guadalupe del Paso before 1692. Since his mother was a López, this is possible. Kessell et al. (1998:1174) suggest that Jacinto may have been Pedro's father, but this is unlikely because Jacinto was only 10 or 11 years older than he. They suggest this because a Pedro is listed as an orphan of Jacinto's in records of the disbursement of goods and livestock to the New Mexican settlers in 1697 (Kessell et al. 1998:1151). Rather than Pedro Sánchez de Iñigo, this record probably refers to his son Pedro, who is discussed later.

Pedro Sánchez de Iñigo married Leonor Baca at El Real de San Lorenzo on 7 January 1692 (Chávez n.d.:1691). Both were quite young–Pedro was 18 and Leonor only 13. Leonor was the daughter of Sargento Mayor Ignacio Baca and Juana de Anaya Almazán, who with their four small children had survived the Pueblo Revolt of 1680 and fled south to the El Paso District. Interestingly, Ignacio Baca was a distant relative of Francisca Gómez Robledo, wife of Ignacio de Roybal (Chávez 1992:142-143). Ignacio Baca was dead by 1689 (Chávez 1992:11), but Juana and their children returned to New Mexico with the Reconquest. Juana was 28 at the time of the 1692 to 1693 census, and she and her family were living in San Lorenzo at that time. In addition to the children, her household included a niece and ten other dependents (Kessell et al. 1995:55). Francisco de Anaya Almazán was Leonor's uncle, and was a witness to her and Pedro's wedding. An *encomendero* before the Pueblo

Revolt, Francisco de Anaya Almazán played an important role in the Reconquest of 1692 to 1693, and was the first post-Reconquest alcalde of Pecos Pueblo (Kessell 1979).

Pedro and Leonor were in New Mexico by 1696, and had three children. Leonor's mother, Juana de Anaya Almazán, also returned to New Mexico where she married Juan de la Cruz y Olivas in 1693 (Hendricks 1993). She died a few years later, a victim of the Pueblo Rebellion of 1696. Killed at San Ildefonso during the rebellion were Juana, her seventeen-year-old son Alonso, and Leonor and two of her children (Espinosa 1988:261-262). A second daughter named Rosa is also listed among the dead at San Ildefonso (Kessell et al. 1998:734), but no daughter with this name is given in the census of 1692 to 1693. There is also a reference to a second son, Andrés, having been killed at Nambé during the first days of the rebellion (Kessell et al. 1998:729, 732; Twitchell 1916:345). Again, no child with this name is listed in the census of 1692 to 1693. Either the names listed in Vargas's journal are nick-names or middle names that were used by preference, or these persons were not children of Juana de Anaya Almazán.

Thus, the Sánchez de Iñigo family may have been established in the San Ildefonso area as early as 1696. Unfortunately, it is unknown whether they were living in the village or at a nearby ranch. Pedro was not in San Ildefonso when the rebellion broke out, and was apparently stationed elsewhere. Reference is made to a Pedro Sánchez commanding a small garrison at Bernalillo in an order written by Vargas on 19 August 1696 (Kessell et al. 1998:993; Twitchell 1917). This was undoubtedly Sánchez de Iñigo, and may help account for his fortuitous absence from San Ildefonso when the rebellion began. As early as 6 June 1696, Vargas sent five soldiers to Fernando Durán y Chaves at Bernalillo (Kessell et al. 1998:728), and it is possible that Pedro was among them. In any case, Pedro was serving as a soldier and, in light of growing unrest among the Pueblos in 1696, was probably on active duty. While he was otherwise occupied, it would appear that Leonor and two of their children were staying with her mother. In several descriptions of the massacre, the Bacas and Sánchezes died in the convent along with the priests from San Ildefonso and Nambé (Espinosa 1988; Kessell et al. 1998; Twitchell 1916). The most detailed account was in a letter from Vargas to the Viceroy dated 31 July 1696, which notes that the Spaniards' bodies were found in a room of the convent where they suffocated from the smoke of a fire set by the San Ildefonsans (Espinosa 1988:261-262). What the civilians (other than the priests) were doing there is not mentioned.

Sánchez de Iñigo remarried around 1698; his new wife was María Luján, the eighteen-year-old sister of Juana Luján (Chávez 1992:369, n.d.:1697; Kessell and Hendricks 1995:83). At that time he was listed as a soldier of Santa Fe (Chávez n.d.:1697). They eventually settled in the Rio Arriba at or near Santa Cruz de la Cañada, since Sánchez de Iñigo witnessed a land transaction at that town in 1713 (SANM I 1713). Chávez (1992:280) lists four children for Pedro Sánchez de Iñigo, three from his second marriage and one apparently from his first. He died around 1720 (Hendricks 1993).

At least one of Pedro and Leonor's children survived the Rebellion of 1696. Also named Pedro, he was listed as 21 years old during a prenuptial investigation in 1718 (Chávez n.d.:1696). Since his parents were given as Pedro Sánchez and Leonor Baca, his age in this document is probably off by a year or two. An age of 21 in 1718 would mean he was born after Leonor's death; thus, he had to have been at least 22. Information on how he survived the Rebellion of 1696 is not provided, but he was not with his mother and siblings at San Ildefonso. Perhaps while Leonor and the other children were staying with her family, young Pedro was left with other relatives. Those other relatives may have been the family of Jacinto Sánchez de Iñigo.

During the distribution of livestock and supplies on 1 May 1697, the orphaned children of Jacinto Sánchez are listed as Juana, Gertrudis, and Pedro (Kessell et al. 1998:1151). But Jacinto did not die until 1734, so these may have been children taken into his household because one or both of their parents had been killed. This Pedro was most likely the son of his brother, Pedro, and Leonor Baca. Since the elder Pedro was a soldier, he was probably unable to care for his child while still in service. Because the younger Pedro was with Jacinto's family at this time, it is also possible that he was with them when his mother and siblings were killed at San Ildefonso. If so, the Sánchez de Iñigo family may not have had direct ties with the San Ildefonso area at this early date.

Thus, the younger Pedro was born before the Rebellion of 1696. He married Michaela Quintana, daughter of Miguel de Quintana and Gertrudis Trujillo of Mexico City, in Santa Fe in 1720 (Chávez n.d.:1698). Pedro may have spent some time as a soldier, since he is listed as "Captain Pedro Sánchez" in a 1749 baptismal record and a 1763 lawsuit (AASF n.d.:379; SANM I 1704). Like his father, the younger Pedro resided at Santa Cruz de la Cañada. He and Michaela stood as godparents to several children born in that village between at least 1738 and 1762 (AASF n.d.). Ignacio Roybal and Francisca Gómez Robledo were godparents to their son Bernardo, who was baptized at Santa Cruz de la Cañada on 9 April 1733 (AASF n.d.:376), and in the census of 1750 they are listed as residents of that village (Olmstead 1981). Though the family's main home was at Santa Cruz, they had other grants including one in the San

Ildefonso area.

Information on one of those grants was presented during Martinez v. United States, in which the heirs of Juan García de la Mora and Diego de Medina sought title to the Black Mesa Grant along the lower Rio Ojo Caliente (Bowden 1969:1178-1182). This grant had originally been made to ". . . either Miguel Quintana or his son-in-law, Pedro Sanchez, by Governor Juan Domingo de Bustamante in about the year 1731. . . ." (Bowden 1969:1179). But these grantees had never occupied the land as legally required. Testimony presented in this case showed that Pedro had attempted to use the land, but had been unsuccessful. He had apparently once planted some fields of corn and pumpkins on the grant, but had abandoned them after about four months (Bowden 1969:1180). He had also tried running sheep on the property, but stopped when his shepherds had trouble with wolves (Bowden 1969:1180). The new applicants were given possession of the grant in 1743, but by that time Pedro had moved on. This brings us back to LA 65005.

The Pedro Sánchez Grant

The younger Pedro Sánchez was the recipient of a grant made in 1742. A copy of that grant was included in Manuel Sánchez et als. v. George N. Fletcher et als., a lawsuit brought in 1901 in the 1st Judicial District of New Mexico (Prince Papers n.d.). While likely that the grant was made in or around 1742 as the documents contend, Ebright (1994) indicates that the copy of the grant submitted as evidence in that case was a forgery. However, it is likely that this document was a partial copy of the original, with certain information omitted (Ebright 1994:233). In this discussion we will assume its general accuracy.

The translation of this copy of the Pedro Sánchez Grant request (Prince Papers n.d.) reads as follows:

> Pedro Sanchez, a native of this kingdom, and a resident of the town of Santa Cruz, in the most approved manner prescribed by law, and most convenient to myself, appear before your excellency, representing that, whereas I have to support twelve children and three orphans [sic] nephews, who are without father or mother, three female servants, and with my wife, will make in the all the number of twenty persons, and having a piece of land acquired by purchase, which is so small that I am compelled to borrow land from my other immediate neighbors in order to extend my crops every year, and even in this manner I cannot support myself, nor can I maintain on said land a few sheep and four cows and some mares and horses, all which are necessary to the support of so large a family, and which are poor for want of pasture and suffer a great many wants, and, in order to supply them I have deemed proper to register and do register a piece of land on the other side of the Rio del Norte, uncultivated and abandoned, and as such unoccupied, there being no one having any claim thereto; the boundaries being on the North the land enjoyed by right of the Indians of the Pueblo of San Ildefonso in the South the lands of Captain Andreas Montoya, on the East Del Norte River, and on the West the Rocky Mountain; and imploring the Royal aid of your Excellency, as a loyal subject of his Majesty, in view of all that I have stated, I pray and request that you be pleased to grant said land in the name of his Majesty, (whom may God preserve) in order that I may settle upon it so soon as the Alcalde himself of Santa Cruz places me in possession, all of which I expect from the charity and justice of your Excellency, and I swear by God, our father, and the sign of the most holy cross that my petition is not made in malice, but of absolute necessity, and whatever my necessity, &c. —Pedro Sanchez

A second document (Prince Papers n.d.) records Governor Mendoza's response to Sánchez's request:

> In the City of Santa Fe, on the twentieth day of the month of March in the year one thousand seven hundred and forty two, I, Don Gaspar Domingo de Mendoza, Lieutenant Coronel [sic], Governor and Captain General of this Kingdom of New Mexico, having seen the present petition of the person whose name is signed on the reverse side, consider it as presented and in view thereof, I should order, and did order, that the land asked for be granted to him, in the name of the King, our sovereign, in order that he may settle upon, cultivate, and improve it, for himself, his children, heirs and successors, according to right and this grant is understood to be made without injury to any other third party, and which he will settle within the period prescribed by the royal law, and I direct the senior justice of the jurisdiction of Cañada to give him possession, observing in his proceeding the form used in similar cases. I have so ordered directed and signed, with my attending witnesses, in the well known absence of a royal and public notary in this vicinity, and in the present paper in the absence of stamped.
>
> Don Gaspar Domingo de Mendoza
>
> José de Terrus [witness]
> José Trujillo [witness]

Later in the same month, Sánchez was put in possession of his grant (Prince Papers n.d.):

On the twenty-eighth day of the month of March, in the year one thousand seven hundred and forty two, I, Lieutenant Juan Joseph Lovato, senior justice and acting war captain of this jurisdiction of the new town of Santa Cruz &c by virtue of the above order, issued by his Excellency Don Gaspar Domingo de Mendoza, governor and captain general I proceeded to the land granted by his Excellency to Captain Pedro Sanchez by royal grant, and, in order to give his possession without injury to any third party, I consider that I should order, and did order the principal Indians of the Pueblo of San Ildefonso, and, having no deeds to the lands they hold on the side called for by the boundary of Captain Pedro Sanchez, however, in order that no obstacles or disputes should arise in the future with the Indians, I include that which they consider to be the best in order that they might increase their crops and, by the common consent of the aforenamed, a holy cross was erected, to serve as the southern boundary of said Indians and the northern boundary of said Captain Pedro Sanchez, and, taking said Indians and those in my attendance as witnesses, I gave Captain Pedro Sanchez royal possession of said land, with the customary solemnity, with the boundaries set forth in his petition, to which reference is made, and in order that it may so appear, I signed, with those in my attendance, acting by appointment in the well known absence of a public or royal notary, and on the present paper, there being none of the stamped in this vicinity, to all of which I certify, and done in the month and year first above mentioned.

Juan Joseph Lovato

Attending
Joseph Quintana
Juan Garcia de Mora

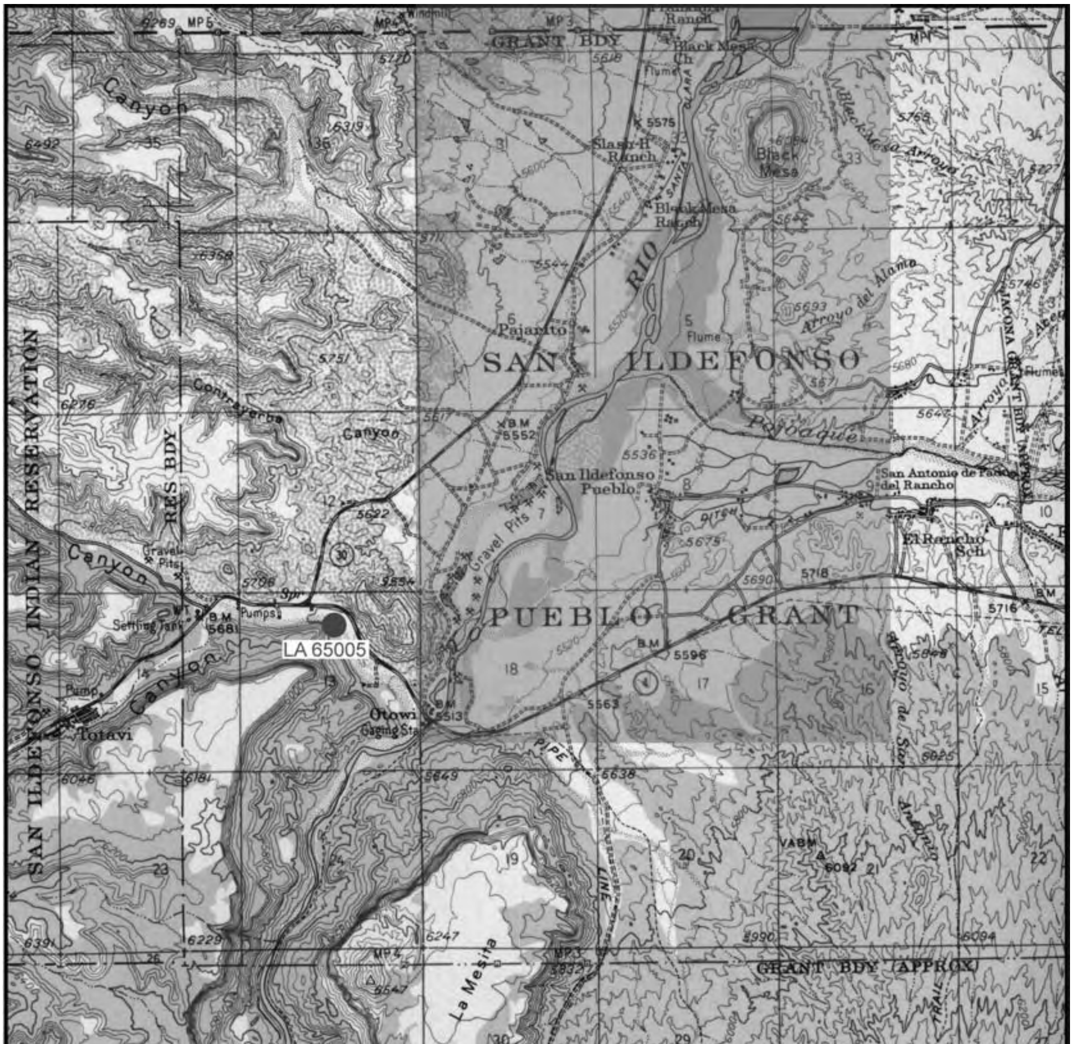

Figure 12.1. Approximate location of the San Ildefonso Grant boundary according to the Roybal decision of 1704.

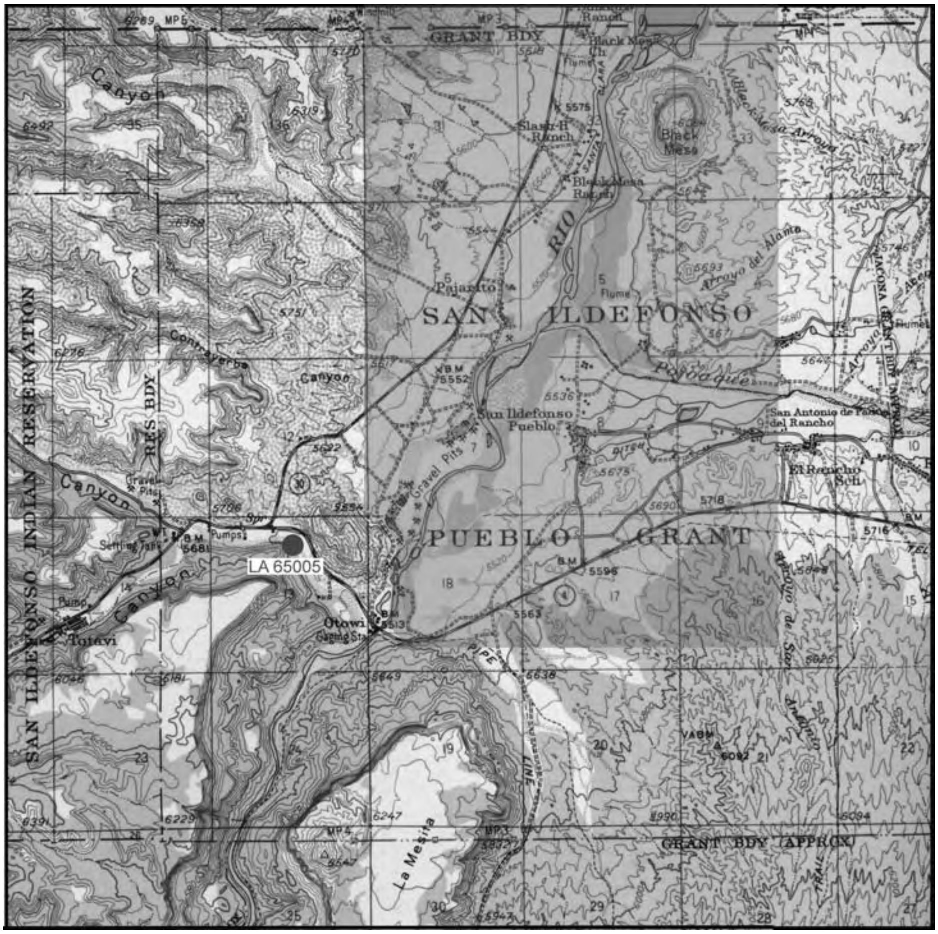

Figure 12.2. Approximate location of the adjusted San Ildefonso Grant boundary according to the Pedro Sánchez Grant of 1742.

According to these documents all of the legal requirements were addressed–San Ildefonso was represented and Sánchez's grant did not appear to trespass on their land, the boundaries were marked, and the ceremony putting Sánchez in possession of his grant was duly witnessed. It is interesting that the Sánchez grant was described as south of San Ildefonso's land on the west side of the river. In the interpretation of the Roybal decision, San Ildefonso was granted land extending a league from the churchyard on the north, and half a league in the other cardinal directions. The approximate boundaries of this area are shown in Figure 12.1. LA 65005 is outside the west boundary of this version of the grant, but is north of its south boundary. However, in the grant papers entered as evidence in Sánchez v. Fletcher, Lovato noted that San Ildefonso did not have any deeds for the land they used on the west side of the river. He also inferred that he added a buffer to the land farmed by San Ildefonso in that area, erecting a cross to serve as a boundary between their land and the Sánchez Grant (Prince Papers n.d.).

Lovato does not seem to have thought that San Ildefonso's land extended even half a league to the south on the west side of the river. Instead, he only included farmable land. The location of the southern part of this area on the west side of the Rio Grande is estimated in Figure 12.2, and the suggested boundary in this illustration is north of LA 65005. The area being farmed was probably around the ancestral village of Perage (LA 41), which may have been related to the ditch noted on the west side of the river in the Roybal suit (SANM I 1704). That area was certainly used for farming before the Spanish arrived–a survey of part of the area located three farming sites used during the Classic period and, in one case, possibly as early as the Developmental period (J. Moore 1990).

Pedro Sánchez undoubtedly knew about Roybal's earlier grant and where those boundaries were drawn by Arellano in 1704. His family was close to the Roybals; not only was Roybal's wife a distant relative of Pedro's mother, the Roybals also stood as godparents to at least one of his children. In addition, Juana Luján's family was close to the Roybals, and Pedro was her step-nephew. The grant was probably applied for in good faith, since the requested land does not seem to include the area farmed by San Ildefonso in 1742. However, those boundaries may have been interpreted a bit in his favor to provide better access to the river. The north border of the Sánchez Grant was probably at or near Guaje Canyon, and his rancho was built near that boundary. If this analysis is correct, Ebright's (1994) conclusion about the grant papers presented in Sánchez v. Fletcher is probably right–they were fairly accurate copies of the originals, with some rather incriminating information left out.

The information that seems to have been intentionally omitted concerned a suit brought in 1763 by San Ildefonso against several persons considered to be encroaching on their grant (SANM I 1763). On February 4 of that year, Felipe Tafoya, representing San Ildefonso Pueblo, filed a suit against the heirs of Juana Luján, Marcos Lucero, and Pedro Sánchez (or his heirs). Numerous documents from that suit are curated at the New Mexico State Archives and Records Center in Santa Fe, and only pertinent sections are cited at length. In the initial suit filed by Tafoya, he states:

> Also, on the west part of said pueblo, a grant was made to Captain Pedro Sanchez, they being the only commons of said pueblo. He built a house so near that it is also within its boundaries, and although, when the grant was given to him, they remonstrated, they were not heeded. With said ranch they have been greatly damaged with the cattle and horses of said Sanchez and others who, under the pretense of having title to the said ranch, put theirs there. Those who go to gather them kill their [the Indian's] horses and take away their oxen and cows from their pasture grounds and many are lost to them and to said residents of this villa who put their [livestock] in said place, as it has always been commons. Not satisfied with this, at the present time Antt [Anttonio] Mestas, a resident of Chama, a son-in-law of said Sanches, intends to put another ranch at the place on the other side, which is the only watering place opposite the channel of the river, the only place of descent which the Mesa de Pajarito has, and which is a free watering place for the cultivated land and for the sheep and horses of said pueblo and for the other herds which are pastured in those places; and at times when there is much pasturage they put the horses of the royal garrison in there. (SANM I 1763:3)

Many of these statements contradict the version of the original grant entered as evidence in Sánchez v. Fletcher. In this suit, Tafoya insisted that San Ildefonso protested the Sánchez grant at the time it was made, but was ignored. Rather than the area being uncultivated and abandoned, as Sánchez indicated in his grant petition, Tafoya claimed it was and always had been recognized as commons for San Ildefonso. This contradiction was probably one of the ramifications of the shortening of the Pueblo league in the Roybal decision. Sánchez understood the area he had applied for to be open and not part of any current grant. San Ildefonso considered it part of their commons.

Governor Cachupín ordered Don Carlos Fernández, the alcalde mayor of Santa Cruz de la Cañada, to investigate the allegations made by Tafoya on behalf of San Ildefonso. Fernández was to make measurements and determine whether the lands granted to Juana Luján, Marcos Lucero, and Pedro Sánchez were within the Pueblo league (SANM I 1763:4). In addition, he was to inform Antonio Mestas that he could not build where he intended, and if he did the house would be forfeit and he would be fined a hundred pesos (SANM I 1763:4). On or around 18 February 1763, Fernández measured west in the direction of Pedro Sánchez's grant. He stated that:

> . . . I measured from the cemetery wall, which corresponds to said direction, reaching said house and corral with 32 cords containing 100 varas each, the said house remaining to the south. (SANM I 1763:7)

Thus, Fernández determined that the Sánchez grant was at least partly within the Pueblo league. He also provided an important clue concerning the location of the Sánchez ranch house, a topic that is addressed in greater detail later.

Among the documents submitted as evidence in this case were copies of a grant made to Matias Madrid in 1702, the sale of that grant to Juana Luján in 1714, and the decision in the Roybal case of 1704. Interestingly, Tafoya used the Roybal decision as a precedent, but did not mention the statement by Arellano concerning the measuring of the Pueblo league, which was shortened on three sides with San Ildefonso's implied consent (SANM I 1704:11, 1763:13-14). Perhaps he thought it might prejudice his case or it was unavailable. Had that document been used, it may have convinced the court that the Sánchez grant did not encroach on San Ildefonso lands as defined by the measuring of the Pueblo grant in 1704, and that Pedro Sánchez's ranch house was actually outside the grant as measured at that time.

It is possible that in the years since the Roybal suit, San Ildefonso had become aware of the full implications of that decision in regards to the amount of land to which they were entitled by Spanish law. In addition to trying to rid themselves of Spanish encroachers, perhaps they were now trying to claim their full league. Conversely, it is also possible that in the nearly sixty years since the Roybal case they had forgotten that only useable farmland was technically granted to them in 1704, and assumed they were granted a full league in all directions as were other pueblos (as the decision actually said). A third possibility is that they were fully aware of the size of the grant they were entitled to in 1704 but their wishes were either mistakenly or purposely misrepresented by Arellano. If this was the case, the letter of San Ildefonso's governor to Hurtado on 28 September 1704 may have been written with this in mind, but to no avail. Since they recovered the farmland they needed and the rest of the Roybal grant appears to have returned to commons status, they may have let the situation rest. Then Pedro Sánchez appeared on the scene. Sánchez seems to have been aware of the Roybal decision, and requested lands that conformed fairly closely to the boundary of the San Ildefonso grant as measured in 1704. Perhaps the outcome of the 1763 suit would have been different had all the documents associated with the Roybal decision been entered into evidence. Unfortunately for Sánchez, they were not.

On 12 November 1763, Governor Cachupín sent copies of the proceedings to Don Fernando de Torija y Leri, attorney of the Royal Councils and Magistrate of the Villa of San Felipe de Real de Chihuahua for his opinion (SANM I 1763:24). In agreement with Torija's reply (SANM I 1763:24-25), on 12 April 1765 Governor Cachupín ordered that the heirs of Juana Luján be left in possession of their land, the judgement being made that their grant was not prejudicial to San Ildefonso's interests at the time it was made. Other intruders lost their grants, including the Sánchezes:

> There shall be included in their property the ranch which was called Pedro Sanchez's, now abandoned, which is situated in the Canada of the little arroyo called "Los Guajes" [the calabashes]. (SANM I 1763:26)

Thus, the San Ildefonso Grant was established as extending a full league in all directions, and the Sánchez

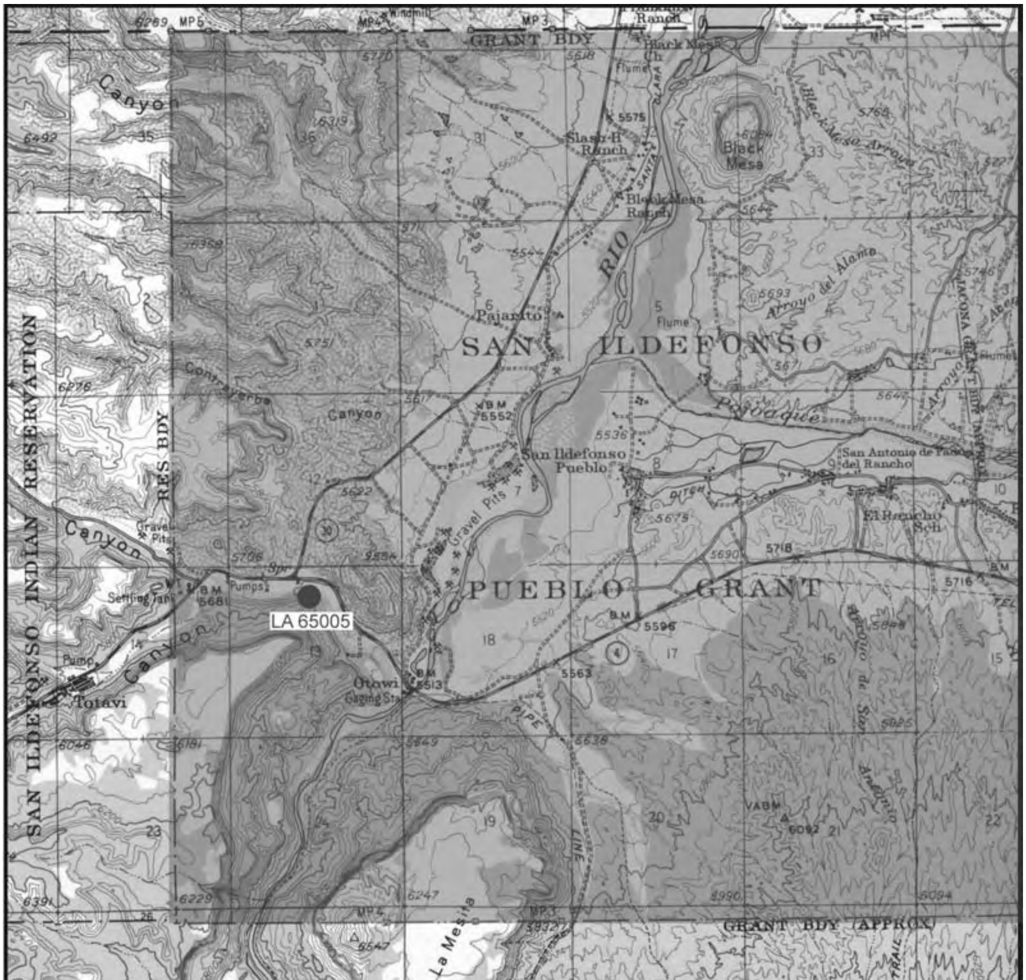

Figure 12.3. Location of the San Ildefonso Grant boundary according to the 1763 decision (LA 65005 marked by dot).

grant clearly encroached upon it. The Sánchez ranch was in Los Guajes Canyon, and appears to have been abandoned by the time this decision was rendered. Figure 12.3 shows that LA 65005 is near the confluence of Guaje and Los Alamos Canyons, well within the boundaries of the San Ildefonso league.

While this ends our discussion of the history of the Sánchez Grant, there was no resolution to the problems it caused until the twentieth century. Ebright (1994) concentrates on the later history of the grant, which continued to be used by intruders into the American Territorial period. At that time it was recognized as a legal grant by the Territorial government, and was deeded to Ramón Vígil.

The Location of the Sánchez Ranch House

The 1763 suit brought by San Ildefonso against the Pedro Sánchez Grant contains important clues concerning the location of the associated ranch house. In our discussion of the earlier Ignacio de Roybal Grant we noted the absence of references to any house. However, the documents do mention a house and torreon built on the west side of the Rio Grande by residents of San Ildefonso at the urging of their priest (SANM I 1704). It seems clear that these structures were built to provide a visible claim to the lands under dispute. Had Roybal a house on his grant it probably would have been mentioned, thereby strengthening his claim. Since no reference to a Spanish-built structure was made, it is probably safe to assume that such did not exist. The same documents are unclear about the location of the San Ildefonso ranch house and torreon. However, it is likely that they were situated among the farmlands on the west side of the river that San Ildefonso seems to have been most interested in reacquiring. Thus, LA 65005 is probably not the location of those structures.

Two important clues concerning the location of the Sánchez ranch house are provided by documents related to the later suit (SANM I 1763). The first was mentioned by Don Carlos Fernández, alcalde mayor of Santa Cruz de la Cañada, during his measuring of the Pueblo league in 1763. At that time he stated that the Sánchez's ranch house and corral were south of a point 3,200 *varas* west of the San Ildefonso cemetery, which should have been in front of the church where it is currently located. This is the first mention of any ranch house in these documents, and provides a relatively accurate distance from a known point. That is, the point of departure is known if the church at San Ildefonso was in the same location in 1763 as it is today.

Two early histories of the mission at San Ildefonso are confusing and contradictory. In his discussion of religious architecture in New Mexico, Kubler (1940) notes that the current church was built in 1905, possibly on the site of the seventeenth-century church. Adams and Chávez (1956) provide a short but confusing history. Citing Scholes and Bloom (1944), they indicate that the original church was built in 1601 and note that it may have been destroyed during the Pueblo Revolt of 1680 (Adams and Chávez 1956:n64). Either a new church was built or the pre-Revolt structure was repaired and reused after the Reconquest, and was subsequently burned in the Rebellion of 1696. Then, citing Hackett (1937), they note that:

> In 1706 a new church was under construction at a site a mile north of the present church...and it was dedicated in 1711. This church was destroyed around 1910, and the present church, which dates from 1905, may be at the location of the seventeenth century church. (Adams and Chávez 1956:n64)

However, this location is contradicted by Dominguez's discussion of his visit in 1776, the document they were annotating. Dominguez stated:

> Now then, the pueblo itself is to the east in relation to the church, with a sort of street between it and the church on the Epistle side, with the Chapel of St. Anthony lying across it. (Adams and Chávez 1956:70-71)

How could the church be a mile north of its current location and directly west of the pueblo at the same time? This is, of course impossible, and Adams and Chávez (1956) appear to have incorrectly cited Hackett (1937). That reference, which concerns a translation of the declaration of Fray Juan Álvarez in 1706, makes no mention of a new church a mile north of the one burned in the Rebellion of 1696; it simply states that the church was being built at the time of his visit in 1706, and that its construction was well advanced (Hackett 1937:374). However, while this suggests that the post-Rebellion church was next to the village, it still leaves its exact location up in the air.

Fortunately, Kessell (1980) provides a more detailed and comprehensive history of the mission at San Ildefonso, and places the post-Rebellion church at the location occupied by the current church. The post-Rebellion church was dedicated in 1711. This, the second or third church at San Ildefonso (depending on whether the church burned in the 1696 Rebellion was new or the rebuilt pre-Revolt building), lasted until 1905 when it was demolished and replaced by a tin-roofed structure built on the same spot (Kessell 1980:79). That church was replaced between 1958 and 1968 by the current church, which is a replica of the 1711 church, and

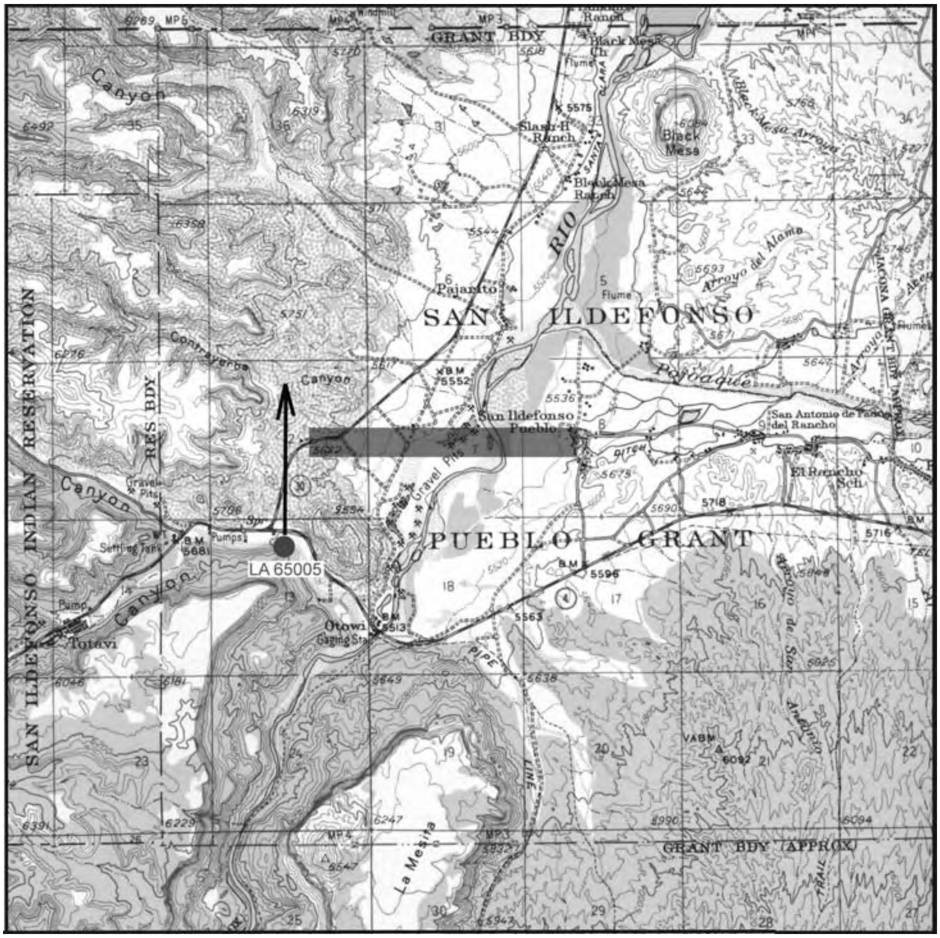

Figure 12.4. True north from LA 65005 in relation to the approximate 3,200 vara point in Fernandez's measurement of the San Ildefonso Grant league in 1763. Transect corridor is shaded.

was again built in the same location (Kessell 1980:n81).

Thus, a measurement from the current churchyard would be a reasonable approximation of the Pueblo league as measured in 1763, since the current church is in the same location as the eighteenth-century church. The legal definition of a *vara* was set at 33 inches by William Pelham, the first surveyor general of the Territory of New Mexico (Hall 1984). This decision was based on the California vara, which was determined to measure 33 inches by the surveyor general of California in 1851 (Hall 1984:85). The *vara* sticks used by Pueblos at the time of the American take-over in 1846 were relatively uniform in length, though they varied between 32.3 and 33.3 inches (Hall 1984:85). For our purposes, the *vara* will be considered equivalent to 33 inches, keeping in mind its documented variability.

Fernández noted that he was north of the Sánchez ranch house when a distance of 3,200 varas was measured west from the San Ildefonso cemetery (SANM I 1763:7). That distance equates to roughly 2,682 m (8,800 ft). Figure 12.4 shows the approximate location of this transect, and LA 65005 is not directly south of the end point. However, it is likely that directional measurements in eighteenth-century New Mexico were made according to magnetic rather than true north. Thus, we must try to determine the declination for this area in the 1760s. This is difficult because only two archaeomagnetic dates from around that time are currently reported for the Southwest. Those samples were taken from historic lime kilns in southeast Arizona, which appear to have been used between 1780 and 1800 (Lange and Murphy 1989). However, the dates are estimated and were not verified independent of archaeomagnetic dating. Data from these samples yielded possible declinations for the San Ildefonso area of 7.9 and 13.3 degrees (Daniel Wolfman, OAS Archaeomagnetic Laboratory, pers. comm. 1993). While the former represents a significant departure from the modern declination of 13.5 degrees, the second is remarkably similar.

Figure 12.5 illustrates LA 65005 in relation to Fernández's measurements, using a declination of 7.9 degrees. With this declination, LA 65005 is much closer to due south of the 3,200 vara point. A declination of 13.3 degrees is shown in Figure 12.6. This angle comes

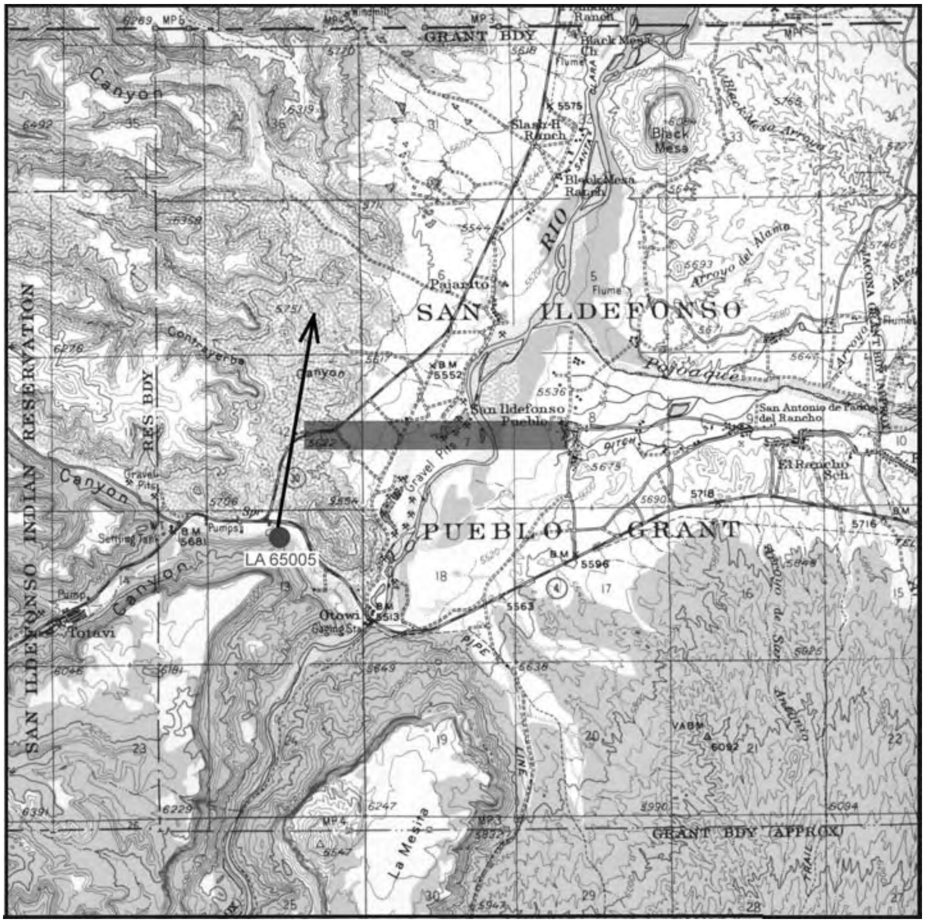

Figure 12.5. Declination of 7.9 degrees from LA 65005 in relation to the approximate 3,200 vara point in Fernandez's measurement of the San Ildefonso Grant league in 1763. Transect corridor is shaded.

close to intersecting the estimated location of the 3,200 vara point. Considering the inaccuracy of Pueblo league measurements due to variation in terrain and the length of a *vara,* problems with stretching of the rope used to measure the league (Hall 1984), and the likely lack of a compass during the measuring, this can be considered good enough. Simply stated, LA 65005 is south of a point 3,200 *varas* from the San Ildefonso church cemetery, which coincides with Fernández's location for the ranch house and corral of Pedro Sánchez.

The second piece of information needed to identify the location of the Sánchez ranch house is provided by Governor Cachupín's decision. His description placed the ranch in Los Guajes Arroyo, which has retained that name and is now called Guaje Canyon. LA 65005 is just east of the confluence of Guaje and Los Alamos canyons. While this area is considered part of the latter on modern topographic quadrangles, it could just as easily be part of Guaje Canyon. Indeed, this is the case in Harrington's study of Tewa Indian ethnogeography (1916, Map 61), where Los Alamos Arroyo appears as a tributary of Guaje Arroyo. The lower part of the canyon was undoubtedly considered part of "Los Guajes" Canyon during the Spanish Colonial period.

A third clue is included in a group of documents pertaining to a later lawsuit, when the area was known as the Ramón Vigil Grant. Included with legal documents from that case is the translation of a grant transfer dated 1749, in which it is stated that Francisco Sánchez had obtained his siblings' interest in the Pedro Sánchez Grant:

> At the Villa Nueva de Santa Cruz de la Cañada on the 15th day of the month of August 1749, there appeared before me Don Nicholas Ortiz Alcalde Mayor and War Captain of said Villa and its jurisdiction, my compadre Francisco Sanchez, whom I state and certify had a piece of land at La Mesilla, consisting of forty yards and one house containing twenty four beams. The said land and house was sold or exchanged to his sisters for the right which they had in the abrevadero of the Guajes River up to the hill of the Frijoles Creek, which is bounded by lands of Montoya; further I should mention the names of his sisters which are Barbara Sanchez,

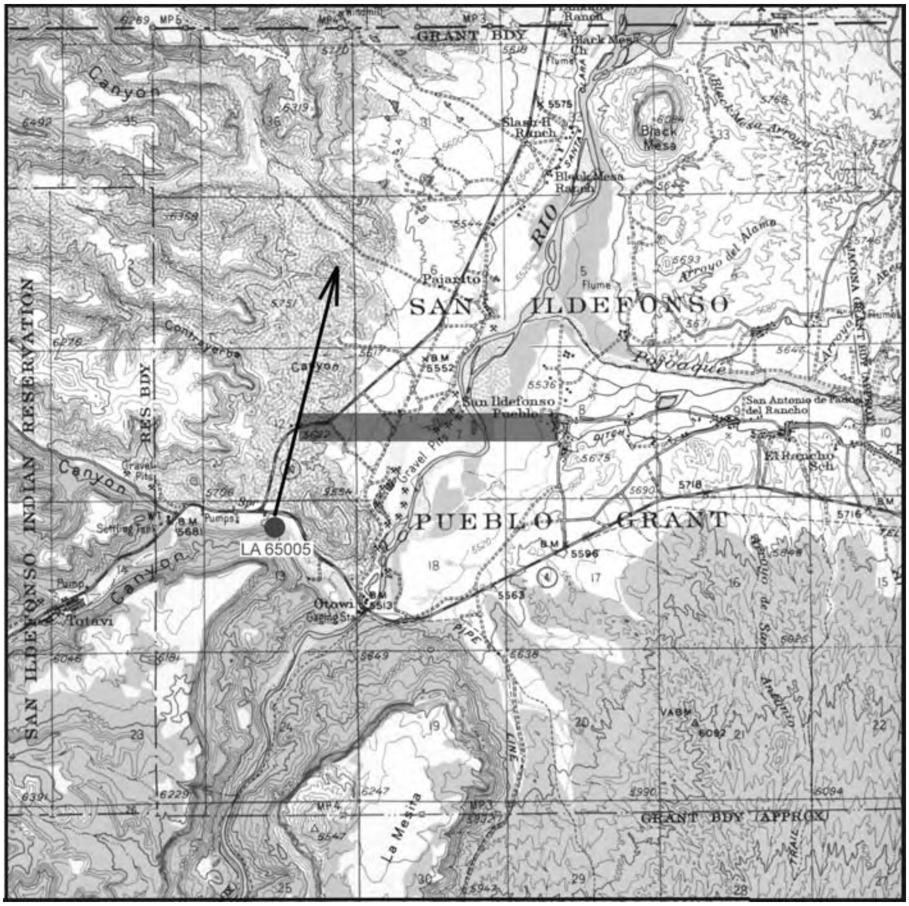

Figure 12.6. Declination of 13.3 degrees from LA 65005 in relation to the approximate 3,200 vara point in Fernandez's measurement of the San Ildefonso Grant league in 1763. Transect corridor is shaded.

Maria Tereza Sanchez, and Maria Sanchez, which have given their free right before a competent authority and also his brothers which appeared before the justice who made the transfers and who unanimously agreed to convey their rights to their brother Francisco Sanchez at the same place of the Abrevadero de los Guajes River to the hill of the Rito de los Frijoles in settlement of accounts which they have had with Francisco Sanchez brother of the vendors, Miguel Sanchez eight ewes, which he owed the same as the others, Julian Sanchez eight dollars in money, Bernardo Sanchez eight ewes, Pedro Sanchez one bull, all that has been stated which was due by said brothers to Francisco Sanchez, they have paid with lands in the same Abrevadero of the Guajes River to the hill of the Rito de los Frijoles above mentioned to said Francisco Sanchez which he can possess and sell with full rights for himself and sons and successors without there being any suits brought against them by any one and if there should be any the vendors will defend them until they shall leave them in quiet possession and they request the royal tribunals to compel them to faithful compliance. (Prince Papers n.d.)

Ebright (1994:346) indicates that the original document is on page 86 of Day Book C of the Surveyor General's Register of Land Titles (curated at the State Records Center and Archives in Santa Fe). This deed is interesting for two reasons. First, it indicates that Francisco Sánchez consolidated his claim to the grant in 1749, suggesting that Pedro no longer had any interest in the land. Ebright (1994:229) notes that Pedro requested the Bartolome Trujillo Grant near Abiquiú in the late 1740s, and suggests that this action is evidence that he had abandoned the grant near San Ildefonso. Bowden (1969:1127) indicates that his attempt to get this grant occurred in 1750. Bartholome Trujillo filed to reoccupy his grant when the Abiquiú area was ordered resettled by the Viceroy following a period of abandonment due to conflict with the Comanche (Bowden 1969:1127). Pedro Sánchez attempted to register the grant, but Trujillo successfully petitioned to retain possession (Bowden 1969:1128).

Thus, Pedro may have had a history of using various pieces of land for a short time and then moving on. He was unsuccessful in farming and herding sheep on the Black Mesa Grant and lost it. Apparently, he also lost interest in the Pedro Sánchez Grant, and in less than 10 years was trying to gain possession of the Bartholome Trujillo Grant. But other members of his family were not as eager to leave their grant west of San Ildefonso Pueblo. Perhaps Francisco was stationed at the ranch in Guaje Canyon and liked the area. In any case, he consolidated his claim on the land when his father lost interest. Thus, the materials at LA 65005 may reflect occupation of the site by one of Pedro's sons and his family rather than the original grantee. When Fernández referred to the ranch and corral of Pedro Sánchez in 1763 he was probably assuming that the grantee occupied the ranch, but it is more likely that it was used by his son Francisco.

The use of the term "Abrevadero of the Guajes River" is of interest to our discussion of the grant's location. *Abrevadero* means watering place, and perhaps refers to a spring located less than 100 m from LA 65005. It might also refer to the watering place along the Rio Grande mentioned in the 1763 suit against Pedro Sánchez where Antonio Mestas was planning to build a house (SANM I 1763:3). If so, this is further evidence that our identification of LA 65005 as the location of Pedro Sánchez's ranch is correct.

These arguments suggest that LA 65005 was the location of Pedro Sánchez's ranch and corral in 1763. The site relates correctly in distance and direction to the location provided by Fernández, it is in the canyon where Governor Cachupín's decision placed the Sánchez ranch house, and it is near the probable location of the abrevadero referred to in Francisco Sánchez's deed. During the initial survey for this project (Moore and Levine 1987) and our examination of the area around LA 65005 and the nearby LA 65006 during data recovery, no other remains dating to the Spanish Colonial period were found. The lack of other such remains in this area combined with the close fit of LA 65005 with the documented location of Pedro Sánchez's ranch suggests that this site indeed represents the remains of his ranch house and corral.

Dating the Pedro Sánchez Site

Dates for the occupation of the Pedro Sánchez site are provided by two sources, documents discussed in the previous section of this chapter and pottery. While charcoal was available from trash deposits, no samples were submitted for absolute dating. Because of problems inherent in the radiocarbon dating of wood samples this type of analysis is not sensitive enough to provide the necessary temporal data. Pottery is often equally unsatisfactory as a temporal indicator, but it was felt that documentary evidence would offset this problem. In addition, it should provide a sorely needed accuracy check for dates provided by the literature.

The documentary sources discussed above suggest that the site was occupied between 1742 and 1763. Ebright (1994) feels that the grant may have been abandoned earlier, citing Pedro Sánchez's application for the Bartolomé Trujillo Grant. Since Spanish law did not allow a person to hold more than one grant, he thinks it likely that Pedro abandoned the land near San Ildefonso before requesting the grant near Abiquiú. However, the Sánchez Grant was still being used by someone in 1763, since the suit mentions difficulties with those who were keeping their herds there. This was probably Francisco, who had consolidated his claim on the grant by 1749 (SANM I 1763:28). Pedro seems to have died between June of 1762 when he is listed as godparent to a child in Santa Cruz de la Cañada (AASF n.d.:377) and early 1763, when the lawsuit was brought against him or his heirs.

If the 1749 grant transfer to Francisco Sánchez is real and not another forgery it is possible that Pedro gave the land to his children and moved on, thus accounting for his attempt to acquire the Bartolomé Trujillo Grant in 1752. Why his heirs did not dispute San Ildefonso's claims is unclear. Perhaps the land transfer was illegal or they did not have the resources to fight the lawsuit. Whatever the reason, the grant appears to have been officially occupied for 21 years between 1742 and 1763. Since it was sold to Ramón Vigil in 1851 by one of the heirs of Pedro Sánchez (Ebright 1994:225), it is possible that the family simply disobeyed the order and continued to use the land, though almost certainly less openly. While the house was undoubtedly abandoned after 1763, perhaps the Sánchez family continued to run some livestock in the area.

In Levine's analysis of the pottery from LA 65005 (in *Ceramic Analysis and Interpretation,* Chapter 9), she concludes that it reflects a late seventeenth-century occupation. This is based on the presence of Sakona and Tewa polychromes, a low frequency of Ogapoge and Powhoge polychromes, a high frequency of polished red wares, and a low frequency of polished black wares. This contradicts the documentary evidence, which suggests a mid-eighteenth-century occupation. However, some researchers have begun to question the accuracy of dates for the Tewa polychrome series (C. Snow, pers. comm. 1993), and it is possible that the ending dates provided in the literature are too early (J. Batkin, pers. comm. 1993; D. Snow, pers. comm. 1993).

The historic upper Rio Grande Tewa pottery series was originally defined by Mera (1939). Sankawi Black-on-cream provides a link between the late prehistoric and early historic periods. Tewa Polychrome represents a divergence from Sankawi Black-on-cream, retaining earlier vessel forms but adding a new bowl type in addition to a polished red-slipped base (Mera 1939:11). The origination of this type was placed in the last quarter of the seventeenth century by Mera (1939:11-12), based on its occurrence at a few sites dated to that period. No later sites were known to contain Tewa Polychrome at that time. Ogapoge and Pojoaque polychromes succeeded Tewa Polychrome, and were tree-ring dated to the mid-eighteenth century (Mera 1939:16).

Other types defined at that time for the upper Rio Grande include Posuge Red and Kapo Black–two varieties of polished plain wares. The former was thought to have originated at the same time as Tewa Polychrome (Mera 1939:12), while the latter was probably not developed until around 1680 (Mera 1939:15). Of course, it must be remembered that the use of absolute dating techniques was in its infancy when Mera defined and provided dates for these types. The technique of using tree-rings for dating sites was only a decade old (Bannister 1970), and other methods like radiocarbon dating had not yet been developed. In addition, few historic sites occupied by Pueblos or Spaniards had yet been investigated. Thus, these dates must be viewed as tentative.

Harlow (1973:28), in his classic study of historic Rio Grande matte-painted wares, discusses Sakona Black-on-tan and Polychrome, suggesting that manufacture of the former began by about 1580 and continued throughout the seventeenth century. This type represented a change in design layout from the earlier Sankawi Black-on-cream, which closely resembled styles seen later in Tewa Polychrome. Sakona Polychrome was made between 1650 and 1700, and simply represents the addition of a red-slipped base to the Sakona Black-on-tan style. It is interesting to note that only a single example of Sakona Polychrome was known at the time of Harlow's (1973) initial publication. Thus, we must ask whether it represents a new pottery type or variation within the Tewa Polychrome style.

The production of Tewa Polychrome is dated between 1650 and 1730, Ogapoge Polychrome between 1720 and 1760, and Powhoge Polychrome between 1760 and 1850 (Harlow 1973). Powhoge also appears to have had a black-on-red variety that was manufactured concurrently. In a later discussion of the Tewa series, Sakona and Tewa Polychrome are both considered to have been manufactured until around 1730 (Frank and Harlow 1974:33). It is also stated that "In the following twenty years or more these gradually evolved into two excellent types, Ogapoge Polychrome and Pojoaque Polychrome (circa 1730-1760)."

Thus, the transition from Tewa to Ogapoge Polychrome appears to have taken some time, rather than occurring instantaneously, and some Tewa Polychrome may have been produced until the 1750s or later. Based on the excavation of historic sites at Cochiti Reservoir, Warren (1979:237) provides dates of 1675 to 1720 for Tewa Polychrome and 1720 to 1800+ for Ogapoge Polychrome. The latter is problematic, because later in her discussion Warren (1979:243) refers to Ogapoge Polychrome as an early to mid-eighteenth-century type.

Batkin (1987, 1991) has reviewed the Tewa polychrome series, and provides several important observations and revisions. He rejects both Sakona Black-on-tan and Sakona Polychrome as valid types (Batkin 1987:199), suggesting that the definition of Sakona Polychrome merely compounded an error made by Mera (brackets mine):

> Mera's error was selection of a Pojoaque Polychrome olla to illustrate the Tewa Polychrome type . . . (Batkin 1987:199)
>
> The confusion became greater when Francis Harlow disregarded Mera's definition [of Tewa Polychrome] and accepted the Astialakwa fragment [of the Pojoaque Polychrome vessel misidentified as Tewa Polychrome] as the "type specimen" of Tewa Polychrome. Rather than recognizing Mera's error, Harlow rewrote the definition of the Tewa Polychrome olla, which became a red-slipped type [red-slipped base rather than simply having a red-slipped band on the base]. However, Harlow recognized the existence of an early white-slipped type, not much different from Sankawi Black-on-cream, and created yet another name, Sakona Polychrome, to identify it. Worse still, Harlow disregarded Mera's assertion that red paint did not always occur in Ogapoge Polychrome designs, and assigned all white-slipped Tewa ollas without red design paint to his new Sakona Polychrome. Consequently, one olla from Gobernador Canyon, now at the University of Colorado (catalogue number 381) became a type specimen for both Mera's Ogapoge Polychrome and Harlow's Sakona Polychrome. The author disregards Sakona Polychrome. Sakona Black-on-tan [or white] is also rejected for merely duplicating Mera's recognition of bowls as "an alien form" at Sankawi Black-on-cream sites. (Batkin 1987:199)

Thus, misidentification and misinterpretation appear to have led to the definition of Sakona Polychrome as a distinct type, when in reality it appears to have been a variant of Tewa Polychrome.

There are also difficulties involved in distinguishing Tewa Polychrome from Ogapoge Polychrome (Batkin 1987:199). Part of this is due to the lack of a complete underbody from a Tewa Polychrome jar. Since Mera

(1939) defined the transition from Tewa Polychrome to Ogapoge Polychrome as a shift from a solid red underbody to a red-slipped underbody band, this is particularly significant (Batkin 1987:199). In addition, the presence of a feather motif, which Mera (1939) considers a hallmark of Ogapoge Polychrome, can also occur on Tewa Polychrome (Batkin 1987:199). Batkin (1987:38) notes that:

> . . . a significant difference between Tewa Polychrome and Ogapoge Polychrome may not exist. Study of sherd collections suggest, instead, a gradual transition from one type to the next, in which red paint and feather motifs may or may not be significant characteristics. Ogapoge Polychrome is interpreted by archaeologists as an eighteenth century type, but no evidence proves it was not made in the late seventeenth or early nineteenth century.

In addition, Tewa Polychrome exhibits a greater variety in decorative motifs than suggested by Mera (Batkin 1987:37-38), bowls and soup plates of this type continued in use long after jars (which were used to define the type) lost their popularity, and Tewa Polychrome sherds occur at sites dating well into the eighteenth century (Batkin 1987:38).

Posuge Red and Kapo Black are difficult types to use and are rather restrictive in terms of vessel form and dating. Thus, Batkin (1987:38-39) suggests Tewa Polished Red ware and Tewa Polished Black ware as alternate names. He also suggests that Posuge Red may not exist at all (Batkin 1991:3). While Mera (1939) described Posuge Red as a jar form, there are examples of Polished Red bowls, soup plates, and other forms but not a single indisputable example of a jar (Batkin 1991:3). The sherds used by Mera to define this type may instead be from Pojoaque Polychrome jars (Batkin 1991:3). The Red-on-tan wares that were popular in the eighteenth and nineteenth centuries, particularly at San Juan Pueblo, are variants of the Tewa Polished Red Wares in which only the vessel upperbody was slipped.

Batkin's (1987) revisions are particularly interesting in light of data recovered from the Pedro Sánchez site and its presumed occupation dates. If Harlow (1973) was correct in his definition of Sakona Polychrome and the dates assigned to it and Tewa Polychrome, the pottery from this site suggests a date at odds with the documentary evidence. Rather than a mid-eighteenth-century date, LA 65005 should date 20 to 50 years earlier. These are the data on which Levine's conclusions in this volume are based (see *Ceramic Analysis and Interpretation,* Chapter 9). However, when Batkin's criticisms and revisions are considered, pottery and documentary dates coincide. Perhaps most important is his observation that due to misinterpretation, a single vessel became the type specimen for both Sakona Polychrome and Ogapoge Polychrome. Also important are his observations that it is often difficult to distinguish between Tewa and Ogapoge polychromes, and that Tewa Polychrome sherds occur on sites dated well into the eighteenth century. This, in addition to Frank and Harlow's (1974) uncertainty over a clear ending date for Tewa Polychrome, suggest there are major problems with this sequence.

Most of the decorated wares from the Pedro Sánchez site are small and impossible to assign to specific types. Thus 73.8 percent of the painted sherds are simply classified as Tewa polychrome, assigning them to the series rather than a specific type. Another sherd (.4 percent) was simply designated carbon-on-cream. Thus, 74.2 percent of the decorated sherds could not be assigned to specific types. Ceramic dates are therefore based on only about 26 percent of the decorated sherds including 7 (3.1 percent) Sakona Polychrome, 18 (7.9 percent) Tewa

TABLE 12.1. TRADITIONAL AND REVISED POTTERY DATES

CERAMIC TYPE	TRADITIONAL DATE	REVISED DATE
Sakona Polychrome	1650-1730	Eliminated, probably Tewa or Ogapoge Polychrome
Tewa Polychrome	1650-1730	1650-1760
Ogapoge Polychrome	1720-1760	Mostly eighteenth century, possibly extending from late seventeenth to early nineteenth centuries
Pojoaque Polychrome	1730-1760	1690-1750, possibly into early nineteenth century
Powhoge Polychrome	1760-1850	ca. 1760-1900
Puname Polychrome	1680-1740	1630-1750
Red-on-tan	Seventeenth through twentieth centuries?	Seventeenth through twentieth centuries?
Black-on-tan	1760-1920	Seventeenth through twentieth centuries?

(Batkin 1987; Frank and Harlow 1974; Harlow 1973; Mera 1939; Warren 1979)

Polychrome, 5 (2.2 percent) Pojoaque Polychrome, 9 (3.9 percent) Tewa or Pojoaque Polychrome, 4 (1.8 percent) Powhoge Black-on-red sherds, 3 (1.3 percent) San Juan Red-on-tan, and 1 (.4 percent) each of Puname Polychrome, Ogapoge Polychrome, and Powhoge Polychrome. Finally, 10 sherds (4.4 percent) with red in their design that initially could not be assigned to either Tewa or Ogapoge Polychrome round out the identifiable portion of this assemblage.

When Sakona Polychrome is eliminated, those specimens could either be Tewa Polychrome or a variety of Ogapoge Polychrome that lacks red in the upper body design. They were shown to Batkin in order to resolve this question, who suggests they are probably a Tewa Polychrome variant, though they could not be conclusively assigned to any existing type (J. Batkin, pers. comm. 1993). Similarly, there are 10 sherds with red in their design that could not be assigned to a specific type. Levine notes that most of these sherds seem to be from the same vessel, but that their geometric designs are usually not a characteristic of Ogapoge Polychrome. The design on one specimen is a checkerboard with red fill (Fig. 9.2). A similar design is illustrated by Mera (1939:63) and Batkin (1987:38) on an Ogapoge Polychrome olla that lacks red in the design. Indeed, examining Ogapoge Polychrome vessels illustrated by these authors and Harlow (1973), it is evident that while this type does not tend to be decorated with abstract geometric panels, individual design elements are often geometric in form. Thus, it is likely that these sherds represent sections of Ogapoge Polychrome vessels.

Examining the reassessed decorated assemblage, we still find it dominated by undifferentiated Tewa Polychrome sherds (74.2 percent). However, Tewa Polychrome now comprises 11 percent of the assemblage, Ogapoge Polychrome 4.8 percent, Pojoaque Polychrome 2.2 percent, Tewa/Pojoaque Polychrome 3.9 percent, and Powhoge Polychrome .4 percent. One of the most important aspects of this assemblage is the co-occurrence of Tewa, Ogapoge, Pojoaque, and Powhoge polychromes in deposits dating between 1742 and 1763. As Table 12.1 indicates, the traditional dates for these types suggest that all should not overlap.

As our assemblage suggests, Tewa Polychrome was used until the 1760s. Ogapoge Polychrome was also manufactured at this time, yet does not dominate the assemblage. It is possible that the temporal range for this type should be pushed a bit forward in time, perhaps from the 1740s to the late eighteenth or early nineteenth century. However, we should keep in mind a comment made by Batkin (1987:38) concerning these types:

> . . . a significant difference between Tewa Polychrome and Ogapoge Polychrome may not exist. Study of sherd collections suggests, instead, a gradual transition from one type to the next, in which red paint and feather motifs may or may not be significant characteristics.

Differences between these types that may be apparent in a whole vessel could be irrelevant or impossible to discern when faced with a collection of sherds. Beginning dates for Powhoge Polychrome might be extended back to the 1740 or 1750s, but it should be remembered that only one sherd was assigned to this type. Again, using a sherd rather than a partial or complete vessel could have led to an incorrect identification of this specimen.

The traditional manufacturing dates assigned to these pottery types are not anchored by absolute dates, except in a few cases at Cochiti Reservoir, at early historic sites in Gobernador Canyon, and at Astialakwa, Black Mesa, and Old Kotyiti (Batkin 1987; Mera 1939; Warren 1979). The documentation of the Pedro Sánchez site adds to this data base, suggesting that revision of the traditional dates is very necessary. Indeed, traditional pottery dates and classifications suggest a late seventeenth to early eighteenth-century use predating the documented occupation of LA 65005. The revised ceramic dates suggest a mid-eighteenth-century use that is more in line with documentary data. While the latter is more likely, there are possibilities associated with the traditional dates that must be considered. In particular, could multiple historic occupations be represented, or does the pottery used at the site represent castoffs dating several decades earlier than the site itself?

Documentary data do not suggest the presence of a Spanish-built structure in this area before the Pedro Sánchez Grant was made in 1742. It is unlikely that any such structure was built by Ignacio de Roybal in the short time he held the grant. However, it remains possible that one might have been built by someone from San Ildefonso Pueblo. Considering this possibility, surface artifacts outside the construction zone were re-examined. One or two possible trash pits were noted in that area during survey and excavation, and are represented by clusters of pottery and chipped stone artifacts eroding out of a stream bank at the south edge of the site. While it was initially assumed that these features date to the same time as the feature excavated by this project, it is also possible that they contain later pottery whose traditional dates would be more in line with the documented occupation.

However, our re-examination of artifacts associated with these unexcavated features suggests that this is not the case. While results were not quantified, the plain wares are dominated by polished red wares, though a few polished black wares were also noted. Of the decorated sherds that could be identified, one was a possible Ogapoge Polychrome and the rest (about 20 to 30) were Tewa Polychrome. An aberrant sherd with a Tewa Polychrome design that included a few dots of red paint was also noted. The unexcavated trash pits appear to contain materials dating to the same period as Feature 1, and there is currently no evidence for more than one use of the site. In addition, the presence of at least three trash pits suggests a more intensive occupation than would be expected if this was the location of the house and torreon built by San Ildefonso and rather reluctantly occupied on a temporary basis.

It would also have been dangerous for someone from San Ildefonso to use LA 65005 as a farmstead at any time during the period being considered. The late seventeenth and early eighteenth centuries were a time of almost continual raiding by hostile Indian groups including Apache, Navajo, Ute, and Comanche. Apache raids contributed to abandonment of several Saline and Piro villages in the late seventeenth century, and continued into the early eighteenth century (Forbes 1960; Kessell 1979; Lange 1979). A letter written by Fray José García Marín in March 1696 noted that Santa Clara Pueblo was ". . . on the frontier of the enemy Apachs [sic] and Utes. . . ." (Espinosa 1988:174). In a letter written by Fray Diego de Chavarria, again in March 1696, he notes that Utes had raided Taos many times, and had even killed people in their cornfields (Espinosa 1988:176).

During the mid-eighteenth century, the Comanches were supplied with arms by the French and actively encouraged to raid Spanish and Pueblo settlements (Lange 1979:202). Massive raids by Comanches and Utes in the 1740s caused the abandonment of many villages on the east side of the Rio Grande from Albuquerque northward (Carrillo n.d.; Noyes 1993:25). Pecos Pueblo was raided by Apaches during the early eighteenth century, and after 1730 came under fierce attack by Comanches (Kessell 1979), who reportedly killed 150 Pecos Indians between 1744 and 1749 (Noyes 1993:25). Utes attacked the Santa Cruz de la Cañada district in 1749 to avenge the destruction of a large ranchería by Governor Joachín de Codallos y Rabal (Noyes 1993:51). Policies instituted by Governor Cachupín between 1749 and 1754 established peace with the Comanche, Ute, and Apache (Noyes 1993). Unfortunately those policies were not continued by his successor, Governor Marín del Valle, and the Comanche again began to raid Spanish and Pueblo villages after 1754 (Noyes 1993:54-55). These attacks continued until 1762 when Governor Vélez returned for a second term and managed to conclude another peace with them (Noyes 1993). These were dangerous times along the eastern edge of New Mexico.

The continual threat of raiding suggest that farmsteads were unsafe and may not have been used by the Pueblos during this period. Indeed, it is likely that the use of field structures at Pecos Pueblo was abandoned after around 1700 for this reason (Moore 1995). While a Spanish ranch would have suffered the same dangers, the distance of this grant from the main Sánchez home in Santa Cruz de la Cañada would have required the establishment of some sort of residence for shelter as well as protection.

Pottery at the site could represent castoffs that were no longer being used or in style. The main Sánchez residence was elsewhere during this period, and it is likely that the ranch house was occupied sporadically by a family member or servant whose job it was to tend grazing livestock. As is often the case in modern line camps and seasonally occupied ranches, this house may have been furnished with whatever was no longer needed or wanted at the main residence. Thus, old pottery and mismatched dishes may have been used. Conversely, it would have been easier to simply acquire new pottery from San Ildefonso, which was just across the river, than to transport it from the main house at Santa Cruz.

While associated documents and site data clearly indicate that evidence for multiple historic uses is lacking, the possibility that ceramic castoffs were used is not as easily rejected. However, breakage over time would have depleted the original supply of pottery, and we might expect a higher representation of later replacements like Ogapoge and Powhoge Polychromes than was found. Either way, the relatively high percentage of Tewa Polychrome suggests it was used, if not manufactured, for some time after the traditionally ascribed end date. Thus, the documentary dates are probably more reliable than the ceramic dates.

Imported Goods on the New Mexican Frontier

As discussed earlier, frontier acculturation can be examined at two levels–New Mexico as a frontier to New Spain, and New Mexico as comprised of frontier and core area. However, there were important differences in economics and population makeup before and after the Pueblo Revolt. This section examines economic processes in New Mexico, and the events that affected and shaped them. In this discussion, imported goods are defined as any products that were produced elsewhere in New Spain or obtained abroad and transported to New Mexico.

Site data used to examine economic trends in New Mexico usually suggest a general lack of wealth and access to goods imported from Mexico that may be illusory. C. Snow (1993:74-75) notes that there were numerous examples of wealth in New Mexico during the seventeenth century, both personal and in the church. This trend continued into the eighteenth century, as attested by the contents of wills and estate inventories (C. Snow, pers. comm. 1993). It was practical goods like iron and steel that were in short supply. This situation has created an archaeological anomaly–site inventories are almost completely different from the contents of wills and estates. While the former primarily contain inexpensive goods like local ceramics, the latter often reflect numerous examples of imported luxury items. Few materials of any value are found in deposits at seventeenth and eighteenth century Spanish sites. This suggests that items which retained value were curated, even if worn or broken. Thus, while the contents of archaeological sites can be used to suggest economic trends, the situation was not quite as bleak as these data suggest.

Economic Conditions in Early Spanish Colonial New Mexico

During the early Spanish Colonial period (1598 to 1680) the economy was controlled by the church and a group of citizen-soldiers. The New Mexico colony existed during this period because its maintenance was underwritten by the Spanish Crown (Simmons 1979:181). Since it was primarily viewed as a mission effort, the secular population received little official support. The church in New Mexico was supplied by a caravan system, which was notoriously inefficient. Scholes (1930:94-95) notes that while caravans were theoretically scheduled every three years, as many as five or six years often passed between deliveries. However, Ivey (1993:41) indicates that there was an average of three years between caravan arrivals through most of the seventeenth century.

Goods carried by the caravans were meant for support of the missions, though at times materials were also carried north for profit (Hackett 1937). This was particularly true between 1664 and 1671 when the caravan passed out of the church's control and was contracted to Don Juan Manso. Apparently, Manso used up to half of the wagons to carry goods for sale in New Mexico (Scholes 1930). According to Ivey's (1993:44) calculations, the supply caravans carried in excess of 80 tons of goods. Products shipped out of New Mexico by the missions provided income that enabled them to purchase luxury items that would not otherwise have been available (Ivey 1993:46).

In addition to shipments controlled by the missions and governors, private trade over the Camino Real also occurred. A fairly wide variety of goods moved in both directions.

> Imports represent practical, utilitarian tools, equipment, household items, and a range of luxury goods, primarily clothing and textiles. The latter consisted of materials made in New Spain as well as yard goods imported from Europe and China. In return, New Mexicans sold coarse, locally made textiles and clothing (mostly stockings), hides, and aside from animals on the hoof, occasional subsistence foods locally produced. (D. Snow 1993:141)

Most pottery used for domestic purposes was purchased from the Pueblos and Apaches; majolica was considered somewhat of a luxury, at least into the nineteenth century (D. Snow 1993:143). This was partly due to the cost of long-distance freighting. However, it was still cheaper than Chinese porcelain and, initially, English ironstone (D. Snow 1993:143). While the markup on majolica was not as great as might be expected (D. Snow 1993:143), the manipulation of the New Mexican monetary system by Chihuahuan merchants probably assured them of considerable profit and kept the price of imported pottery high when compared to locally produced Pueblo wares.

On the civilian side, the seventeenth-century upper class was mainly comprised of the families of the governor and 35 *encomenderos,* the citizen-soldiers referred to earlier (Scholes 1935; D. Snow 1983). Though the governors were banned from engaging in trade, they often broke this regulation by sending goods south with the caravans or shipping them independently (Scholes 1935). Rather than furnishing a permanent garrison for New Mexico, the government created a corps of civilian soldiers to provide the colony with protection, and they were given *encomiendas* in lieu of salaries (Scholes 1935). The *encomiendas* consisted of the right to collect tribute from pueblos. For example, at one time Francisco Anaya Almazán held half of the villages of Quarai and Picurís, and all of La Cienega in *encomienda* (D. Snow 1983:355).

Not all *encomenderos* were equal. A few dominant families formed the core of the upper class:

> Their wealth was greater than that of families of lesser social standing; the best lands were theirs; they had greater opportunities to engage in trade; and they probably received the best encomiendas. (Scholes 1935:98)

The Lucero de Godoy, Goméz, Domínguez de Mendoza, Romero, Baca, and Duran y Chávez families were among the most prominent in seventeenth-century New Mexico (Scholes 1935). The *encomenderos* were critical to the early Spanish Colonial economy. Not only did they receive goods like cotton blankets and buffalo hides from Pueblos as tribute, they may also have acted as the upper level of a redistribution network based on kin ties or population clusters (D. Snow 1983:351). The prestige of the *encomenderos* coupled with the requirement that they maintain a residence in Santa Fe raised them to a dominant position in the local government and economy (Anderson 1985:362).

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

Economic Conditions in Late Spanish Colonial New Mexico

All of New Mexico can be viewed as a frontier in the early Spanish Colonial period due to repeated attempts at revolt by the Pueblos and attacks by Athabaskans. This situation changed after 1700. The pueblos were finally pacified early in the late Spanish Colonial period (1696 to 1821), and a secondary core area developed around the social and economic center at Santa Fe. Other parts of New Mexico remained a frontier. The development of New Mexico into core and frontier was undoubtedly related to its physical separation from the primary core in Mexico, and because for much of its history it essentially had to stand alone. While the local economy remained linked to the primary core in Mexico through a few wealthy families and merchants, New Mexico also developed an internalized economy dominated by trade between the Spanish and both Pueblo and Plains Indians. This is probably what led to the formation of what Frank (1992:17) has called ". . . the dynamic folk culture and innovative elaboration of Spanish tradition. . . ." that prevailed in New Mexico. Separated from the mainstream economy and society, the territory generated its own versions of them.

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

With the re-establishment of the New Mexican colony, much of the earlier economic system was abandoned. The *encomienda* system was abolished, as was the dominance of the church and formal mission supply caravans. The military role of the *encomenderos* was filled by regular presidial garrisons at Santa Fe and El Paso, while they were replaced as an economic force by families who prospered by dealing in sheep. However, most of the people who reoccupied New Mexico were poor farmers and herders. By the 1730s, attempts were being made to re-establish the New Mexico sheep industry, with at least one shipment of wool sent south by 1734 (Baxter 1987:26). In the following year, the governor embargoed all exports of wool, livestock, and grain, considering them harmful to the colony (Baxter 1987:26). This was protested by a number of citizens, who petitioned the governor to lift the embargo, arguing that: "…trade in the forbidden commodities offered the only means available to purchase manufactured goods for themselves, their wives, and children" (Baxter 1987:27). Even so, the embargo remained in place. Thus, the acquisition of manufactured goods remained difficult.

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

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

By the mid-1750s the embargo on livestock trading seems to have been relaxed. A few traders had managed to manipulate the system, which was dominated by merchants in Chihuahua, and had accumulated fortunes by this time. As Baxter (1987:44) notes:

> Frequently allied by marriage ties, this little group of "haves" not only maintained a tight grip on New Mexico's economy, but increasingly dominated political and religious affairs as well. Usually, extensive livestock interests, cared for by dependent partiderios, provided the foundation for their growing wealth and set them apart from less affluent competitors.

The development of wealthy *partiderios* and relaxation of the trade embargo should have set the stage for accelerated economic growth. Unfortunately, other factors intervened, slowing growth for several decades.

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

By 1740 the Apaches had been driven off the Plains or south of the Canadian River, and the Comanches were at peace with the Spanish (Noyes 1993:24-25). This peace was short-lived, because by the mid-1740s the Comanches were mounting intensive raids against Pecos and Galisteo pueblos, culminating in a series of devastating attacks against Spanish settlements east of the Rio Grande. While Governor Vélez established short-lived periods of peace during his two terms of office (1749 to 1754 and 1762 to 1766), most of the years between 1750 and 1780 were marked by war with the Comanches (Noyes 1993).

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

During the early 1770s the government of King Carlos III began to rebuild its power in New Spain (Frank 1992:88). Solving the problem of Indian raids against the northern provinces was part of this process. Beginning in 1772, the defenses of northern New Spain were reorganized, and by 1776 vigorous campaigning had driven the Apaches back, and a line of presidios was established (Frank 1992; Thomas 1932). Despite these successes, Indian raids continued to be a major problem. With the reorganization of northern New Spain into the Provincias Internas in 1776 came the development of a plan that eventually proved successful.

> Established in 1776, Don Teodoro de Croix received the command of the Interior Provinces and arrived in Mexico City early in 1777 to take over his duties. In the few brief years, 1777-1783, that Croix served his king on this immense frontier, he found a solution for this Indian problem and held for all time the border line of Mexico against northern aggression. (Thomas 1932:14)

According to Croix's plan, continual campaigns were to be undertaken against the Apaches from Nueva Vizcaya, Sonora, Coahuila, and New Mexico, and an alliance was to be sought with the Comanches against the Apaches (Thomas 1932:18-19). Governor Juan Bautista de Anza of New Mexico concluded a peace treaty with the Comanches in February 1786, which also allied the two nations against their common enemy, the Apaches (Noyes 1993:80; Thomas 1932:75). Soon afterward, the Comanches and Utes reconciled their differences and also concluded a peace (Thomas 1932:75). Later in the same year, Anza successfully broke up an alliance between the Gila Apaches and Navajos that had been plaguing settlements in southern Arizona, and concluded a peace with the Navajos (Thomas 1932:52). As Frank notes, these events.

> . . . brought New Mexico into an era of relative peace for the first time since mid-century. Although the province experienced continued occasional raids, nothing close to the frequency and magnitude of the Comanche and Apache raids of the 1770s occurred during the next quarter century. . . . Until the last years of Spanish rule, the alliance system erected to protect the northern provinces from Plains Indians hostility gave the inhabitants of New Mexico respite from the burden of their own defense and freed energies needed to improve the quality of other aspects [of] their lives on the frontier of New Spain. (Frank 1992:95)

Unfortunately, just as hostilities on the New Mexican frontier were ending, a second disaster hit. A major smallpox epidemic struck New Mexico in 1780 to 1781, killing a large portion of the population (Frank 1992:64). While rising birth rates soon countered the immediate effects of the epidemic on the population, it had a much longer-lasting effect on demography.

> . . . Although more spectacular and shorter-lived than the Indian hostilities, smallpox brought with it a fundamental change in the demographic structure of the population. The reaction of the Vecino population to the death and suffering produced by the dis-

> ease changed the balance between the Pueblo Indians and Vecinos. They emerged from the trauma as the largest group of people in the province, a position that the Vecinos retained until the second half of the nineteenth century. (Frank 1992:64-65)

Frank (1992:71) suggests that the reduction of population concentrated capital at the same time as communications with Mexico over the Camino Real were freed up, and settlers gained the ability to open new lands without fear of Indian attack. Thus, while in the short run the epidemic seriously disrupted New Mexico, in the long run it may have enhanced the province's ability to take advantage of the economic opportunities provided by the newly established peace.

Frank (1992:166) suggests that the juxtaposition of these trends created an economic boom between 1785 and 1815. Beginning in 1732, a 10 percent tithe was levied on New Mexico by the Bishop of Durango, and the right to collect it was auctioned for a flat annual fee (Frank 1992:168-169). He traces the economic boom through the value and competition for the tithe rental in New Mexico:

> The increase in the real value of the tithe contracts represents a measurable and significant increase in the per capita production of the Vecino population of late colonial New Mexico. The rising value of the tithe rental signifies an active and expanding provincial economy during the last decades of colonial New Mexico. (Frank 1992:191)

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

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

While circulating cash is considered to have been nearly nonexistent in colonial New Mexico, Baxter (1987) notes several occasions on which relatively large sums of cash were used to pay taxes or purchase goods for shipment north. This indicates that hard cash did exist in New Mexico during this period, but was concentrated in the hands of a few at the top of the economic ladder and rarely entered into local economic transactions.

Thus, economic conditions for most New Mexicans through the seventeenth and eighteenth centuries seem to have been rather dismal. The economy was controlled by small groups of wealthy families both before and after the Pueblo Revolt, who retained most of the profits realized through trade with Mexico. Some of this wealth trickled down from the upper class to the bulk of the Spanish population. During the seventeenth century this may have taken the form of a redistribution system, with goods collected as tribute from the Pueblos finding their way into the hands of the Spanish lower class. During the eighteenth century this was replaced by the *partido* system, which theoretically provided a means for poor Spanish settlers to better themselves.

Even with the growth of the sheep trade, New Mexico remained comparatively poor. Goods could only be imported from Mexico, and this trade was manipulated to the detriment of New Mexico by merchants in Chihuahua. Imported goods remained expensive and hard to acquire, and supply from Mexico was difficult and often dangerous. This changed with Mexican independence from Spain and the opening of the Santa Fe Trail in 1821 when eastern goods that were both cheaper and of better quality became available. The improving economy of the late Spanish Colonial period undoubtedly set the stage for this development, increasing the amount of wealth in the province and providing a rudimentary market system. With the opening of the Santa Fe Trail, money began to circulate for the first time in the province (Carroll and Haggard 1942). This allowed increased access to manufactured goods for the population in general. When the railroad arrived around 1880, the supply of manufactured goods was further augmented and transport costs reduced, improving the general availability of affordable manufactured goods imported from outside New Mexico.

Economic Trends in the Archaeological Record

The economic trends discussed in the last section should be visible in the archaeological record. Throughout the

TABLE 12.2. ARTIFACT ASSEMBLAGES FROM SPANISH COLONIAL SITES IN NEW MEXICO

SITE	DATE	LOCAL POTTERY	MEXICAN POTTERY	MAJOLICA	OTHER POTTERY	CHIPPED STONE	GLASS	METAL	OTHER
Palace of the Governors–LA 4451	pre-1694	26,707	159	432	ca. 100[1]	81[2]	43	> 100[3]	[4]
Cochiti Springs Site–LA 34	seventeenth century	575	1[5]	20	0	29	0	0	0
Las Majadas--LA 591	seventeenth century	7965	39	?[6]	0	26[7]	2	12[7]	0
Signal Site--LA 9142	seventeenth century	691	1	20	2	5[7]	0	1	0
La Fonda Parking Lot Site–LA 54000	seventeenth century	ca. 15,000	9	13	0	135	12	623	[4]
Old Federal Building–Santa Fe [8]	seventeenth century	602	0	11	0	?	0	1[7]	0
LA 9138	ca. 1750-1800	727	0	0	0	329	0	6	0
LA 16769	ca. 1750-1850	873	0	191	3	65	5	10	2[4]
Las Huertas--LA 25674	ca. 1765-1838	1614	0	14	0	26	1	13	4[4]
Santa Cruz de Cochiti–LA 70	eighteenth century	818	0	102	0	3[7]	3	7	0
LA 5013	eighteenth century	1	0	0	0	22	0	0	0
Torreon Site–LA 6178	eighteenth century	948[9]	22	34	0	104[7]	14	9	0
LA 9139	eighteenth century	59	0	2	0	0	0	0	0
LA 10114	eighteenth century	341	0	0	0	386	0	5	0
LA 12161	eighteenth century	2363	0	0	0	1187	3	6	17[4]
LA 12507	eighteenth century	48	0	0	0	6	0	0	0
Pedro Sánchez Site–LA 65005	eighteenth century	582	0	0	0	249	1	7	0
LA 85802	eighteenth century	535	1	9	0	?	2	0	0
La Puente–LA 54313	late eighteenth-early nineteenth century	10,629	0	25	20	275[10]	4	28	1
La Puente–LA 54313	mid-nineteenth century	4441	0	11	140	-	52	154	4
Ideal Site–LA 8671	ca. 1835-1860	955	1	4	95	5[7]	3[7]	26[7]	0

TABLE 12.2. CONTINUED.

SITE	DATE	LOCAL POTTERY	MEXICAN POTTERY	MAJOLICA	OTHER POTTERY	CHIPPED STONE	GLASS	METAL	OTHER
LA 13291	ca. 1850-1900	172	0	0	2	981	0	1	0
Trujillo House--LA 59658	ca. 1850-1900	5783	6	1	554	189	622	415	149
LA 25466	ca. 1890-1915	127	0	0	60	190	42	64	8
La Puente--LA 54313	late nineteenth century	3868	0	19	55	-	71	105[11]	118[11]

1 Chinese porcelain, estimated number.
2 Only tools and cores were analyzed and quantified.
3 Metal artifacts were recovered but no numbers are reported.
4 Pieces of slag.
5 Complete vessel.
6 Majolica totaled less than 1 percent of ceramic assemblage, but no numbers given.
7 Minimum number; not all artifacts quantified.
8 Only includes materials from Room 2, Level 6.
9 Rims counted only.
10 All debitage from La Puente included here because it could not be separated by time period.
11 Metal and leather artifacts of unidentified function not included.

References Cited: Alexander 1971; Brody and Colberg 1966; Chapman et al. 1977; Ferg 1984; Honea and Bussey 1971; Hunter-Anderson et al. 1979; Laumbach et al. 1977; Levine et al. 1985; Moore et al. n.d.; Reed and Tucker 1983; Schutt 1979; Seifert 1979; C. Snow, pers. comm., 1993; D. Snow 1973, 1976a, 1976b, 1991; Snow and Warren 1973; Wiseman 1988.

Spanish Colonial period, wealth was mostly concentrated in the hands of a few families whose primary residences were in the capital. Thus, there should be evidence for better access and increased accumulation of manufactured goods in Santa Fe than elsewhere on the New Mexican frontier. Exceptions to this might be ranches outside Santa Fe owned by *encomenderos* in the seventeenth century, or by wealthy *partiderios* in the eighteenth century. While some access to manufactured goods should be evident in sites occupied by poorer Spanish residents, there should be distinct differences between material culture at these sites versus those in the economic core. This should begin to change with the opening of the Santa Fe Trail in 1821. Evidence for increased access to manufactured goods at all levels of society should increase at that time. There should also be evidence for a major change in trade patterns, shifting from south to east. This should become even more visible in sites occupied after the arrival of the railroad, reflecting the increased supply and decreased shipment costs provided by that means of transport.

Differences may also occur between sites occupied in the late Spanish Colonial period before and after 1785. These differences should be linked to improving economic conditions as discussed earlier. They should be most visible at sites occupied by the wealthier strata of society, but might also be discernable in sites occupied by poorer New Mexicans.

Table 12.2 provides information on material culture from tested or excavated Spanish Colonial through American Territorial period sites in New Mexico. Occupational dates are derived from site reports, with three exceptions. LA 5013 was originally assigned a seventeenth-century date based on the presence of a Tewa Polychrome sherd, which was the only ceramic artifact recovered (Laumbach et al. 1977). However, Tewa Polychrome could as easily be ascribed to the eighteenth century. Since LA 5013 more closely resembled the eighteenth-century sites, it was assigned a like date for this analysis. Three components were defined for La Puente (LA 54313); one was dated to the late Spanish Colonial period, one to the Mexican Territorial period, and one to the American Territorial period (Boyer n.d.). However, the presence of pottery imported from the United States in the late Spanish Colonial assemblage suggests it may actually date to the early Mexican Territorial period, since goods from the East do not appear at other sites before the opening of the Santa Fe Trail. Thus, the date originally assigned to that component was changed to correspond to that trend. Finally, two occupations were initially defined at the Torreon site (LA 6178), dating to the early and late Spanish Colonial periods (Snow and Warren 1973). However, further consideration of this site in light of more recent data suggests that only a single eighteenth-century occupation is indicated (Warren 1979).

Several divisions of artifact types were made in order to study local economic contributions versus imports from Mexico or the United States. Eight categories are included in Table 12.2, though one (Other) refers to no specific artifact class. Seven categories are of particular interest to this discussion, four of which are related to pottery assemblages. The local pottery category includes both Indian and Hispanic earthenwares manufactured in New Mexico. Mexican pottery refers to wares other than majolicas that were made in Mexico, and includes traditional types made by Mexican Indians as well as olive jars (which were also manufactured in Spain). Majolicas are tin-glazed coarse earthenwares imported from, and usually manufactured in, Mexico. The Other pottery category includes various imported wares running the gamut from Chinese porcelain to English ironstone. Thus, three ceramic categories reference imported goods.

Three categories record the occurrence of other types of nonperishable items. The chipped stone category includes artifacts such as gunflints, strike-a-light flints, debitage, and cores. Other imported materials like glass and metal are quantified when possible. Nonperishable items are only included for a few Mexican and American Territorial period sites because of variation in preservation between sites occupied in the seventeenth century and those used during the late nineteenth and twentieth centuries. When included, these artifacts are quantified in the Other category.

Data from sites included in this and subsequent tables are not always directly comparable because there is wide variation in the quality and types of information presented in site reports. However, they are sufficient to illustrate general trends between sites through time and from different areas that reflect variation in wealth and access to certain classes of goods.

Locally made pottery dominates each assemblage in Table 12.2. Mexican pottery is fairly common at seventeenth-century sites but, with the exception of the Torreon site and LA 85802, is absent from eighteenth-century assemblages. It again appears at nineteenth-century sites; however, olive jar sherds are the only type of Mexican ware in the nineteenth-century assemblages, while types manufactured by Mexican Indians also occur at seventeenth-century sites. At the Palace of the Governors, this category includes lead-glazed and slipped and polished earthenwares in addition to olive jar sherds (Seifert 1979:61). The only example of Mexican pottery from the Cochiti Springs site was an effigy vessel apparently manufactured in the Valley of Mexico (Bussey and Honea 1971). All of the Mexican wares at Las Majadas were Aztec Black-on-red (D. Snow 1973).

An olive jar sherd was the only pottery of possible Mexican manufacture at the Signal site (Alexander 1971), while seven olive jar and two green glaze sherds of apparent Mexican manufacture were found at the La Fonda Parking Lot site (Wiseman 1988). Though no Mexican wares were recovered from the Old Federal Building deposits included in Table 12.2, a seventeenth-century olive jar rim and four sherds of a lead-glazed Mexican ware resembling types found elsewhere in seventeenth-century contexts were recovered from mixed strata (D. Snow 1991). About two-thirds of the Mexican pottery from the eighteenth-century Torreon site were fragments of olive jars. The remaining third consisted of sherds from a lead-glazed red ware vessel with a black luster finish that probably copied a contemporary English ware and was produced in Puebla or Michoacan (Snow and Warren 1973). A single sherd of Mexican manufacture was recovered during test excavations at LA 85802 (C. Snow, pers. comm. 1993).

Majolica sherds were found at 64 percent of the sites. They occurred at all seventeenth century sites, 46 percent of eighteenth-century sites, all Santa Fe Trail period sites (1821 through 1880), and 60 percent of railroad period sites (post-1880). Only four sites contained significant numbers of majolica sherds (more than 35)–two apiece date to the seventeenth and eighteenth centuries. Two–the Palace of the Governors and LA 16769–are in the Santa Fe core; the others are in the Cochiti area.

Pottery of other than local or Mexican manufacture is rare at sites occupied before the opening of the Santa Fe Trail. While other types of imported wares were common at sites dating to the Mexican and American Territorial periods, they occurred at only four earlier sites. Chinese porcelains were recovered from the Palace of the Governors and the Signal site–both occupied during the seventeenth century (Alexander 1971; Seifert 1979). A single seventeenth-century Chinese porcelain sherd was also recovered from mixed deposits at the Old Federal Building in Santa Fe, and is thus not included in Table 12.2 (D. Snow 1991). Euroamerican wares were found at LA 16769 and La Puente–both occupied during the late eighteenth and early nineteenth centuries (Levine et al. 1985; Moore et al. n.d.). It is possible that Spanish Colonial deposits from these sites overlap the early years of the Mexican Territorial period when Santa Fe Trail imports became available. However, as is discussed in more detail later, the Euroamerican wares from LA 16769 are probably intrusive and this site seems to date before 1821.

Chipped stone artifacts were recovered from all but one site, LA 9139 (Chapman et al. 1977; D. Snow 1976). Glass and metal artifacts were also rather common in small numbers, with the former occurring at 64 percent of the sites and the latter at 80 percent. In terms of actual numbers, glass was most common at nineteenth-century sites and fairly common at seventeenth century sites. Again, except for the Torreon site, only a few pieces of glass occurred at any eighteenth-century site. Metal artifacts followed a similar pattern. They were most common at nineteenth century sites and a few seventeenth-century sites, and occurred in small numbers at several eighteenth-century sites. Both glass and metal were absent from only 16 percent of the sample, mostly eighteenth-century sites.

Table 12.3 presents percentages of each assemblage comprised of imported items. Many of these percentages must be considered tentative because of inconsistencies in databases. For example, it was not possible to break the remains from the Palace of the Governors into Pueblo Revolt period Tano deposits and post-Reconquest Spanish remains, so all seventeenth- and eighteenth-century artifacts recovered from that study were included. This probably skews the percentage of imported articles downward, since a considerable proportion of the local ceramics may be related to the earlier occupation. In addition, accurate totals of other pottery types and metal artifacts were not provided (Seifert 1979), and some of the numbers listed in Table 12.2 are rough estimates provided by C. Snow (pers. comm. 1993). It is likely that more artifacts of these types were recovered, again skewing the percentage in Table 12.3 downward.

Similarly, though majolica sherds were recovered from Las Majadas (D. Snow 1973), no count was provided. Instead, it was noted that these sherds comprise less than 1 percent of the ceramic assemblage, inferring that the count could have been as high as 300. Thus, percentages for this site represent low and high ranges, while the actual percentage was probably somewhere near the median. The local ceramic count for the Torreon site includes rims only (Snow and Warren 1973), while counts of other ceramic types include body sherds as well. In addition, neither the plain wares nor utility wares were quantified. This has caused the percentage of imports to be skewed upward.

Total counts of chipped stone artifacts were not available for six sites including the Palace of the Governors, Las Majadas, the Signal site, the Torreon site, and the Ideal site. Again, this has skewed the percentage of imports upward for these sites, though probably not to a large degree. Mixed data are reported for LA 16769; E. Boyd's surface collections were biased toward Euroamerican materials and identifiable local ceramics, and Levine et al.'s (1985) collections were from testing. Finally, complete counts of glass and metal artifacts from early excavations at the Ideal site are not available (Brody and Colberg 1966), and it is likely that this has skewed the percentage of imports downward.

TABLE 12.3. COMPARISON OF PERCENTAGES OF ASSEMBLAGES COMPRISED OF IMPORTED GOODS BY SITE, PERIOD OF OCCUPATION, AND LOCATION

DATE	SITE	LOCATION	PERCENTAGE OF IMPORTS
Seventeenth century	Cochiti Springs Site–LA 34	Cochiti area	3.4
	Las Majadas–LA 591	Cochiti area	0.7 to 4.4
	Palace of the Governors–LA 4451	Santa Fe core	3.0
	Signal Site--LA 9142	Galisteo Dam area	3.3
	Old Federal Building--Santa Fe	Santa Fe core	2.0
	La Fonda Parking Lot Site–LA 54000	Santa Fe core	4.2
Eighteenth century	Santa Cruz de Cochiti–LA 70	Cochiti area	12.0
	LA 5013	Cochiti area	0.0
	Torreon Site–LA 6178	Cochiti area	7.0
	LA 9138	Cochiti area	0.3
	LA 9139	Cochiti area	3.3
	LA 10114	Cochiti area	0.7
	LA 12161	Cochiti area	0.3
	LA 12507	Cochiti area	0.0
	Pedro Sánchez Site–LA 65005	San Ildefonso area	1.0
	LA 85802	La Cienega area	2.2
Eighteenth to early nineteenth centuries	LA 16769	Santa Fe core	18.2
	Las Huertas–LA 25674	Bernalillo area	1.7
	La Puente–LA 54313 (Component 1)	Abiquiú area	0.7
	La Puente–LA 54313 (Component 2)	Abiquiú area	7.4
Nineteenth century	Ideal Site--LA 8671	Bernalillo area	11.9
	LA 13291	Cochiti area	0.3
	LA 25466	Abiquiú area	34.4
	La Puente–LA 54313 (Component 3)	Abiquiú area	6.1[1]
	Trujillo House–LA 59658	Abiquiú area	21.1

[1] Metal artifacts of unidentified function not included.

Even with these problems some interesting trends are visible. Seventeenth-century assemblages contain very similar percentages of imported materials, averaging between 2.8 and 2.4 percent, depending on how many majolica sherds were actually present at Las Majadas. The Palace of the Governors is on the low end of the distribution, but as discussed above, that percentage was probably skewed downward by inclusion of Pueblo Revolt period Tano materials.

Of the eighteenth-century sites, six contained 1 percent imports or less, two were similar to the seventeenth-century sites, and two had significantly higher percentages of imports. Thus, 60 percent of the eighteenth-century sites contained few imports, while 40 percent contained slightly more to significantly more imported materials. Of the assemblages containing percentages of imported goods similar to those of seventeenth-century sites, LA 85802 has only been tested, while LA 9139 was completely excavated (Chapman et al. 1977; C. Snow, pers. comm. 1993; D. Snow 1976). The moderate percentage of imports at LA 9139 is probably a function of sample error. Only 2 of 61 sherds from this site were majolicas, the rest were locally produced wares. Except for bone (which is not considered in this discussion) no other types of artifacts were recovered. LA 85802 is near La Cienega, slightly closer to the Santa Fe core than were the Cochiti sites. While this may account for the moderate percentage of imports, it is not a very satisfactory explanation. Initial indications suggest that this site is fairly large; thus it may have been the residence of a wealthy landowner. However, further studies are needed to confirm this.

Santa Cruz de Cochiti was comprised of three blocks of remodeled rooms in prehistoric Pueblo del Encierro, and contained a relatively high percentage of imported goods. Since this ranch was within a larger prehistoric ruin it was difficult to accurately ascribe certain classes of artifacts to a specific occupation. Among these were the chipped stone artifacts, and the few that were assigned to the historic occupation were all found on floors in Spanish-used rooms. This may have skewed the percentage of imports upwards a bit, but probably not enough to account for the rather high proportion of nonlocal goods. Most of the imports at Santa Cruz de Cochiti were majolica sherds. This suggests that the occupants were comparatively wealthy and had better access to imported goods than did the occupants of most of the other sites in this group. In fact, C. Snow (1979:225) speculates that Santa Cruz de Cochiti was headquarters for one of the absentee landowners of the Las Majadas Grant or the Santa Cruz Tract, though documentary evidence for this was not found.

As noted earlier, only rims were quantified for the local pottery category at the Torreon site, plain wares and utility wares were not quantified, and accurate counts of the chipped stone assemblage were not available, suggesting that the percentage of imported goods is skewed upward. However, while the other sites listed in Table 12.3 were residences, the Torreon site had a defensive function. C. Snow (1979:221) suggests that the Cochiti garrison, which was ordered into the area by Governor Cuervo y Valdes in the early eighteenth century, may have been quartered at this site. While continued (or intermittent) occupation was suggested by the presence of later ceramic types, the Torreon site probably continued to be defensive in nature. Thus, the relatively high percentage of imports could be a function of its use. Williams (1992) indicates that presidios tend to contain more high-status imported goods than do contemporary missions. This is because presidios contained mostly Spanish soldiers and their families (Williams 1992:13). A similar process could account for higher percentages of imported goods at the Torreon site, since it seems to represent a temporary garrison for soldiers from Santa Fe.

The occupation of LA 16769 seems to have overlapped the late eighteenth and early nineteenth centuries, and it contains a high percentage of imported goods. Thus, it is the only late Spanish Colonial period site from the Santa Fe core in our database. LA 16769 is 3.2 km south of Santa Fe proper, and was investigated by E. Boyd and Levine et al. (1985). While collections from E. Boyd's studies were examined and used by Levine et al. (1985), they were not published before that time. The date for this site was derived from associated ceramics, including one Euroamerican sherd manufactured after the opening of the Santa Fe Trail. The relative lack of Euroamerican wares and predominance of majolicas suggest that the former were intrusives or the site was not long occupied after the trail opened. Since all of the Euroamerican sherds were found on the surface, their association with subsurface deposits is suspect. Thus, for the purpose of this discussion, LA 16769 is considered a late Spanish Colonial site. The high percentage of imports suggests that its occupants had easy access to merchandise imported from Mexico over the Camino Real, and may reflect the improved economic prosperity of the post-1785 Spanish Colonial period. It also implies that they were relatively wealthy, since imported goods were more expensive than those produced locally. However, as noted earlier, many of these artifacts were from surface collections that were biased toward Euroamerican materials and identifiable locally made pottery. Data produced by Levine et al. (1985) may be more representative of actual percentages at the site. With E. Boyd's surface collections eliminated, only 9 Euroamerican artifacts (2 majolica, 6 glass, 1 metal) are present in an assemblage containing 549 artifacts. Of the glass, all but 2 fragments seem to be later intrusions and can be eliminated. Only 0.9 percent of the revised assemblage are imported goods, and this percentage is in line with other eighteenth-century sites. Thus, while imported goods are very common at this site, they may only comprise a small part of the total assemblage.

The occupations of two other sites overlapped the late eighteenth and early nineteenth centuries, as did LA 16769. Las Huertas was occupied into the late 1830s (Ferg 1984), while Component 1 from La Puente was thought to reflect a late Spanish Colonial occupation. However, since nearly half of the imported sherds in that component were from England or the United States, it is likely that the features from which they were recovered continued to be used (or were solely used) after the Santa Fe Trail was opened and goods transported west from the United States became available. Thus, improved access to manufactured goods transported over the Santa Fe Trail probably accounts for the moderate percentages of imports in these assemblages.

With the exception of LA 13291, the nineteenth-century sites represent a significant departure from those of the earlier two centuries. The other four assemblages from this period contain relatively large percentages of imported goods, yet were not the residences of wealthy persons. Component 3 from La Puente contained the smallest percentage of imports, and reflects railroad period remains. However, only three earlier sites had larger percentages of imports, and appear to have either been the residences of wealthy families or military posts. The Ideal site has the next lowest percentage of imports, and was occupied after the Santa Fe Trail opened but before the railroad arrived in New Mexico. While the Trujillo House could have been built as early as 1840, the trash pit that provided most of the artifacts was used after 1890 (Moore et al. n.d.). Similarly, LA 25466 was occupied between 1880 and 1925 (Reed and Tucker 1983). Thus, the two sites with the highest percentages of imports were occupied after the arrival of the railroad in New Mexico. The comparatively large percentages and diverse nature of imports at these sites suggest that access to goods from the east was considerably improved by rail transport. Imported goods were undoubtedly more plentiful and cheaper than at any earlier time.

Several tentative conclusions can be derived from these data. First, there was a significant difference in access to goods and buying power between the four periods represented in Table 12.3. During the seventeenth century, people received imported goods from the south. With the exception of Chinese porcelain sherds at a few sites, nearly all imports that can be sourced are from Mexico or elsewhere in the Spanish empire. Mexican pottery other than majolica is more common at these sites than it is in later assemblages. Only two later assemblages, LA 85802 and the Torreon site, contained Mexican wares other than olive jar sherds. Much of the Mexican pottery at the Palace of the Governors probably reflects goods that came north with the Spanish settlers who reoccupied New Mexico after the Pueblo Revolt, since deposits in several rooms date to the last half of the 1690s (C. Snow, pers. comm. 1993).

With few exceptions, imported goods comprise only small percentages of eighteenth-century Spanish assemblages. Four of the five atypical sites from this group can be explained fairly easily. The Torreon site was a military outpost rather than a residence, only part (possibly a small part) of the local pottery assemblage was quantified, and an accurate count of chipped stone artifacts was not available. Thus, the high percentage of imports could either be the result of sample error or because of its military function. In either case, this site should probably be eliminated from consideration. Sample error is the likely source of the moderate percentage of imports at LA 9139. Santa Cruz de Cochiti may have been the residence of a wealthy landowner. LA 85802 has not been fully investigated, and moderate percentages of imports at this site could be the result of its closer location to the core area relative to the other sites, or because it was the residence of a wealthy family. Finally, the high percentage of imports at LA 16769 seems to be the result of several factors: it is in the Santa Fe core where access to imported goods was relatively easy, it was probably the residence of a wealthy family, and it appears to have been occupied during the period of economic growth at the end of the late Spanish Colonial period. While imported goods seem more common than at other contemporary sites, the high percentage could also be due to sample error, with a large part of the assemblage reflecting a biased surface collection. When only artifacts recovered during testing are considered, the proportion of imports is more comparable to other eighteenth-century sites.

Improved access to affordable imports is evident in the sites whose occupation overlapped the Spanish Colonial and Mexican Territorial periods, or were occupied after the opening of the Santa Fe Trail but before the railroad arrived. Moderate percentages of imports occurred at Las Huertas and in Mexican Territorial period deposits at La Puente. A fairly high percentage of imports was recovered from the Ideal site, whose occupation seems to have postdated the opening of the Santa Fe Trail. LA 13291 is rather anomalous, but was not well dated. A moderate percentage of imported goods at this site could indicate occupation prior to the railroad's arrival, making it similar in date to the Ideal site. Finally, a significant improvement in access to and affordability of imports is demonstrated by two of the three components occupied after the railroad arrived. These sites contained the highest percentages of imported goods, which were primarily of Euroamerican rather than Mexican derivation. Component 3 from La Puente contained comparatively fewer imports than did the other sites in this group, but it should be noted that these deposits are from an individual structure, and may be somewhat skewed.

Trends in Local Pottery Use

Variation in access to goods imported from outside New Mexico is visible in these assemblages, though differences in data quality and apparent function and wealth structure also appear to be conditioning factors. Similar trends should also be visible in other assemblage categories. In particular, it is likely that the use of locally produced pottery varied as access to imported cooking, serving, and storage vessels changed. This should be accompanied by stylistic variation.

Table 12.4 shows vessel form by ceramic type categories for sites for which these data are available. The decorated ware category includes all painted ceramics except for Tewa Buff Wares with a partial red slip, which are included with the polished red wares. Thus, the polished red ware category includes Salinas Red, Tewa

TABLE 12.4. VESSEL FORM PERCENTAGES BY CERAMIC GROUP FOR SELECTED SPANISH SITES IN NEW MEXICO; "OTHER" INCLUDES UNIDENTIFIED FRAGMENTS, COMAL FRAGMENTS, AND RING BASES

Site No.	Decorated Wares				Polished Red Wares				Polished Black Wares				Micaceous Wares				Other Wares			
	B	J	S	O	B	J	S	O	B	J	S	O	B	J	S	O	B	J	S	O
LA 34	24.8	5.8	0.2	0.2	5.8	6.8	4.4	-	-	-	-		-	-	-	-	-	52.1	-	-
LA 591 [1]	12.0	10.8	1.8	-	1.25	2.0	9.5	-	0.5	1.0	0.3	-	-	-	-	-	-	25.1	-	-
LA 9142	15.6	18.7	-	1.0	-	-	-	0.9	-	-	-	3.6	-	-	-	6.5	-	-	-	53.7
LA 54000 [2]	15.1	3.5	4.6	1.4	20.2	0.9	20.4	2.4	4.2	0.7	5.5	0.2	1.2	16.1	-	-	-	3.5	-	-
LA 9138	5.6	65.4	-	-	4.4	6.1	-	0.2	0.2	4.5	-	-	-	-	-	-	1.7	11.1	-	0.9
LA 9139	15.4	-	-	-	7.7	7.7	-	-	-	-	-	-	-	15.4	-	-	-	53.9	-	-
LA 10114	17.0	3.5	0.3	1.2	2.9	1.5	-	-	1.5	-	-	-	-	5.0	-	0.9	-	66.4	-	-
LA 12161	6.9	7.4	0.6	1.3	1.5	10.5	0.3	0.7	0.8	0.3	-	1.0	-	3.1	-	-	8.0	46.8	0.04	11.0
LA 12507	93.6	-	-	-	-	2.1	-	-	-	-	-	-	-	-	-	-	-	2.1	-	-
LA 65005	12.2	8.4	1.0	17.2	2.2	7.2	-	4.0	-	3.1	-	1.6	-	5.7	0.2	13.3	0.4	2.8	0.7	20.0
LA 85802	16.3	13.6	1.4	0.2	2.7	3.9	0.0	0.0	7.2	6.4	0.2	0.4	0.0	6.2	0.0	0.0	24.5	9.9	0.0	2.1
LA 16769 [3]	12.6	13.8	0.2	0.6	10.2	11.3	0.2	0.2	5.8	5.5	-	-	29.6	3.2	-	-	6.4	0.6	-	-
LA 25674 [4]	6.5	22.8	-	12.2	-	-	-	-	3.1	4.2	-	0.7	-	-	-	-	0.6	2.8	-	47.1
LA 54313-1 [4]	3.6	4.0	-	4.2	2.2	4.2	-	5.9	7.4	14.6	-	8.5	1.3	4.8	-	23.6	2.2	2.7	-	10.1
LA 54313-2 [4]	3.8	3.2	-	2.8	3.2	2.2	-	3.3	12.6	17.9	-	7.1	0.2	2.9	-	25.9	2.2	3.3	-	9.3
LA 8671 [5]	1.7	11.1	-	0.6	-	-	-	-	31.7	6.7	-	20.6	-	-	-	-	-	6.1	-	21.7
LA 13291	19.2	34.3	-	0.6	2.3	-	-	3.5	1.2	-	-	7.6	-	-		-	2.3	20.9	-	8.1
LA 54313-3 [4]	4.7	5.3	-	2.7	3.6	2.0	-	4.6	6.7	18.9	-	5.2	0.0	2.2	-	31.6	0.6	2.7	-	9.3
LA 59658	17.7	3.1	1.7	1.1	0.9	7.8	0.08	-	25.5	8.7	10.7	4.2	0.8	8.1	0.08	5.1	1.0	2.3	0.2	1.1

B = bowl, J = jar, S = soup, O = other. [1] No percentages given for sherds with unidentified forms in report; [2] Rim sherds only; [3] Includes polished Tewa buff and red-slipped Tewa wares; [4] Some soup plate forms found, but counted as bowls; [5] Includes data from Ferg's (1984) excavations only.

Polished Red Ware, Posuge Red, Hispanic polished red ware, San Juan Red-on-buff, and other types classed as polished red wares in site reports. The polished black ware category includes Kapo Black, Tewa Polished Black Ware, Hispanic polished black ware, and other types classed as polished black ware in site reports. Micaceous wares were made from clays containing mica, had micaceous temper, or were slipped with micaceous clay. The other wares category was used as a catch-all because of inconsistencies in the way ceramic types are reported. Thus, pottery that did not fit the above classifications are included in this category, which is mostly comprised of utility wares.

In general, locally made ceramic assemblages are dominated by the decorated and other wares categories. Polished red wares are dominant at only one site, and outnumber the other wares category in only that case. Polished black wares dominate on one site, and micaceous wares likewise are most common in only one assemblage. Eliminating the "other" category from consideration, bowls and jars are the most common forms in the decorated ware category, each dominating at about half the sites. A small percentage of decorated soup plates occur in 47 percent of the assemblages.

Jars are the most common form in the polished red ware category for most sites, though bowls are slightly more common in two components, soup plates and bowls are the more common forms on another, and one site contains equal percentages of bowl and jar sherds. Polished red ware soup plates occur at 37 percent of the sites. Interestingly, the distribution of polished black wares is patterned differently; bowls are most common in seven cases, jars in eight, and soup plates in one. Polished black ware soup plates were found at only 25 percent of the sites.

Jars are the most common micaceous ware vessel form, though bowls dominate in one assemblage. Micaceous ware soup plates are comparatively rare, occurring in small amounts at only 16 percent of the sites. Similarly, with few exceptions jars are also the most common form in the "other" wares category, with bowls dominating in only two cases. Soup plates are rare in the other wares category, occurring in small numbers at 21 percent of the sites.

In order to better examine trends in vessel form and ware type over time, information from Table 12.4 was separated into those categories. Table 12.5 shows variation in the percentages of bowls, jars, and soup plates through time. Since high percentages of sherds whose vessel form could not be identified significantly reduce other percentages and introduce variation, only those with identified vessel forms were used to calculate this table. Quite a bit of variation is evident, but a few general trends are visible. Soup plates are most common at seventeenth-century sites, and jars are comparatively less common. Bowls seem most common at nineteenth-century sites.

In order to reduce noise caused by individual site variation, vessel forms were averaged by period and are shown in Table 12.6. LA 12507 was eliminated because small sample size created an anomalous distribution. LA 16769 is included with the eighteenth- century sites since it is thought to represent an almost pure late Spanish Colonial occupation, while the other two sites in its category reflect Santa Fe Trail period occupations. The distribution in this table suggests the trends identified in Table 12.5 are real. Bowls decline slightly in importance

TABLE 12.5. OVERALL VESSEL FORM PERCENTAGES FOR SPANISH SITES IN NEW MEXICO

SITE NO.	BOWL	JAR	SOUP PLATE
LA 34 (seventeenth)	30.7	64.8	4.6
LA 591 (seventeenth)	35.2	35.3	29.5
LA 9142 (seventeenth)	45.6	54.4	0.0
LA 54000 (seventeenth)	42.5	25.7	31.7
LA 9138 (eighteenth)	12.0	88.0	0.0
LA 9139 (eighteenth)	23.1	76.9	0.0
LA 10114 (eighteenth)	21.8	77.9	0.3
LA 12161 (eighteenth)	19.9	79.0	1.1
LA 12507 (eighteenth)	91.7	8.3	0.0
LA 65005 (eighteenth)	33.7	62.0	4.3
LA 85802 (eighteenth)	57.2	41.2	1.6
LA 16769 (eighteenth-nineteenth)	65.1	34.5	0.4
LA 25674 (eighteenth-nineteenth)	25.5[1]	74.5	0.0[1]
LA 54313 (eighteenth-nineteenth)[2]	35.0	65.0	up to 7.0
LA 54313 (mid-nineteenth)[2]	42.6	57.4	up to 10.4
LA 8671 (nineteenth)[3]	58.3[1]	41.7	0.0[1]
LA 13291 (nineteenth)	31.2	68.8	0.0
LA 54313 (late-nineteenth)[2]	33.5	66.5	up to 5.7
LA 59658 (nineteenth)	51.8	33.8	14.4

Century(s) to which sites are dated in parentheses.
[1] Some soup plate forms found but included with bowls.
[2] Bowl and jar percentages from rough sort and soup plate sherds are included with bowls; approximate soup plate percentages are from intensively analyzed sample.
[3] Includes data from Ferg's (1984) excavations only.

TABLE 12.6. OVERALL VESSEL FORM PERCENTAGES FOR SPANISH SITES IN NEW MEXICO BY PERIOD

PERIOD	BOWLS	JARS	SOUP PLATES
Early Spanish Colonial period (1598 to 1680)	38.5	45.0	16.5
Late Spanish Colonial period (1692 to 1821)	33.3	65.6	1.1
Santa Fe Trail period (1821 to 1880)	31.3	64.6	4.1
Railroad period (post 1880)	47.1	48.1	4.8

TABLE 12.7. OVERALL VESSEL FUNCTION PERCENTAGES FOR SPANISH SITES IN NEW MEXICO BY PERIOD

PERIOD	SERVING AND CONSUMPTION	STORAGE AND COOKING
Early Spanish Colonial period (1598 to 1680)	39.2	60.8
Late Spanish Colonial period (1692 to 1821)	30.9	69.1
Santa Fe Trail period (1821 to 1880)	36.4	63.6
Railroad period (post 1880)	46.1	53.9

through time until the Railroad period. Soup plate use dropped radically after the seventeenth century, but they seem to regain some of their popularity during the Santa Fe Trail and Railroad periods. Percentages of soup plates are under-represented for these periods in Table 12.6 because they are included with bowls in one assemblage from each. Finally, jars comprise less than 50 percent of early Spanish Colonial and Railroad period assemblages, and make up about 65 percent of assemblages from the intervening periods.

Vessel function by period is shown in Table 12.7. Bowls and soup plates are assumed to have been used for food serving and consumption, while jars were used for storage and cooking. The distribution in this table suggests that variation in vessel form is related to increased use of pottery for storage and cooking during the late Spanish Colonial and Santa Fe Trail periods. Use of pottery for storage and cooking appears to have been somewhat less common during the early Spanish Colonial period, and decreased rather significantly during the Railroad period.

Basic ceramic ware categories are shown in Table 12.8. Certain trends are apparent from this table. First, with a few exceptions, the other wares category tends to dominate at Spanish Colonial sites, and declines in importance during later periods. The use of polished red wares decreases through time, while polished black wares become increasingly more popular. Micaceous wares appear to follow no real pattern, though there are some indications that they were most popular in later periods.

Table 12.9 averages percentages of ceramic categories by occupational period. Again, LA 12507 is eliminated and LA 16769 is included with the late Spanish Colonial sites. Some of the trends noted in Table 12.8 are visible here, in addition to some that were not. Decorated wares are common in all time periods, but with significant variation. This category comprises almost 30 percent of early and late Spanish Colonial assemblages, with a considerable decrease in later time periods. The use of polished red wares declines steadily through the Railroad period, while the use of polished black wares increases radically during the Santa Fe Trail and Railroad periods. Micaceous wares follow a similar trajectory, occurring in small percentages at Spanish Colonial sites and increasing tremendously at Santa Fe Trail and Railroad period sites. Finally, the other wares category comprises over 40 percent of Spanish Colonial assemblages, and drops to under 20 percent during later periods.

Pottery category and vessel form information are combined in Table 12.10, and include data from three early and seven late Spanish Colonial period sites, three Santa Fe Trail period components, and four Railroad period components. Sherds that could not be identified by form were dropped from consideration. There are fairly significant differences between early and late Spanish Colonial sites. Decorated early Spanish Colonial wares are almost evenly split between serving-consumption and storage-cooking functions, while polished red wares are dominated by sherds used for serving-consumption. Polished black wares and micaceous wares are rather rare in these assemblages, but polished black wares were mostly used for serving-consumption while micaceous wares were almost exclusively used for storage-cooking. The other wares category contains the largest percentage of sherds, and mostly represents a cooking-storage function, with few bowl sherds occurring.

Decorated wares are relatively common in late Spanish Colonial assemblages, but nearly two-thirds were used for storage-cooking. The mean percentage of polished red wares drops by nearly half, and 71 percent were used for storage-cooking versus only 14 percent

TABLE 12.8. CERAMIC CATEGORY PERCENTAGES FOR SPANISH SITES IN NEW MEXICO

SITE NO.	DECORATED WARES	POLISHED RED WARES	POLISHED BLACK WARES	MICACEOUS WARES	OTHER WARES
LA 34 (seventeenth)	30.9	17.0	0.0	0.0	52.1
LA 591 (seventeenth)	55.7	13.9	2.0	2.9	25.5
LA 4451 (seventeenth)	19.9	29.8	3.6	0.0	46.7
LA 9142 (seventeenth)	35.3	0.9	3.6	6.5	53.7
LA 54000 (seventeenth)	24.6	43.9	10.7	17.3	3.5
LA 9138 (eighteenth)	71.0	10.6	4.7	0.0	13.7
LA 9139 (eighteenth)	15.4	15.4	0.0	15.4	53.8
LA 10114 (eighteenth)	21.9	4.4	1.5	5.8	66.4
LA 12161 (eighteenth)	16.3	12.5	2.2	3.1	65.9
LA 12507 (eighteenth)	95.8	2.1	0.0	0.0	2.1
LA 65005 (eighteenth)	39.0	13.5	4.7	19.1	23.7
LA 85802 (eighteenth)	31.4	6.8	14.6	6.2	41.0
LA 16769 (eighteenth-nineteenth)	27.1	21.9	11.3	32.7	7.0
LA 25674 (eighteenth-nineteenth)	41.6	0.0	7.9	0.0	50.5
LA 54313 (eighteenth-nineteenth)	11.8	13.0	30.5	29.7	15.0
LA 54313 (mid-nineteenth)	9.8	8.8	37.6	29.0	14.8
LA 8671 (nineteenth)[3]	20.4	5.2	52.1	0.1	22.2
LA 54313 (late nineteenth)	12.6	10.2	30.8	33.8	12.6
LA 13291 (nineteenth)	54.1	5.8	8.7	0.0	31.4
LA 25466 (nineteenth)	0.0	25.2	45.6	27.6	1.6
LA 59658 (nineteenth)	23.7	8.7	49.0	14.0	4.6

Century(s) to which sites are dated in parentheses.
[1] Includes all analyzed sherds from eighteenth- and nineteenth-century deposits.
[2] Only includes sherds from Spanish Colonial deposits.
[3] Includes all available data from Ferg's (1984) and Brody and Colberg's (1966) excavations.

during the early Spanish Colonial period. Polished black wares and micaceous wares are slightly more common at these sites, and are nearly evenly split between serving-consumption and storage-cooking. The other wares category was slightly more common overall, with just over 20 percent used for serving-consumption (versus 0.8 percent in the early Spanish Colonial period).

Percentages of decorated wares drop considerably during the Santa Fe Trail period, with nearly 60 percent of this category used for storage-cooking. Fewer red wares occur, and most functioned as storage-cooking vessels (62 percent). The use of polished black wares increases tremendously during this period, with nearly two-thirds functioning as storage-cooking vessels. The similar increase in micaceous wares seen in Table 12.9 is not visible here because most of these sherds were from vessels that are unidentifiable as to form. Even so, this category seems to have been mostly used for storage-cooking. A significant decrease in the percentage of other wares is evident, with somewhat more than half used for storage-cooking.

Decorated ceramics are somewhat more common

TABLE 12.9. OVERALL CERAMIC CATEGORY PERCENTAGES FOR SPANISH SITES IN NEW MEXICO BY PERIOD

PERIOD	DECORATED WARES	POLISHED RED WARES	POLISHED BLACK WARES	MICACEOUS WARES	OTHER WARES
Early Spanish Colonial period (1598 to 1680)	28.4	25.9	3.4	1.2	41.1
Late Spanish Colonial period (1692 to 1821)	29.1	12.4	4.9	8.3	45.2
Santa Fe Trail period (1821 to 1880)	14.2	10.6	30.2	26.6	18.4
Railroad period (post 1880)	17.2	9.0	37.1	23.8	12.9

TABLE 12.10. VESSEL FUNCTION BY CERAMIC CATEGORY FOR NEW MEXICO SITES

	DECORATED WARES		POLISHED RED WARES		POLISHED BLACK WARES		MICACEOUS WARES		OTHER WARES	
PERIOD	SERVING-CONSUMP-TION	STORAGE-COOKING	SERVING-CONSUMP-TION	STORAGE-COOKING	SERVING-CONSUMP-TION	STORAGE-COOKING	SERVING-CONSUMP-TION	STORAGE-COOKING	SERVING-CONSUMP-TION	STORAGE-COOKING
Early Spanish Colonial (1598 to 1680)	15.8	15.5	20.9	3.4	2.4	1.4	0.2	2.3	0.03	38.2
Late Spanish Colonial (1692 to 1821)	11.9	18.7	4.0	9.7	2.2	2.8	3.7	4.1	9.1	33.9
Santa Fe Trail period (1821 to 1880)	8.1	11.8	4.8	7.7	17.5	30.1	1.8	7.9	4.3	6.0
Railroad period (post 1880)	14.8	10.1	4.9	5.6	24.8	26.6	0.3	5.9	1.3	5.7

during the Railroad period, and about 60 percent were used for serving-consumption. Polished red wares are comparatively rare, and are almost evenly split between functional categories. Polished black wares are the most abundant type, and are again almost evenly split between functional categories. The micaceous ware and other ware categories comprise relatively minor percentages of the average assemblage, and mostly functioned as storage-cooking vessels. However, it must again be noted that this table is not completely representative of these categories because large percentages were unidentifiable as to vessel form. This is particularly true of the micaceous wares.

Trends in local ceramic type and vessel use are probably related to style and economy. Types of decorated wares favored for use change through time, beginning with a dominance of glaze wares during the early Spanish Colonial period, and switching to matte-painted wares by the late Spanish Colonial period. Similar tendencies are visible in the major plain ware categories. Polished red wares comprise a large percentage of early Spanish Colonial period assemblages, while polished black wares are rare. Red wares wane in popularity through time, while black wares increase in use until they are the most common type in the Santa Fe Trail and Railroad periods. The use of decorated wares also decreases significantly during these later periods. Micaceous wares follow a trajectory similar to that of the polished black wares. Beginning as a minor component of early Spanish Colonial assemblages, use of these wares increases considerably by the late Spanish Colonial period, though they continue to be a minor part of the average assemblage. By the Santa Fe Trail and Railroad periods, micaceous wares are the second most common category. Finally, other wares comprise a large percentage of both early and late Spanish Colonial assemblages, but are much less common in later time periods.

Changes in the local wares used through time are undoubtedly related to style, taste, and supply. Certain types, like polished black wares, grew in popularity while others, like polished red wares, waned. The popularity of micaceous wares may have increased because of physical characteristics rather than style. In folk wisdom, micaceous vessels make the best bean pots (Carrillo 1997). Whether there is any quantitative increase in quality when this type of vessel is used or not, this idea may have stimulated the use of this ware. Then again, it is also possible that the popularity of this ware was the result of closer contact with the Jicarilla Apache after they were forced to settle in specific areas by the United States government after 1855. The Jicarilla were one of the main producers of micaceous pottery in northern New Mexico, and the manufacture of this type of pottery was important to their economy. Either taste or increased availability (or both factors) may have led to the increasing popularity of this ware.

Supply and availability were probably important factors in the switch in the type of decorated wares used from glaze wares to matte-painted wares. Where glaze wares are very common in early Spanish Colonial assemblages, they only rarely occur in those of the late Spanish Colonial period. Matte-painted wares are comparatively uncommon in early Spanish Colonial assemblages, yet these types dominate late Spanish Colonial assemblages. One of the keys to this change in decorative style is probably the depopulation of the Galisteo Basin pueblos after the Spanish Reconquest. The Galisteo Basin pueblos were some of the main producers of glaze wares before the Pueblo Revolt, but except for Galisteo Pueblo, none of these villages were occupied after the Reconquest. Warren (1979:241) suggests that glaze wares continued to be manufactured there in the early decades of the eighteenth century, but then glaze wares disappear. Apparently the other glaze ware-producing pueblos in the Rio Abajo all began importing or manufacturing matte-painted wares shortly before 1700.

Perhaps the lack of reliable supplies of glaze wares early in the late Spanish Colonial period forced the Spanish to turn to other Pueblo villages for pottery, or perhaps the inhabitants of those villages simply took advantage of a good opportunity. Whatever the reason, matte-painted wares soon dominated the late Spanish Colonial period. Indeed, the latter style spread throughout the pueblo villages of New Mexico soon after the Reconquest. Matte-painted wares were probably manufactured in the northern Tewa villages by at least the mid-seventeenth century, and similar wares had replaced glaze wares in the Puname district around Zia by the time of the Pueblo Revolt (Batkin 1987). Perhaps the proximity of these villages to the other Rio Grande Keres stimulated their change to the new style. No conclusive reason for this widespread change has yet been given, though restricted access to the minerals used for glazing may have contributed to it, as did the dislocation of much of the Pueblo population.

Variation in the use of certain vessel forms may have been both stylistic and economic in nature. Soup plates were most popular during the early Spanish Colonial period, and were less popular in later periods. While the distribution in Table 12.6 suggests that the popularity of this form decreased significantly between early and late Spanish Colonial periods and increased slightly in later periods, this trend may be illusory. Since soup plate sherds are usually rare and the number of sites in each time period is not as large as might be wished, sample error may be partly responsible for this distribution. Soup plates might be under-represented in assemblages containing few sherds, like LA 9139 and LA 12507, which contained less than 50 sherds apiece. Conversely, when wealthy families with better access to manufactured goods are represented (such as at LA 16769), soup plates may be more common among imported wares. Thus, while it is likely that the popularity of this form declined after the seventeenth century, the variation in later periods may be less than is suggested by these tables.

Perhaps the most interesting variation over time is in functional categories. Vessels used for serving and consumption comprise nearly 40 percent of early Spanish Colonial assemblages, dropping to just over 30 percent of late Spanish Colonial assemblages. During the Santa Fe Trail period, the percentage of vessels used for serving and consumption increases to nearly the early Spanish Colonial level, and during the Railroad period it grew to nearly equal the percentage of vessels used for cooking and storage. This variation may be due to economic conditions, and in particular may reflect access to metal cooking vessels or alternate forms of storage. As was seen in Table 12.3, the percentage of imported goods was usually smaller at late Spanish Colonial sites than at early Spanish Colonial sites. This seems to reflect decreased access to imports. Metal artifacts were in short supply in New Mexico, and nearly all metal had to be imported from Spain (Simmons and Turley 1980). While imported metal was comparatively inexpensive in Mexico, by the time it arrived in New Mexico it was quite costly. The lack of metal tools led most people to get along with little furniture, and farm tools were often made entirely of wood (Gregg 1844; Jones 1932).

Average percentages of pottery used for serving and consumption are compared with average percentages of imported goods for each time period in Figure 12.7. The lower percentage of imports was used for Las Majadas, and the two atypical late Spanish Colonial sites (Santa Cruz de Cochiti and LA 16769) were dropped from the import category because they significantly skewed the distribution. These curves are almost identical in shape, suggesting a relationship between ceramic functional category and the availability of imported goods. That the relationship reflects the availability of metal cooking utensils is a valid, though speculative, explanation for

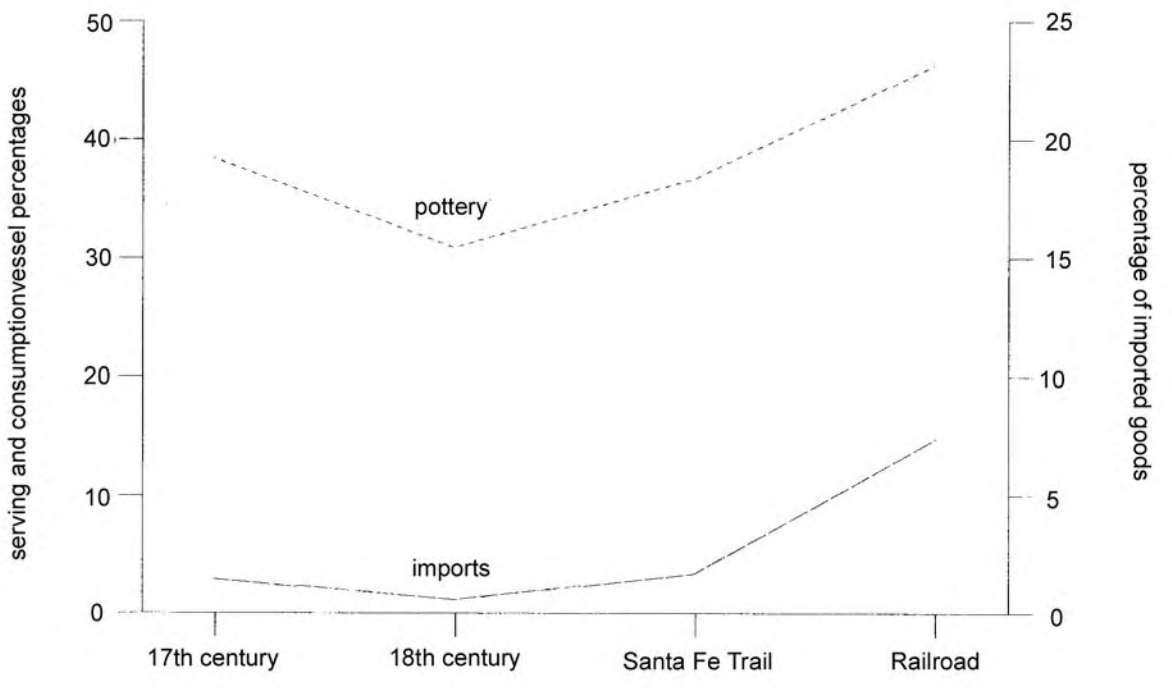

Figure 12.7. Comparison of percentages of pottery used for serving and consumption versus imports by time

TABLE 12.11. COMPARISON OF EIGHTEENTH-CENTURY VESSEL FORM PERCENTAGES WITH AND WITHOUT LA 65005

Components	Bowl	Jar	Soup Plate
With LA 65005	33.3	65.6	1.1
Without LA 65005	33.2	66.2	0.6

TABLE 12.12. COMPARISON OF VESSEL FUNCTION PERCENTAGES FOR EIGHTEENTH-CENTURY SITES, WITH AND WITHOUT LA 65005

COMPONENTS	SERVING AND CONSUMPTION	STORAGE AND COOKING
With LA 65005	30.9	69.1
Without LA 65005	30.5	69.5

this pattern. The pattern certainly shows that when imported goods were more accessible there was less use of pottery vessels for cooking and storage.

Patterns of Imports and Pottery Use at the Pedro Sánchez Site

In terms of imported goods, the Pedro Sánchez site fits well with other late Spanish Colonial sites. Only eight imported artifacts–one glass and seven metal–were recovered. However, other metal appears to have been present in trash deposits at one time, as indicated by metal adhesions on chipped stone artifacts that did not originate during fire-making activities. Unfortunately, there was no way to quantify those artifacts because they were completely deteriorated. The lack of majolica sherds suggests occupation by a person or family at the lower end of the economic scale; however, it must be kept in mind that only one of as many as three trash pits was excavated. If majolica vessels were at one time present but rare, occasional breakage could cause deposition in one feature and absence in others.

Tables 12.11 through 12.14 illustrate various aspects of late Spanish Colonial period site assemblages, with LA 65005 included and omitted. Examination of these tables suggests that the LA 65005 assemblage is fairly typical of this period. With the exception of soup plates, vessel form percentages in Table 12.11 exhibit little variance when LA 65005 is excluded. The soup plate percentage is nearly halved, but this was expected because LA 65005 contained the highest percentage of that form among the late Spanish Colonial sites. Soup plate sherds were slightly more common at one early Spanish Colonial period site, and were much more common at two. Even so, vessel form percentages at LA 65005 are closer to the average for late Spanish Colonial sites than they are for early Spanish Colonial sites.

When vessel forms are categorized by implied function (Table 12.12), there is less than 0.5 percent difference when LA 65005 is omitted from the assemblage. However, when examined alone, these percentages are closer to early Spanish Colonial sites than they are to other late Spanish Colonial sites (38.0 percent serving and consumption, 62 percent cooking and storage). Ware percentages are compared in Table 12.13. Again, there is not a great deal of variation when LA 65005 is removed from the assemblage; however, there are slightly lower percentages of decorated and micaceous wares with a corresponding increase in the other wares category. When compared with average assemblages for each time period, LA 65005 closely resembles the other late Spanish Colonial sites.

The final comparison is provided by Table 12.14, which shows vessel function percentages for each ceramic category. Again, while there are some differences when LA 65005 is omitted, they are not large and mostly concern variation in the same ceramic categories noted for Table 12.13. When compared to the average assemblages, LA 65005 again fits most closely with the array of late Spanish Colonial sites.

In short, removal of LA 65005 from the array of late Spanish Colonial sites does not significantly alter patterns in the locally manufactured ceramic assemblage. In only one of four comparisons does LA 65005 appear to resemble the early Spanish Colonial pattern more than that of the late Spanish Colonial period. It is perhaps

TABLE 12.13. COMPARISON OF CERAMIC CATEGORY PERCENTAGES FOR EIGHTEENTH-CENTURY SITES, WITH AND WITHOUT LA 65005

COMPONENT	DECORATED WARES	POLISHED RED WARES	POLISHED BLACK WARES	MICACEOUS WARES	OTHER WARES
With LA 65005	29.1	12.4	4.9	8.3	45.2
Without LA 65005	27.8	12.3	5.0	6.7	48.1

TABLE 12.14. COMPARISON OF VESSEL FUNCTION PERCENTAGES BY CERAMIC CATEGORY FOR EIGHTEENTH CENTURY SITES, WITH AND WITHOUT LA 65005

WARE CATEGORY	FUNCTION	WITH LA 65005	WITHOUT LA 65005
Decorated wares	Serving-consumption	11.9	10.7
	Storage-cooking	18.7	18.7
Polished redwares	Serving-consumption	4.0	4.0
	Storage-cooking	9.7	9.2
Polished blackwares	Serving-consumption	2.2	2.4
	Storage-cooking	2.8	2.5
Micaceous wares	Serving-consumption	3.7	3.9
	Storage-cooking	4.1	3.5
Other wares	Serving-consumption	9.1	9.5
	Storage-cooking	33.9	35.7

most important that the percentage of polished red wares at LA 65005 is close to the average for late Spanish Colonial sites, and is much lower than the early Spanish Colonial average. Micaceous ware percentages are also much higher at LA 65005 than the average for early Spanish Colonial sites, and the percentage of other wares is much lower. In fact, these categories are actually closer to those of the Santa Fe Trail period than they are the early or late Spanish Colonial period averages. Overall, this suggests that the assemblage from LA 65005 reflects a late Spanish Colonial period occupation, as was concluded from the documentary evidence.

ECONOMIC INTERACTION IN LATE SPANISH COLONIAL NEW MEXICO

This analysis suggests that the postulated economic patterns for New Mexico from the early Spanish Colonial period until the arrival of the railroad are relatively accurate. New Mexico was an economic frontier to New Spain throughout the Spanish Colonial period. This is confirmed by documentary evidence and archaeological data. With few exceptions, imported goods are relatively rare at Spanish Colonial sites. All of the early Spanish Colonial sites examined contain moderate percentages of imported goods. However, our inability to separate materials from the Pueblo Revolt period Tano deposits at the Palace of the Governors from those related to Spanish reoccupation in 1694 may have skewed that percentage downward.

Moderate percentages of imports occur in two late Spanish Colonial period site assemblages–LA 9139 and LA 85802. As noted earlier, the moderate percentage for LA 9139 is probably a function of sample error, since only a small assemblage was recovered from that site. Testing at LA 85802 suggests that it is a large site and may reflect occupation by an affluent family. Large percentages of imports occur at three sites including Santa Cruz de Cochiti, the Torreon site, and LA 16769. The Torreon site was a military outpost, and contains the smallest percentage of the three. Santa Cruz de Cochiti and LA 16769 both contained large structures and appear to be the residences of wealthy families (though percentages for the latter may be skewed). Thus, the atypically large percentages of imported goods at these sites may reflect the use to which they were put or the positioning of site occupants in the upper rungs of the economic scale. Another important factor that must be considered is the dating of LA 16769 to a period of improved economic prosperity after 1786. This may have further increased the availability of imported goods, particularly to the wealthy.

None of the other late Spanish Colonial sites were extensive, either in size or in percentage of assemblages comprised of imported goods. Thus, while early Spanish Colonial sites reflect a similar level of access to imports between large and small sites as well as between sites within and outside the Santa Fe core, the pattern for the late Spanish Colonial period is different. Imported goods are common only at sites within the Santa Fe core and at large sites outside that area. Small sites, which may reflect residence by people occupying a lower rung on the economic ladder, contain few imported goods.

This pattern began to change in the Santa Fe Trail period. Most components from this period contain moderate to high percentages of imported goods, even though they were all outside the Santa Fe core and were not occupied by wealthy families. This process accelerated in the Railroad period. Percentages of imports at sites from this period reach levels not seen in earlier times even though, again, none of these sites were in the Santa Fe core or were inhabited by wealthy families.

While access to imported goods is partly moderated by location in or near Santa Fe, wealth also affects percentages of imported goods on sites, particularly during the late Spanish Colonial period. Larger sites from that period contain the highest percentages of imported goods. Imports in the assemblages of the two sites that appear to represent wealthy family residences–Santa Cruz de Cochiti and LA 16769–average 15.1 percent (though the latter may be skewed). With the addition of LA 85802, which may have been the residence of another wealthy family, the average is 10.8 percent. Other sites from this period average 1.7 percent imported goods, even with the Torreon site and LA 9139 included. Since the Torreon site was a military outpost, and because small sample size may be responsible for the moderate percentage of imports at LA 9139, those sites were again removed from the sample, yielding an average of .64 percent imports in late Spanish Colonial period small sites.

Data on percentages of imported goods at sites combined with information on the relative wealth of site occupants (in this case, structure size) suggest real differences in access to manufactured goods between time periods and social strata. Access may have been rather even during the early Spanish Colonial period when the supply system was in the hands of the church rather than private entrepreneurs. In addition, the upper economic stratum seems to have been restricted to the families of the governor and 35 encomenderos. If, as D. Snow (1983) suggests, the encomenderos were at the top of a redistributive network, materials flowing downward probably included many of the manufactured goods they were able to obtain. Similar goods were distributed to the Pueblos by the missions. Thus, all rungs of society were able to access imported materials to some extent.

Both the social and economic systems underwent major changes in the late Spanish Colonial period. The encomienda system was never re-established, and regular presidial troops were installed for the province's protection. During most of this period the economy was based on the partido system of sheep tenure (Baxter 1987). Wealth still flowed downward from more affluent members of society, but it was now in the form of sheep rather than goods. Individuals at all levels of society were responsible for their own acquisition of manufactured goods, and differences in wealth and access to such goods are visible in archaeological remains from this period.

Access to imports began to even out again when the Santa Fe Trail opened and created a large increase in the amount of affordable manufactured goods. Inequalities still undoubtedly occurred, but are not visible in the assemblages examined by this study because we lack the residences of affluent families. For example, from observations made around 1855, Davis (1857:189-190) noted that the upper classes in Santa Fe were adopting American dress and abandoning their traditional costumes. While the lower classes mostly continued to dress in the traditional manner, they too were adopting some articles of Anglo dress. The upper classes also began to purchase American-made wagons (Davis 1857:213), which were apparently unavailable to the lower classes because of cost. Thus, there continued to be inequalities in access to imported goods based on economic status.

The arrival of the railroad in the 1880s completed the process. Not only did the railroad make imported goods even more affordable by decreasing transport costs and increasing supply, it also expanded the inventory that could be easily and economically imported. Breakable goods were probably always comparatively expensive when transported over the Santa Fe Trail because they had to be carefully packaged. With the arrival of the railroad, fragile glass window panes, glass and ceramic tableware, and other breakable items seem to have become even more accessible to all levels of society. In general, the percentage of imports again increased considerably during this period, but we again lack data from sites occupied by wealthy families and cannot distinguish economic variations in the assemblage examined.

Conclusions

Several assumptions have been implicit in this analysis. For example, it is assumed that the analyzed sites represent habitations. In reality, it is likely that several were limited-use pastoral camps rather than year-round residences. It is also assumed that the larger sites represent year-round residences. This may be incorrect as well, particularly in the assemblage of early Spanish Colonial sites. In that case, wealthy encomenderos were required to maintain homes in Santa Fe in addition to whatever other residences they had. Thus, few full-time residences may actually be represented in this assemblage.

Even considering these assumptions and the relatively small sample of sites available for analysis, the economic trends observed seem to confirm our predictions. New Mexico's position on the Spanish Colonial frontier is evident in the amount of imported goods recovered from sites. The distribution of imports by general site type suggests that access to such goods was affected by proximity to Santa Fe as well as the wealth of site occupants.

Pedro Sánchez established his grant near San Ildefonso for economic reasons, apropos Billington's (1963) argument. As stated in his grant application he lacked sufficient land at his main residence in Santa Cruz de la Cañada to support his large extended family. Even though the site was not far from the economic core of the province, it was on the late Spanish Colonial New Mexican frontier. The nearby Chama Valley was devastated by Comanche and Ute raids in 1747, forcing the evacuation of villages and farms and a general retreat to Santa Cruz de la Cañada and San Juan Pueblo (Carrillo n.d.). Nomadic Indian raids continued to be a problem in that area for many years, even after the Chama Valley was resettled in 1750. Ursula Guillen, daughter-in-law to Juana Luján, stated that her two sons were killed by Utes in 1766 (Ahlborn 1990; SANM I 1763). These events essentially bracket the occupation of the Pedro Sánchez site, and suggest continuing unrest and danger in the area.

The rarity of imported goods also suggests it was on the local frontier. No imported ceramics were recovered; the only imported goods were seven metal fragments and one piece of glass. Locally produced ceramics were exclusively used at the site, and all seem to have been obtained from local Tewa villages. There also appears to have been some substitution of chipped stone for metal tools, suggesting that the latter were rare or otherwise difficult to procure. Six pieces of debitage were informally used in activities other than fire-making, and a single formal tool (a chopper) was also recovered. While some of the debitage may have been scavenged from earlier sites, most of the chipped stone assemblage was probably produced in situ.

These observations suggest the general veracity of the model constructed to examine cultural remains at LA 65005. To reiterate, the model holds that access to manufactured goods and the distribution of wealth help condition the assimilation of native technology by disparate parts of a colonizing group. Analysis of the assemblage from the Pedro Sánchez site suggests that its occupants were not wealthy, though they did have moderately affluent relatives. The site was also occupied before relative peace and prosperity arrived on the New Mexican frontier with the treaties of 1786. Thus, the danger associated with transport of goods over the Camino Real combined with the poor economic conditions that prevailed through most of this period and kept the supply of imported goods down.

Access to imports was limited during the occupation of the Pedro Sánchez Site, and is reflected by the near absence of such goods in the remaining assemblage. The lack of such goods was countered by use of native goods and technologies. Pottery was almost entirely obtained from nearby Tewa villages. This suggests that while site occupants were not wealthy, they were affluent enough to purchase or trade for their ceramic needs rather than having to produce it themselves. The presence of a probable gunflint also suggests a moderate level of affluence, since firearms were not common at the time in New Mexico. In 1752 there were only 388 muskets and 53 pistols inventoried in the province (Reeve 1960:211). A 1775 letter to Viceroy Bucareli, which cites a report by Governor Mindinueta, states that the settlers had only 600 muskets and 100 pistols by that time (Thomas 1940). Finally, the apparent rarity of metal tools seems to have been offset by the use of chipped stone tools.

The assemblage from this site does not contradict Pedro Sánchez's complaints of economic hardship as stated in his grant application of 1742 (Prince Papers n.d.). Obviously, since his household included three female servants, the family was not poverty stricken. However, they also did not possess the wealth of their relatives, the Luján-Gómez del Castillo clan. Even though their main residence was in Santa Cruz de la Cañada and LA 65005 was just a rancho occupied on a temporary basis or by a son responsible for livestock on the grant, our conclusions are not contradicted. A family with disposable wealth would be expected to display their affluence in all of their various residences. Thus, were the Sánchezes as wealthy as the Lujáns, there should be more evidence of imported goods at the site.

In general, LA 65005 is typical of the array of late Spanish Colonial sites available for study. Detailed examination of documents related to the Pedro Sánchez Grant provide a strong indication that LA 65005 represents the rancho mentioned by those sources. The local ceramic assemblage recovered during excavation does not differ significantly from those of other sites from this period. The documented dates for its occupation suggest that the periods of manufacture for those wares that are currently presented in the literature may be incorrect. An examination of economic conditions in New Mexico between the seventeenth and late nineteenth centuries suggests that our model is essentially correct, though it must be remembered that the sample of sites is small. Thus, this examination can be considered a first step in relating historic Spanish remains to economic conditions in the province, and in determining how location and wealth condition access to expensive imported goods.

CHAPTER 13. AN ARCHAIC WORKSHOP: SAN ILDEFONSO SPRINGS, LA 65006

James L. Moore

The San Ildefonso Springs site (LA 65006) contains at least three Late Archaic occupations, a Classic period Pueblo use, and a recent Historic period component. Only a few historic artifacts were found in the area studied, the bulk of those materials being outside project limits. Thus, historic use of the site is not discussed any further. Similarly, the Classic period Anasazi occupation was limited in extent, and left few remains that can be separated from Archaic materials; the only exceptions were pottery and Feature 1. This occupation also is not considered further.

Four components were defined at this site (see *Analysis of the Chipped Stone Assemblages,* Chapter 8). Component 1 originated during the earliest occupation and contains the largest artifact assemblage as well as most of the features found during excavation. Component 2 contains materials from the next definable occupation. While this assemblage was mostly derived from a Late Archaic use of the area, it was recovered from Stratum 1, which was exposed on the surface of the lower terrace. The presence of a hearth or roasting pit (Feature 1) dating to the Classic period in this stratum in addition to pottery at the top of the unit suggests some mixing of later materials with those originating during the Archaic occupation. However, analysis of the chipped stone assemblage suggested that these remains represent a relatively undisturbed Archaic occupation.

Component 3 was associated with the youngest of four paleosols, and was eroded away from most of the area within project limits. Thus, only a small assemblage is available from that occupation. Similar to Component 2, the paleosol containing this assemblage was partly exposed on the surface of the upper terrace at the west end of the site. However, a thin mantle of colluvial wash covered much of this paleosol in the area examined. The colluvial wash contained a few chipped stone artifacts thought to have originated during sporadic Anasazi use of the area. Thus, some mixing of Archaic and Anasazi materials may be indicated for this component as well, perhaps to a greater extent than was indicated for Component 2.

Component 4 contains materials from the surface of the lower terrace and was divided into two subcomponents. Subcomponent 4a contains materials collected from the edge of the lower terrace that were eroding from the lowest occupational level. However, artifacts eroding from the second paleosol are also present among these materials, as are materials washed off the surface of the terrace. Artifacts collected from the surface of the lower terrace comprise Subcomponent 4b. This assemblage contains a mixture of Classic period Anasazi materials deposited on the terrace surface and Late Archaic artifacts exposed by deflation of Stratum 1. Artifacts in Component 4a were completely out of place, and no vertical or horizontal provenience could be assigned to them. Similarly, artifacts in Component 4b lacked vertical integrity. While horizontal proveniencing was assigned, these materials cannot be considered in situ since most have undoubtedly been moved by erosion.

Because of the lack of trustworthy vertical and horizontal proveniencing for surface components and since they contain mixed materials, these assemblages are not further considered. Only the three buried Archaic components are discussed in detail. Most of our attention will focus on Component 1 because it represents the only sizeable occupation, both in quantity of materials and size of area used. Before the Archaic occupation of the San Ildefonso Springs site is discussed, the research orientation used to examine these remains is presented.

Research Orientation

A research orientation was developed for the San Ildefonso Springs site based on information recovered during testing (J. Moore 1989, 1993). Unfortunately, those data suggested that the site was occupied during the Basketmaker II period, and the research orientation was partly based on that premise. Radiocarbon dates obtained during data recovery indicate that while the site was occupied during the Late Archaic, those uses occurred before the accepted dates for the Basketmaker II period. Thus, while the basic research orientation is useable, it must be modified to account for the erroneous date suggested by testing.

Because few data concerning site function, cultural affinity, and date of occupation were recovered during testing, data recovery was aimed at filling those blanks. Determining the type of occupational pattern represented by these remains was the main focus. Either a forager or collector pattern of logistical exploitation was thought to have been used before the Basketmaker II period. Though Irwin-Williams's (1973) research in the Arroyo

Cuervo District of north-central New Mexico suggests that corn was grown by Archaic peoples before the Basketmaker II period, there does not appear to have been a great degree of dependence on horticulture until that phase. Thus, there should be no evidence of heavy dependence on cultivated foods before Basketmaker II, and probably not until relatively late in that phase.

Foragers Versus Collectors

Binford (1980) has identified two basic hunter-gatherer organizational systems, one in which consumers move to resources (foragers) and a second in which resources are moved to consumers (collectors). According to Irwin-Williams's (1973) model of Archaic adaptations, Early (Jay and Bajada) and Middle (San Jose) Archaic sites represent a forager adaptation. However, the larger and more intensively occupied sites of the San Jose phase suggest that the shift to a collector lifestyle may have begun during that period. A collector pattern may have been followed during the Late Archaic (Armijo and En Medio phases). Fuller (1989:17) has summarized Binford's (1980) discussion of foragers, and states that they are:

> . . . highly mobile, moving frequently and cumulatively several hundred miles annually; are highly flexible in terms of social structure; have no need to invest much in facilities; live in environments where resources are widely scattered or annually variable; and procure daily food requirements on a day to day basis. Variability between recognizable sites will be based more on seasonal or annual differences of resource use and duration than on site functional differences. Specialized activity sites are rarely recognizable except where rare resources are procured through an encounter strategy.

Two basic site types are theorized: residential or base camps, and resource extractive locales. In most instances, the latter are archaeologically invisible (J. Moore 1980; Vierra 1980).

In addition to residential camps, collectors: ". . . should use field camps for short-term, task group residence; for task-group information exchange stations, and for caches for product storage" (Fuller 1989:18). Fuller characterizes collectors as follows:

> . . . collectors employ logistical mobility and specialized task organization to keep supplied. They are characterized by use of storage facilities and logistically organized food-procurement parties (Binford 1980:10). A group tends to move into a resource zone and exploits that zone through specialized task groups in response to a resource structure that is either temporally or spatially aggregated. Task groups consist of skilled individuals who seek to procure specific resources in specific contexts, rather than through random encounter. (Fuller 1989:18)

Foragers inhabit base camps for a short time, ranging out from them to exploit resources on an encounter basis. Collectors inhabit base camps for longer periods, exploiting surrounding resources through day trips and sometimes through the use of short-term field camps. Collectors use storage features to cache resources at their residential camp in preparation for seasons of limited food availability, a strategy that is not employed by foragers (who simply move on).

Collectors Versus Sedentary Farmers

In the original research orientation (J. Moore 1989), different views concerning the degree of Late Archaic dependence on cultivated foods were presented. Irwin-Williams (1973) considers Basketmaker II the final stage before the adoption of farming resulted in a shift to a sedentary lifestyle. Major differences between the Basketmaker II and earlier Archaic phases include a greater dependence on storage facilities, increased use of ground stone tools, and increasing use and control of soft hammer percussion and pressure flaking in chipped stone reduction (Irwin-Williams 1973; Woodbury and Zubrow 1979).

However, research in southwest Colorado and southeast Utah suggests that Basketmaker II was highly sedentary and dependent on corn horticulture by at least 500 B.C. (Fuller 1988, 1989; Matson 1991; Matson and Chisholm 1986; Matson et al. 1983). Fuller (1989:27) cites evidence from Black Mesa (Arizona), Cedar Mesa (Utah), and the Durango and Navajo Reservoir (Colorado) areas in support of this idea. However, intensive survey and excavation in northwest New Mexico suggest that the Late Archaic collector pattern continued to be followed in that area during Basketmaker II times.

It will not be possible to examine these seemingly contradictory ideas in the detail anticipated because the San Ildefonso Springs site dated earlier than expected. However, dates for the various components were based on radiocarbon analysis of fuels from hearths and other features encountered during excavation. A problem inherent in radiocarbon analysis is the use of old wood as fuel. While relatively accurate dates can be obtained when the plant materials being analyzed are from annuals or are twigs from woody plants, wood from trees presents several problems. First, tree wood can last on the surface for long periods in the Southwest, especially species like juniper that are resistant to deterioration. Second, wood from tree interiors date differently from that on the outside, especially when calibrated. In fact, currently used calibrations are based on analysis of decadal groups of tree rings from long dated sequences (Suess 1986). Thus, when wood from trees was used as fuel, the dates derived may be considerably older than the actual time of occupation unless only outer rings were obtained for analysis. Even when this is the case, the use of seasoned old wood must also be considered.

Features associated with Component 2 provided dates that extend nearly to 800 B.C., the currently accepted beginning of the Basketmaker II phase. Since tree wood was used as fuel in those samples, the possibility that an early Basketmaker II occupation is represented by Components 2 and 3 must be considered. Thus, this question retains some applicability, though that applicability is limited by the probability that any Basketmaker II occupation was likely very early in the phase.

Research Expectations

A series of expectations was generated for each possibility in the research orientation. In general, our focus was to define the type of occupation represented by these remains. This includes an examination of site structure, occupational pattern, activities performed, and subsistence pattern followed.

Foragers Versus Collectors

Theoretically, three types of camps are possible for Archaic occupations: residential bases, field camps, and resource extractive locales. The last is presumed to be archaeologically invisible except under rare circumstances. Residential base camps are the location at which groups resided, and were the focus of subsistence activities (Vierra 1994). A foraging residential base camp should reflect a wide range of maintenance, production, and food processing activities without a heavy investment in habitation or storage structures. Structural remains, if present, should be ephemeral and indicative of short-term use.

Collector residential base camps should not only contain evidence of a wide range of activities, they should also demonstrate a corresponding investment in habitation and storage structures, denoting a lengthy occupation. Collector field camps should reflect temporary occupancy by a small group engaged in specialized activities. Therefore, a severely limited range of tasks should be represented, storage features should be absent unless the site was used as a cache, and structures (if present) should be ephemeral.

A potential problem in applying this model involves separating foraging camps occupied for short periods from field camps used by collectors. Both should exhibit evidence of short-term occupation, and the range of activities visible in the artifact assemblage might be quite limited for both. In many cases, they may be indistinguishable. This problem can be dealt with through analysis of the chipped stone assemblage.

The manufacture of general purpose bifaces reflects a mobile lifestyle, and more commonly occurs at residential base camps than at field camps or resource extractive locales. Kelly (1988:731) defines three types of bifaces:

1. Bifaces used as cores and general purpose tools;
2. Bifaces functioning as long use-life tools that can be resharpened;
3. Bifaces serving as function-specific tools, with shapes designed for limited uses.

Each type of biface is curated, but for different reasons and in different ways. Use of bifaces as cores is conditioned by the type and distribution of raw materials. An expedient core-flake technology can be expected when suitable raw materials are abundant and tools are used where the materials from which they are made were procured (Kelly 1988:719). Little use of bifaces as cores should accompany this pattern. When local raw materials are scarce or of poor quality, bifaces can be made to help overcome the difficulties involved in using materials obtained at a distance from where they are used (Kelly 1988:719). When raw materials are extremely scarce, mobility is low, or a specific bifacial tool is required for activities performed away from the residential camp, there may be some use of bifaces as cores and extensive rejuvenation of bifacial tools (Kelly 1988:720).

Bifaces with long use lives may be manufactured under a variety of conditions:

> In particular, tools designed for use on long search-and-encounter (as opposed to target specific) logistical forays will be under greater pressure to be designed to meet a variety of needs and tasks (e.g., cutting or scraping tools) and thus will need to be bifacial. This requirement can be relaxed for the equipment of target-specific forays. (Kelly 1988:721)

Bifaces may also be manufactured as by-products of the shaping process, and illustrate the importance of the haft to which the tool was attached (Kelly 1988:721). This type of biface might be more frequently maintained or replaced at residential rather than logistical sites (Kelly 1988:721).

Using these concepts, Kelly develops a model to aid in distinguishing between residential and logistical or field camp sites (Fig. 13.1). The model has not been rigorously tested, but it does provide a series of predictions that can be applied to the chipped stone assemblage from LA 65006. When combined with other data sets such as feature type and placement, number and diversity of activity sets represented, and types of resources exploited, the applicability of the model to the site can be assessed. For example, if residential features are present but analysis suggests that the site was a logistic locale or field camp, the model may be incorrect. However, if the residential pattern as predicted by both Kelly's model and site structure are in agreement, the model may be tentatively accepted as valid.

Collectors Versus Sedentary Farmers

Parts of the San Ildefonso Springs site may have been occupied during the Basketmaker II period. If so, two adaptive patterns are possible–hunter-gatherers following a collector pattern or farmers leading a sedentary lifestyle. Irwin-Williams (1973, 1979) suggests a basic collector pattern for this period, with the addition of seasonal maize horticulture. Other researchers suggest that Basketmaker II people were sedentary farmers, with maize comprising at least 80 percent of their diet (Fuller 1988, 1989; Matson and Chisholm 1986; Matson et al. 1983).

Our ability to determine whether one of these patterns applies to LA 65006 depends on how it functioned in the Late Archaic settlement system. If it was a limited activity locale used repeatedly over time, noise generated by overlapping occupations may have scrambled site structure to the extent that it cannot be unraveled, making it impossible to examine this problem in detail. If it was a residential locale this problem can be addressed using site structure and assemblage data.

If Irwin-Williams's (1973, 1979) model is correct, the pattern described earlier for collectors should be found. To summarize, a collector residential camp should contain evidence of a wide range of activities and a relatively heavy investment in habitation and storage features denoting a lengthy occupation. Since occupation was either sporadic or for only a season or two, sheet trash rather than middens is expected. A heavy dependence on bifaces should be visible in the chipped stone assemblage. Collector field camps should reflect a severely limited range of activities, storage structures should be absent (unless the site was a cache), and habitation structures (if present) should be ephemeral.

A completely different pattern should be visible if the site was a residence for sedentary farmers. Expediently produced and used chipped stone tools should be associated with substantial habitation and storage features. A wide range of activities should be represented, and at least one midden should occur. While general purpose bifaces might be present, most formal chipped stone tools should have specialized shapes produced for specific functions. Field camps should be similar to those described for collectors, but there should be an emphasis on expediently produced and used chipped stone tools rather than bifaces.

Foragers Versus Collectors Versus Farmers

Foragers and collectors should have left remains behind that can be distinguished from one another. Forager residential sites should reflect an occupation of limited duration, and may contain ephemeral structures. Collector residential sites should reflect a longer and more intensive occupation, and should contain more substantial habitation structures as well as storage features. Collector field camps may resemble forager residential sites in many ways, but it should be possible to distinguish between them using the range and types of activity sets and chipped stone artifacts represented. Kelly's (1988) model of biface production and use will be employed to help make this distinction.

Residence by sedentary farmers should be relatively easy to distinguish from the other patterns. Features should be more substantial and indicative of long-term occupation. Formal middens should occur, and the character of the chipped stone assemblage should differ considerably from that of hunter-gatherers.

Component 1

Component 1 represents the most extensive prehistoric occupation of the San Ildefonso Springs site, and contains 80 percent of the chipped stone artifacts recovered. Radiocarbon samples from three features included in this component suggest occupation between ca. 1429 and 1053 B.C. Since most of the fuel woods used were juniper and conifers, the possibility that these dates predate the actual time of occupation must be considered. Thus, it is likely that Component 1 dates to the latter half of this range or later. Irwin-Williams (1973) dates the Armijo phase between 1800 and 800 B.C. These dates fall within that range, suggesting that an Armijo phase association is likely, though no temporally diagnostic artifacts were recovered.

Features associated with Component 1 contained three types of edible seeds including chenopodium, cactus, and possible squawberry. These types of seeds are only available in the fall, suggesting that the site was used during that time of year. In general, the presence of edible plant remains, bone from animals ranging in size from rabbit to deer, at least five hearths, numerous

A1. The production and use of bifaces as cores in residential sites should result in:
1) a positive correlation between measures of the frequency of bifacial-flaking debris, utilized biface flakes, or biface fragments and measures of the total amount of lithic debris;
2) a high percentage of utilized biface flakes relative to unretouched flake tools;
3) a low incidence of simple percussion cores, especially unprepared of "casual" cores; and
4) evidence of "gearing up" at quarries: a low incidence of flakes with much cortex on their dorsal surfaces in residential sites and use of high-quality raw material, such as fine-grained cryptocrystallines, possibly from distant sources.

A2. The production of bifaces in residential sites which are then used as cores in logistical sites should result in:
1) a division of sites into two basic categories, one in which there is a high, and another in which there is a low incidence of utilized biface-reduction flakes, the former being logistical and the latter residential sites; bifacial tools would be produced and maintained in residential sites, whereas they would be used as tools or cores in logistical sites;
2) likewise, residential sites should display a higher rate of increase (i.e., a higher slope of a regression curve) than logistical sites between biface fragments and measures of the frequency of biface knapping as a function of tool maintenance and replacement; and
3) residential sites should contain a higher frequency of utilized simple flake tools as opposed to utilized flakes removed from a biface.

B. The use of bifaces as long use-life tools should result in:
1) infrequent unifacial examples of the tool type (e.g., projectile points); these rare unifacial examples may be instances of expedient tool production;
2) a pattern of tool production in residential sites similar to C (below), with a high correlation between bifacial debris and tool fragments, but these fragments should show evidence of rejuvenation and resharpening;
3) a high frequency of resharpened or recycled instances of the tool type relative to (a) other tool types or (b) the same tool type from other areas or time periods.
4) evidence in logistical sites of the tool having been resharpened, resulting in a low rate of increase in biface fragments relative to biface flaking debris, as in A2.3, but with few of the biface-reduction flakes having been utilized; and
5) possibly evidence of haft manufacture and maintenance in residential sites as in C.4 (below).

C. The manufacture of bifaces as a by-product of the shaping process should result in:
1) a concentration of bifacial-flaking debris in residential sites, especially very small bifacial-retouch flakes, and a positive correlation between biface fragments and bifacial-flaking debris;
2) a low incidence of the use of biface-reduction flakes as tools;
3) a relatively high incidence of unifacial instances of a normally bifacial tool type (contrast with B.1 above); and
4) an archaeological record at residential sites indicating the maintenance of hafted tools, including stone tools used for the manufacture of organic items, e.g., flake tools, burins, gravers, spokeshaves, and scrapers.

Figure 13.1. Kelly's (1988:721-723) model predicting the hypothetical association between site type and lithic artifact assemblage character.

chipped and ground stone artifacts, and olivella shell beads suggest that this component represents a residential locale. The size of the chipped stone assemblage may indicate a rather lengthy occupation, but this is uncertain. Analysis indicated that the manufacture of large bifaces was an important activity in this component. The only other formal tools found were a hammerstone, which was probably used for chipped stone reduction, and a scraper. However, numerous informal tools were recovered, suggesting that manufacturing or maintenance activities associated with the processing of medium-hard to hard materials like bone, antler, or wood also occurred.

Thus, analytical data suggest a Late Archaic Armijo phase residential occupation during the fall. The size of the occupying group as well as the structure of that occupation remain undetermined. A more detailed analysis of site structure may shed some light on these questions.

Excavation Areas and Features

As noted in an earlier chapter, the San Ildefonso Springs site was divided into six excavation areas during data recovery. While the excavation areas were artificial constructs, they remain a good way to divide the site for discussion and will continue to be used. Four excavation

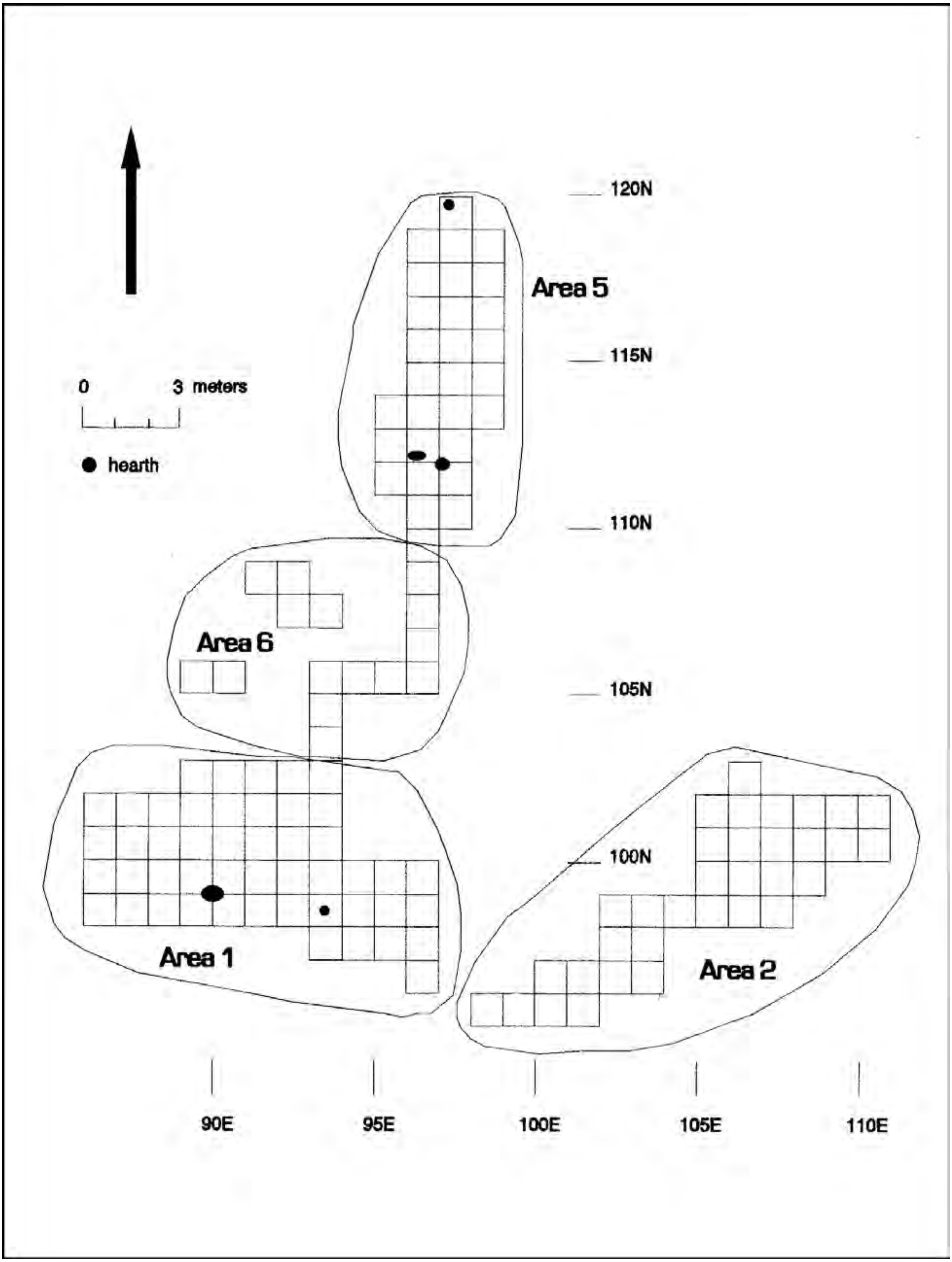

Figure 13.2. Excavation areas in Component 1.

areas contained materials and features associated with Component 1 (Fig. 13.2). Areas 1 and 2 were exposed along the south edge of the lower terrace, Area 5 was in the north-central part of the lower terrace, and Area 6 was between Areas 1 and 5.

Component 1 contained five features, all simple hearths. Features 2 and 8 were in Area 1, while Features 5, 6, and 7 were in Area 5. For reasons that are discussed later, it is likely that there was once a hearth in Area 2 that eroded away before archaeological investigations were conducted at the site. It is also possible that there was an undocumented hearth in Area 6.

Ground Stone, Olivella Shell Beads, Other Formal Tools, and Fire-Cracked Rock

The distribution of ground stone tools, olivella shell beads, and other formal tools is shown in Figure 13.3. Six pieces of ground stone and three olivella shell beads were recovered, all from Area 1. The ground stone assemblage contains fragments of two basalt basin metates, one sandstone slab metate, two quartzite manos, and one undifferentiated igneous mano. While all ground stone tools are broken, the basin metate fragments are large enough to have continued in use. This is especially true of the fragment found southwest of Feature 8. Except for basin metate fragments, ground stone tools were clustered around or in Feature 2. No ground stone tools were recycled as heating elements.

The basin metate fragments, which were large enough to continue in use even though broken, were situated away from Feature 2. One fragment was southwest of Feature 8, and the other was about 1.5 m north of Feature 2. The scatter of unusable ground stone fragments around Feature 2 suggests that area served as a discard zone after the hearth was abandoned. If so, Feature 8 may have been built and used after Feature 2 fell into disuse. It is also possible that broken manos were salvaged from earlier occupational zones and used as heating elements, but were not burned to the point where oxidation or heat fracturing occurred.

Three olivella shell beads were also found around Feature 2. When these artifacts were initially recovered it was thought that a burial might be located in this area. However, no human bone was found at the site, and this lack suggests that no burial was ever present. Since none of the beads were broken, it is likely that they represent an accidental loss. Perhaps a string of beads was broken while the owner was sitting or working around this hearth, and several were lost in the sand. Whatever the reason for their presence, these beads suggest the existence of an extensive exchange network, and are evidence for the low-level but large-scale Archaic communication system proposed by Irwin-Williams (1979) and J. Moore (1980).

Only two formal tools were recovered from Component 1 other than fragments of large bifaces. A quartzite hammerstone was found in Area 6 in a concentration of reduction debris, and an obsidian end scraper was found northwest of Feature 8 in Area 1.

The distribution of fire-cracked rock is shown in Figure 13.4. While no heavy concentrations of fire-cracked rock were found, most fragments were distributed around hearths. The exceptions were those found in Areas 2 and 6. About two-thirds of the fire-cracked rock was scattered around Features 2 and 8 in Area 1. There appear to have been two main discard zones for fire-cracked rock–southeast of Feature 2 and west of Feature 8. Several fragments were also discarded around and south of Feature 7 at the north edge of Area 5. Unfortunately, the limits of excavation in that area and the loss of much of Area 1 to erosion make conclusions about fire-cracked rock discard zones tentative.

There are two interesting aspects to the distribution of these artifact classes. First, the ground stone tools, olivella shell beads, and scraper were clustered around Features 2 and 8. Limited evidence suggests that Feature 2 was used and abandoned before Feature 8, either indicating a relatively long occupation or reuse of this area for more than one residential episode. Second, most of the fire-cracked rock was scattered around hearths, as might be expected. The few exceptions include five fragments in Area 2 and one in Area 6. While the occurrence of these artifacts away from hearths may simply mean that hearths were cleaned and the materials removed from them discarded away from work zones, it could also suggest that there were other hearths that were either eroded away or remained undiscovered during excavation. No ground stone tools, olivella shell beads, or fire-cracked rock was recovered from around Features 5 and 6 in the central part of Area 4. This tentatively suggests that these hearths may have functioned differently than the others. These questions are further addressed with other data sets.

Chipped Stone Artifacts

The distribution of all chipped stone artifacts is shown in Figure 13.5. The patterning of chipped stone artifacts essentially replicates that of other artifact categories. By far the heaviest concentration of chipped stone was around Features 2 and 8 in Area 1. However, very heavy concentrations also occurred in Areas 2 and 6, and a moderate concentration was south of Feature 7 at the north edge of Area 5. Very few chipped stone artifacts were found around Features 5 and 6 in the central part of Area 5.

In Area 1, the heaviest chipped stone concentrations

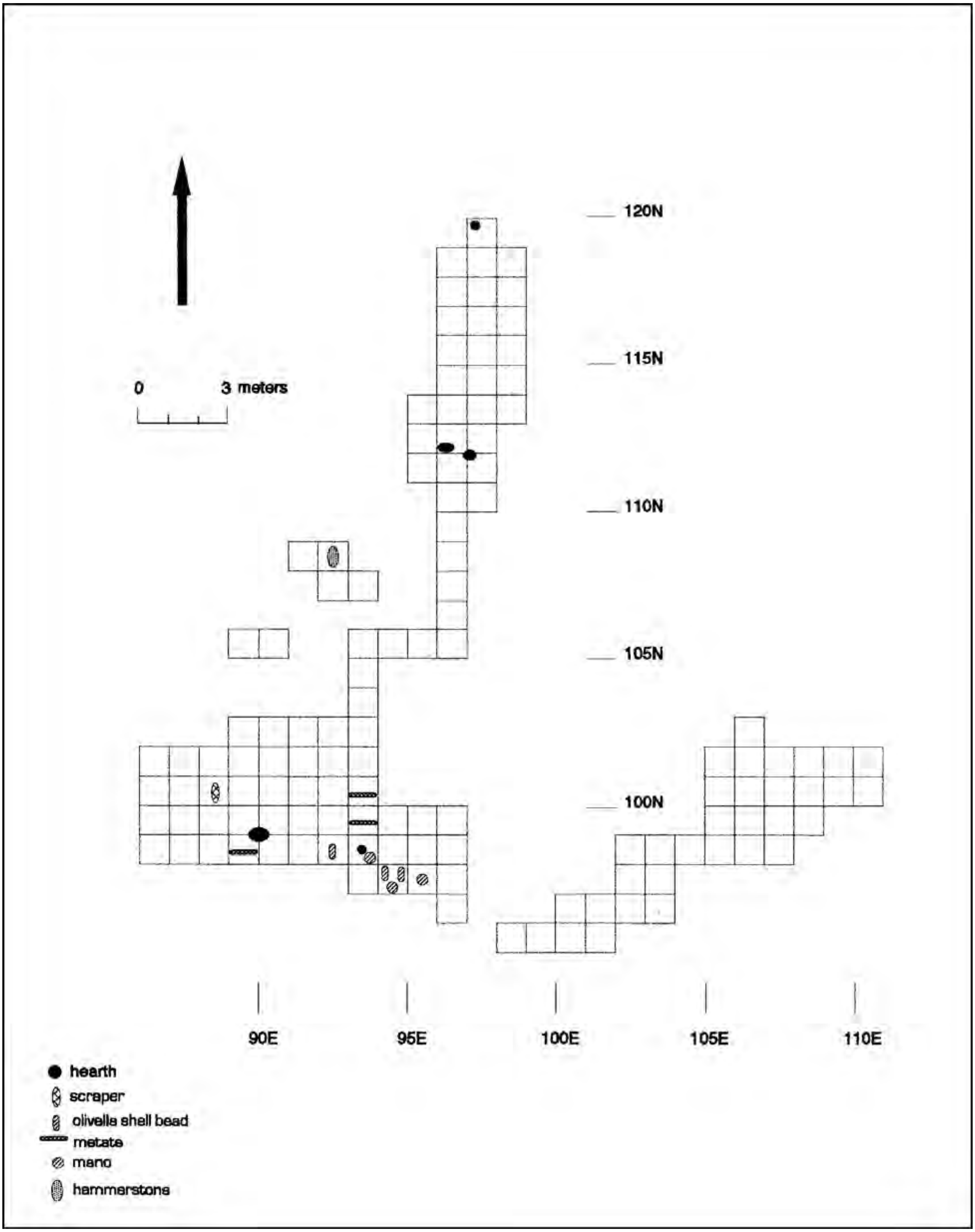

Figure 13.3. Distribution of formal tools and beads in Component 1.

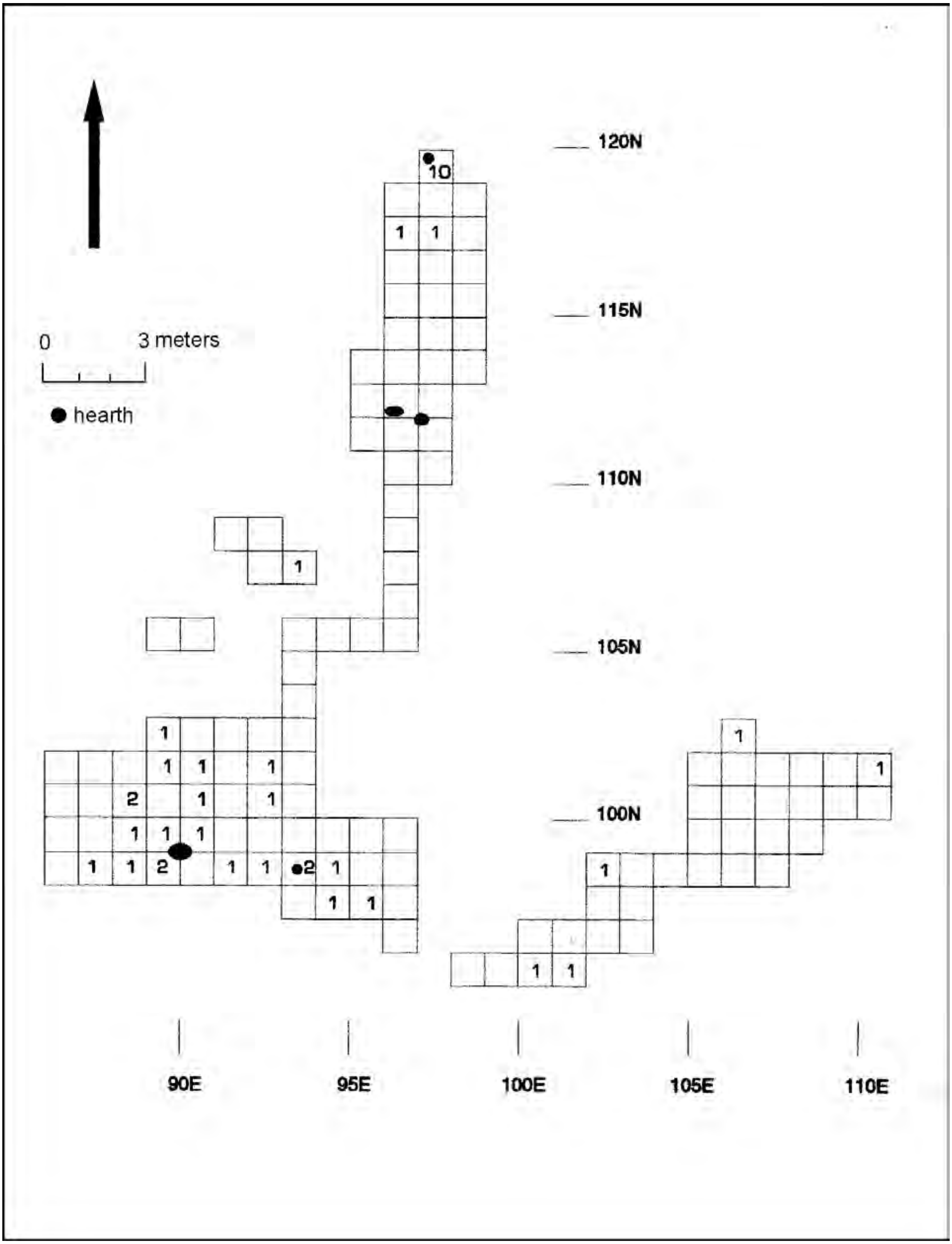

Figure 13.4. Distribution of fire-cracked rock in Component 1.

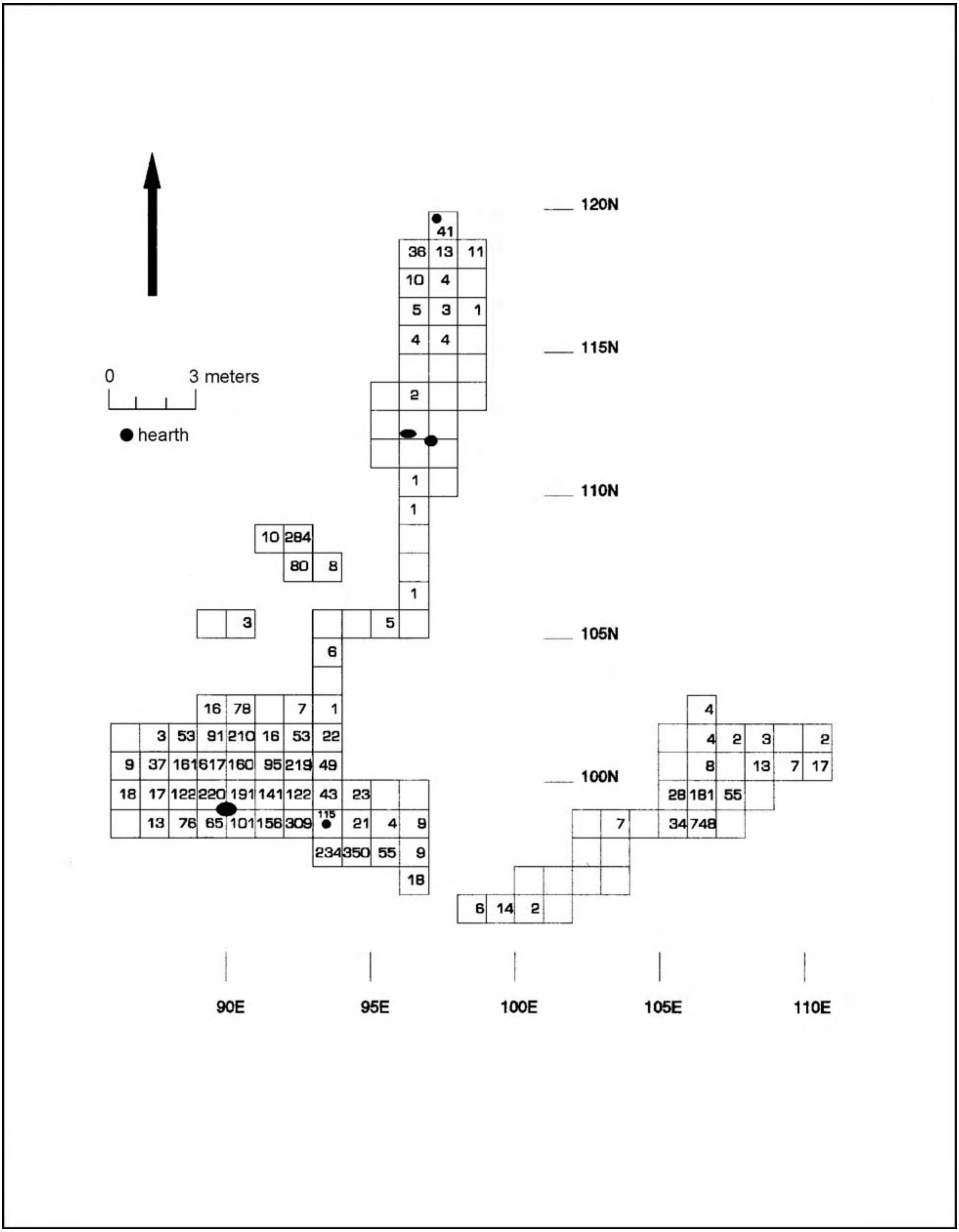

Figure 13.5. Distribution of all chipped stone artifacts in Component 1.

were northwest of Feature 8, in the zone between Features 2 and 8, and southeast of Feature 2. This suggests that flintknapping occurred in relatively discrete zones around these features, though debris was scattered across the area. This was probably due to a several factors, including wide scattering of debris removed by percussion, cultural movement caused by the use of debitage as informal tools, and bioturbation. Unfortunately, it was impossible to determine whether there were chipping areas south of Feature 8 and southwest of Feature 2 because that area was eroded away before excavation began. However, a drop in debitage frequencies in grids directly southwest of Feature 8 suggests that there was no chipping area in that direction.

Two grids contained a very heavy concentration of chipped stone artifacts in Area 2–99N/107E and 100N/107E. Moderate amounts of debitage occurred in other grids in that area. In addition, a very heavy chipped stone concentration was found eroding from Area 2 on an exposed slope adjacent to Grid 99N/107E. The heavy concentration of chipped stone artifacts in such a small area suggests the existence of another chipping area, perhaps related to a single reduction episode.

Similarly, a heavy concentration of chipped stone artifacts in Area 6 may be evidence of another reduction episode. However, since only a few grids were excavated there we cannot be certain of this. Some reduction also seems to have occurred south of Feature 7 in Area 5. Unfortunately, the area north of this feature was not investigated because it was outside project limits. No chipped stone reduction appears to have occurred around Features 5 and 6.

Figure 13.6 shows the distribution of obsidian in Component 1. This material was probably obtained from Jemez Mountain sources, and while no chemical sourcing was conducted, visual inspection suggested that most was obtained from the Cerro del Medio, Obsidian Ridge, and Polvedera Peak sources. Obsidian was the most common material in this component, and concentrated in three areas. Obsidian in Area 1 concentrated around and between Features 2 and 8. Two grids (99-100N/107E) contained a heavy concentration of obsidian debitage in Area 2. Finally, there was a moderate to light concentration of obsidian debitage around and south of Feature 7 in Area 5. The rather ubiquitous distribution of obsidian debitage, particularly in Area 1, may be masking the actual loci of reduction. For this reason, Figure 13.7 was constructed to show grids containing more than 100 obsidian flakes. The concentration in Area 2 remains distinct, while the extent of the concentration in Area 1 is considerably reduced in size. Three possible chipping areas can be defined. One is north of Feature 8, the second is between Features 2 and 8, and the third centers on Feature 2.

Figure 13.8 shows the distribution of chertic flakes in Component 1, a category that combines all cherts and silicified woods. There are two main concentrations of these materials. In Area 1, chertic flakes were concentrated around and northwest of Feature 8. Two grids in Area 6 contained a moderately heavy concentration of these materials. Small numbers of chertic flakes occurred in Areas 2 and 5, and were distributed similarly to obsidian flakes in those areas. To clarify the distribution of chertic flakes, Figure 13.9 was constructed and illustrates grids containing more than 100 chertic flakes. One major chipping area is evident in Area 1, and was centered northeast of Feature 8. Only one grid in Area 6 contained a high density of chertic flakes. It is likely that this represents only part of a chipping area, with the rest located to the north or east.

Figure 13.10 shows the distribution of other material types in Component 1. Most of these materials were reduced in Areas 1 and 6, with only a few flakes occurring in Areas 2 and 5. Zones of reduction in Area 1 were northwest of Feature 8 and southeast and west of Feature 2. In Area 6 they were distributed similarly to the chertic materials, but this may not be significant since only a small part of that area was excavated.

In general, obsidian and chertic materials demonstrate different patterns of reduction. Other materials occur in comparatively negligible quantities, and were reduced in the same areas as were the obsidians and cherts. While the distribution of chert and obsidian flakes overlap, the areas in which their reduction concentrated do not, as shown by Figure 13.11. This suggests that different reduction episodes are represented.

There is also some evidence for the differential reduction of these materials in various areas. Pedernal chert dominated the chert material category, and cannot be separated into individual cores (with one minor exception). Thus, all artifacts made from this material are considered together in Figure 13.12. Only grids containing more than three artifacts are included, and since this material was mostly reduced in Area 1, analysis is restricted to that area. Most Pedernal chert was reduced around Feature 8 and west of Feature 2. A single Pedernal chert core was recovered outside the main zone of distribution for this material. While the primary locus of core reduction was in a diagonal along the northwest side of Feature 8, biface manufacture appears to have occurred west and south of that hearth. Though some Pedernal chert artifacts occur around Feature 2, the heavier concentration around Feature 8 suggests that its reduction was mostly associated with use of that hearth.

In many ways, the distribution of obsidian flakes shown in Figure 13.13 resembles that of Pedernal chert. Only grids containing at least three artifacts are included, and only Area 1 is analyzed. Core reduction was accom-

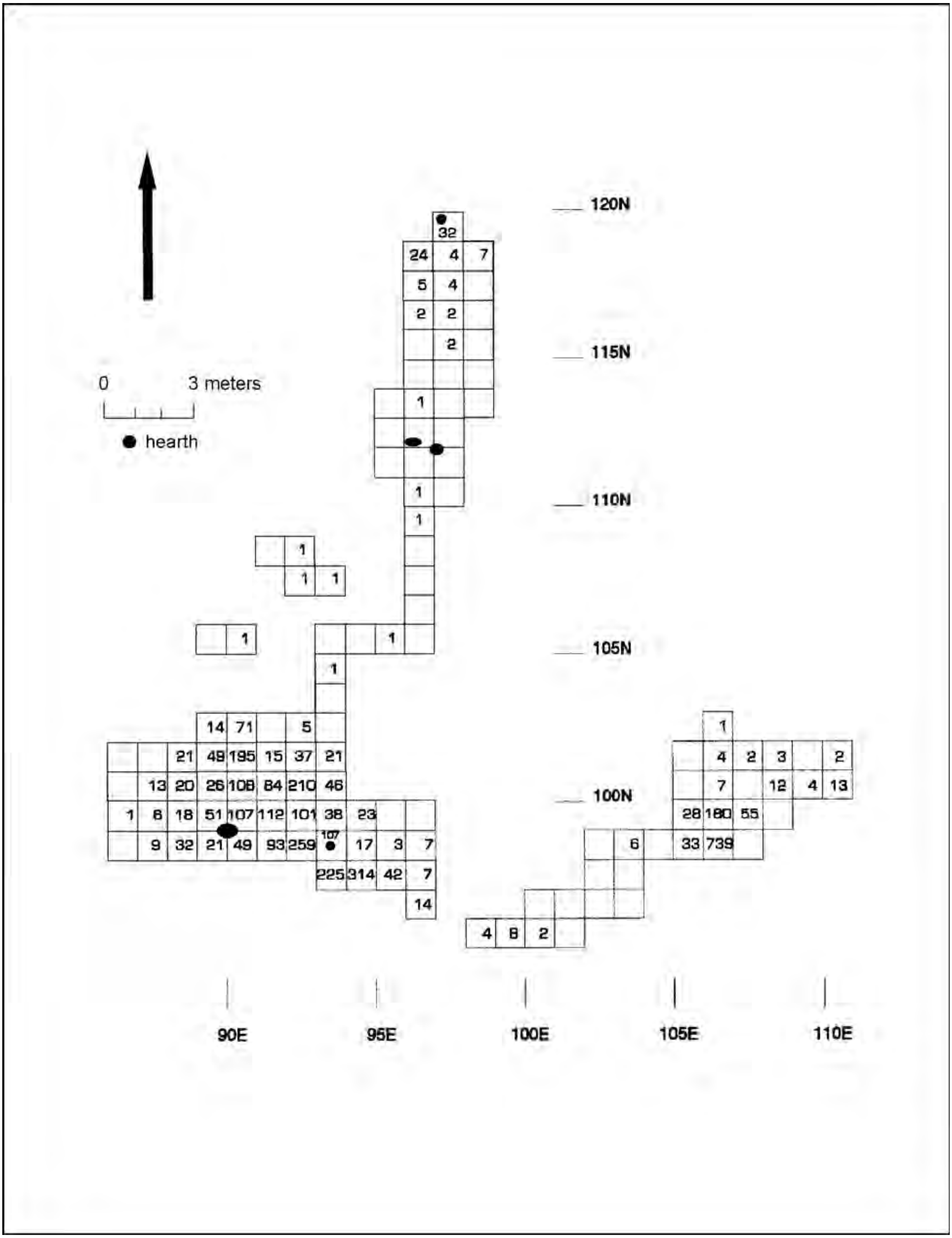

Figure 13.6. Distribution of obsidian artifacts in Component 1.

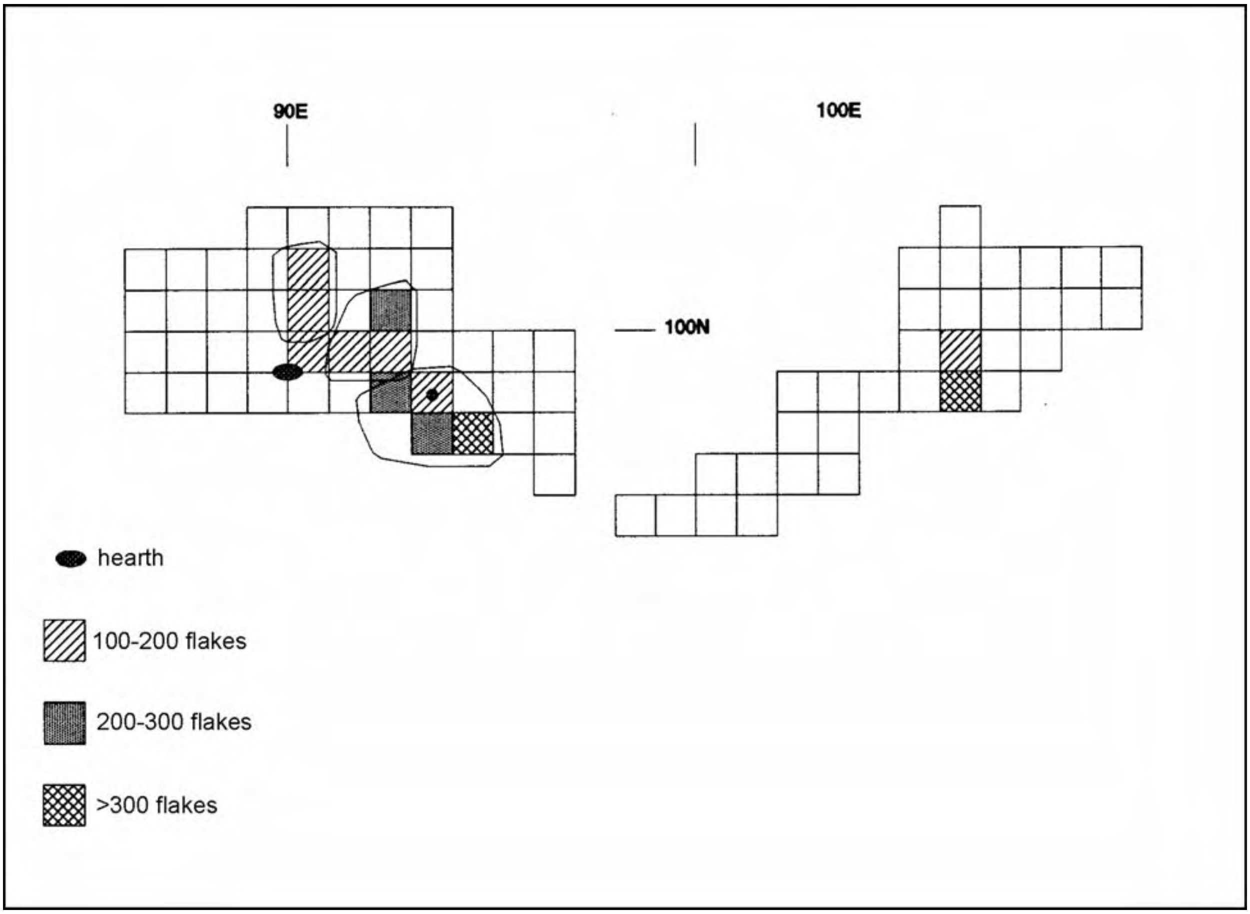

Figure 13.7. Concentations of obsidian flakes in Areas 1 and 2.

plished along a diagonal from north of Feature 8 to southwest of Feature 2. Biface reduction also occurred through most of this area. Tool manufacture dominated west and southwest of Feature 8 and in one grid northwest of Feature 2. Core reduction dominated in three grids north of Feature 8 and in three grids north of Feature 2. Six fragments of bifaces broken during manufacture were also found in this area, mostly in the zone where core and biface manufacture overlap.

When Figure 13.13 is compared with the possible chipping areas shown in Figure 13.7 the pattern becomes a little clearer. The three concentrations in Figure 13.7 include most of the zone in which core and biface reduction co-dominate in Figure 13.13. At least three overlapping reduction episodes may occur in this area, and both cores and bifaces seem to have been reduced during each one. Unfortunately, the sheer number of obsidian artifacts in this area and the probability that several reduction episodes are represented produce noise that cannot be easily removed. As opposed to the complex distribution of obsidian debris through the central part of Area 1, the zone southwest of Feature 8 may have been used for a single reduction episode dominated by biface manufacture.

Even with these complications, some conclusions can be drawn from the distribution of obsidian debitage. Obsidian reduction was ubiquitous across Area 1, and seems to represent multiple flintknapping episodes. There was also a major locus of obsidian reduction in Area 2, which was concentrated in a few grids at the edge of an eroded exposure. Pedernal chert was mostly chipped around Feature 8 in Area 1, and there seems to be differences between loci of core and biface reduction. Interestingly, the area in which biface manufacture dominates in the Pedernal chert assemblage also contains mostly obsidian biface manufacturing debris. Thus, one or more obsidian bifaces may have been manufactured in this area at the same time that Pedernal chert was being worked.

Finer distinction of reduction loci cannot be determined for these materials because debitage from individual cores could not be traced. However, this is not true for some other materials. As noted in Chapter 6, *San Ildefonso Springs Site (LA 65006),* several cores were

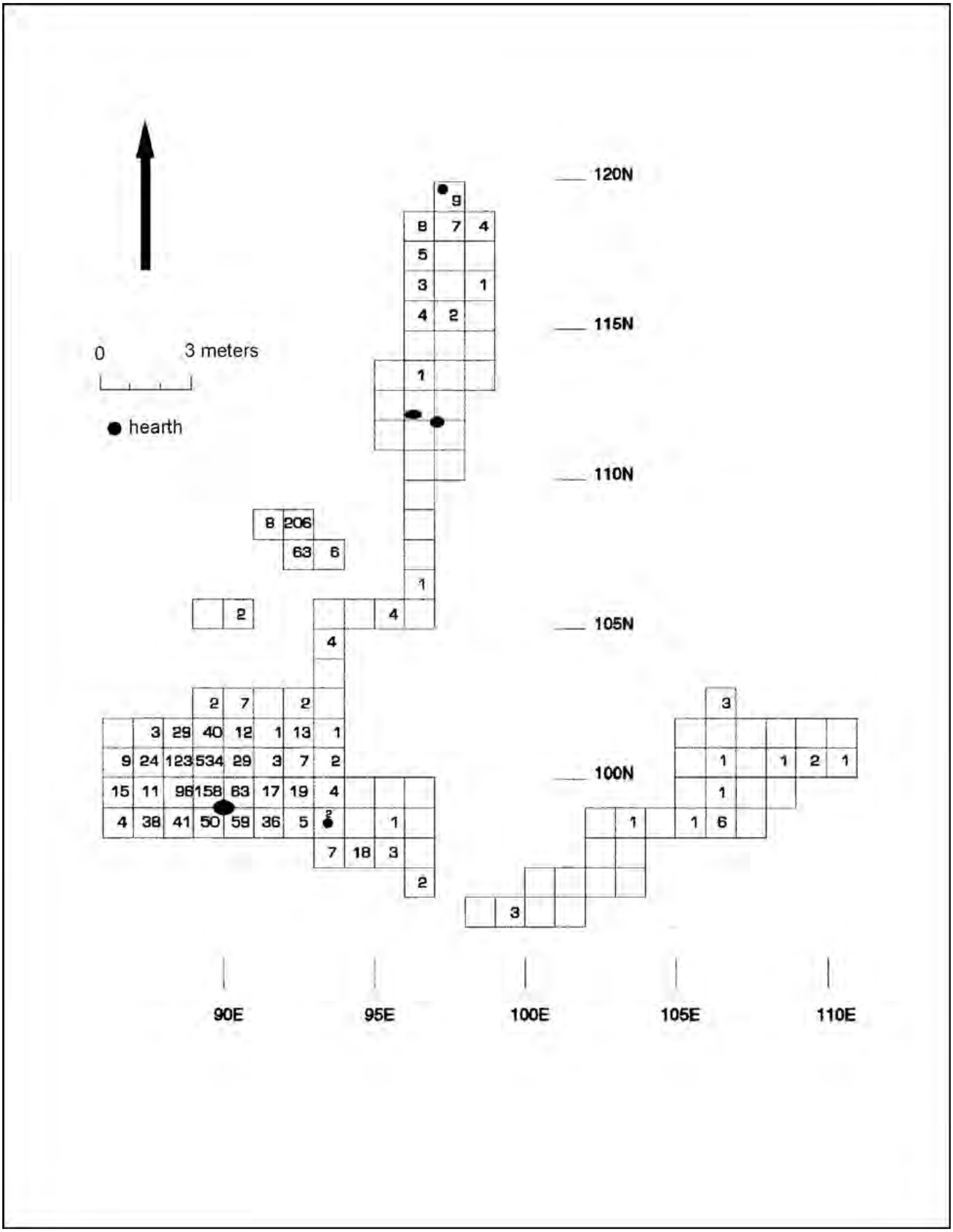

Figure 13.8. Distribution of chertic flakes in Component 1 (cherts and silicified woods).

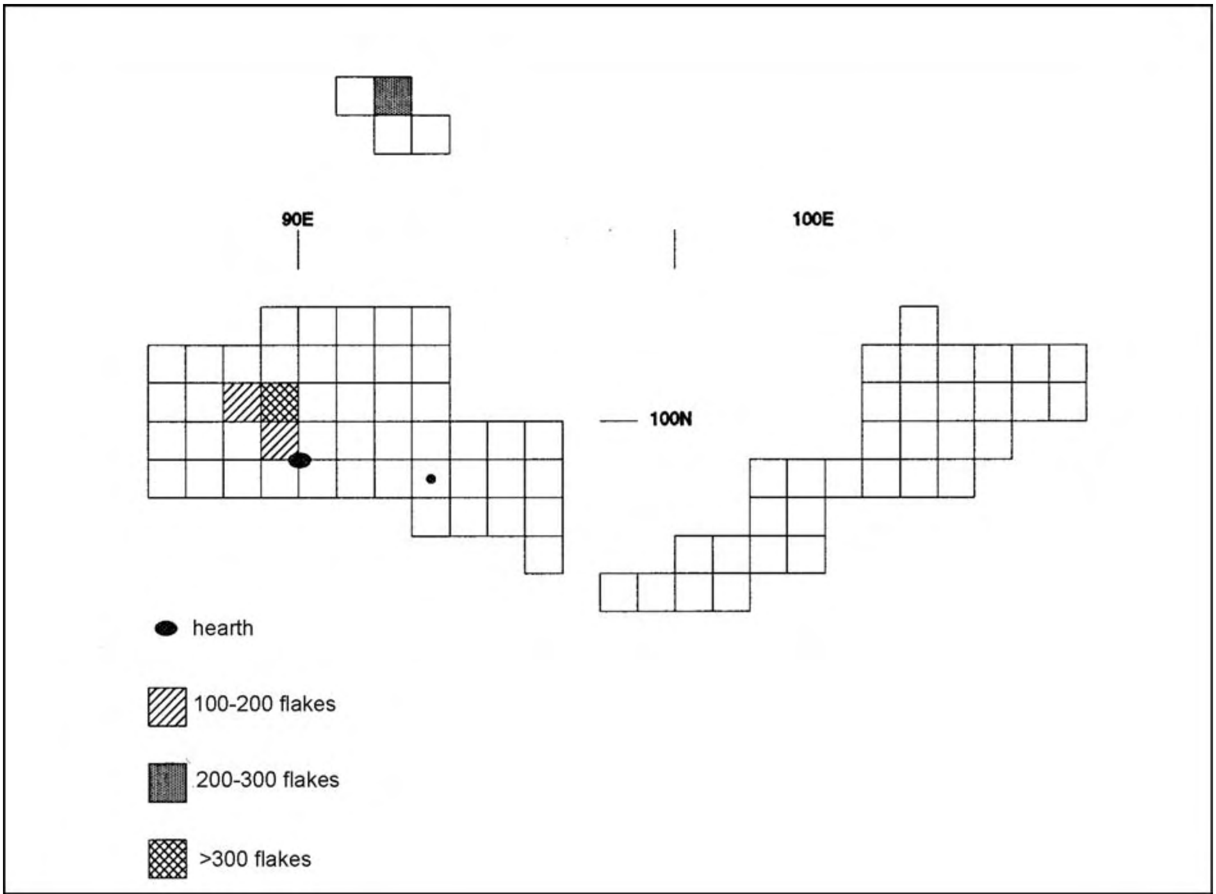

Figure 13.9. Concentrations of chertic flakes in Areas 1, 2, and 6.

traced through cultural deposits at this site. The tracing was done visually, and no refitting was attempted. While several cores are only represented by a few examples apiece, there were a hundred or more flakes from some. Figure 13.14 shows the distribution of flakes from these cores, which mostly match that of the chertic materials.

Core 2 is a fine-grained light brown and white silicified wood. Flakes from this core were scattered through the west part of Area 1, particularly around Feature 8. While a few flakes were found around Feature 2, it is unlikely that this material was reduced there since only one flake was found in either grid. Core reduction centered in a grid northwest of Feature 8. Biface reduction concentrated in the same area and in three adjoining grids directly northwest of Feature 8. One flake from this core was found in Area 2, and a second was in Area 5. No debitage from this core was used as informal tools.

Core 4 is a fine-grained reddish brown to yellow chert with white inclusions up to 3 or 4 mm in diameter. The distribution of debitage from this core is very similar to that of Core 2, with flakes occurring though the west part of Area 1. Core reduction concentrated in two grids northwest of Feature 8 and in two grids east of the same hearth. Biface reduction concentrated in the same grids as Core 2. One flake of this material was found in Area 2, and two pieces of debitage were used as informal tools in Area 1.

Core 6 is a fine-grained yellow chert with white inclusions. While the distribution of this material was somewhat different from Cores 2 and 4, there are several important similarities. Core reduction concentrated in one grid northwest of Feature 8. Biface reduction centered in the same four grids as Cores 2 and 4. No flakes from this core were found in other analytical areas, and only one example was used as an informal tool.

Like Cores 2 and 4, flakes from Core 7 concentrated in the west part of Area 1 around Feature 8, with a few also occurring near Feature 2. This material is a fine-grained brown silicified wood with white laminar streaks. Core reduction centered on four grids northwest of Feature 8. The center of biface reduction partly overlapped this zone, and included the two southern grids as well as a third directly northwest of Feature 8. One flake from this core was recovered in Area 2, and none were used as informal tools.

The distribution of flakes from Core 8 is again similar to those already discussed. This material is a fine-grained light brown and tan silicified wood with black

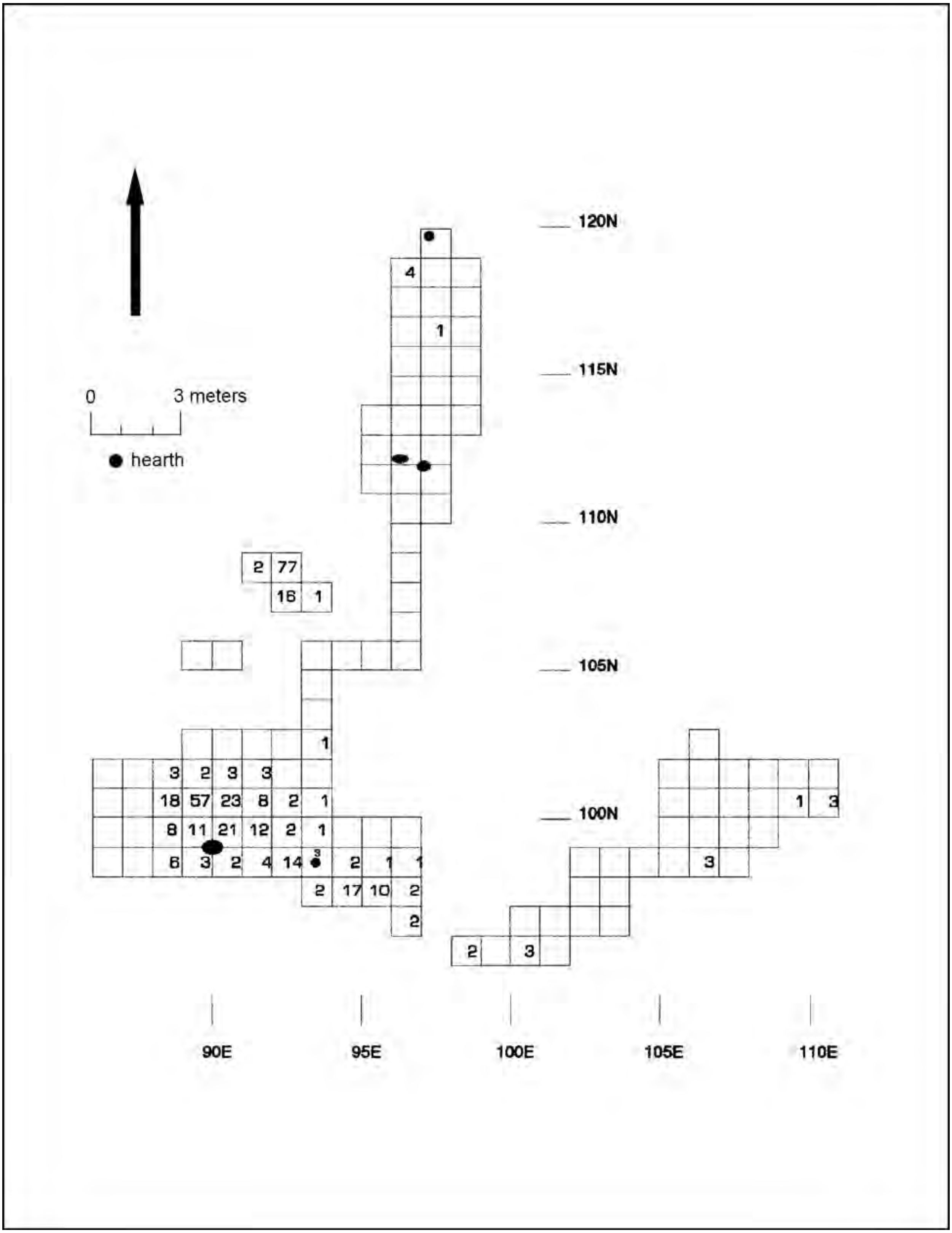

Figure 13.10. Distribution of other materials in Component 1.

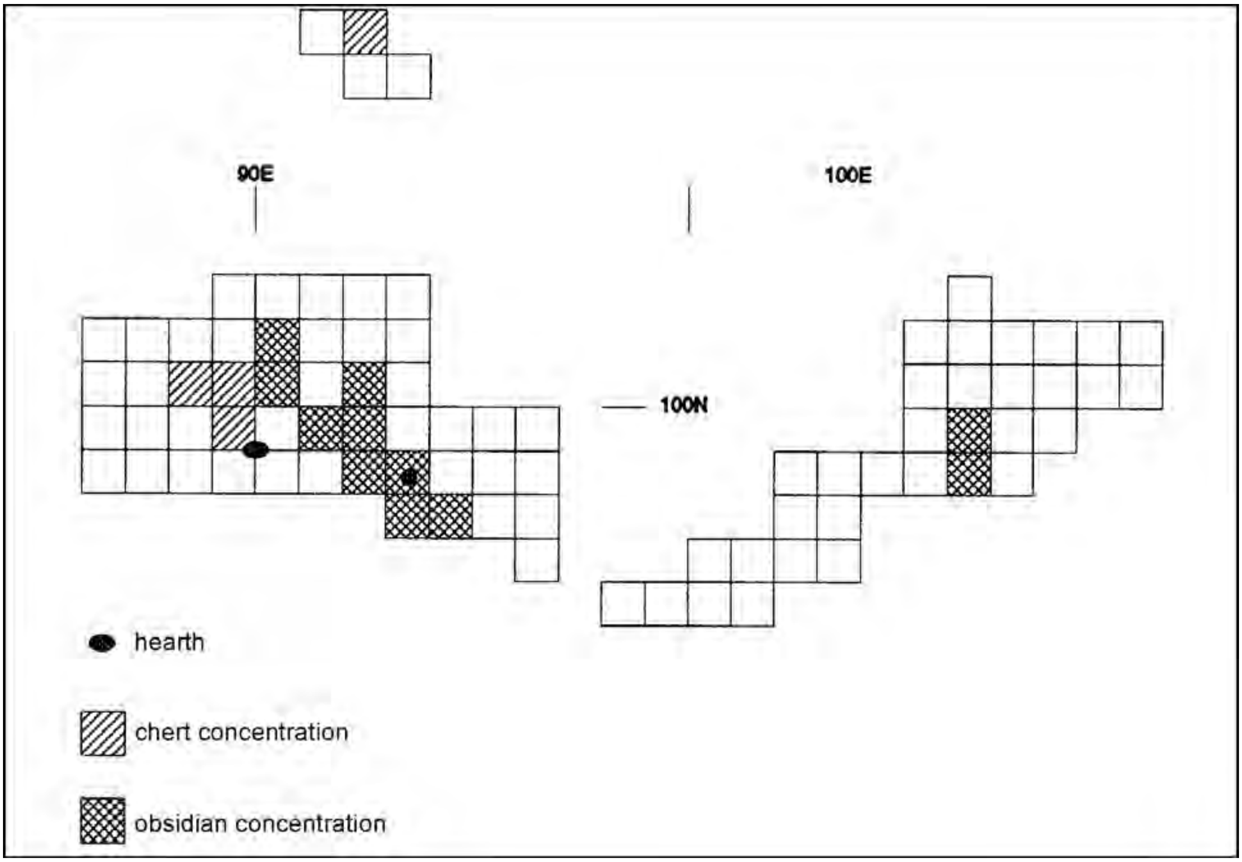

Figure 13.11. Obsidian and chertic material concentrations in Areas 1, 2, and 6.

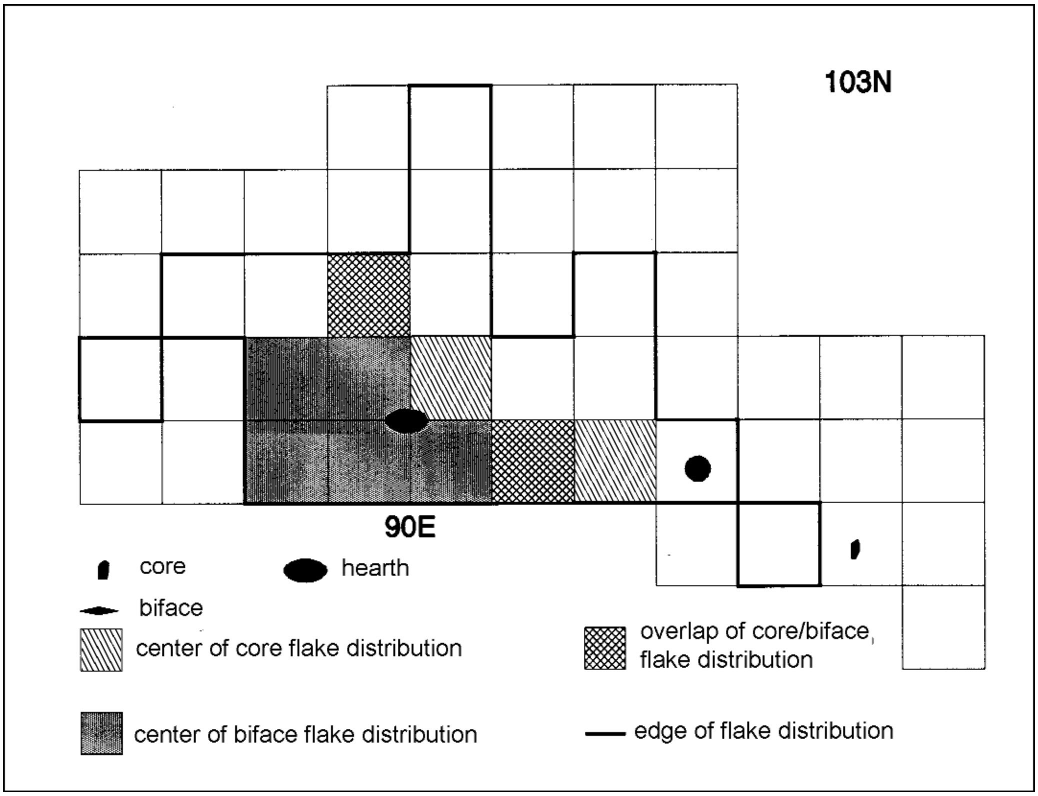

Figure 13.12. Distribution of Pedernal chert flakes and cores in Area 1.

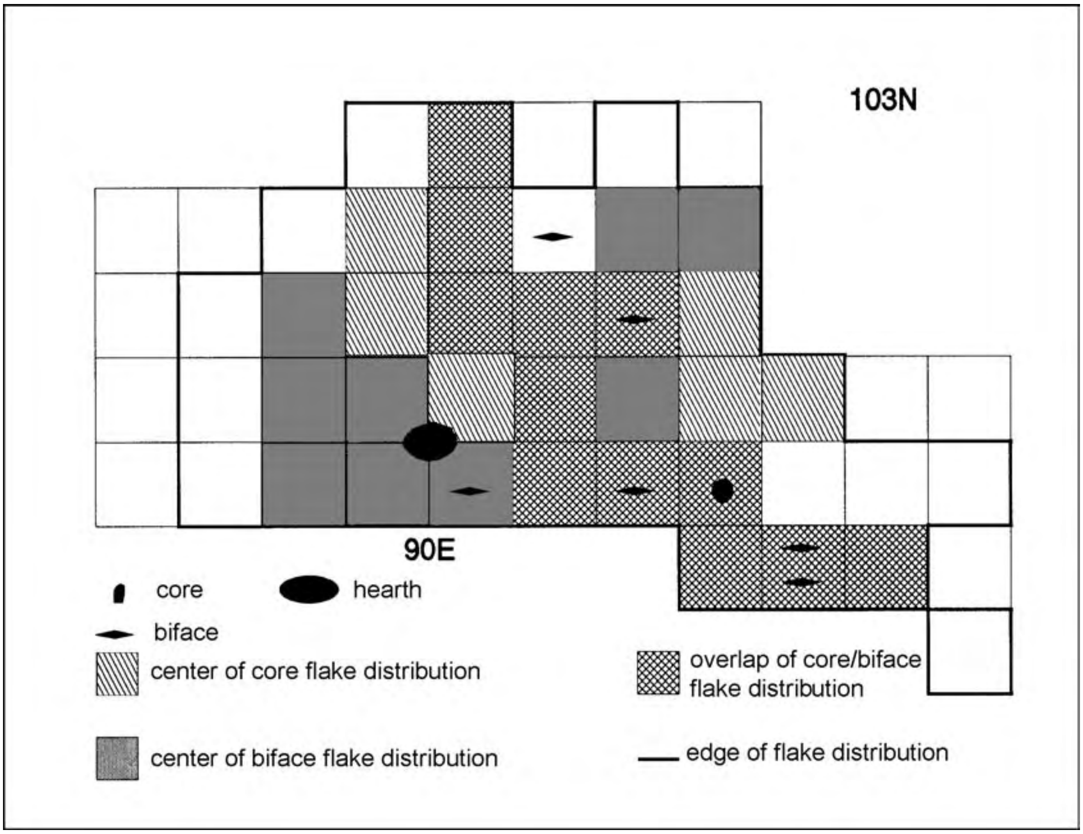

Figure 13.13. Distribution of obsidian flakes and bifaces in Area 1.

laminar streaks, and was scattered across the west part of Area 1. Core reduction centered on two grids northwest of Feature 8. The center of biface reduction overlapped one of these grids, and occurred in the same grids as Core 7. No flakes of this material were found in other analytical areas, and none were used as informal tools.

Core 9 is a fine-grained brown to light brown silicified wood. Again, most flakes from this core were scattered across the west part of Area 1, with a few also occurring near Feature 2. Core reduction centered on one grid northwest of Feature 8. Biface reduction overlapped this grid, and included four other grids northwest of Feature 8. One flake from this core was recovered in Area 2, and none were used as informal tools.

Core 10 is a fine-grained yellow-brown quartzitic sandstone, and was bimodally distributed, centering on areas northwest of Feature 8 and southeast of Feature 2. Core reduction around Feature 8 centers on two grids northwest of that hearth; biface reduction centers on the same grids in addition to a third. Core reduction around Feature 2 centered on one grid directly southeast of that hearth, and biface reduction centered on the next grid to the east. One flake from this core was found in Area 2, while a second was recovered from Area 5. No flakes of this material were used as informal tools.

Finally, Core 11 is a medium-grained brown quartzite. While only 23 flakes and a biface fragment of this material were recovered, their distribution is shown because they concentrate in one area. Core reduction centered on a grid northwest of Feature 8, while biface reduction centered on an adjacent grid directly northwest of Feature 8. However, the biface fragment was found near Feature 2.

There are several interesting aspects to the distribution of materials from these cores. First, with few exceptions, most core and biface reduction concentrated in a few grids northwest of Feature 8. This suggests that a single reduction episode which included materials from a diverse selection of cores may be represented by most of these materials. The only exception is Core 10, which is represented by two reduction episodes, each at a different hearth. The reduction episode associated with Feature 8 probably occurred at the same time as the others, while the other occurred at a different time.

While debitage from these cores were occasionally recovered from other analytical areas, none found away from the reduction loci were used as informal tools. This may be illusory, since many of the activities in which informal tools were used rarely caused sufficient edge damage to allow them to be distinguished from debris damaged by noncultural processes. However, since these pieces of debitage concentrate in Area 1 and there is no

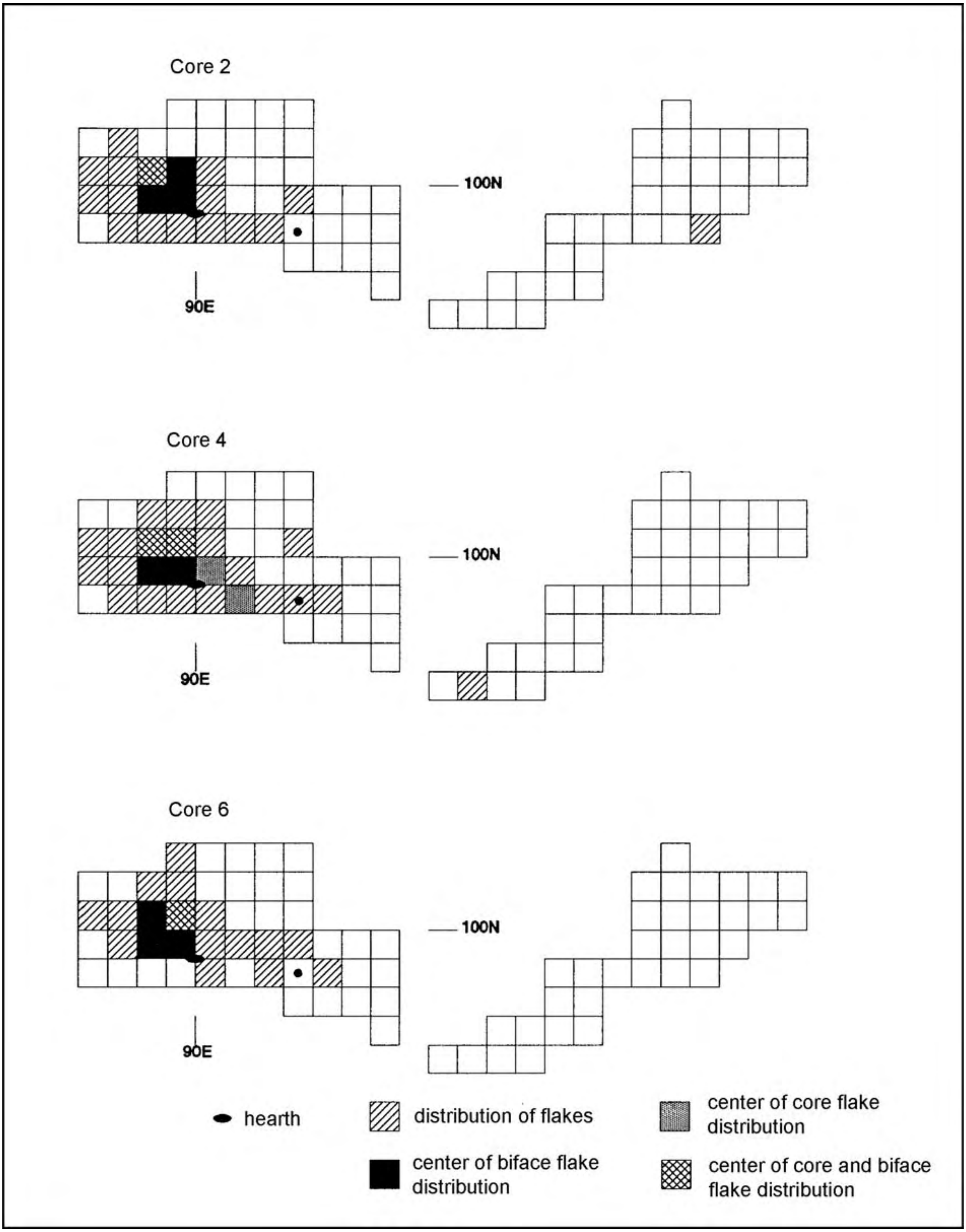

Figure 13.14. Distribution of flakes from identified cores in Areas 1 and 2.

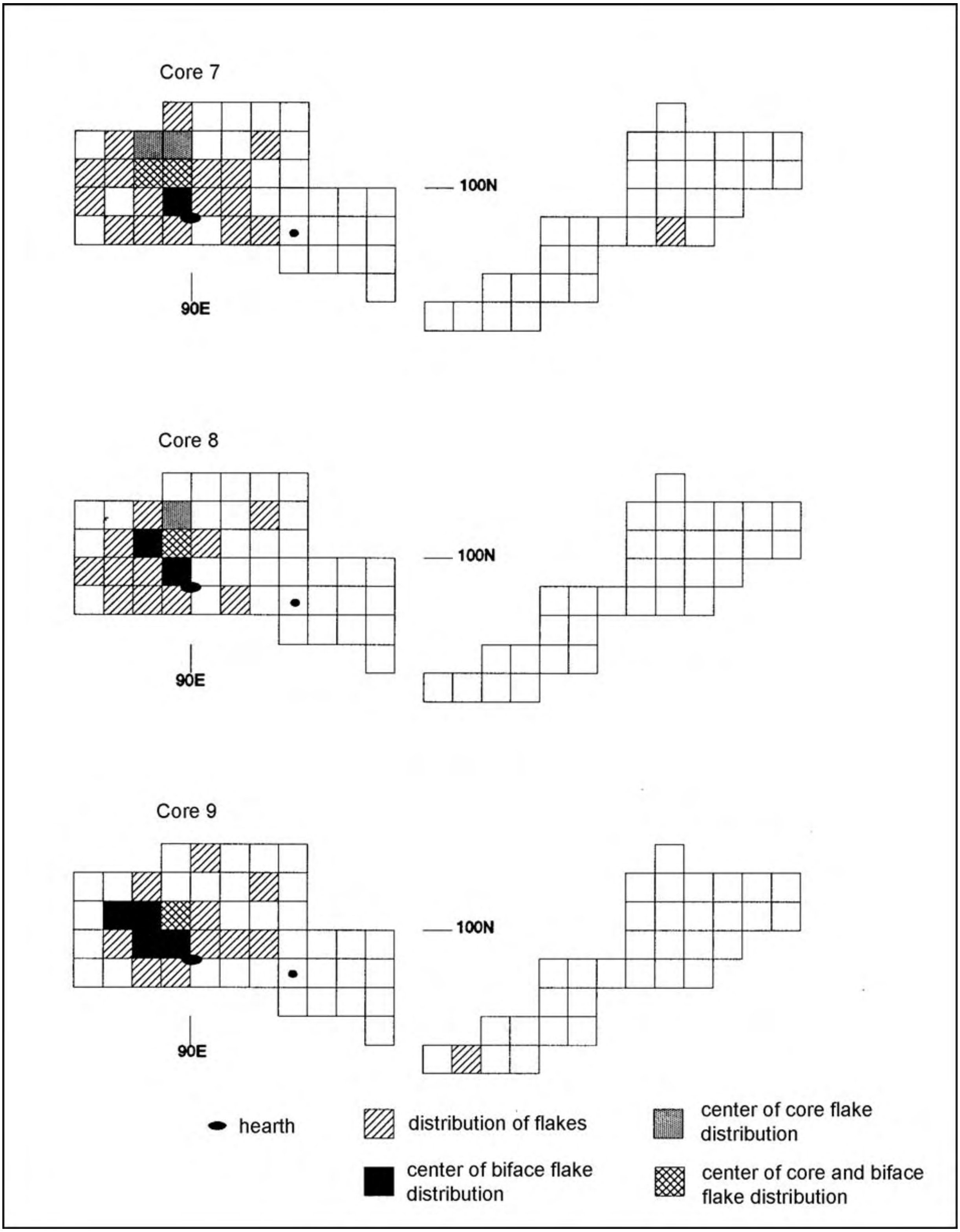

Figure 13.14. Continued.

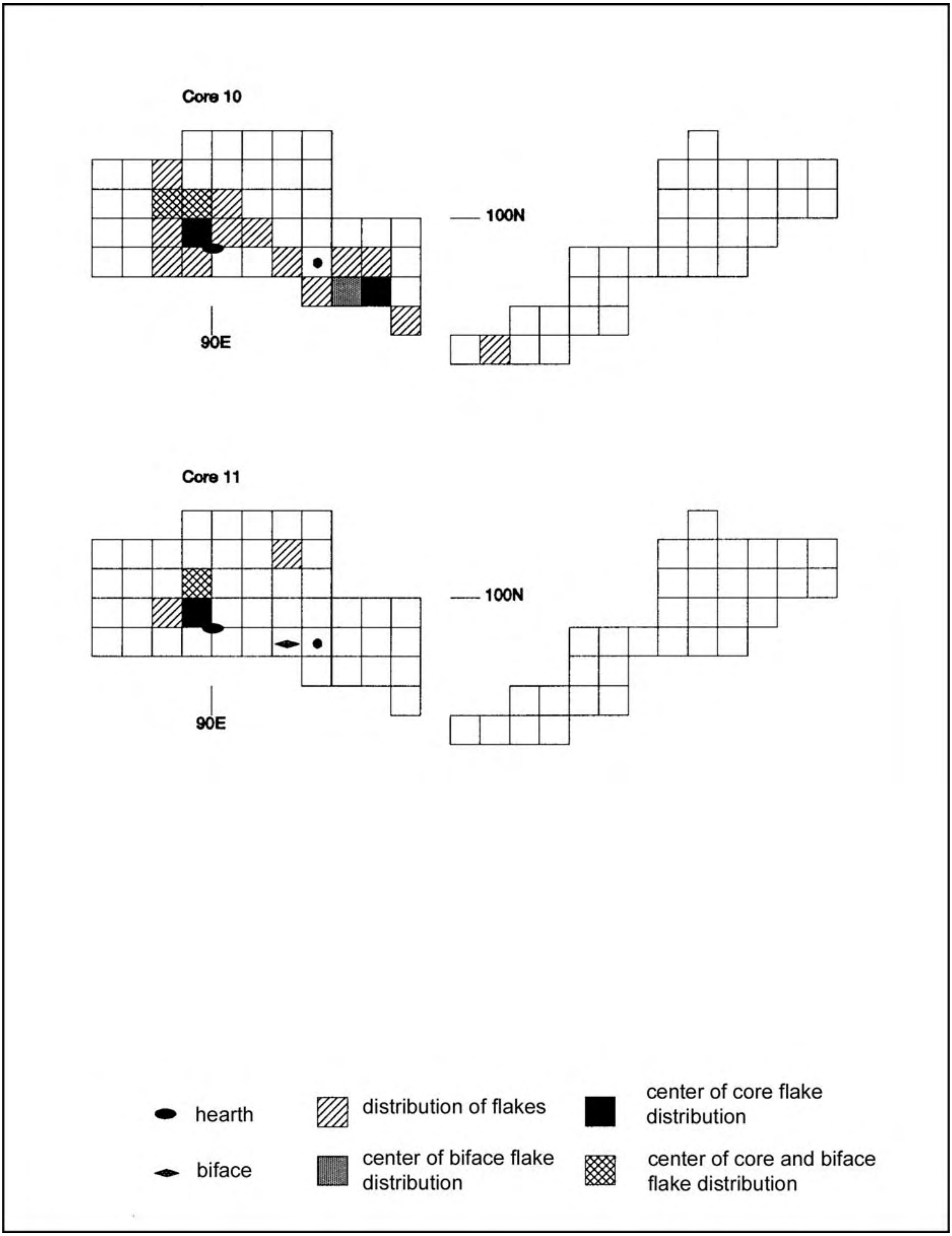

Figure 13.14. Continued.

good evidence for transport to other parts of the site for use, it is likely that most are the result of tool manufacture rather than being purposely struck for informal use.

Finally, it is interesting that the only biface related to any of these cores was found near Feature 2, while most reduction occurred northwest of Feature 8. Perhaps the biface fragment was separately discarded in that area after it was broken, suggesting that the hearth was no longer in use. This possibility is addressed with other information.

To summarize data from analysis of the distribution of debitage, there is evidence for several reduction episodes, especially in Area 1. Obsidian reduction is ubiquitous across that zone, but mostly concentrates in the central part of Area 1 and to the south and southeast of Feature 2. Pedernal chert was mostly reduced around and to the west and southeast of Feature 8. The reduction of seven of eight cores tracked through this area centers on a zone northwest of Feature 8. Thus, different materials were reduced in various parts of Area 1, suggesting multiple flintknapping episodes.

A concentration of obsidian debitage in two grids in Area 2 suggests that most of that debris resulted from a single reduction episode. Materials from three cores (14 through 16) concentrated in two grids in Area 6 (Fig. 13.15). They include a fine-grained black basalt, a medium-grained light brown and tan chert, and a fine-grained dark brown quartzite. This area probably represents a second reduction locus similar to the one identified northwest of Feature 8. No debitage from these cores was found in any other analytical area. Reduction also occurred around Feature 7 in Area 5, but there are insufficient data to analyze these debitage in similar detail.

At least eight reduction episodes can be documented for the initial site occupation in three analytical areas. While obsidian debitage was distributed ubiquitously across Area 1, three concentrations were identified and suggest that at least that many reduction episodes occurred. Pedernal chert was reduced less often, and was distributed differently from both obsidian and other chertic materials. Thus, at least one distinct reduction episode seems to be represented. Finally, seven of eight cores traced through Area 1 seem to represent a single reduction episode. The eighth was partly reduced during that episode, but was also knapped at another location and represents a separate reduction event. A single episode involving the reduction of obsidian occurred in Area 2, while at least three cores were reduced in Area 6. Again, those materials seem to represent a single reduction episode.

Whether the various reduction episodes, particularly those in Area 1, represent individual events occurring over a rather lengthy period or a single event involving several knappers is impossible to determine. However, the former is probably more likely, and is discussed in greater detail with other data.

While there appears to be slight differences between loci of core and biface reduction in some cases, this may be illusory. This is due to the manner in which the reduction sequence can proceed, and because of our classification scheme. The latter is artificial and biased toward providing data considered critical to discussion of chipped stone reduction, even though it is also based on observations made during experiments. Dividing the reduction sequence into different stages is artificial, and helps determine how and where chipped stone reduction occurred. In so doing, the impression can be given that various reduction stages occur at different times and in different places, and this is not necessarily true. Cores can be reduced to produce debitage that are then turned into formal tools, and both processes can occur in the same area. Thus, core reduction and tool manufacture loci do not necessarily have to occur in different places, they can be part of a continual reduction episode that was completed as a single event.

The analytical scheme used to examine debitage allows some flakes to be comfortably assigned to certain categories, but is far from exact. For example, the polythetic set of variables used to distinguish manufacturing debris mostly identifies flakes removed during late stage biface manufacture. Flakes removed during early tool production are often irregular in shape and appearance and do not fit the idealized model of a biface flake. Thus, they are classified as core flakes, and areas in which early tool manufacture occurred could be misidentified as core reduction loci. In addition, many flake fragments are too small for reliable identification as manufacturing debris, and are classified as core flakes by default. Since biface flakes are usually thin and prone to fracture by secondary compression, areas containing large numbers of biface flake fragments could easily be misidentified as core reduction loci.

Table 13.1 includes only whole flakes and proximal portions for each analytical area in Component 1. The latter are included because they generally retain enough attributes to be accurately classified, as opposed to medial and distal fragments for which this can rarely be accomplished. Overall, slightly more than half of the debitage are biface flakes, which is an extremely high percentage. Areas 1 and 6 contain similar percentages of core and biface flakes. While Area 2 contains a slightly smaller percentage of biface flakes, the proportion is still very high. In contrast, Area 5 contains a much smaller percentage of biface flakes and a correspondingly high percentage of core flakes. Biface manufacture certainly dominated the first three areas, and appears to have been important in Area 5 as well, although to a somewhat lesser degree.

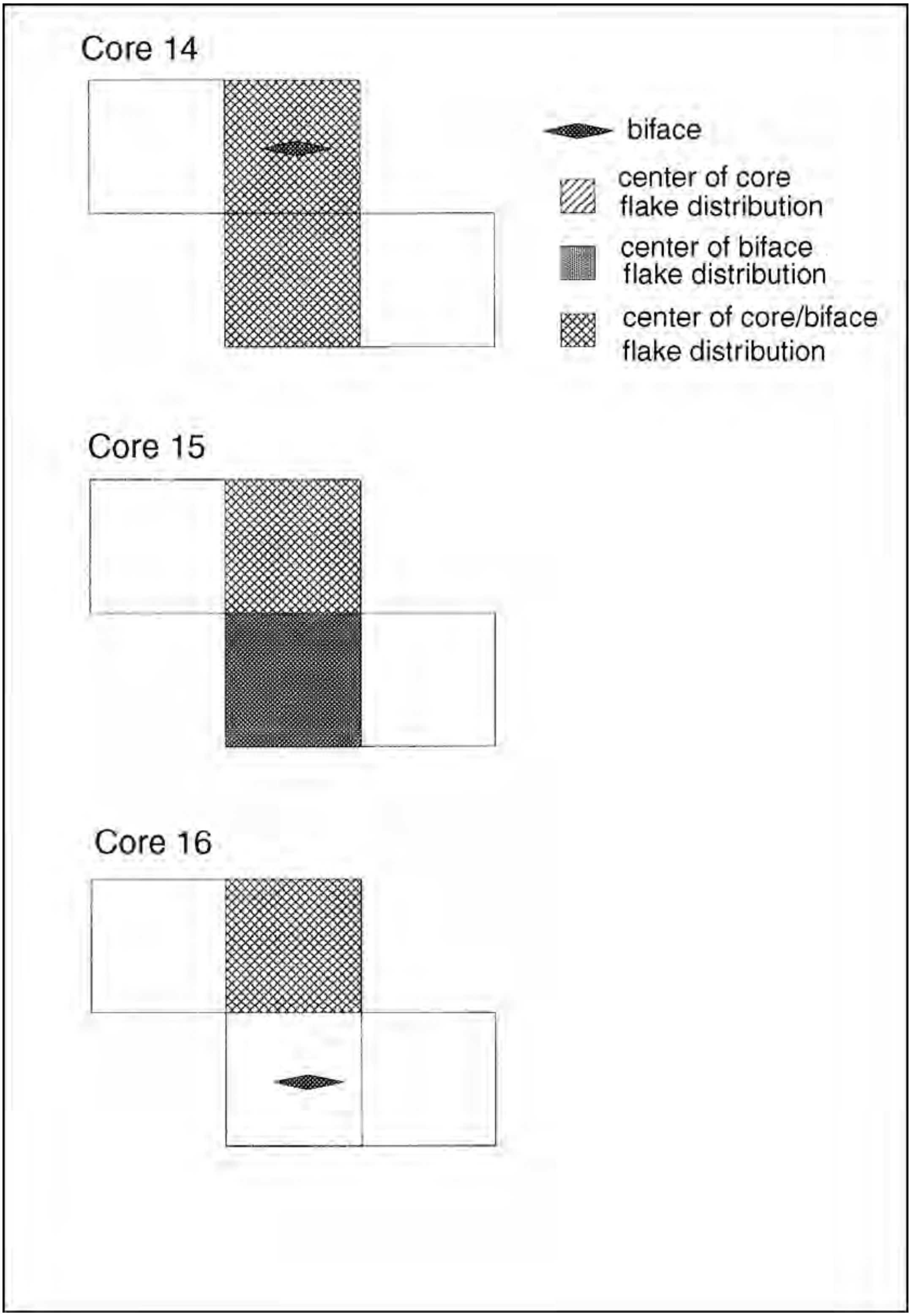

Figure 13.15. Distribution of flakes and bifaces from identified cores in Area 6.

Table 13.1. Whole Flakes and Proximal Fragments by Artifact Morphology for Each Analytic Area in Component 1

Location	Core Flakes	Biface Flakes	Totals
Area 1	952 47.4	1057 52.6	2009 74.1
Area 2	273 56.4	211 43.6	484 17.8
Area 5	38 76.0	12 24.0	50 1.8
Area 6	82 48.2	88 51.8	170 6.3
Total Percent	1345 49.6	1368 50.4	2713 100.0

Overall, 35 percent of Component 1 flakes are biface flakes. The increase to over 50 percent when medial, distal, and lateral portions are removed suggests that many fragments were misclassified. In order to examine this possibility, several attributes of the identified core assemblage are shown in Figure 13.16. Only identified cores are used because they probably resulted from discrete reduction episodes. Average numbers of core and biface flakes are similar, but the resemblance ends there. Twice as many biface flakes as core flakes occur in the assemblage of whole and proximal fragments. In contrast, nearly twice as many core flakes are distal fragments. Interestingly, a much higher percentage of core flake platforms were modified. These data coupled with the clustered distribution of debitage suggest that these flakes are mostly the result of biface reduction, and that little if any core reduction occurred. Thus, both early and late stage tool manufacture are indicated, with debitage from the later stages being classified as biface flakes and those from the early stage as core flakes.

If these trends are visible in the other materials, similar conclusions can be drawn for the entire assemblage. Eliminating rare materials and the identified cores, the overall distribution of these attributes for obsidian, Pedernal chert, other cherts, and basalt are shown in Figures 13.17 through 13.20. With the exception of basalt, core flakes comprise larger percentages of these assemblages (Fig. 13.17), particularly the undifferentiated cherts. Thus, there is not an even distribution of biface and core flakes for these materials as there was for the identified cores. Percentages of whole flakes and proximal fragments are shown in Figure 13.18, and are distributed similarly to the identified cores (Fig. 13.16). In

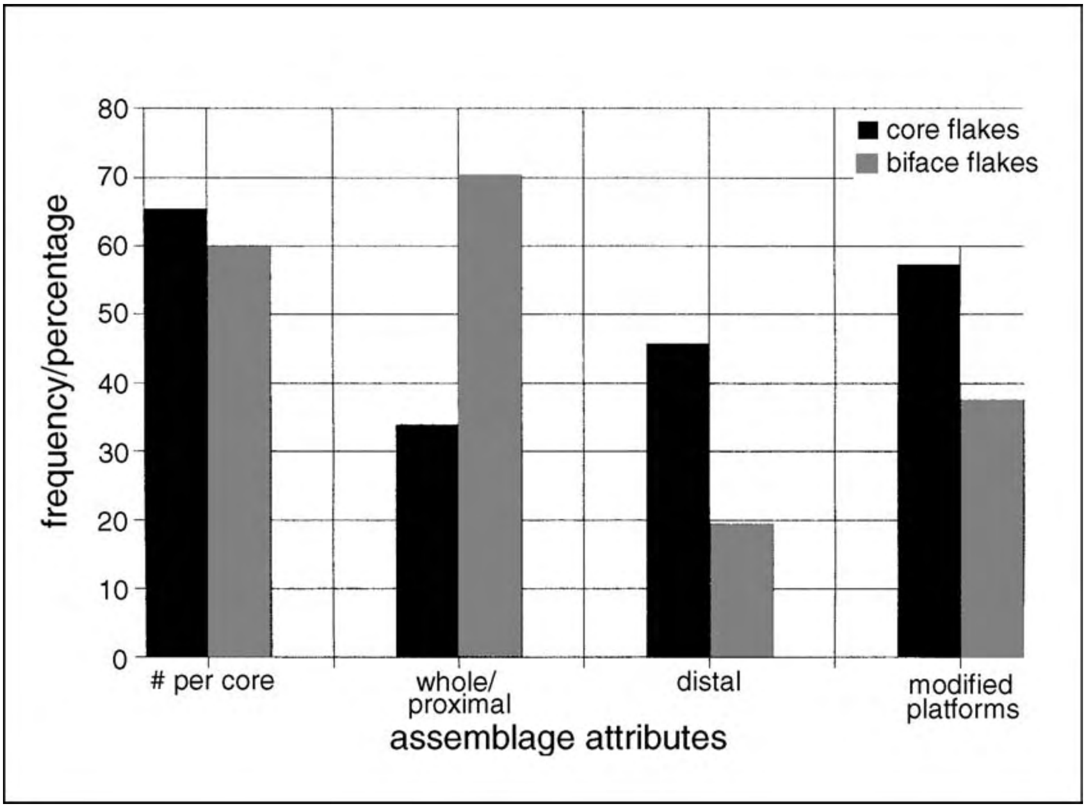

Figure 13.16. Assemblage attributes for the identified cores in Component 1.

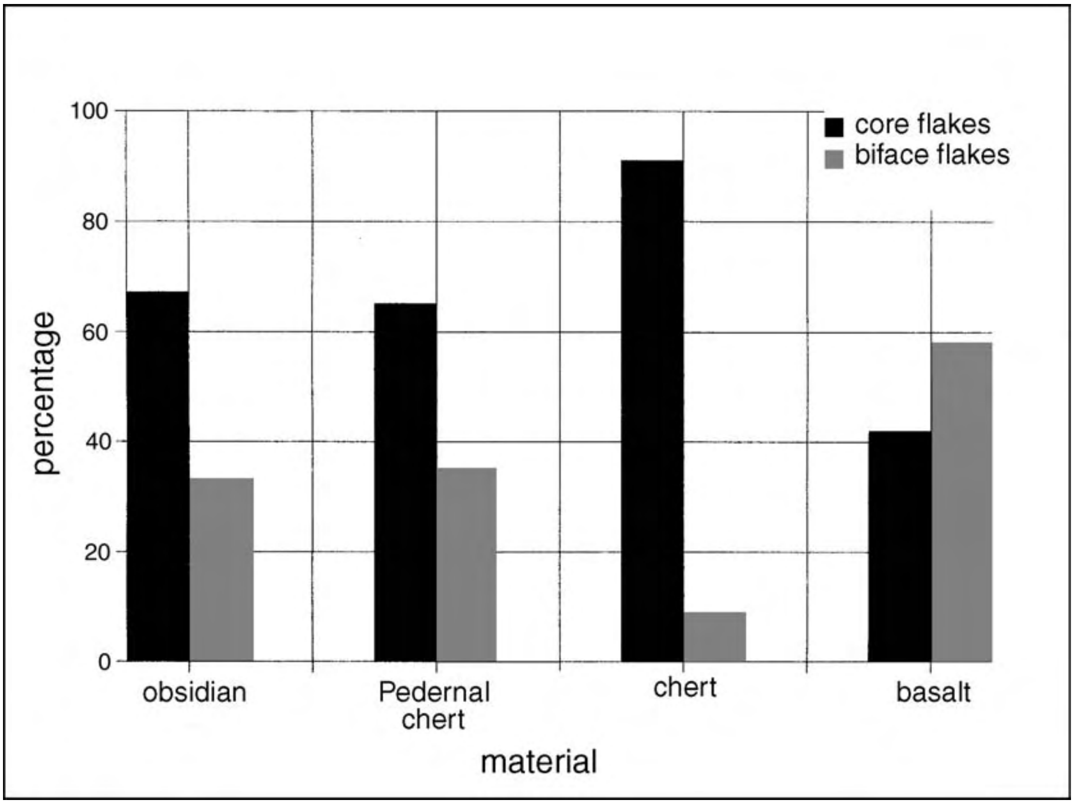

Figure 13.17. Percentages of core and biface flakes by material types.

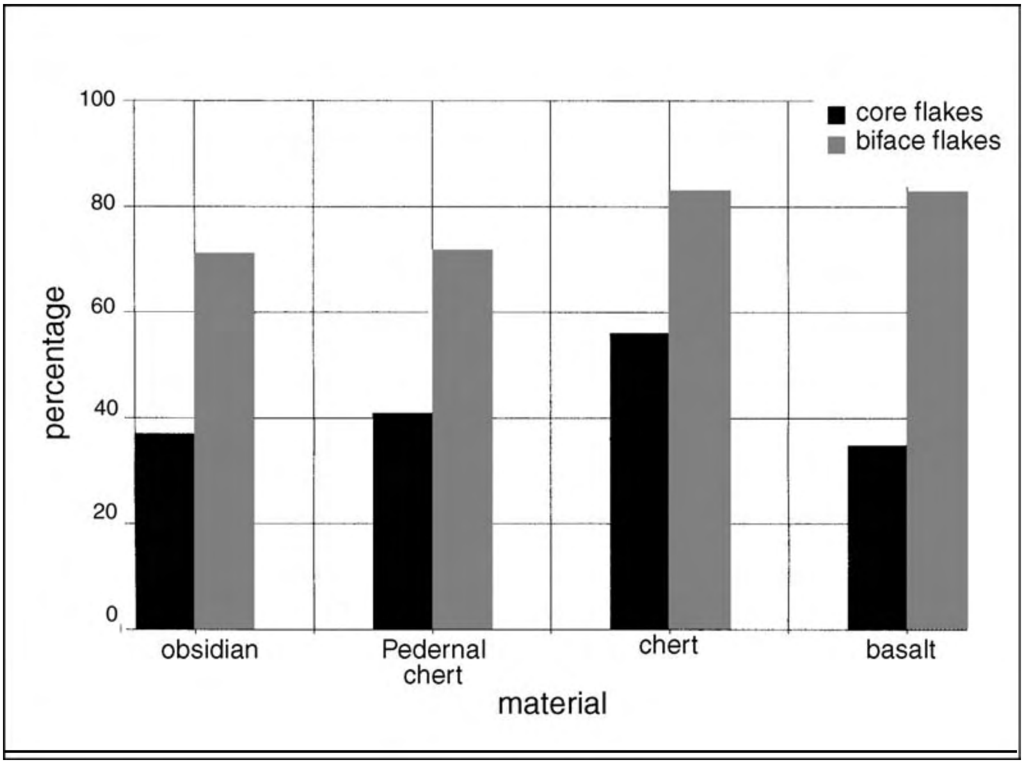

Figure 13.18. Percentages of whole and proximal flake fragments by material.

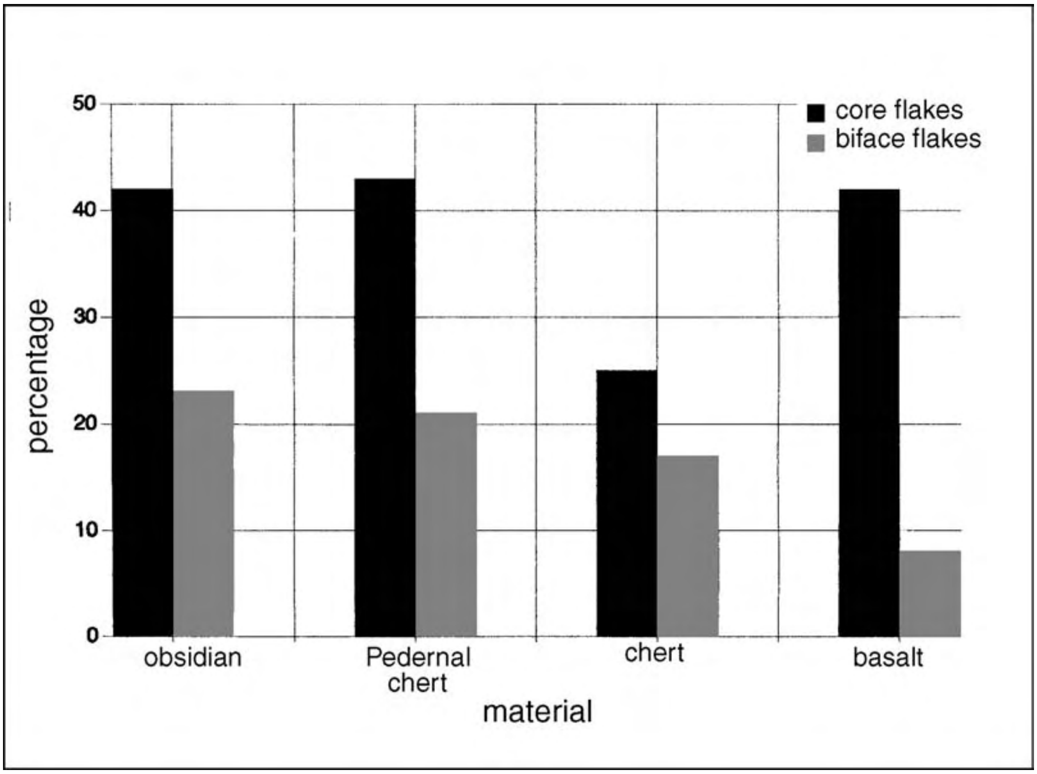

Figure 13.19. Percentages of distal flake fragments by material.

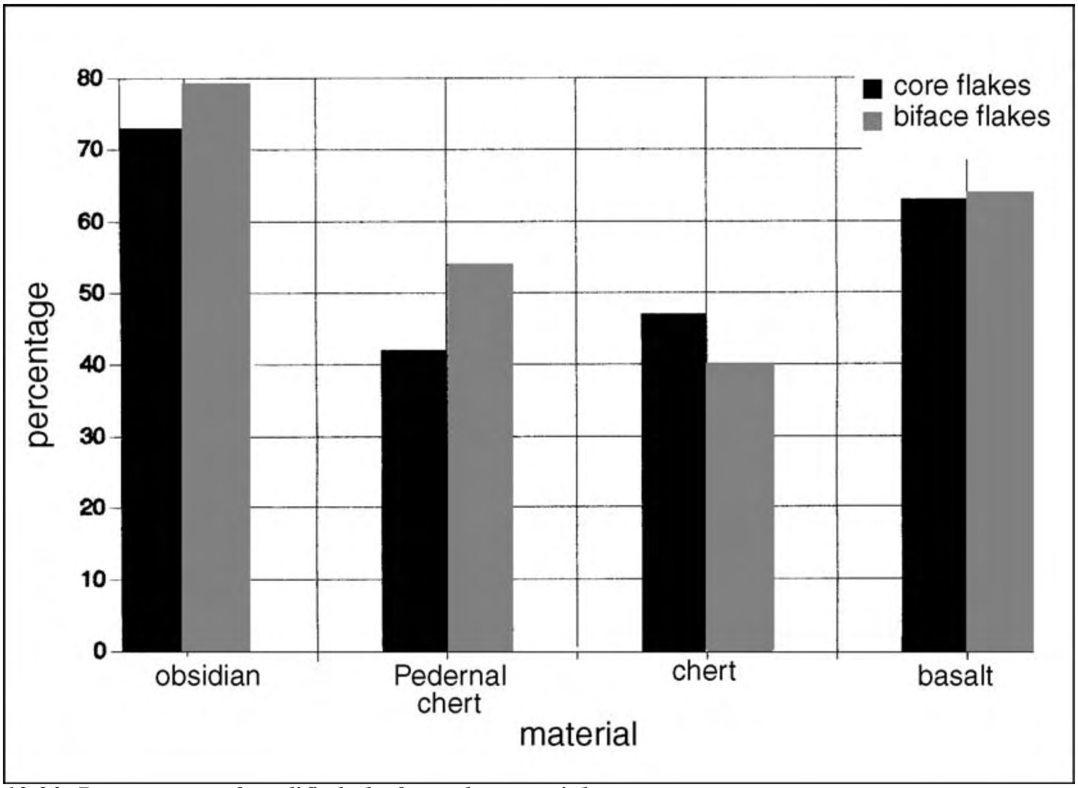

Figure 13.20. Percentages of modified platforms by material.

each case, there are much higher percentages of whole and proximal fragments in biface flake assemblages. Percentages of distal fragments are shown in Figure 13.19. Again, the distributions are similar to those of the identified cores. Finally, percentages of modified platforms are illustrated in Figure 13.20. While these distributions do not match the identified cores, percentages of core and biface flakes with modified platforms are similarly high in all cases.

Distributions of flake portions for these materials and the identified cores show that distal fragments tend to be identified as core flakes while whole flakes and proximal fragments tend to be identified as biface flakes. Platforms on large percentages of both flake classes were modified. Thus, it appears that most of the obsidian, Pedernal chert, other chert, and basalt debitage were also removed during tool manufacture. Debitage classified as core flakes seems to be more related to early stage biface manufacture, while those classified as biface flakes are related to late stage tool manufacture.

Cores, Large Bifaces, and Informal Tools

The distribution of cores and large bifaces is shown in Figure 13.21. These artifacts clustered in the areas that also contain debitage concentrations, which is not surprising since all three are by-products of reduction. Only four cores were recovered–three Pedernal chert and one silicified wood. Thus, our initial conclusions concerning the types of reduction that occurred were not completely wrong. Some core reduction certainly occurred in Component 1, and is reflected by the presence of both cores and core flakes. However, it is still likely that biface reduction dominates this component, especially since fragments of large bifaces outnumber cores by a considerable margin.

All but 1 of 17 large bifaces recovered from Component 1 were broken during manufacture, and include examples from 3 of the identified cores. Most large biface fragments were found in Areas 1, 2, and 6, which were also the major loci of biface reduction. This was not unexpected, since tools broken during manufacture should be discarded at the locus of production. The presence of two large biface fragments in addition to two cores in the north part of Area 5 suggest that both types of reduction occurred there.

All but one large biface in Area 1 are obsidian, and their distribution essentially matches that of the obsidian debitage. The single exception is a quartzite biface fragment from Core 11. As noted earlier, the location of this artifact does not match that of the debitage from Core 11, and it is possible that it was discarded rather forcefully when broken. Except for the fragment found in 102N/92E, large obsidian bifaces were only recovered from grids that contained more than 100 obsidian flakes. That fragment was from a grid bordered on three sides by grids containing large numbers of obsidian flakes.

Similarly, all large biface fragments in Area 2 were either in or adjacent to grids containing large numbers of obsidian flakes. Three of four large biface fragments from Area 6 made of materials other than obsidian were recovered in or adjacent to the grids that contained the densest concentrations of debitage in that part of the site. Since mostly materials other than obsidian were reduced in that area, this is not surprising. Finally, two large obsidian biface fragments were found in the north part of Area 5, which also contained a number of obsidian biface flakes.

The distribution of informally used debitage is shown in Figure 13.22. Most informal tools were found in Area 1, and their distribution generally coincides with that of the unutilized debitage. In other words, grids that contained the largest numbers of informal tools generally contained the highest debitage frequencies. The same is true for informal tools in Areas 2 and 6, but not for Area 5. Only three informal tools were found in that part of the site, and all were in a grid adjacent to but not within the heaviest concentration of debitage in that area.

Bone

Bone did not preserve well, but some fragments were recovered and their distribution is shown in Figure 13.23. These artifacts were only found in Areas 1 and 5. Most of the bone was recovered from Area 1, and was clustered around and between the hearths. This distribution does not correspond well with the proposed reduction loci. Only the obsidian reduction locus southeast of Feature 2 seems to center in the same area. The distribution of bone fragments in Area 5 corresponds somewhat with that of the chipped stone artifacts, or they occur in adjacent grids. Distributions of large mammal (including artiodactyl) and small mammal bone are shown in Figures 13.24 and 13.25. In both cases, nearly all recognizable fragments cluster around and between hearths in Area 1, and there does not appear to be any separate loci of consumption.

Floral Materials

Floral materials were recovered from four of five hearths in Component 1, and one macrobotanical sample was also obtained. Feature 7 did not contain enough materials for sampling, and was the only hearth that did not provide data on the consumption of wild plant foods. Features 2 and 8 each contained the remains of at least

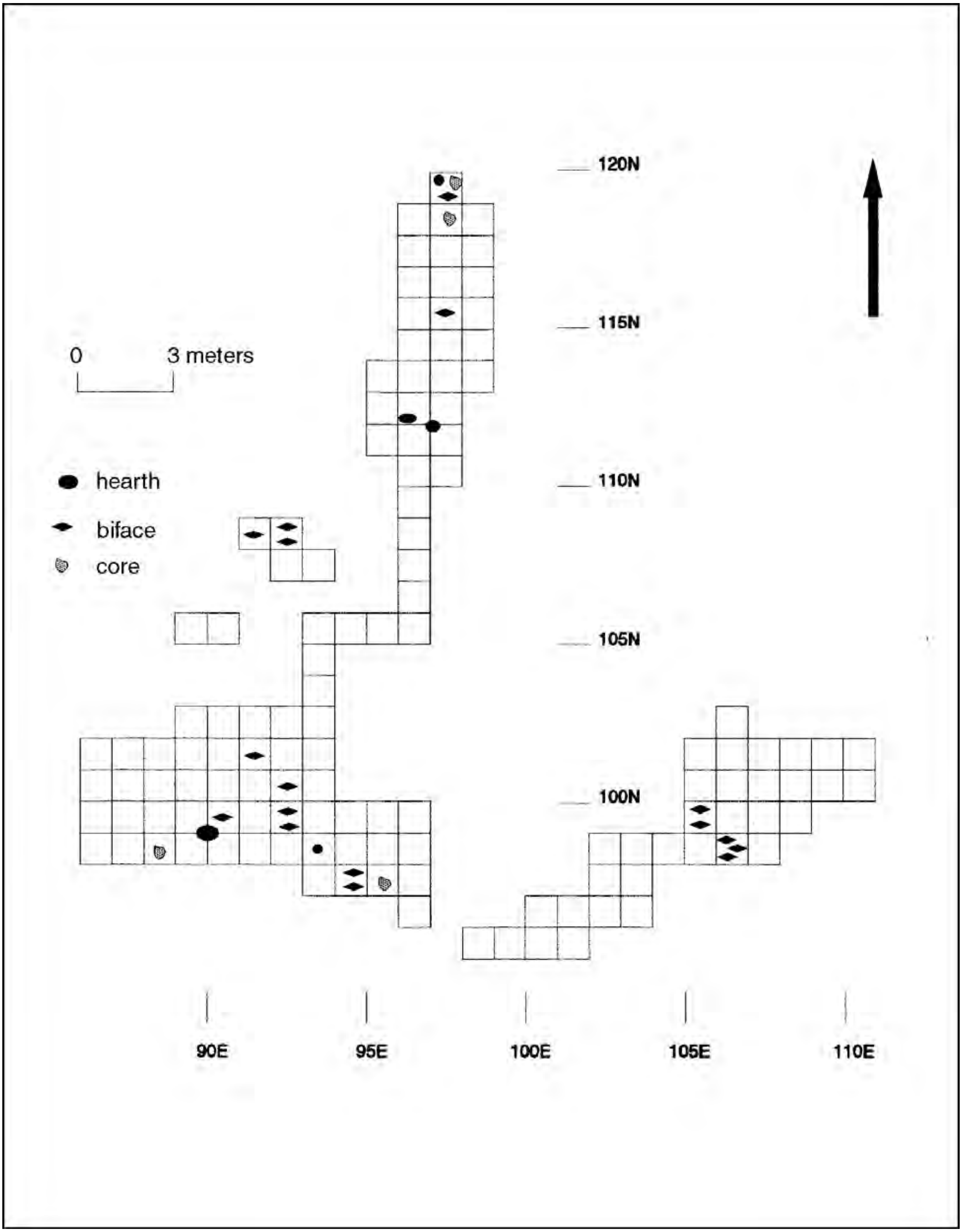

Figure 13.21. Distribution of bifaces and cores in Component 1.

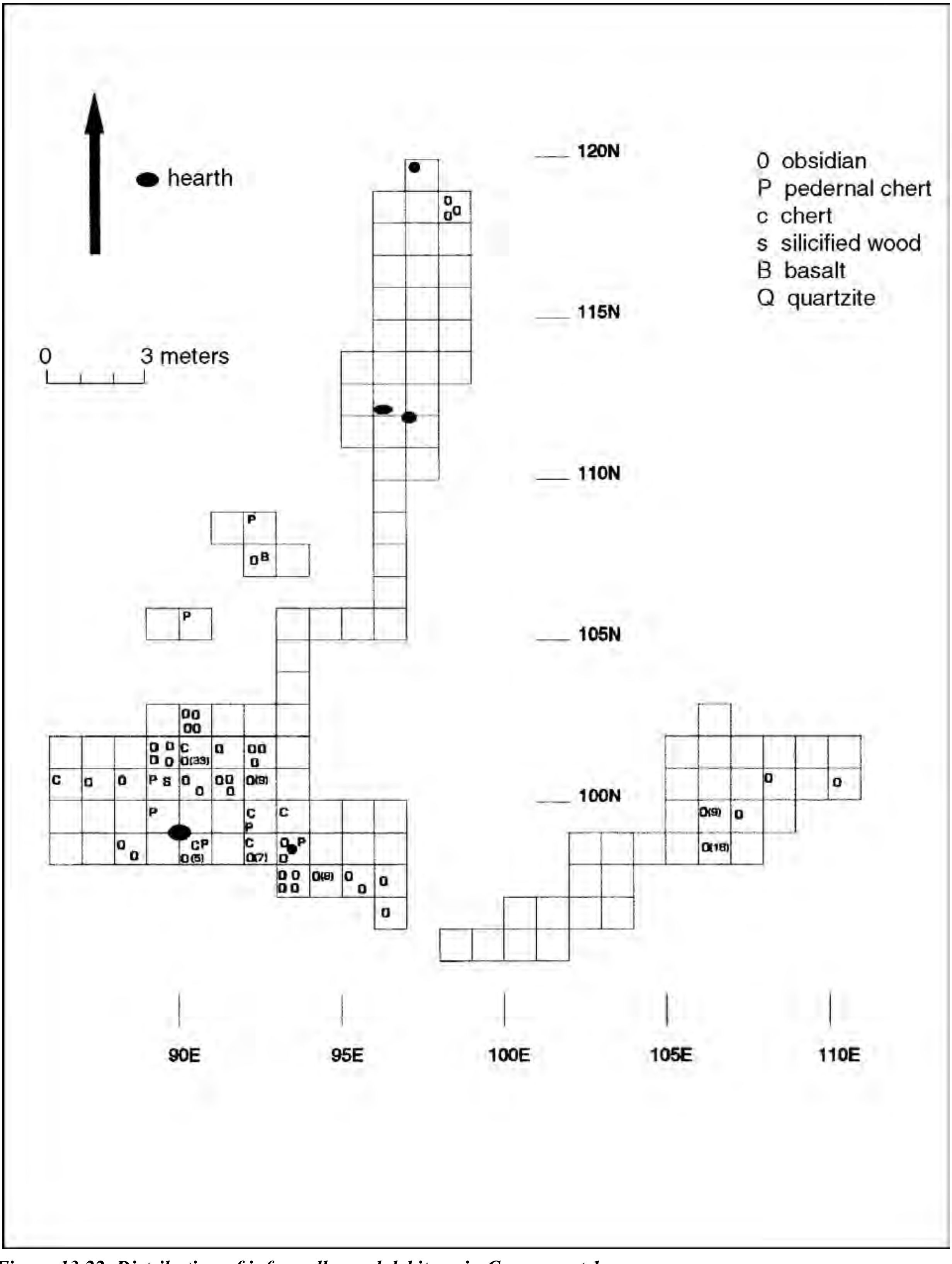

Figure 13.22. Distribution of informally used debitage in Component 1.

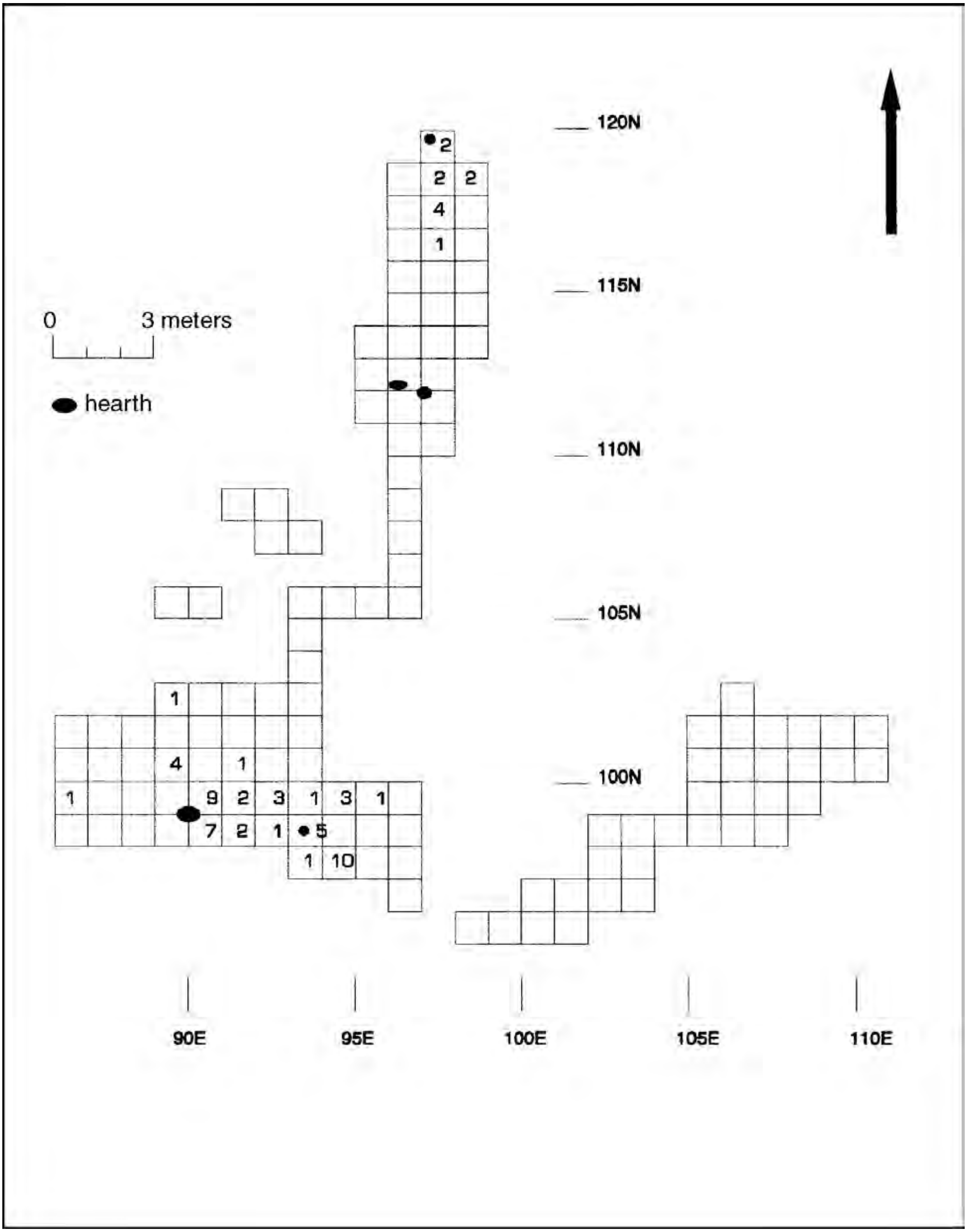

Figure 13.23. Distribution of all bone in Component 1.

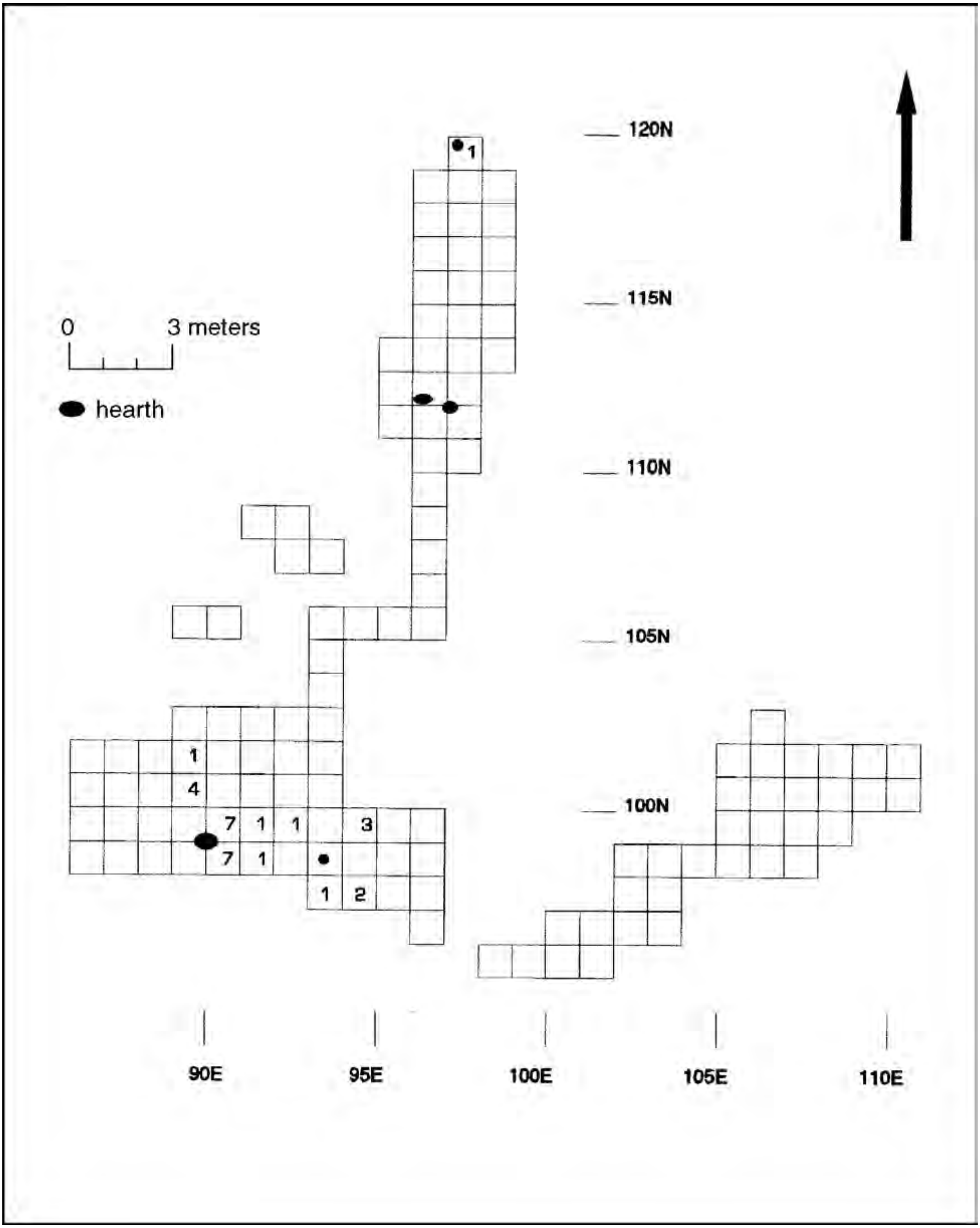

Figure 13.24. Distribution of large mammal and artiodactyl bone in Component 1.

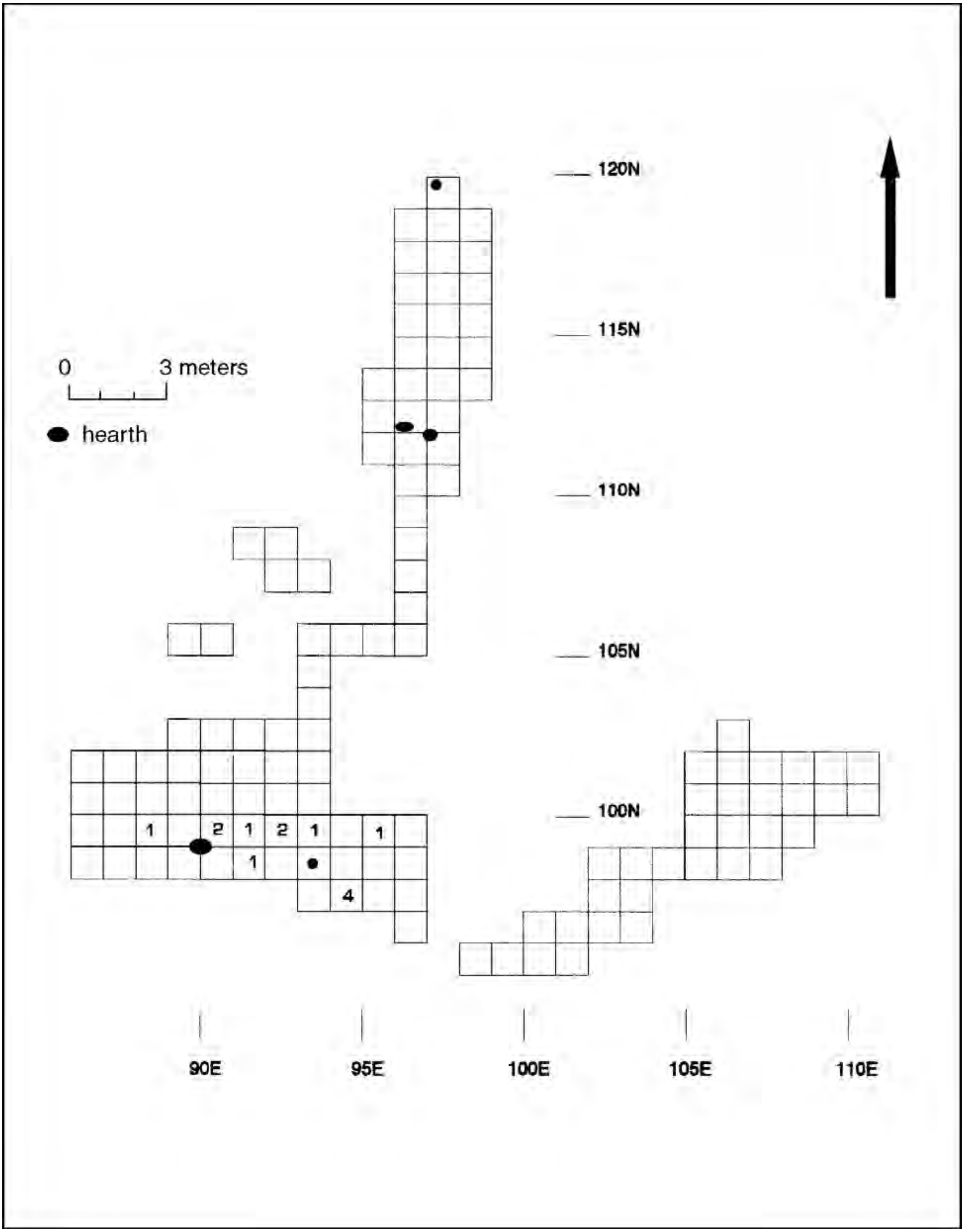

Figure 13.25. Distribution of small mammal bone in Component 1.

two wild plant foods. Burned chenopodium seeds were found in both, Feature 2 contained burned prickly pear seeds, and Feature 8 contained burned squawberry seeds. Burned chenopodium seeds were found in Feature 5, and no burned seeds were recovered from Feature 6.

Though admittedly sparse, there are differences between the content of hearths in Areas 1 and 5. The lack of burned economic seeds in Feature 6 is suspicious and suggests that it may not have been used for processing vegetal foods. While chenopodium seeds were found in Feature 5, that hearth was badly impacted by a rodent burrow. Thus, it is uncertain whether the seeds in that feature burned in place or were introduced from elsewhere. However, since at least 20 specimens were identified in the scanned sample, the former is most likely.

As discussed in *Analysis of Pollen from the San Ildefonso Springs Site,* Chapter 11, some evidence of corn was also recovered. A single corn pollen grain was found in a sample from Stratum 10, a stream bed that truncated cultural deposits in the west part of Area 1. Since this unit was deposited by natural processes and postdates the initial occupation, the presence of corn pollen was unexpected and quite confusing. Several possibilities presented themselves: (1) the pollen was introduced by rodent or insect action from an adjacent cultural unit, (2) it originated in cornfields located upstream from the site that were used at a later time, or (3) rodent or insect activity carried the pollen downward from Classic period deposits higher in the stratigraphic sequence.

Only the first possibility could be tested. This was done by conducting an intensive systematic microscopy scan of the pollen sample from Stratum 4, the adjacent cultural unit. A corn pollen grain was also identified in that sample, yielding a concentration level of 1 grain per gram of soil. This is essentially equal to the concentration level in Stratum 10 and is difficult to interpret. The chipped stone analysis suggested that bioturbation tended to move materials up rather than down. However, as Holloway notes (see *Analysis of Pollen from the San Ildefonso Springs Site,* Chapter 11), these data are insufficient to allow us to determine whether the corn pollen in Stratum 10 originated in Stratum 4 or vice-versa.

If corn was used during the initial occupation it was probably present in very small amounts. No corn macrofloral remains were identified during flotation analysis, and the level of pollen concentration was low. While these data may suggest consumption of small amounts of corn harvested elsewhere, this is uncertain. It is equally likely that the corn pollen was introduced into these strata by rodent or insect burrowing. Fortunately, the possible presence of corn does not significantly alter our interpretations of seasonality or occupation type. The lack of storage features and substantial shelters argue against winter use focused on consumption of stored foods. Indeed, lacking corroboration from flotation samples, the presence of corn from pollen data alone must be considered very tenuous. A burned piñon shell fragment was the only macrofloral specimen recovered, and was found in Area 1 above Feature 2. All four (or five if corn was actually present) vegetal foods recovered from Component 1 are available in the late summer and fall, and indicate an occupation during that time of year.

Discussion

This analysis suggests several things. First, while the vertical distribution of artifacts was affected by bioturbation, the horizontal distribution was sufficiently intact to allow us to complete a spatial analysis. Second, by considering the distribution of various materials, it was possible to more precisely delineate reduction loci and strategies than was permitted by examination of the assemblage as a whole. Finally, some of the limitations of using a precise (though flexible) method of differentiating between core and biface flakes were illuminated.

Since the horizontal distribution of artifacts in Component 1 was relatively intact, it is possible to compare and contrast the various artifact classes examined separately above. Areas 2 and 6 are the easiest to discuss. Both contained mostly chipped stone debris and lacked features. However, the presence of a few pieces of fire-cracked rock and charcoal in both areas suggest that hearths existed nearby at one time. As far as Area 2 is concerned, one or more hearths were probably situated to the south in an area subsequently removed by erosion. Any hearths associated with Area 6 were probably to the north or west in uninvestigated zones. Areas 2 and 6 lacked formal tools other than those associated with chipped stone reduction (hammerstones, cores, and large bifaces), and contained no bone or floral materials other than charcoal flecks. A few informal tools were found in Area 6, and several were recovered from Area 2. In both cases the distribution of informal tools mirrors that of debitage in general. However, this may be illusory for Area 6, since little of that part of the site was excavated.

Because of the sheer numbers of artifacts recovered from Area 1, patterning in that part of the site is more difficult to isolate. However, the distribution of cultural materials has several interesting characteristics. Chipped stone reduction concentrated around and between two hearths. At least five spatially distinct reduction episodes were defined, as opposed to single episodes in Areas 2 and 6. The heaviest concentration of obsidian debitage was southwest of Feature 2, which seems to have been the main reduction locus. Other obsidian reduction loci were northeast of Feature 2 and north of Feature 8. Pedernal chert was mostly reduced around and to the west and southeast of Feature 8, while most of the identified cores were reduced northwest of the same hearth. Ground stone tools, which were fragmentary except for a mano, concentrated in the east part of Area 1 around Feature 2. Most bone fragments were also recovered from this area, though many were found in and around Feature 8. The distribution of informal tools mirrors that of unused debitage. Fire-cracked rock was distributed across Area 1, but was mostly concentrated around the hearths.

Obviously, zones around hearths served as activity areas. It is likely that the hearths in Area 1 were used sequentially rather than concurrently, and certain aspects of the assemblage around Feature 2 suggest it was used before Feature 8. For example, most broken ground stone tools and bone scraps were discarded in that zone. Most of the bone scraps around Feature 8 in Figure 13.23 were actually found in that hearth rather than in surrounding grids, and probably represent a different discard pattern. In addition, a broken biface of Core 11 material was found in the east part of Area 1, while that material was mainly reduced northwest of Feature 8. This biface was probably tossed into the discard zone when it snapped. The only piece of ground stone found around Feature 8 was a shallow basin metate that was broken, but large enough to continue being used. This may have been the only piece of useable ground stone left behind at the time of abandonment. Thus, certain classes of artifacts may have been discarded on top of the reduction debris that resulted from the earlier use of Feature 2 as an activity locus.

Area 5 contained the smallest number of artifacts and also had the most intriguing distribution. All of the chipped stone artifacts, with the exception of four pieces of debitage, were concentrated in the north part of that area around Feature 7. This included all formal and informal tools, fire-cracked rock, and bone. The zone around the hearths in the south part of Area 5 (Features 5 and 6) was very clean when compared with the other hearths. These features also contained fewer burned economic plant remains than did the others in this component.

Heavy concentrations of artifacts around certain hearths (Features 2, 7, and 8), and where other hearths seem to have existed (Areas 2 and 6) suggest that they represent exterior activity areas. This is similar to the pattern noted for !Kung San camps, where cooking, eating, and manufacturing occur around hearths in front of huts (summarized by Vierra 1980:352). These areas also fit the pattern for external features proposed by Vierra (1985:109): multiple hearths occur in a small area (at least in Area 1); hearth contents were discarded around features (as indicated by the ubiquitous distribution of charcoal in Stratum 4), and an extensive drop zone and possible toss zone were present. There were no apparent constraints to the use of space around hearths, and multiple activities occurred around them including chipped stone reduction, informal tool use in manufacturing or maintenance tasks, processing and cooking of floral and faunal foods, and discard of broken or otherwise unusable tools.

The zone around Features 5 and 6 was probably used for sleeping or other activities that would be adversely affected by the amounts of debris found around other hearths. An ephemeral shelter may also have been built in this area; unfortunately, rodent and insect burrowing have obliterated any signs of such a structure, if one actually existed. This type of pattern is suggested by ethnographic studies. As Vierra (1985:109) notes:

> European Paleolithic archeologists have been especially concerned with defining the presence of residential sites on archeological sites. . . . They have traditionally defined the location of houses through the presence of high density artifact epicenters. However, ethnoarcheological studies have shown that house locations should actually be represented by "holes" or empty spaces in surface artifact distributions, rather than the reverse . . .

Citing other researchers (Binford 1978a; Gould 1977; Hayden 1979; Yellen 1977), Vierra (1985:110) suggests that a dichotomy between areas of high and low artifact densities is meaningful. Low density areas around hearths may be an indication of wind direction or the location of huts, and empty spaces in artifact distributions might represent sleeping areas. Thus, because of differences in the distribution of artifacts around hearths as well as variation in their content, there seems to be an important functional difference between Features 5 and 6 and the other hearths in this component. These features probably represent a sleeping area, perhaps containing an ephemeral shelter such as a windbreak or shade for which no evidence was found. A primary function as heating rather than cooking features may account for the paucity of economic plant remains in these hearths.

While this component was undoubtedly occupied during late summer or fall, the number of uses is unknown. However, a single use for a relatively short period, probably no more than a few days to weeks, is probable. Reoccupation of the same area in more than one year is unlikely because of the presence of sharp chipped stone debris and garbage. The possible infestation of abandoned structures by vermin would also make reuse undesirable. Instead, adjacent zones that contained no debris from earlier occupations were probably selected for residential use when the area was reoccupied. This pattern has been suggested for archaeological remains in the northern San Juan Basin by J. Moore (1980) and Vierra (1980). In that study, areally extensive Archaic scatters that contain numerous hearths, chipped stone reduction debris, formal chipped stone tools, and ground stone tools are thought to represent multiple overlapping uses of an area rather than residential base camps, as was hypothesized during an earlier study (Reher 1977). This view was partly substantiated by subsequent work in the same area (Eschman 1983).

Vierra (1985) has studied the process of site reoccupation in detail, using both ethnographic and archaeological data. In summary, several factors appear to affect the decision to reoccupy previously used sites. Sites might be reused if the selection of suitable alternate locations is limited:

> Certain site functions demand much more specific requirements. The more specific the requirements are, and the more limited the number of locations which meet those requirements, the more frequently these advantageous positions will be reused. (Vierra 1985:64)

In general, logistical sites tend to be reoccupied more often than residential locations, especially when hunting is dependent on the planned intercept of game rather than unplanned or unanticipated encounters (Vierra 1985:64). Locational requirements for residential sites are often more flexible, resulting in less need to reoccupy the same spot (Vierra 1985:65). There were also two very good reasons for not reoccupying old residential locations: hygiene and health, and resource depletion (Vierra 1985). Old camps contain unsanitary debris and garbage that can cause infection and sickness as well as parasitic infestation. The zones around them have also been depleted of useable resources, and may require several years to recover sufficiently to allow successful exploitation to again occur. When the same area is reused, new camps tend to be located adjacent to rather than on top of old camps (Vierra 1985:65).

This pattern is replicated archaeologically. Vierra (1985:183-184) found that multicomponent sites containing Archaic and Anasazi materials in the San Juan Basin did not represent a blending of materials, as might be expected when specific areas were reoccupied. Rather, later occupations were structurally distinct, and appear to represent use of adjacent areas. Camilli (1989) found evidence of similar site reoccupation patterns on Cedar Mesa in southeast Utah. While smaller sites appear to represent single-use locales, larger sites contain evidence of overlapping occupations. Eschman (1983) studied site structure at LA 19374 in the San Juan Basin, and concluded that "The overall extent of these cultural deposits . . . appears to be the result of multiple, overlapping occupations over a considerable time period" (Eschman 1983:379). Thus, when short-term camps were reused, the same locations were rarely reoccupied. New camps were instead placed in adjacent areas, at times overlapping earlier deposits. This produced sites of large areal extent with artifact densities similar to those of single-occupation sites.

Component 1 was a residential camp that appears to have been occupied for a relatively short period, probably no more than a few days or weeks. The presence of tools reflecting traditional male and female activities, chipped stone tool manufacturing debris, food-processing tools, waste from floral and faunal food consumption, and spatial variation in artifact densities and feature locations reflecting both external activity areas and sheltered sleeping space are all indications of residential use. The presence of multiple hearths in the probable sleeping area and Area 1, and overlapping activity sets in the latter part of the site could be an indication of reoccupation. However, as seen from ethnographic studies, reoccupation of the same space is rare. The !Kung San only reuse former camps if they are still serviceable (Yellen 1976). This generally occurs within a few months. However, an occupational break of this magnitude does not seem indicated for Component 1. Both hearths in Area 1 and one in the probable sleeping area contained charred chenopodium seeds, suggesting that they were used at about the same time, especially considering the lack of storage features.

Reoccupation in different years is also unlikely. This area seems to have been aggrading through most of its history, though at least one period of erosion is indicated. The vast majority of cultural materials in Component 1 were recovered from a 17- to 26-cm-thick stratum. This layer contained artifacts as well as charcoal and ash in locally variable concentrations, and seemed to represent a single occupational horizon that was vertically smeared by bioturbation. While some vertical movement was evident, there did not seem to be much horizontal restructuring of the assemblage. The thickness of this stratum was most likely the result of smearing rather than buildup over a long period of time or through successive occupations. While the analysis of site structure indicates that there was some overlapping of activities, particularly in Area 1, there is no evidence that it resulted from multiple sequential uses. Rather, only a single occupation seems to be indicated.

The condition of faunal materials tends to substantiate this possibility. As Mick-O'Hara notes in *Identification and Analysis of the Faunal Remains from LA 65005, LA 65006, and LA 65013,* Chapter 10, the condition of these remains suggests that materials in Component 1 were buried soon after discard and were not re-exposed before they were excavated. Thus, there may have been little time available for reoccupation before the initial campsite was covered by sand and no longer visible. Since enough time passed for the development of a soil horizon higher in the stratigraphic profile before this specific area was reoccupied, intervening uses of this area must be elsewhere on the site.

It is likely that most, if not all, of the area excavated in Component 1 represents a single-family campsite. The zone containing Features 5 and 6 appears to have been a sleeping area that was kept clean of debris from other activities. While it is possible that this area also represents internal space, no direct evidence of a structure or shelter was found. Areas 1, 2, 6, and the north part of Area 5 were external activity zones that may have been used sequentially as work proceeded and debris built up around hearths. This is partly substantiated by the structure of debris around Features 2 and 8, which suggests that Feature 2 was used first and then abandoned, becoming a discard zone for activities occurring around Feature 8. If this scenario is correct, the considerably lower density of debitage around Feature 7 probably indicates that it was one of the last activity areas used, perhaps just prior to abandonment.

Similar patterns have not been described ethnographically, but such analogies should always be applied with care, remembering that modern hunter-gatherers have been affected by contact with farming and herding groups, as well as with anthropologists. The postulated pattern of site occupation has important archaeological implications. The occurrence of multiple hearths with overlapping associated artifact scatters, particularly in restricted areas, has sometimes been used to argue for site reoccupation. The sequential use of adjacent areas during relatively lengthy occupations (those occurring for more than just a few days) may be a better explanation for this type of patterning in many cases. The structure of Component 1 suggests that when a relatively long occupation was accompanied by activities that produced a large amount of debris, activity areas were abandoned and adjacent areas were subsequently used for similar tasks. In essence, this replicates the proposed model of site reoccupation, and undoubtedly occurred for similar reasons. The manufacture of large bifaces around hearths resulted in the build-up of large amounts of debris. This created a hazardous situation–use of that area was made dangerous, or at least uncomfortable, by the presence of numerous pieces of sharp debitage. Thus, it was more desirable to use adjacent areas that were comparatively clean. And since this locale was serving as a temporary camp, it was also easier to simply shift the locus of activities than it was to clean up the remains of earlier tasks.

Components 2 and 3

Because these components contain smaller assemblages and were less areally extensive than Component 1 they are discussed together and in less detail. For several reasons, a detailed spatial analysis cannot be provided for these assemblages. Neither contains anywhere near the number of artifacts found in Component 1–Component 2 contains only 493 artifacts and Component 3 only 86. The distribution of artifacts in both of these components was conditioned by the pattern of archaeological excavations. Component 2 contained four artifact concentrations in Areas 1, 2, 3, and 4, and a few artifacts were recovered from a grid in Area 5. While this distribution seems significant on paper, the archaeological reality is quite different. Augering showed that concentrations of cultural materials (charcoal and chipped stone artifacts) occurred only at depths consistent with Stratum 4 through this area. In order to save time and expose as much of that component as possible, this area was mechanically stripped and surface strata, including those associated with Component 2, were removed. While this procedure enabled us to collect more information on the earliest occupation, it also inhibited our ability to subject Component 2 to a similarly detailed analysis.

Component 3 occurred only in a small, spatially restricted area. While other deposits related to this occupation may occur elsewhere, strata containing this component were eroded away from most of the area investigated within project limits. For this reason, it is not possible to examine the spatial distribution of materials associated with this component in detail. However, they can still be compared to remains from Component 1, and this will allow us to determine whether they resemble or differ significantly from the pattern defined for Component 1.

No temporally diagnostic artifacts were recovered from either component. Radiocarbon dates were available from three hearths in Component 2, and suggest occupation between 1150 and 800 B.C. Since most of the fuels used in these features were juniper and conifers, the possibility that this occupation was actually later than the radiocarbon dates suggest must be taken into account. It is likely that Component 2 dates to or after the late part of this range, and was occupied during the late Armijo or early En Medio phase as defined by Irwin-Williams (1973). No absolute dates were obtained from Component 3, but since it was stratigraphically above Component 2 it was occupied later in the Preceramic period. Thus, Component 3 also dates to the Late Archaic, and was also either occupied during the late Armijo or early En Medio phase.

Component 2 hearths contained three types of edible seeds, including goosefoot, squawberry, and purslane.

These seeds are only available during the fall, suggesting that the site was used at that time of year. In general, the presence of edible plant remains, mammal bone, at least three hearths, and numerous chipped stone artifacts suggest that this component represents a residential occupation. The presence of numerous biface flakes indicates that tool production, particularly that of large bifaces, was an important activity. The few formal tools recovered include two large bifaces, while informally used debitage comprise 3.9 percent of the assemblage. Three ground stone tools, including two complete one-hand manos and a slab metate fragment, were found in this component.

No floral remains were recovered from Component 3. The presence of a relatively high percentage of biface flakes suggests that the production of large bifaces was an important activity. The only formal tools are fragments of two large bifaces broken during manufacture, while informal tools comprise 3.5 percent of the debitage assemblage. One ground stone tool, a complete one-hand mano, was recovered from this component. While this assemblage resembles those from other Archaic occupations, there are important differences. Though tool manufacture was important, this assemblage contained more evidence of expedient core reduction than the others. Among the unmixed Archaic assemblages, Component 3 contains the smallest percentage of exotic materials. However, it also contains the highest percentage of glassy and fine-grained materials.

Excavation Areas and Features

Five excavation areas contained materials and features associated with Component 2, while Component 3 occurred in only one. Except for a small cluster of artifacts in Area 4, Component 2 was restricted to the east part of the site. Materials related to Component 2 in Area 4 were restricted to a hearth (Feature 4) and the area immediately adjacent to it. Feature 4 was stratigraphically below Stratum 1, which contained Component 2 in the east part of the site. However, its position near the top of Stratum 9, an otherwise sterile layer of stream-laid sand, and similarities in date suggest it was used just before Stratum 1 was deposited. Thus, this feature represents a separate occupation from those at the east end of the site.

Most artifacts associated with Component 2 were found in Areas 1 through 3. Only a few chipped stone artifacts were recovered from Area 5, which is not surprising considering that most of Stratum 1 in that area was mechanically removed. Thus, only a few grids in the north part of Area 5 and none in Area 6 were excavated and screened from surface to sterile deposits.

Component 2 contained two features in addition to Feature 4; both were in Stratum 1. A second hearth (Feature 3) was mostly outside construction limits, and was investigated to collect flotation samples and charcoal for radiocarbon dating. Feature 9 was a large amorphous charcoal stain. While this feature was just beyond construction limits, it was investigated due to its badly eroded condition and because further erosion was expected to remove what remained of it within a few years. A similar charcoal stain (Feature 10) was associated with Component 3 in Area 4, and was the source of most of the artifacts in that assemblage. The possibility that these features were the remains of ephemeral structures was raised earlier (see *San Ildefonso Springs Site,* Chapter 6, and is further addressed in this discussion.

Ground Stone and Fire-Cracked Rock

Numerous fire-cracked rock fragments and several pieces of ground stone were recovered from these components. Four concentrations of fire-cracked rock are visible in Figures 13.26 and 13.27, and three are associated with features. In addition, Feature 3 (not shown on the plans) also contained a few pieces of fire-cracked rock. The only concentration that was not directly associated with a feature was in five grids in Area 2 (Fig. 13.26). That area contained the heaviest concentration of fire-cracked rock, and suggests that a hearth was once located nearby. While Feature 1 was only a few meters away from this concentration, its late date indicates that it was not associated with the assemblage recovered from Stratum 1, including this cluster of fire-cracked rock.

With the exception of the concentration in Area 2, all but four pieces of fire-cracked rock were recovered from two hearths (Features 3 and 4) and two large charcoal stains (Features 9 and 10). This is considerably different from the distribution of this class of artifact in Component 1. In that assemblage, most fire-cracked rock was scattered through activity areas and presumed to be associated with hearths, but few pieces were actually found in hearth deposits. This suggests that features may have been used differently in the various occupations. In order to examine this possibility, feature sizes are compared in Table 13.2. While approximate sizes had to be estimated for a few features, the areas presented in Table 13.2 are relatively accurate. Features in Component 1 covered an average of 0.18 sq m and were 0.14 m deep. In Components 2 and 3, they covered an average of 7.8 sq m and were 0.12 m deep. Hearths and charcoal stains in Components 2 and 3 were an average of 43 times larger than those in Component 1. With the large charcoal stains dropped, Component 2 and 3 hearths were still 10 times as large as those from the early occupation. Thus, while all features were shallow, those associated with later occupations were much larger and presumably used for different purposes.

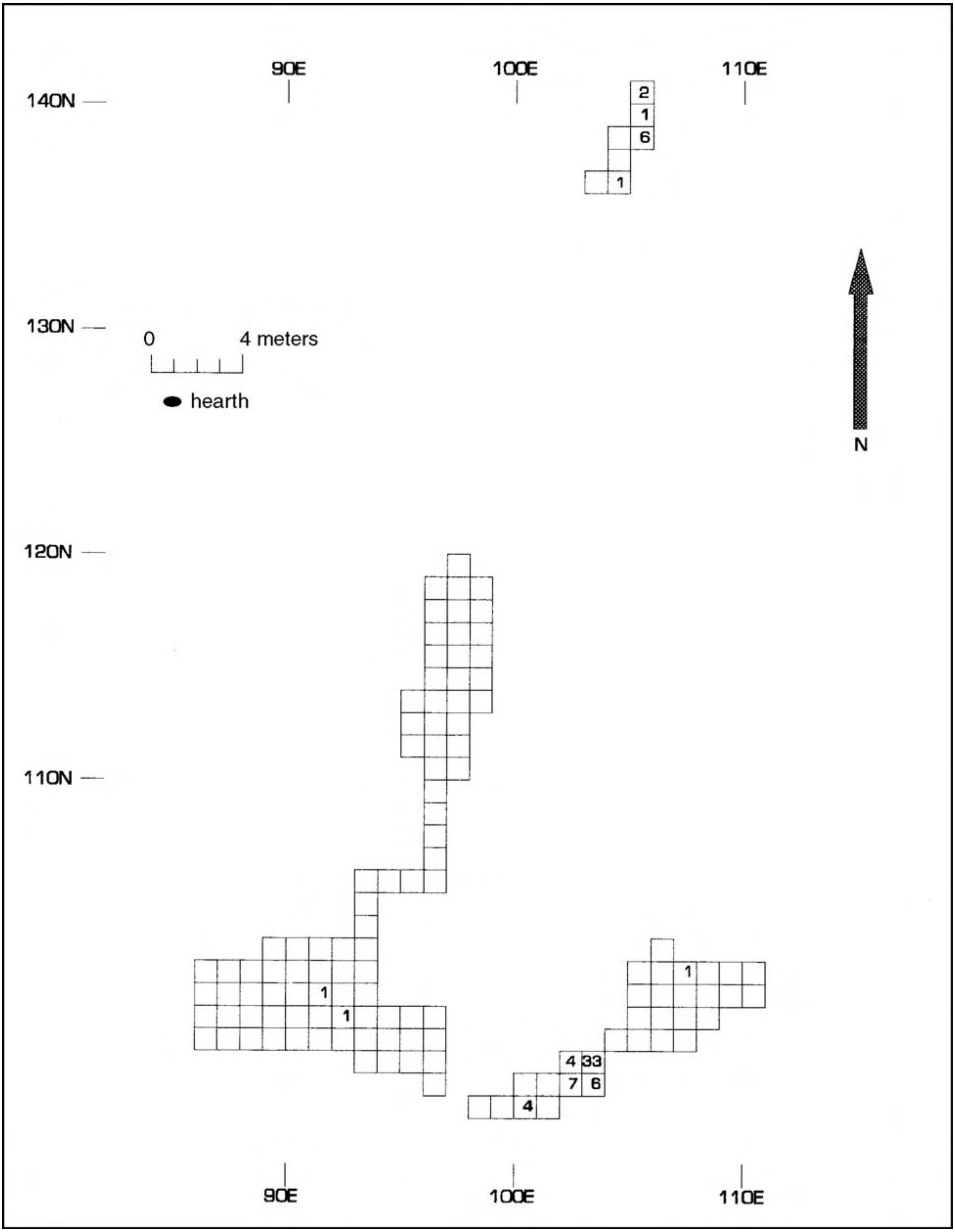

Figure 13.26. Distribution of fire-cracked rock in Component 2.

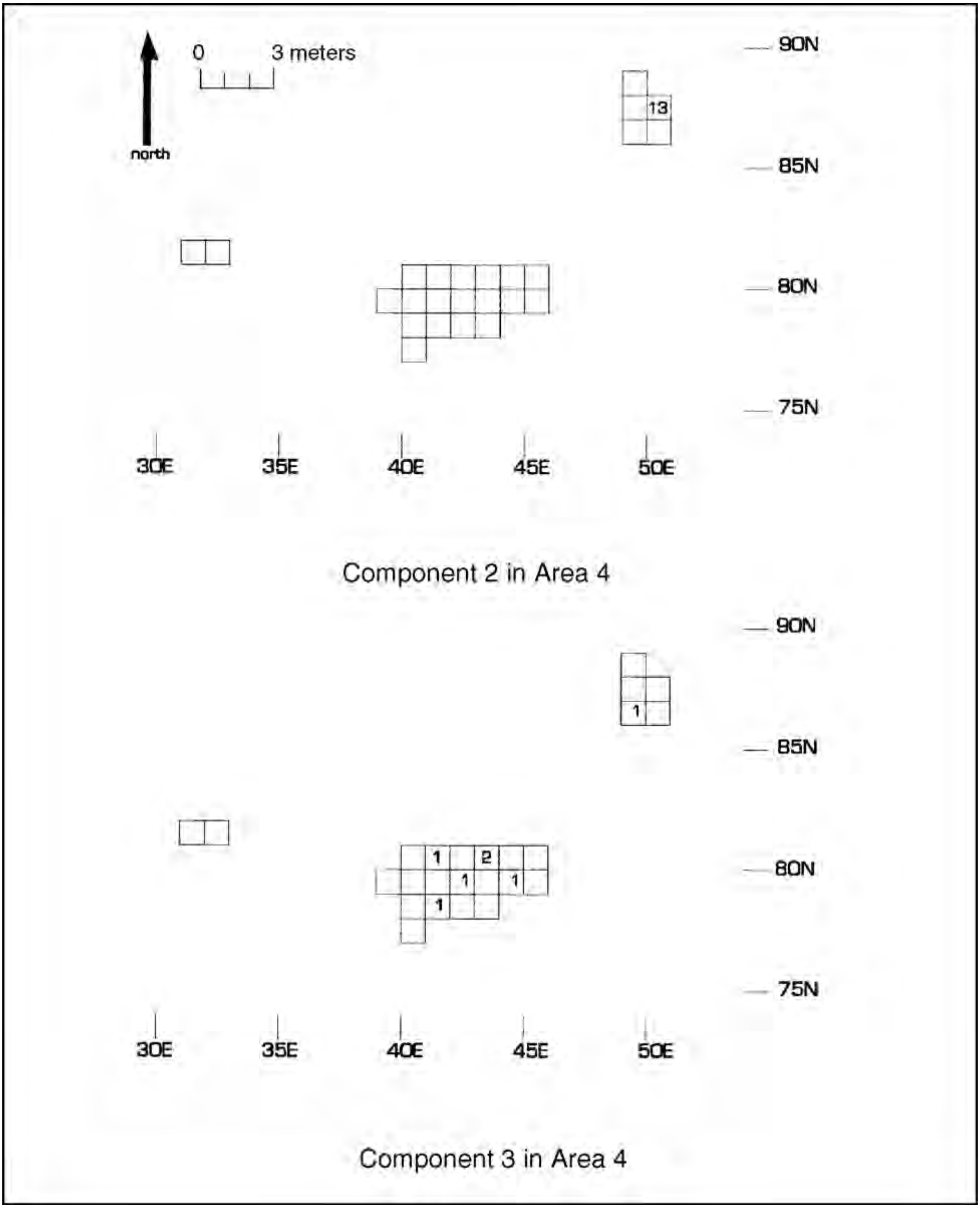

Figure 13.27. Distribution of fire-cracked rock in the west part of LA 65006 for Components 2 and 3.

TABLE 13.2. COMPARISON OF FEATURE SIZES IN COMPONENTS 1, 2, AND 3

COMPONENT	FEATURE NO.	AREA	DEPTH
1	2	.04 sq m	17 cm
	5	.35 sq m	14 cm
	6	.22 sq m	8 cm
	7	.04 sq m	11 cm
	8	.25 sq m*	20 cm*
2	3	2.6 sq m*	12 cm
	4	> 1 sq m	4
	9	10 sq m	17 cm
3	10	17.5 sq m	15 cm

*estimated

Six ground stone artifacts were found in these assemblages, four in Component 2 and two in Component 3; all were recovered from features. Ground stone tools from Component 2 include complete quartzite one-hand manos from Features 3 and 4 (one apiece), and two quartzitic sandstone slab metate fragments from Feature 9. A vesicular basalt slab metate fragment and a whole rhyolite one-hand mano were found in Feature 10 (Component 3). Again, the distribution of these tools is different from that observed in Component 1, where only a single ground stone tool fragment was recovered from a feature, and all other such tools were discarded in activity areas.

It is uncertain whether the whole ground stone tools from Components 2 and 3 were cached in features or were no longer suitable for their original purpose and were reused as heating elements. However, since they lack any evidence of thermal alteration, the latter is unlikely. The significance of the association of four ground stone tools with large charcoal stains remains to be addressed. If those features were structures, as suggested earlier, they may have been cached or abandoned. If they were used for another purpose, such as refuse disposal, they were clearly discarded.

Chipped Stone Artifacts

Distributions of chipped stone artifacts in Components 2 and 3 are shown in Figures 13.28 and 13.29. Like the other artifact categories already discussed, the greatest densities of chipped stone artifacts were in features. The three features associated with Component 2 contained 70 percent of the chipped stone artifacts, while 95 percent of the chipped stone artifacts from Component 3 were recovered from Feature 10. Clearly, this pattern is different from that seen in Component 1, where few chipped stone artifacts were found in features.

There was a moderate scatter of chipped stone artifacts though Area 1 in Component 2, averaging 1.04 artifacts per sq m (Fig. 13.28). A somewhat heavier scatter of chipped stone occurred in Area 2 (3 artifacts per sq m). While no features were found in either area, the concentration of fire-cracked rock in Area 2 suggests that there was once a hearth in that part of the site, which has eroded away. The heaviest concentration of chipped stone artifacts is several meters from the approximate location of this feature (between 2.5 and 5.5 m), rather than directly adjacent to it as was the case in Component 1. Heavy concentrations of chipped stone artifacts were recovered from Areas 3 and 4, nearly all from features (Figs. 13.28 and 13.29). Artifact densities per square meter in these areas were 18.4 for Feature 4, 32.9 for Feature 9, and 4.3 for Feature 10. Thus, Area 1 lacked features and contained the lowest density of chipped stone artifacts, while Features 4 and 9 contained the highest. Densities for Area 2 and Feature 10 were similar.

Debitage from three identified cores were found in Components 2 and 3. Two cores were represented by few examples and have little analytical utility. However, both pieces of debitage from one (Core 12) occurred in a single grid in Area 2, Component 2, and suggest a certain degree of horizontal integrity to deposits in that zone. Except for a few pieces of debitage that may represent other similar cores, all artifacts from Core 3 were found in Feature 9, with 60 percent concentrated in a single grid (Fig. 13.30). While this distribution might be the result of a single chipping episode, it could also have resulted from the dumping of debris produced elsewhere.

Materials from other identified cores also occurred in these areas and are discussed in *Analysis of the Chipped Stone Assemblages,* Chapter 8. To summarize, all other cores identified at the site were initially reduced in Component 1, mostly in Areas 1, 2, and 6. A few specimens were carried upward by bioturbation and deposited in strata associated with Component 2; these include Cores 1, 4, 7, and 10. Debitage from identified cores in Component 3 probably represent materials scavenged from earlier deposits exposed by erosion, and include Cores 2, 4, 6, 8, and 10. While these artifacts could be from other cores that resemble those reduced during the Component 1 occupation, this is less likely than scavenging from earlier deposits.

Reduction data are presented in Table 13.3. Area 5 in Component 2 is eliminated because it includes only a few artifacts from one grid. Feature 3 contained few artifacts and is not representative since it was not completely or systematically excavated. While both core and

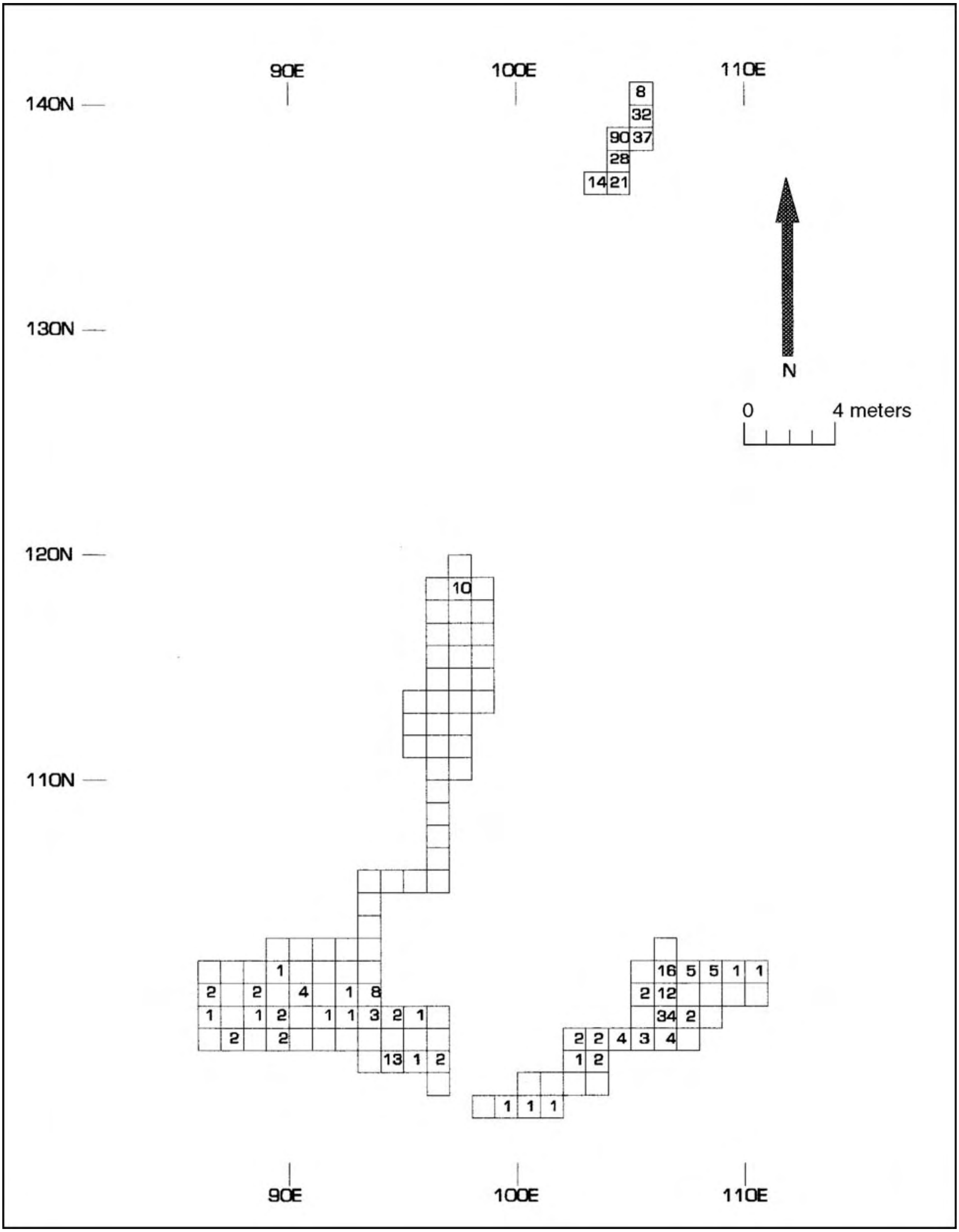

Figure 13.28. Distribution of chipped stone artifacts in Component 2, east end of site.

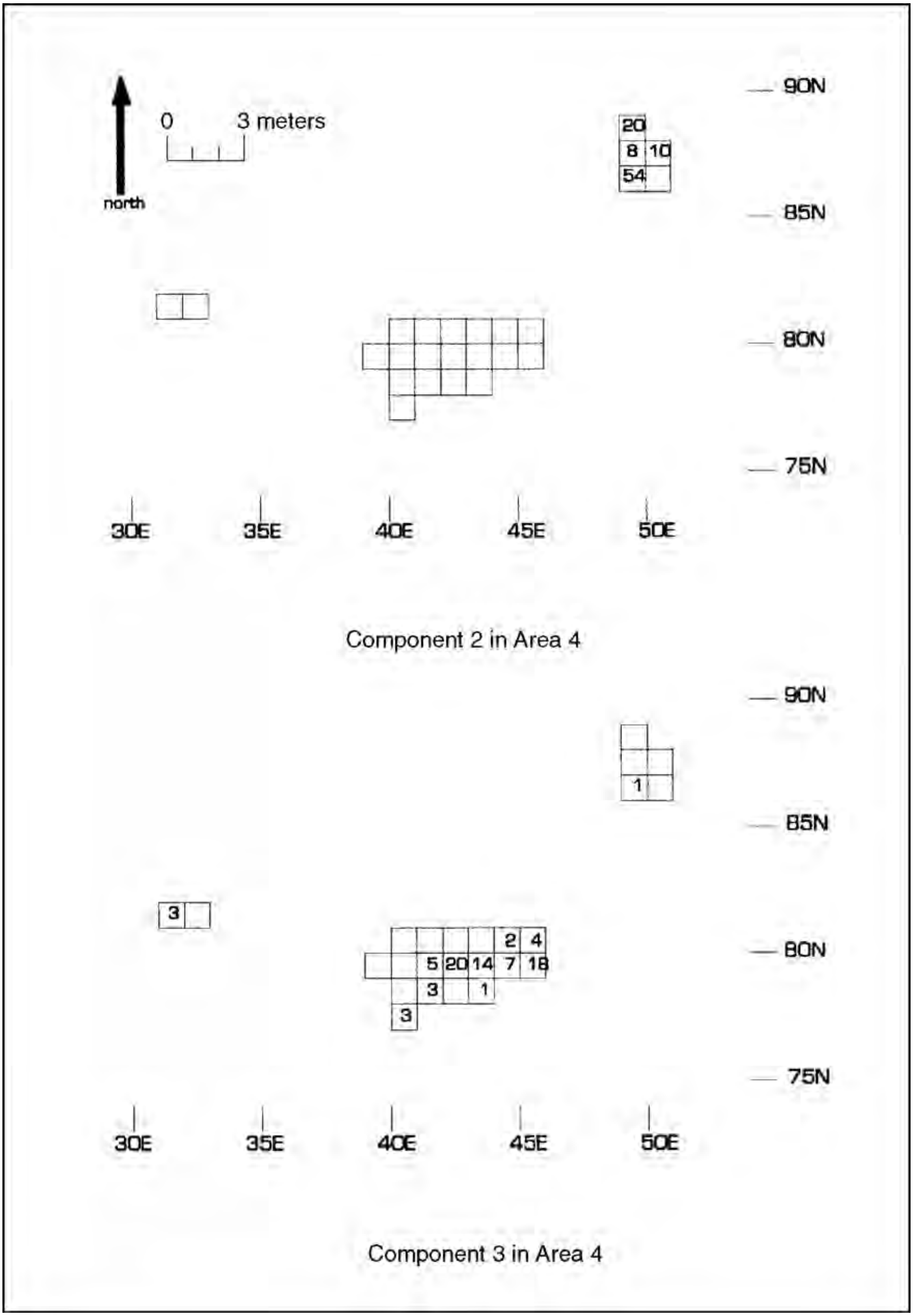

Figure 13.29. Distribution of chipped stone artifacts in Components 2 and 3, west end of site.

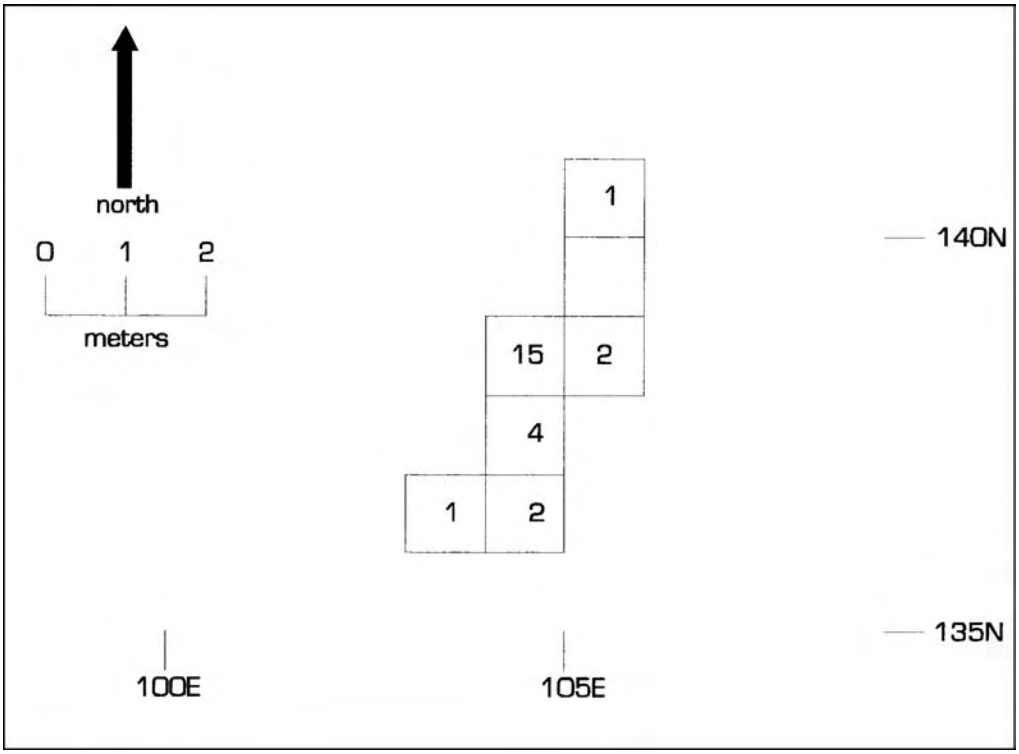

Figure 13.30. Distribution of artifacts from Core 3 in Feature 9, Component 2.

biface reduction occurred in each of the various divisions of these components, differences are evident. Large amounts of manufacturing debris occur in Features 3, 4, and 9, and a moderately high percentage occurs in Feature 10. Areas 1 and 2 contain smaller percentages of biface flakes, suggesting that less biface reduction occurred in those zones. There is also variation in reduction by materials. Except for Feature 10, most biface flakes in Component 3 are obsidian. In Component 2, obsidian comprises 66.7 percent of the biface flakes in Area 1, 100 percent in Area 2 and Feature 3, 57.6 percent in Area 3 (Feature 9), and 80 percent in Area 4 (Feature 4). Chertic materials comprise 76.5 percent of the Feature 10 biface flake assemblage. Thus, at this level of

TABLE 13.3. COMPARISON OF REDUCTION DEBRIS INFORMATION FROM EXCAVATIONAL AREAS IN COMPONENTS 2 AND 3; FREQUENCIES AND ROW PERCENTAGES

COMPONENT	AREA/FEATURE	ANGULAR DEBRIS	CORE FLAKES	BIFACE FLAKES	CORES	BIFACES
2	Area 1	8 16.0	35 70.0	6 12.0	1 2.0	0 0.0
	Area 2	13 13.1	78 78.8	8 8.1	0 0.0	0 0.0
	Area 3/Feature 9	33 14.3	136 59.1	59 25.7	0 0.0	2 0.9
	Area 4/Feature 4	2 2.2	70 76.1	20 21.7	0 0.0	0 0.0
	Area 5	1 10.0	8 80.0	1 10.0	0 0.0	0 0.0
	Feature 3	0 0.0	9 75.0	3 25.0	0 0.0	0 0.0
3	Area 4/Feature 10	11 12.8	58 67.4	15 17.4	0 0.0	2 2.3

Table 13.4. Material Source by Excavation Area and Feature; Frequencies and Row Percentages

Component	Area/ Feature	Local Materials	Exotic Materials
2	Area 1	46.0	54.0
	Area 2	40.4	59.6
	Area 3/ Feature 9	40.9	59.1
	Area 4/ Feature 4	26.1	73.9
	Feature 3	33.3	66.7
3	Area 4/ Feature 10	83.7	16.3

analysis there is differential reduction of various materials between excavation areas.

Exotic materials make up most of these assemblages, with the exception of Feature 10 in Component 3 (Table 13.5). Most of the exotic materials are obsidians that were probably obtained from Jemez Mountain sources. However, a few other types of exotic materials also occur. Pedernal cherts collected at the source comprise 12.5 percent of the exotics in Area 1 and .7 percent in Area 3 (Feature 9).

Flake platform information is presented in Table 13.5, with missing and obscured platforms eliminated. In general, more biface flakes had modified platforms, but platforms on large percentages of core flakes are also modified. In all but one case, over 40 percent of core flake platforms are modified. This is similar to our findings for Component 1, and may occur for the same reason. Many, if not all, of the core flakes with modified platforms may have been removed during early biface manufacture, or are fragmentary. However, there are higher percentages of whole core flakes than whole biface flakes in these assemblages. Thus, the same bias may not exist, perhaps suggesting that core reduction was more important than in Component 1.

To summarize, chipped stone assemblages and distributions in Components 2 and 3 are both similar and different from Component 1. Most chipped stone artifacts in these assemblages were recovered from features, while very few were found in Component 1 features. While data from Components 2 and 3 are somewhat biased since nearly all excavation in two areas concentrated on features, the fact that no features were found in the other two excavation areas may help to even that bias out. The highest densities of artifacts are in two features, while the lowest is in Area 1 which lacked any evidence of features. Area 2 and Feature 10 contain similar artifact densities, closer to that of Area 1 than to Features 4 and 9. There appears to have been a differential reduction of local and exotic materials, with local materials more prone to core reduction, and exotic materials mostly reduced as bifaces.

While the structures of the Component 2 assemblages are mostly similar, there were some important internal variations as well as differences between them and Component 3. At 5.13, the flake to angular debris ratio for Area 1 is the smallest of the Component 2 and 3 assemblages, though not by much. Flake to angular debris ratios for the other assemblages are 6.62 for Area 2, 5.91 for Area 3 (Feature 9), 45.0 for Area 4 (Feature 4), and 6.64 for Component 3 (Area 4, Feature 10). Areas 1 and 2 contain the smallest percentages of biface flakes. All Component 2 assemblages contain high percentages of exotics, but except for those from Features 3 and 4 they are smaller than the percentage for Component 1

Table 13.5. Platform Information by Excavation Area and Feature; Frequencies and Row Percentages

Component	Area/ Feature	Core Flakes		Biface Flakes	
		Unmodified Platforms	Modified Platforms	Unmodified Platforms	Modified Platforms
2	Area 1	81.8	18.2	20.0	80.0
	Area 2	58.1	41.9	0.0	100.0
	Area 3/ Feature 9	45.6	54.4	27.6	72.4
	Area 4/ Feature 4	40.7	59.3	0.0	100.0
	Feature 3	50.0	50.0	0.0	100.0
3	Area 4/ Feature 10	57.1	42.9	22.2	77.8

(64.1 percent). Though the percentage of exotics in Component 3 was moderately high, it was significantly lower than those for Components 1 and 2.

Cores, Large Bifaces, and Tools

Only one core and four large bifaces were recovered from these components. The core was from Area 1 in Component 2, while Area 2 in Component 2 and Area 4 in Component 3 each contained two large bifaces. All large bifaces were broken during manufacture, and none were associated with identified cores. While the core was not associated with a feature, three of the bifaces were found in large charcoal stains, two in Feature 9 and one in Feature 10. The fourth biface was recovered from a geomorphology cut, and while associated with Component 3 was not from any of the grids excavated in Area 4. No other formal chipped stone tools were found in these assemblages.

Component 2 contained 19 informal tools, and there were 3 in Component 3. With one exception, all informal tools were found in features; the exception was found in Area 5. No informal tools were recovered from Areas 1 or 2 in Component 2, and none were found outside Feature 10 in Component 3. Again, while much of our excavation in these components was biased toward features, the lack of informal tools in the small areas excavated outside features may be significant. Like fire-cracked rock and debitage in general, informal tools seem to be closely associated with features. In particular, they mostly occurred in large charcoal stains, though a few were found in hearths. Features 9 and 10 contained 13 and 3 informal tools, respectively, while Features 3 and 4 contained 1 and 4, respectively.

Bone

A total of 37 pieces of bone was recovered from these components, 35 from Component 2 and 2 from Component 3. One fragment from Component 3 was from a domestic sheep, and was recovered from Stratum 13, which articulated with the surface in Area 4. This artifact is undoubtedly intrusive from the historic component located just north of Area 4 outside project limits; thus, it is dropped from consideration.

Of the 35 bone fragments in Component 2, 5 were recovered from Feature 3, 23 from Feature 4, 4 from Feature 9, 1 from Stratum 9 in Area 4, and 2 from Area 2. The only Archaic bone fragment from Component 3 was found in Feature 10. Only a few fragments were identified by order, including 3 fragments of artiodactyl bone from Feature 4 and 1 from Area 2. Remaining fragments were identified by family and size; all were mammal and include indeterminate fragments from Feature 3 (n=4), Feature 4 (n=7), and Feature 9 (n=3), small mammal fragments from Feature 4 (n=1) and Area 2 (n=1), medium mammal from Feature 4 (n=1), and large mammal from Feature 3 (n=1), Feature 4 (n=11), Feature 9 (n=1), Feature 10 (n=1), and Stratum 9 in Area 4 (n=1).

While bone fragments were again mostly associated with features in Components 2 and 3, a few were also recovered from areas that did not contain features. As opposed to other classes of artifacts, most bone was recovered from hearths rather than large charcoal stains. This distribution was in some ways similar to that in Component 1. However, while several fragments of bone were found in features from Component 1 (particularly Feature 8), most were scattered around hearths in activity areas.

Floral Materials

Multiple flotation samples were examined for all three features in Component 2. Unfortunately, no comparable samples were available from Feature 10 in Component 3. Burned chenopodium seeds were ubiquitous in samples from Feature 3, and occurred in some samples from Features 4 and 9. Other economic seeds include squawberry from Features 3 and 4, and purslane from Feature 9. All of these species are available in the late summer and early fall, and indicate occupations during the same season suggested for Component 1.

Discussion

In general, the occupations represented by Components 2 and 3 differ from Component 1, though they represent uses during the same season. Unfortunately, data for all three components are not totally comparable. While a large area was opened to examine Component 1, most excavation in Components 2 and 3 concentrated in and around features. Only in Areas 1 and 2 were comparable zones examined. With these limitations in mind, the various occupations can be compared and contrasted.

During all three uses the site served as a residential camp. Component 1 appears to have been occupied by a microband. Spatial analysis suggests that an ephemeral shelter may have existed around Features 5 and 6, representing interior space used for sleeping and other activities that required a clean surface. Deposits and features in Areas 1, 2, the north part of 5, and 6 represent activity areas that were probably used sequentially. Analysis of the results of auger testing supports this conclusion (Fig. 6.2). Most of the grids that contained cultural materials were in the west half of the lower terrace. Grids in Area 1 contained debitage and charcoal. Subsurface charcoal was found at depths associated with Component 1 in and around Areas 2, 5, and 6. A rather heavy con-

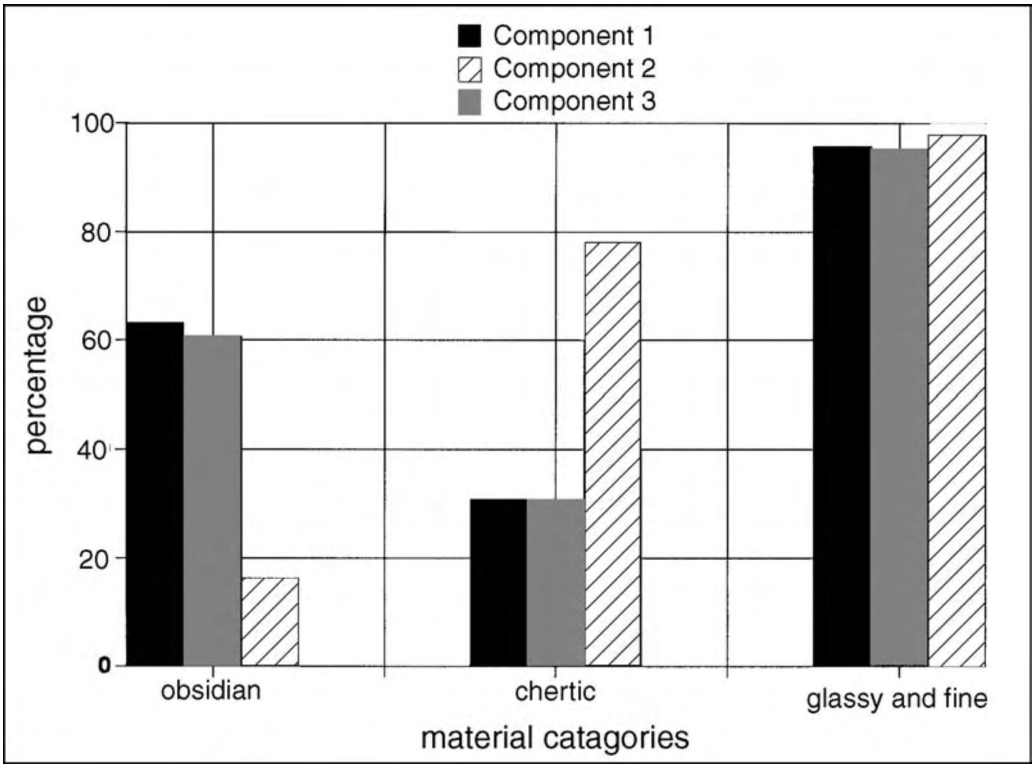

Figure 13.31. Material type and quality selection for Components 1, 2, and 3.

centration of auger tests containing charcoal, debitage, or both occurred north and northeast of Area 5, but could not be examined in more detail because it turned out to be beyond project limits. A few auger tests north of Area 2 and east of Area 5 contained cultural materials, but for the most part were sterile. Thus, extensive activity areas occurred in the excavated zones, but do not seem to have been present in other parts of the lower terrace. Similar patterning was not available for Component 2 because no cultural materials were recovered in auger tests above levels representing Component 1. Thus, augering not only supplements excavation data for Component 1, it also suggests that a similarly dense distribution of cultural materials did not occur in Component 2.

While Component 1 contains a large number of artifacts, a relatively short occupation is indicated. The lack of evidence for structures, storage features, and substantial processing features all indicate that the site was not used for a long period. However, it is difficult to determine whether the same can be said for Components 2 and 3. Though no storage features were found in the areas examined, features associated with these occupations were quite different from those in Component 1, even considering the excavation biases discussed earlier. While the large charcoal stains may represent the remains of deteriorated structures, it is also possible that they were simply shallow middens. Unfortunately, it is impossible to determine which possibility (if either) is correct. However, that is unimportant to this discussion because in either case a comparatively lengthy occupation is indicated, almost certainly longer than that represented by Component 1.

Different types of hearths were used in Components 1 and 2. As discussed earlier, Component 1 hearths were small and contained few artifacts, including fire-cracked rock. Both Component 2 hearths were considerably larger and contained numerous artifacts including fire-cracked rock. In general, activity areas around hearths were used as discard zones in Component 1, while the hearths themselves were used for this purpose in Component 2. The lack of hearths in Component 3 precludes extending this analysis to that occupation.

Chipped stone reduction, particularly large biface production, was an important aspect of each occupation. Material type selection is an important consideration in reduction, especially when tools are being made. Tools are usually manufactured from high-quality glassy and fine-grained materials because they are easier to shape into the desired forms and produce sharp edges. The highest quality materials available were obsidians, cherts, and silicified woods (the latter two combined as chertic materials). Figure 13.31 shows percentages of obsidians and chertic materials in all three assemblages. Components 1 and 2 are dominated by obsidians, and contain identical percentages of chertic materials. The distribution in Component 3 is the opposite of this pat-

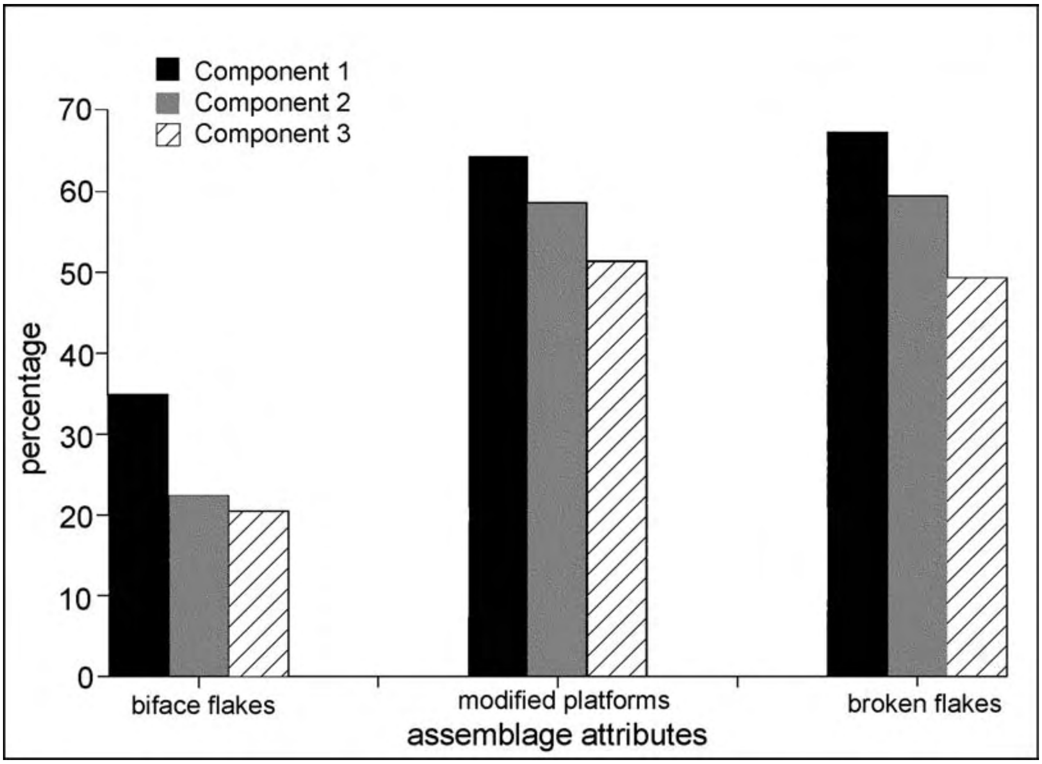

Figure 13.32. Flake assemblage attributes for Components 1, 2, and 3.

tern. That assemblage is dominated by chertic materials with obsidians comprising a substantially smaller percentage. However, when material quality is considered there is little variation between assemblages. In fact, Component 3 contains slightly more high-quality materials.

The lower percentage of obsidians in Component 3 probably does not reflect a change in selection parameters, it may merely mean that less of this material was available. While this may suggest a more restricted foraging range in comparison with earlier occupations, it could also indicate movement in another direction, perhaps toward rather than away from the Jemez Mountain sources.

Overall, Components 2 and 3 contain similar percentages of biface flakes (22.4 and 20.5 percent, respectively). However, there are differences between excavation areas in Component 2, and areas that contain no features had the smallest percentages of biface flakes. At 35.0 percent, biface flakes comprise a much higher portion of the Component 1 assemblage. This is graphed in Figure 13.32 along with two other flake assemblage attributes that are indicators of reduction strategy. Percentages of biface flakes, modified platforms, and broken flakes all decrease from Component 1 through Component 3, and suggest a decrease in the proportion of biface to core reduction over time.

Thus, while there are superficial similarities between components, there are also important differences that suggest they represent at least two patterns of occupation. To summarize, Component 1 represents occupation by a microband for a relatively short period, probably no more than a few weeks. The structure of this component suggests a rather haphazard occupation. A sleeping area, possibly containing an ephemeral shelter, was kept free of surface debris. Activities occurred around small simple hearths beyond this zone, and seem to have moved around the periphery of the camp as debris built up. This suggests that a short occupation was planned, but a longer than anticipated use may have occurred. However, if large biface manufacture was as important as this analysis suggests, a short duration of occupation may still be indicated. The production of a few dozen large bifaces could easily produce the amounts of debitage recovered from this component. Use of zones around hearths for biface manufacture would produce large amounts of debitage, and effectively shorten the life-span of these features. It was simply easier to move an activity area than it was to clean up around a hearth.

Components 2 and 3 represent a different type of occupation. Large charcoal stains suggest the presence of either eroded structures or middens. Larger hearths suggest a more intensive use, perhaps more for food processing than simply heating and cooking, which is how the Component 1 hearths seem to have functioned. If the large charcoal stains represent shallow middens, the lack of heavy concentrations of debitage in activity areas contrasted with large amounts of debris in the stains suggests a formal discard pattern. This is more consistent with camps occupied for relatively long periods, which require a more formal arrangement of activity and discard locations. This contrasts with the haphazard organization seen in Component 1, where activity and discard areas were the same.

If the charcoal stains represent structures, there is no evidence of formal trash discard. However, if this is the case, they represent even more conclusive evidence of lengthy occupations. The presence of a considerable amount of trash within these features suggests the repeated or long-term occupation of adjacent areas, with earlier structures used for trash disposal.

While the condition of the large charcoal stains did not allow us to conclusively demonstrate their function, two possibilities have been suggested. In both cases, a relatively lengthy occupation is indicated, so a determination of their actual function is not critical to these arguments. While data from the occupations represented by Components 2 and 3 are not totally comparable to those from Component 1, lengthier and more intensive occupations are indicated, relative numbers of artifacts and sizes of excavation areas notwithstanding.

Applying the Model

No evidence was recovered from Components 1, 2, or 3 that suggest any degree of reliance on corn horticulture. While corn pollen was found in Component 1, it occurred in very small concentrations and in questionable circumstances, and no evidence of corn was found in associated hearths. If corn was consumed, it was in small quantities, and it was probably grown elsewhere and transported to this location. Thus, there is no good evidence for Archaic farming in this location. This, in addition to the lack of storage features and substantial structures, suggests that the Archaic occupants were not sedentary farmers. Analysis of the chipped stone assemblage appears to confirm this, and indicates a continuing and substantial reliance on biface technology. Thus, further consideration of the parts of the model pertaining to occupation by farmers is unnecessary.

As discussed earlier, hunter-gatherers can be divided into foragers and collectors. Data presented by Irwin-Williams (1973) suggests that Early Archaic hunter-gatherers were foragers, with the transition to a collector organized system beginning during the Middle Archaic and dominating by the Late Archaic. However, neither this sequence nor a division into foragers and collectors are necessarily clear-cut. For example, Vierra (1990:63) feels that Southwestern Archaic hunter-gatherers:

> . . . may have implemented a foraging strategy from spring to fall, and a collector organized strategy during the winter. That is, groups were residentially mobile from spring to fall, mapping onto exploitable resources; while during the winter they utilized stored foods making logistical trips to food caches and for hunting.

With this in mind, it is possible that there was a seasonal fluctuation between foraging and collecting, even during the Late Archaic. If this is so, with a fall occupation indicated for all three Archaic components at the San Ildefonso Springs site, it follows that a foraging pattern of resource exploitation should be evident.

While the site exhibits multiple uses during the same season, as few as three occupations over as many as 600 years does not suggest that the same group reoccupied the site. However, only part of the site was excavated, and evidence of other uses may occur outside project limits. Component 1 represents use as a residential camp for a relatively short period of time. Features are small and informal, and activity areas are haphazardly arranged and cluttered with debris. An area near the center of the artifact scatter that contained two hearths and was nearly devoid of artifacts seems to represent a sleeping area that may have contained an ephemeral shelter. Components 2 and 3 probably also represent short-term camps, though the types of associated features suggest a longer duration of stay.

While a single occupation is likely for Component 1, Components 2 and 3 may represent multiple occupations in adjacent locales, depending on how the large charcoal stains are interpreted. If they represent abandoned structures reused for discard, the general site area may have been reoccupied on a regular basis. On the other hand, if they are simply shallow middens or structures, regular and repeated uses may not be indicated.

Comparable Archaic structures have been studied in northern New Mexico and southwest Colorado (Cella et al. n.d.; Kane et al. 1988; Stiger 1986). All were burned, though whether intentionally or accidentally is unknown. Artifacts were recovered from the fill or in floor associations from several of these structures. For example, Casa de Nada in southwest Colorado contained 71 pieces of debitage and 7 nonflaked stone tools including a one-hand mano and a metate fragment (Kane et al. 1988). Numerous artifacts were also found in the fill of three structures at LA 25358, which is on the edge of Abiquiú Reservoir in northern New Mexico (Cella et al. n.d.). An Archaic structure at a second site in the same area (LA 47940) also contained artifacts in its fill.

While at least the Abiquiú sites represent multioccupational locales, archaeologists have tended to assume that materials found in structural fill are related to use of that structure. This interpretation is probably correct in some cases, especially when artifacts cluster on or near the floor. No such clustering was noted in Features 9 or 10 at the San Ildefonso Springs site, suggesting that the association of those materials with use of the features as structures is tenuous. They more likely either represent discrete discard areas or structures reused for trash disposal.

All three components demonstrate patterning consistent with our predictions for residential camps used by foragers. In short, they reflect a wide range of maintenance, production, and food processing activities without a heavy investment in habitation or storage features. If the large charcoal stains represent structural remains, they were ephemeral and contained no internal features. If they represent shallow middens, no evidence of structures was recovered from any Archaic component.

While the lack of substantial structures and storage features also fits the predicted pattern for a collector field camp, other data do not. The types of features in Components 2 and 3 suggest rather lengthy or repeated occupations, at least in comparison with Component 1. All components exhibit a wide range of subsistence and maintenance activities indicative of occupation by one or more family groups. There is no evidence in any component for task-specific functions carried out by work groups with restricted memberships. Thus, in that there is no evidence of temporary occupancy by a small group engaged in specialized activities in these components, they do not fit the pattern predicted for collector field camps.

Kelly's (1988:721-723) model of the relationship between site function and large biface manufacture and use was summarized in Figure 13.1. Occupation patterns and functions for the Archaic components have been presented based on general assemblage makeup and feature types. It has been suggested that all three components represent residential occupations by foraging populations. By applying these conclusions to Kelly's model, it is possible to provide a preliminary test of his predictions.

Kelly's model distinguishes between residential sites where bifaces were used as cores and those in which they were produced for later use at logistical sites. Large bifaces were produced in all three Archaic components at the San Ildefonso Springs site. This is confirmed by the presence of large percentages of biface flakes, modified platforms on debitage classified as core flakes, and numerous fragments of bifaces that were broken and discarded during manufacture. In particular, biface manufacture appears to have been of extreme importance in Component 1. However, only a third (33.6 percent) of the informal tools in Component 1 are biface flakes. Even fewer biface flakes occur in Component 2, comprising only 15.8 percent of the informal tools. A third of the informal tools in Component 3 are biface flakes, but since only three pieces of utilized debitage were found in that assemblage, little meaning can be ascribed to this.

Cores are rare, being outnumbered by biface fragments in all cases. Many core flakes, particularly those in Component 1, probably actually originated during early biface manufacture. This suggests that biface reduction was even more important than is indicated by percentages of identified biface flakes. Low frequencies of cortical debitage in addition to the rarity of cores suggests that many materials were partly reduced before they arrived at the site. That is, large flakes were removed at quarries and transported to this location for reduction into bifaces. Mostly fine grades of cryptocrystalline materials were selected for reduction. Primarily, these include obsidians procured from Jemez Mountain sources more than a day's journey away, and cherts and silicified woods that were available locally. However, cortical data suggest that some cherts were also obtained from sources located a considerable distance from the site.

From data presented earlier it was concluded that all three Archaic components represent residential occupations. They also fit the pattern for residential sites suggested by Kelly's model. Lacking a large range of sites, we cannot determine whether both residential and logistical sites were used by these groups. However, there is evidence that the San Ildefonso Springs site was used to gear up, with numerous large bifaces being produced. This is particularly true of Component 1, which contains large amounts of debitage patterned in such a way to suggest that many large bifaces were manufactured from a variety of materials over a relatively short time period. Many large biface fragments, nearly all broken during manufacture, also occur. A rather high percentage of biface flakes were used as informal tools, and it is likely that most of the informally used debitage identified as core flakes actually originated during early biface manufacture. However, flakes do not seem to have been removed from bifaces specifically for use as informal tools. Rather, the large amount of manufacturing debris that already existed and was scattered through activity areas was undoubtedly used for such purposes. In most cases they were used where they were struck during the manufacturing process rather than being carried around the site for use in various activities.

All of these attributes fit Kelly's model for the production and use of bifaces in residential sites. However, there are some important differences which set the San Ildefonso Springs site apart, particularly in Component 1. During that occupation, the site seems to have functioned as a temporary residential camp. One of main activities performed was the manufacture of large bifaces. These tools were removed when the site was abandoned, as evidenced by the presence of fragments that were broken and discarded during manufacture, but no whole bifaces. Most of the material from which the bifaces were manufactured was procured at some distance from the site. Whether obsidian was quarried while the band was camped in the Jemez Mountains or adjacent uplands, or a logistical trip was made to the quarries is impossible to determine. There is evidence of similar gearing up activities in Components 2 and 3, though to a much smaller degree.

This pattern is very interesting, particularly in light of Vierra's (1990, 1994) model of Archaic populations organized as foragers from spring to fall and collectors during the winter. It would appear that the Component 1 population was manufacturing large bifaces out of obsidian and other good quality materials in preparation for movement to a winter residential camp, from which logistical parties would be sent out. This may also have been the case during the Component 2 and 3 occupations, though to a lesser degree. From evidence collected at sites presumably occupied during the winter, Stiger (1986:354) has proposed the opposite pattern:

> This may be an indication that the occupants equipped themselves with general-use bifaces prior to a move into a warm-season higher mobility adaptation.

Thus, Stiger's data suggest gearing up before movement out of cold season camps, while our analysis suggests gearing up before movement into winter camps. It is likely that gearing-up activities were more closely related to anticipated movement patterns and availability of suitable raw materials than season. Thus, they could occur at any time of the year when suitable raw materials were available and movement into areas that did not contain such resources was anticipated, or site residents felt they would have a need for such tools in the near future.

Since site residents manufactured large bifaces during all three Archaic occupations instead of making use of similar tools produced elsewhere, it is difficult to assess parts of Kelly's model. Depending on how the term "gearing up" is defined, his assertion that this activity should occur at quarries rather than residential sites can either be accepted or rejected. In Kelly's terms, gearing up seems to include testing cobbles to ensure they contain a high-quality material, and preparation of cores by the removal of cortex. This should result in the presence of few flakes with lots of dorsal cortex at residential sites, along with a predominance of high-quality materials, often from distant sources (Kelly 1988). This is the pattern seen at the San Ildefonso Springs site, where primary reduction flakes are rare and most artifacts are of high-quality exotic materials. When "gearing up" is defined as preparing for anticipated needs by manufacturing large bifaces, it can be suggested that quarries were not the only sites where evidence of this activity can be expected. Perhaps a better term for the former activity would be material acquisition and preparation. Thus, quarries should be loci of material availability where initial trimming of the cortical surface and perhaps the striking of flakes for use in tool manufacture occurred. Actual "gearing up" should include the manufacture of tools for anticipated needs.

Evidence of material acquisition is available from sites in and near the study area. Several quarries were examined and tested during earlier studies along NM 502 (J. Moore 1993; Moore and Levine 1987). No evidence of tool manufacture was noted at those sites, and initial core reduction seems to have dominated reduction activities. A similar pattern was noted at two workshop sites near Obsidian Ridge, one of the major sources of obsidian in north-central New Mexico. Obsidian, either in the form of nodules or partly reduced cores, was carried to these sites for further reduction into formal and informal tools (R. Moore 1986). Thus, there appears to be a distinction between the locus of material acquisition and the locus of large biface manufacture. Quarries contain evidence of early stage core reduction, while tool manufacture occurred at residential sites, like the San Ildefonso Springs site and the Obsidian Ridge workshops.

Analysis of site structure, features, and artifact assemblages suggest that all three components represent forager rather than collector residential camps. Application of Kelly's model partly supports this interpretation; in particular, the pattern proposed for a residential camp in which bifaces were made for use as cores in logistical sites. Unfortunately, it also fits most of the attributes suggested for the production and use of bifaces as cores in residential sites. Thus, it is not possible to conclusively determine which organizational pattern was followed by analysis of the chipped stone assemblage alone. Only when other site attributes are considered is it possible to make this determination.

Conclusions

While differences were detected between Archaic occupations, all three components seem to represent use by foragers. The most extensive body of information is available from the earliest occupation, which dates to the later half of the Armijo phase. Though limited evidence for the presence of corn during this occupation was found, it was inconclusive and could just as easily represent contamination from later strata. In the absence of corroborating data such as macrobotanical specimens, it is difficult to ascribe importance to a few grains of corn pollen. The structure of this component and its assemblage suggest occupancy by a small band consisting of at least one family group. The amount of debris found suggests that the occupation may have been longer than planned for. Conversely, assemblage size, particularly that of the chipped stone artifacts, may bear no relation to the length of stay. Our analysis suggests that one of the main activities performed during this occupation was the manufacture of large bifaces, presumably for transport to another location since only broken fragments of these tools were recovered. It is quite easy to produce large amounts of debris in a short period when making bifaces, and it is likely that this is the case.

The two later Archaic components seem to have been used during the late Armijo or early Basketmaker II phases. Fewer data were available from these assemblages, particularly Component 3. However, enough information was recovered to suggest that the pattern of site occupancy reflected by these remains differed from that displayed by the earliest component. The presence of either simple structures, middens, or structures from an earlier occupation reused as middens suggests a somewhat longer period of occupation. A corresponding lack of storage features, however, indicates that those occupations were not long term, and that the site still served as a temporary camp rather than a residential camp. While large biface manufacture continued to be an important activity, it did not assume the degree of importance suggested by Component 1. Like the earlier assemblage, the structure of remains in these components suggested use as a short-term camp rather than a permanent or semipermanent residence.

Kelly's (1988) model of the association of site type and assemblage characteristics was applied to these remains, with conflicting results. While these components fit the expected pattern for residential sites in which bifaces were made and used as cores, they also fit the pattern expected for residential sites in which bifaces were made for use at logistical sites. This is particularly true of Component 1, and to a lesser degree for the two later components. Perhaps this is because there was really no clear-cut distinction between foragers and collectors in the Southwest during the Late Archaic.

If, as Vierra (1990) suggests, the Late Archaic occupants of this region switched between both organizational patterns on a seasonal basis, a very confusing array of sites might be expected. One could conclude that since Component 1 appears to represent a forager camp in which many large bifaces were manufactured, site residents were preparing to move into a region where raw materials were either scarce or of poor quality. On the other hand, these remains could also represent preparation for the switch to a collector strategy during the winter months, necessitating the manufacture of large bifaces for use at logistical sites. As such, this occupation could be interpreted as logistical in nature, even though it reflects varied activities performed by a diverse group.

Unfortunately, theories concerning Archaic settlement and subsistence are easier to come by than are well preserved and reported sites representing a wide array of occupational types. The Archaic components examined by this project represent both well preserved and poorly preserved remains. While some vertical movement was noted for materials in Component 1, the horizontal integrity of these remains was extremely good for an open-air site. This allowed a detailed analysis of site structure and conclusions concerning occupation type and function that might not otherwise have been possible.

Components 2 and 3 were poorly preserved. This was partly due to their proximity to the modern surface. For Component 2 this was particularly unfortunate, because deflation mixed part of this assemblage with that of a later Pueblo occupation on the surface of the lower terrace. Because of this, surface materials could not be considered. This reduced the size of the associated assemblage and made it more difficult to analyze its structure. Both later components contained large charcoal stains that were impossible to interpret with any degree of accuracy. Depending on the function assigned to these features, it was possible to derive various interpretations of the occupations represented. Thus, while we have provided an analysis of these components and how they fit the model presented at the beginning of the chapter, the results are much less reliable than those provided for Component 1.

Finally, Kelly's (1988; Parry and Kelly 1987) and similar models of chipped stone technology assume that changes in reduction strategy are closely related to mobility. While this may be partly true, others have suggested that the relationship is more complex. Bamforth (1989) argues that curated strategies are more related to the availability of suitable raw materials than mobility. Our model incorporates this idea, and suggests that desirable exotic materials may be reduced using a curated strategy, while local materials are expediently reduced. This may occur even when local materials are of equivalent quality. Vierra (1993) suggests that the relationship is even more complex. Rather than being directly related to mobility, as Kelly suggests, Vierra feels that the key factors in a switch from a curated to an expedient reduction strategy were increasing dependence on agriculture, a concomitant change in labor organization, and investment of energy into other nonchipped stone technological components. While this analysis can do little to resolve these questions, it has hopefully provided information on Late Archaic chipped stone technology and site use that can eventually help to more conclusively model changes in prehistoric technology and settlement systems over time.

CHAPTER 14. A CLASSIC PERIOD FIELDHOUSE: LA 65013

Joan K. Gaunt

The archaeological remains at the FH site (LA 65013) and its specific location in the physiographic and cultural landscape suggest that it functioned as a fieldhouse. Woodbury (1961:14) was the first to define the function of this type of site. The fieldhouses that he investigated at Point of Pines in Arizona consisted of one- or two-room masonry structures associated with nearby fields. In form, they may have been crude windbreaks with low semicircular walls, and were either roofless or had simple brush roofs. Similar types of farming shelters have also been observed at Hopi (Forde 1934:230) and Zuni (Stevenson 1904). More recent studies have contributed considerable data that are useful in more fully understanding the physical, social, and economic implications of fieldhouses and their relationship to larger aggregated communities (Greenwald 1993; Kohler 1992a; B. Moore 1978, 1980; Orcutt 1990a, 1990b, 1991; Preucel 1990; Sebastian 1983; Van Zandt 1993; Wilcox 1983).

Some evidence suggests that many single-room sites could have functioned as shrines, playhouses, hunting lodges, gathering stations, or permanent year-round dwellings (B. Moore 1980; Gregory 1975). Small special-use sites were also used as camps while gathering piñon, traveling, gathering wood, collecting wild foods, during religious observances, and as sheep herding camps (Russell 1978). Wilcox (1983:26) points out that the functions inferred for fieldhouses could have occurred at sites of very different morphologies. For example, ramadas, brush shelters, or multiroom structures could have fulfilled the same function as single-room structures. Thus, fieldhouses should be represented by a wide range of architectural forms dependent on such factors as duration of use, availability of construction materials, weather patterns, and group size.

A Model of Fieldhouse Use

A model defining expected patterns of remains for fieldhouse versus farmstead use was developed for examination of the FH site (J. Moore 1989:27-32), and was adapted from two lists of characteristics defining fieldhouses or seasonally utilized farm shells (SUFS) (B. Moore 1978:10, 1980:9-10). The behavioral aspect of interest in our model was the use of small sites. Pilles and Wilcox (1978:1) define this class of site as ". . . ones whose size and artifactual assemblage suggest a limited temporal occupation by a small group of people, gathered at the locality to carry out a specific, seasonally-oriented set of activities."

In a Pueblo context, small sites reflect sets of activities that may or may not have also been performed at the primary residence. By studying small sites, it should be possible to isolate material traces that are indicative of discrete activities. Recognition of such traces can be an invaluable adjunct to the investigation and analysis of more permanent sites, where specific toolkits inevitably become mixed and obscured by later activities. More importantly, small sites represent part of the general Pueblo adaptive system. If only large villages are studied, our conclusions concerning prehistoric life will be skewed. By studying sites of all types we can develop a more accurate view of prehistoric life.

The small size of the FH site and the insubstantial appearance of architectural remains there suggest that it served as a fieldhouse. As a preliminary statement, this functional assignment is sufficient. In terms of explanation, it is not. In order to test this assumption, a working definition of the fieldhouse concept within the general Pueblo adaptive system is necessary. Thus, a model of fieldhouse use is presented here, and is applied to the remains found at the FH site in the next section.

Bruce Moore (1978, 1980) has presented detailed discussions of SUFS. He defines SUFS as architectural shells built within or in close visual proximity to fields, which were used seasonally by farmers for agrarian activities (B. Moore 1978:10). Wilcox (1978:25-26) essentially agrees with this definition, describing fieldhouses as architectural components of the subsistence-settlement system used as temporary residences during the growing season which are located near or within fields or gardens. Fieldhouses can contain storage facilities, but this is not necessary. These definitions make two aspects of the fieldhouse concept quite clear–they are located near or on agricultural land, and they are temporarily occupied.

Two important distinctions are noted by Wilcox. First is the difference between *fieldhouses* and *farmsteads.* Fieldhouses are occupied seasonally by part of a family, and farmsteads serve as year-round residences for entire families (Wilcox 1978:26). In both cases the site is used by small groups. A second important distinction is made between temporary fieldhouses and masonry fieldhouses. The latter may have appeared coincident with the development of water and soil control systems, reflecting greater labor investment in agriculture (Wilcox 1978:28). It is possible that both types of features (masonry fieldhouses and water and soil control systems) correlate with increased frequency of field use and an attendant reduction in the fallow cycle, as well as with changes in the land tenure system (Wilcox 1978:28).

Our definitions for fieldhouses and farmsteads differ somewhat from those presented by Wilcox (1978). In this study, fieldhouses represent sporadically occupied farming structures used by part of a family on a temporary basis. In contrast, farmsteads served as seasonal residences for entire families. Thus, fieldhouses might be occupied by a few family members while tending fields, but they would continue to reside at the main village during most of the growing season. Whole families moved to farmsteads for the entire growing season, only returning to the main village to fulfill ritual or social obligations, visit, or perhaps to replenish food supplies or obtain other needed goods.

B. Moore (1978:10, 1980:9-10) has presented two lists of characteristics defining SUFS. These can be combined into a single list of expected SUFS attributes. While a rigorous test of the model is beyond the scope of this study, the fit of observations made during data recovery to the expected pattern can be examined. The following variables comprise the model:

1. Though SUFS may vary morphologically and compositionally, no more than one to three rooms should be present. Each room should share at least one wall with another room. At least one room should be large enough to permit occupation by at least one adult. The floor area of each room should be (roughly) no larger than the mean floor area of contemporaneous habitation rooms in the same settlement system or cultural tradition. The structure should be isolated; no other contemporaneous architectural unit should be present.

2. Kivas should be lacking. As temporary components of the settlement system, SUFS should lack ritual functions (except those directly related to agrarian practices). If kivas or other ritual features are present, they could be an indication of permanent residence rather than seasonal use.

3. SUFS should be located where their view of nearby fields is unimpaired.

4. The range of activities at a SUFS should be limited relative to habitation sites or villages.

5. One or more of three patterns of use should be evident: (a) daily, where night time use is limited to the period of crop ripening; (b) seasonal, with continuous use during the farming season; (c) throughout the year by travelers.

Other aspects of SUFS are more suited to regional rather than site-specific studies, but are mentioned because they help define the model. B. Moore (1978:11) feels that SUFS result from inconvenience rather than aggregation, with the perception of inconvenience being sufficient reason to build them. Site aggregation alone is not a satisfactory explanation for this phenomenon. SUFS and other small sites also functioned as extensions of the village. As such, villages cannot be studied in isolation, they are inextricably linked to their support sites, and no single site type is representative of the entire adaptational system. Finally, SUFS may have contributed to social stability (B. Moore 1978). In addition to providing temporary shelter for farmers, SUFS may have served as refuges for individuals or groups who were fed up with some aspect of village life and needed to get away for a while. This ability to escape from domestic tensions may have served as a safety valve, helping to prevent conflict and stress from building to the point where fissioning was the only viable solution. At the very least, this mechanism may have slowed the process of group disintegration. However, it is doubtful that it led to the development of SUFS; rather, it is more likely that this function originated after fieldhouses came into use.

Expectations

Expected patterns of material remains can be developed for the five variables that comprise the model of fieldhouse use. These patterns are amplifications of the model, and provide implications against which the observed pattern of remains from the FH site can be compared. Test implications fall into five general categories, and are discussed below. Since the specific interest of this study is whether the FH site was a fieldhouse, expectations for farmstead use as discussed in the original model (J. Moore 1989) have been dropped and will only be introduced if they become pertinent.

1. *Site morphology and composition:* If LA 65013 was a fieldhouse, the following characteristics are expected:
   a. Only one to three rooms should be present.
   b. If more than one room is present, each should share at least one wall with other rooms.
   c. At least one room should be large enough to permit occupation by at least one adult.
   d. Floor areas should be consistent with the average for rooms at contemporaneous villages of the same settlement system or cultural tradition.
   e. There should be no other contemporaneous habitation structures present.
2. *Kivas:* Kivas and similar ritual features should be absent. Ritual objects or features related to farming may occur, but the presence of features indicating more than a limited and specific ritual function would be inconsistent with use as a fieldhouse.
3. *Site location:* Land with farming potential should be located in direct line of sight with the structure if LA 65013 served as a SUFS.
4. *Range of activities:* Material remains should be sparse and reflect a limited range of activities. Architecture

should be insubstantial and insufficient for year-round occupancy. Trash should be surficial or restricted to shallow subsurface deposits.

5. *Pattern of use:* A limited use pattern should be evident, consisting of daily use with overnight stays restricted to the harvest season or seasonal use during the growing season.

Though subjective judgments are included in the set of characteristics related to site morphology and composition (how much space is required by a single adult, for example), most are quite specific. The implied pattern of use is perhaps the hardest characteristic to study because the two patterns proposed for SUFS may be indistinguishable from one another and, in certain cases, from year-round occupancy. If LA 65013 functioned as a fieldhouse, a daily use pattern with overnight stays restricted to the period of crop ripening should produce the fewest remains. Food preparation tools may be present, but processing tools should be rare or nonexistent. Artifacts associated with farming or farm tool maintenance may occur. There may be evidence of hunting or wild plant gathering, but the processing of these foods should have occurred elsewhere unless they were used at the site immediately after collection. Hearths should be outside the structure, and designed for food preparation rather than heating.

Other occupational patterns are possible, depending upon the function of this site. Seasonal use with continuous occupation during the growing season (farmstead function) may be difficult to distinguish from year-round occupancy (residential function). Nearly a full range of food preparation, tool production, and maintenance activities could occur in this type of assemblage. Aspects of full-time residency that should be lacking include architecture suitable for cold season use, interior hearths built for heating as well as cooking, and ritual features such as kivas or ceremonial rooms. Year-round occupancy should be represented by a wide range of food preparation, tool production, and maintenance activities in the assemblage. Architecture should be suitable for cold as well as warm season use, and interior hearths should have been built for heating as well as cooking.

Applying the Model

The results of excavation at LA 65013 suggest that this site fits several of the criteria developed as indicators of fieldhouse use.

Expectation 1: Site Morphology and Composition

LA 65013 contains, at best, a single-room masonry structure of which little architectural debris remains. The structure is isolated, with no other contemporaneous structures nearby. It is hard to determine just how large this possible room was since only the southwest corner remains. We were also unable to determine whether an actual room or a simple masonry windbreak was represented. Thus, floor area dimensions are not complete, and cannot be compared to the mean floor area of contemporaneous rooms. In general, LA 65013 appears to fit most of the parameters of this expectation.

Expectation 2: Kivas

No kivas were present at LA 65013, and no evidence of features or artifacts with ritual functions were found. The site fits the parameters of this expectation.

Expectation 3: Site Location

The floodplain location of LA 65013 in Los Alamos Canyon would have been ideal for farming. Good, sandy soil occurs throughout the valley bottom, and water for agricultural purposes was available in Totavi Creek. Thus, potential field areas were all around and in direct line of sight of the FH site. This type of location fits the parameters of this expectation.

Expectation 4: Range of Activities

The artifacts recovered from this site fit the model for day-use activities. Most of the sherds are from one or two Sapawe Micaceous Washboard jars. Thus, very few pottery vessels seem to have been used here, and those that were present probably functioned as storage vessels, either for food or water.

Quite a few chipped stone artifacts were recovered, but most were debris from core reduction activities. Only four formal tools were found, two of which (hammerstones) were probably also used in core reduction. Evidence of informal tool use was found on a fairly large proportion of the debitage (4.3 percent), and mostly suggested use for cutting or scraping medium hard to hard materials. No ground stone artifacts were found. All in all, even though more artifacts were recovered than expected, a rather limited range of activities is indicated. Pottery was probably used for the storage or transport of food, while chipped stone tools seem to have functioned in the maintenance or production of wooden implements. The veritable lack of food processing equipment suggests that this activity was performed elsewhere.

Architecture at LA 65013 was insubstantial. Not enough stone was present to suggest full-height walls, and it is possible that the superstructure was jacal, the structure was a ramada with low walls, or a simple stone masonry windbreak is represented. Trash deposits were shallow or surficial, and no formal midden area was defined. LA 65013 appears to fit the parameters of this expectation.

Expectation 5: Pattern of Use

LA 65013 could have functioned in at least two of the use patterns outlined above. It could have functioned as a day-use structure with limited night-time use during the period of crop ripening. It could also have been used by travelers throughout the year, but this is impossible to determine since this form of occupation is not represented by distinctive artifacts or features. It is doubtful that LA 65013 functioned as a farmstead, with continual use by an entire family during the growing season. Neither the artifact assemblage nor the architectural remains and array of features present at the site support this type of use. The probable pattern of use for LA 65013 fits the parameters of this expectation.

Summary

The FH site contains a single structure of uncertain dimensions, and it appears to have lacked full-height walls as well as a formal floor and internal heating or storage features. No evidence of ritual activity was found, and the structure was situated in direct line of sight of potential farm lands. When compared with residential sites, a limited range of activities was performed and food processing tools (particularly ground stone) are conspicuously absent from the assemblage. There is no evidence for use on a permanent or even seasonal basis. Thus, LA 65013 seems to have been used on a daily basis, with limited overnight stays. A few ephemeral hearths were found, all outside the structure. This lack of internal heating features suggests use during the warm season, when crops would be growing. Thus, LA 65013 seems to fit all of our expectations for fieldhouse use, and there does not appear to be any possibility that it was used on a more permanent basis.

Discussion

LA 65013 is 2.9 km southwest of the village of Perage, which is considered ancestral to San Ildefonso Pueblo, situated directly across the Rio Grande. This is the nearest large Classic period village to LA 65013, and both sites were occupied during the middle to late Classic period (A.D. 1400 to 1600). Thus, it is feasible that LA 65013 was used by residents of that village. The relationship of fieldhouses to larger aggregated communities in terms of size and distance has been the focus of recent research by the Bandelier Archaeological Survey in an area 19 km southwest of LA 65013 (Orcutt 1990b). These data can be used to help determine the potential relationship between LA 65013 and Perage or San Ildefonso.

Fieldhouses on the mesas and in the canyons of the Pajarito Plateau have received a lot of recent attention (Kohler 1990, 1992a, 1992b; Orcutt 1990a, 1990b, 1991; Preucel 1990; and Van Zandt 1993). Fieldhouses were situated between 200 m and 6.5 km from communities in that area (Orcutt 1990a). Those that were harder to reach because of topography or distance were substantially larger than fieldhouses built for a short-lived occupation and within close proximity of the main village. During the development of large aggregated villages there seems to have been movement afoot within communities to transfer and allocate land and assert ownership (Van Zandt 1993). If LA 65013 was indeed a fieldhouse for Perage, the 2.9 km distance could be walked in an hour or less. When compared with survey results from the Pajarito Plateau, substantial architecture was unnecessary at LA 65013 because it was relatively near the main village and access was not difficult.

One possible function of fieldhouses was to claim territory or a specific field area (Kohler 1992a; Preucel 1990; Wilcox 1983; Van Zandt 1993). Fieldhouses could have been built before an area became a field, and may have outlasted the life of adjacent fields. These types of fieldhouses would have received little use and should contain few archaeologically visible features and artifacts, especially sherds. During periods of population growth and related competition for farm land, fieldhouses may have been used to mark territorial claims (Kohler 1992a). Besides functioning to mark claims to farm lands, fieldhouses also helped minimize transportation costs between village and fields (Preucel 1990).

Fieldhouses located on prime agricultural land may have been built more substantially to visually verify claims on that land (Kohler 1992a). Van Zandt (1993:17-18) has outlined four reasons to expect increased architectural investment in some fieldhouses after aggregation: (1) Fieldhouses on the best agricultural land may be more substantially built in order to visually establish claims to that land (Kohler 1992a). The great increase in the number of fieldhouses and the ratio of fieldhouses to habitations in the Classic period indicates that fieldhouses became more and more important in land-use patterns. (2) Fieldhouses, in general, and those on the best land in particular, may be more substantial because the builders anticipated repeated reuse of the site (Kent 1992). (3) Fieldhouses near the boundaries of community territories may have had greater architectural investment in order to signal territory ownership to members of other communities. (4) More fieldhouses may have been built of shaped stone because of the increased availability of materials from abandoned habitations.

Kohler (1992a) notes that fieldhouses in the Dolores area that contained few sherds were located where soils were less productive, implying a shorter use-life for the field and its associated fieldhouse. Conversely, more sherds were found at fieldhouses located in areas containing better soils, indicating a heavier use of the field and its associated fieldhouse. LA 65013 contained comparatively few ceramics, suggesting it had a short use-life.

The median size of refuse scatters at nonhabitation sites found at Bandelier varied from 200 to 800 sq m between the early and late Classic period. The refuse area at LA 65013 encompassed 1,140 sq m, and was slightly larger than those found at Bandelier. Indeed, the size of the artifact scatter associated with LA 65013 was closer to the median scatter size for nonhabitation sites than for habitation sites recorded during that survey (2,400 to 10,200 sq m). However, it is often difficult to compare survey and excavation results. When LA 65013 was initially recorded the size of the associated scatter was calculated at only 255 sq m, which is well within the parameters of the Bandelier study. Thus, the larger size of the scatter during excavation may simply be a function of a greater investment of time in surface examination.

A fieldhouse dating to the early Classic period in the Jemez Mountains was strikingly similar to LA 65013 (Gauthier and Elliot 1989). It contained a masonry wall with too little rubble in the associated mound to account for full height walls, suggesting that the upper walls were constructed of perishable materials. Like Structure 1 at LA 65013, its walls appeared to be dry-laid masonry with no evidence of mortar. Other similarities include its small size (3.12 sq m) and unprepared floor. The only substantial difference between these sites is that the example from the Jemez Mountains had an internal hearth. That may be accounted for by colder nights at higher elevations, which may have required an internal heating feature.

Fieldhouses investigated during the Eastern Interconnection Project between Albuquerque and Santa Fe were considered expedient structures that exhibited little evidence of prolonged or repeated occupation (Harlan et al. 1986:47). Inhabited on a short-term basis, they usually consisted of perishable architectural features such as ramadas, brush wind screens, and stone foundations for jacal walls. Some or all of the four small stains that contained rocks and aligned with the fieldhouse at LA 65013 may represent the remains of an associated architectural ramada or wind screen built of perishable materials, though this could not be determined for certain.

Architectural evidence for seasonality of residence sheds more light on the structural remains at LA 65013. Architectural sites in the Cochiti study area were examined in terms of use as cold or warm weather residences, or for prolonged bulk storage (Biella 1979). Warm weather structures had exterior facilities such as hearths or bins that indicate routine performance of outdoor activities, and evidence of ramadas, open-sided rooms, or rooms with dry-laid masonry walls that contained hearths. Most of the 15 Classic period one-room sites recorded in the Cochiti study area were masonry surface rooms built of unshaped dry-laid stones. Ten of the structures had large boulders incorporated into their walls, and all 15 lacked formal floors. Using these parameters, LA 65013 appears to have been occupied during the warm season. It lacks substantial architecture and a formal floor, and had exterior hearths denoting the performance of activities outside the field structure.

The Classic period settlement system in the Cochiti study area was:

> . . . characterized by a distinct shift toward a large site or village-based residential strategy, concomitant with contemporaneous occupation of small one and two room sites distributed throughout the landscape. . . . The overall change in regional adaptive behavior was extremely abrupt, beginning as early as ca. A.D. 1325 or 1350 and continuing as the dominant pattern of settlement and land use until ca. 1525. (Chapman and Biella 1979:393)

Population density had increased significantly for nearly 150 years before this period, which in turn exerted considerable stress on the food production capacity of the system. The construction of LA 65013 may have been prompted by this type of stress, and this and other similar sites may have been used as claim markers by the residents of large villages in the area, like Perage Pueblo.

Other excavations at Cochiti Reservoir defined small sites or fieldhouses as one- to three-room structures (Hubbell and Traylor 1982). Most of the sites examined by this study dated to the Classic period. Six Glaze I sites and one late Santa Fe Black-on-white site conformed to their fieldhouse parameters. All were located on level, presumably arable land and lacked large numbers of artifacts. Most of these sites were quite substantial when compared with LA 65013. Architectural features included interior bins, hard-packed floors, entryway/door sills, portions of intact walls, and remnants of roofing material. No similar features were found at LA 65013, which more closely resembles ramadas found in association with two-room masonry structures in Hubbell and Traylor's (1982) study.

Sebastian (1983) conducted a study aimed at understanding the structural and associated remains of three site types: habitation, fieldhouse, and gathering/hunting camps. Through studies of ethnographic groups living in similar environments, expectations for the types of sites that would be found and their associated remains were established. The term fieldhouse, as a morphological category, covers a wide variety of architectural types ranging from multiple-room masonry structures to half-walls with ramada-like superstructures, ramadas, lean-tos, stacked-brush shades, or the simple shelter of a convenient tree or tall bush (Sebastian 1983).

Sebastian (1983) suggests that a fieldhouse used on a daily basis should contain an ephemeral shelter and a small amount of trash, since there would be no cooking of meals or performance of domestic activities. Ethnographic data show that the only items brought to these day-use shelters were agricultural tools, prepared foods, and water. Thus, the archaeological remains at these sites would include jar sherds, remains of agricultural tools, and possibly a few expedient chipped stone tools for the maintenance or production of farming equipment. A continual use pattern would produce a more substantial structure, a greater amount of trash, and evidence of a wider variety of activities. Since LA 65013 rather closely follows the ethnographic pattern of fieldhouses established by Sebastian (1983), it most likely functioned in that capacity.

Conclusions

Structural and assemblage evidence from LA 65013 suggests that this site served as a fieldhouse with a use type falling somewhere between the day-use and continual-use patterns. It was located a relatively short distance from Perage, which is presumed to be the associated main village, and that distance could easily have been covered at the beginning and end of a day's labor. The presence of at least one extramural hearth represents a slight increase in the amount of use the site experienced over a simple day-use pattern. However, this type of feature might be expected if there were occasional overnight stays.

LA 65013 could possibly fit B. Moore's (1978) sporadically used fieldhouse model that characterizes these structures as being used when fields and crops required attention. Archaeologically, these sites are similar to those used on a daily basis, and contain a small amount of domestic trash. Sporadically used fieldhouses could have been used on a daily basis and perhaps for occasional overnight stays, with prepared foods being carried in and little domestic trash produced (B. Moore 1978; Sebastian 1983:407).

A late-season pattern of fieldhouse use involves occupation mostly as the crop approaches maturity and during and shortly following the harvest (B. Moore 1978). During most of the growing season, fields situated away from the village could be tended during daily visits, and it was not necessary for anyone to remain with them overnight. However, as crops reached maturity and during the harvest a constant watch requiring overnight stays might have been required. Ethnographic evidence of this pattern is provided by Cushing (1920) for Zuni, who observed fires burning at most fieldhouses at night as children and old men remained near the fields to protect ripening crops from predators. Ethnographic studies of the Shonto Navajo demonstrate a similar pattern, with young children or elderly persons assigned to guard the crops (Russell 1978). While these types of individuals might not have been able to work the fields, they were capable of scaring predators off.

Preucel (1990) studied the role of Pajarito Plateau fieldhouses in the seasonal agricultural cycle, and suggests that inhabitants of a village would travel farther to secure farmland as the local population grew. Seasonal residence possibly developed as a result of claiming the best farm land (Preucel 1990). He found that, over time, distance between seasonal sites and villages increased. This recognizes the speed at which the best arable lands were being claimed and utilized. Late Coalition period fieldhouses were located an average of 1.62 km from their villages, which represents a slight increase over the distance separating villages and fieldhouses during the early Coalition period (Preucel 1990). By the early Classic period, this distance had increased to 2.28 km, and by the middle Classic period fieldhouses averaged 2.55 km away from villages (Preucel 1990). LA 65013 seems to fit this pattern. It was used during the middle or late Classic period, and is 2.9 km distant from the nearest village of the same age, Perage.

In general then, the FH site fits our model of a Pueblo fieldhouse as defined earlier in this chapter. It has the proper size, lacks any evidence of ritual features, is situated among suitable farmlands, reflects a limited range of activities, evidences a limited pattern of use, and is properly configured for warm-season use. Its close proximity to the large village of Perage indicates that it could have been reached on a daily basis when necessary. The site may have been most heavily used during the late part of the growing season when fields and mature crops needed the most attention. The relatively small associated assemblage of artifacts suggests that the site was used on a daily basis, with agricultural tools and foods being carried to the fieldhouse rather than manufactured or prepared there. The presence of one or more extramural hearths suggests that the structure was sometimes occupied overnight, and that food may have been prepared for consumption at those times. For the most part, however, it is likely that the small structure at LA 65013 served more as a shady resting place for tired farmers than a temporary residence.

CHAPTER 15. CONCLUSIONS AND RECOMMENDATIONS

James L. Moore

Goals of the Study

The ultimate goals for this study were set at two levels. First, the sites were to be examined as individual entities using research designs developed in the data recovery plan submitted for the project (J. Moore 1989). This goal was attained in the preceding chapters. Data recovered from each site have been examined, they have been compared to the expectations of the plan, conclusions concerning dates and types of occupations have been developed, and the specific questions asked for each site have been answered as best they could.

The second goal is more abstract and has not yet been addressed. That goal was presented in the introduction to the study, and was stated as a question:

> What can these sites tell us about patterns of use of this area during three different periods? Were there any similarities among these sites or did varying social, economic, and political characteristics result in different patterns of use?

In essence, the ultimate goal of this study is definition of changes in land-use patterns through time and how they relate to social, economic, and political systems. Examining this question can be both simple and difficult. The three sites excavated in Los Alamos Canyon can be viewed as representative of the economic and cultural systems that created them. As such, we can view our sites as exemplifying three cultural systems that used the same area at different times, and compare each of the patterns of use demonstrated by those remains. This would provide a rather simplistic view.

The difficulties arise when we recall that, rather than representing an independent entity, each site was part of a settlement system that contained other site types and complex relationships with other cultural groups. Of necessity, analysis at this level remains rather abstract. We do not have data on the entire settlement system that prevailed during the periods of occupation represented by our sites. Even using information from other studies will probably fail to illuminate complete systems. Thus, we cannot currently address this aspect of the question to our complete satisfaction.

While we may not be able to completely address the general question posed in the introduction, we can at least examine it in a simplistic manner. The more difficult aspects of the question may have to be left to future researchers who have a better grasp on regional settlement and subsistence systems through time in northern New Mexico. However, we will endeavor to begin examining this aspect of the question as far as the current limits of data will allow us. Before proceeding to a comparison of our sites, we summarize our findings.

A Summary of the Results of This Investigation

The Pedro Sánchez Site–LA 65005

While excavations were more limited in extent at this site than at the others, a wealth of documentary information exists that enabled us to examine LA 65005 at a level of detail that was not possible for the earlier sites. Excavation at LA 65005 focused on a deposit of trash in what appears to have been an abandoned gully. Several features exist outside project limits but could not be examined in detail. They include two probable trash-filled pits and what appear to be the remains of a stone foundation. The nature of the trash deposits in addition to the presence of a probable house foundation indicate that this was a residential site.

Documentary information strongly suggests that this site was related to a grant made in 1742 to Pedro Sánchez, the son of Pedro Sánchez de Iñigo. The latter was born in New Mexico before the Pueblo Revolt and returned with Vargas during the 1693 Spanish reoccupation of the province. The younger Pedro was born shortly before the Pueblo Rebellion of 1696, and was fortunate to survive since his mother and siblings were killed at San Ildefonso during the early days of that insurrection. LA 65005 is the location of the rancho and corral of Pedro Sánchez, as alluded to in several documents associated with a lawsuit filed by San Ildefonso Pueblo in 1763, alleging that several Spaniards were encroaching on their grant. The lawsuit was settled in 1765, and the Sánchez Grant was found to illegally encroach on Pueblo lands. Since the rancho appears to have been abandoned by 1763, we have a firm occupational span of 1742 to 1763.

The documented date of occupation for this site is critical because it is at odds with dates provided by pottery analysis. Examination of this problem concluded that the documentary date is the more accurate, and called into question dates traditionally assigned to several pottery types in the historic Tewa polychrome series. Analysis of the overall site assemblage found that it fits well with other Spanish sites dating to the late Spanish Colonial period (1696 to 1821), and not with those dating to the period before the Pueblo Revolt of 1680. Thus, this analysis corroborated our conclusions concerning the dating of the site.

The occupational type represented by these remains was difficult to determine. The main residence of the Sánchez family was in Santa Cruz de la Cañada near modern Española. This may indicate that LA 65005 represents a temporarily occupied residence, used when someone was tending livestock that the family kept on the grant. However, it was also discovered that Pedro's son Francisco consolidated his claim to the grant in 1749, even though Pedro was still alive. This suggested that Pedro had moved on (and this appears to be part of his pattern of short-term grant use and then abandonment), and left the grant to his children. In this case, it is also possible that the rancho represented the full-time residence of Francisco Sánchez and his family. This seems rather unlikely, however, since the site appears to have been abandoned by 1763 and there were no statements in associated documents that would have suggested this was the case. Thus, LA 65005 probably represents a limited occupation site associated with the pastoral use of this area.

Few Euroamerican artifacts were found in this assemblage. For the most part, cultural remains consist of pottery made at nearby Pueblo villages and chipped stone artifacts. Many of the latter demonstrate use in fire-making toolkits, but wear patterns on some chipped stone artifacts suggest they were used as substitutes for expensive metal tools in other production or maintenance tasks.

The San Ildefonso Springs Site–LA 65006

Our most extensive excavations were conducted at this site, which contained evidence of multiple periods of occupation. Late Archaic remains were visible in buried strata and occasionally in eroded parts of the site; in the latter case they are often overlain by a veneer of later materials. Classic period Pueblo and early twentieth-century remains were visible on the site surface, but were mostly outside project limits. The only exception to this was a hearth that was radiocarbon dated to the Pueblo occupation and a few sherds that were most likely contemporaneous. While chipped stone artifacts attributable to the Pueblo occupation were also present on the lower terrace, they were inextricably mixed with Late Archaic materials that were exposed by deflation.

Thus, of the three temporal components evident at LA 65006, only the Archaic occupations could be examined in detail. Three periods of Archaic occupation were determined through analysis of stratigraphy, radiocarbon dates, and artifact distributions. The earliest Archaic occupation seems to have occurred between ca. 1429 and 1053 B.C. According to the sequence developed by Irwin-Williams (1973) for north-central New Mexico, this use probably occurred during the Armijo phase. The second occupation occurred between ca. 1150 and 800 B.C. This range of dates falls at the end of the Armijo phase, and considering the probability of old wood use, could also reflect use during the early En Medio or Basketmaker II phase. No dates were obtained for the third occupation, but its position in the stratigraphic sequence suggests that it too represents a late Armijo or early En Medio phase use.

Component 1. The earliest occupation of LA 65006 that we have evidence for was also the most extensive, both in terms of area and number of recovered artifacts. Analysis of features, artifacts, and site structure suggest that this component represents a single occupational episode that occurred during the late summer or fall. While evidence of the processing and consumption of both large and small game animals as well as vegetal materials was found, the main activity reflected by this occupation was the manufacture of large bifaces.

Site structure analysis suggested that the use of space during this occupation had both formal and informal aspects. The formal aspect was the central location of a probable sleeping area demarcated by the presence of two hearths and a surrounding zone that was nearly devoid of artifacts. These hearths also contained fewer economic plant remains than others used during this occupation, which potentially suggests that their main use may have been for something other than food preparation.

Activity areas were found to the south, southwest, and north of the central sleeping area, and contained a jumble of materials from several different activities. While it is possible that other activity areas existed to the east of the sleeping area, this was not substantiated by augering and no excavations were conducted in that area. Analysis of the activity areas suggested that they represent loci where several tasks were accomplished. Hearths served as the centers of activity loci, and probably provided heat and light as well as cooking facilities. The manufacture of large bifaces occurred adjacent to hearths and was well patterned in most cases. Production of large amounts of sharp chipped stone debris in activity areas probably led to their abandonment, with tasks shifting to areas that were clear of debris. Older activity areas may then have served as loci for trash disposal. Biface manufacture in the new task loci led to the generation of more chipped stone debris, and they too were abandoned.

Activity areas may have shifted around much of the circumference of the site in this way until the occupying group moved on. Thus, the presence of multiple hearths and activity areas does not necessarily reflect group size or occupational duration. In fact, it is likely that this occupation reflects use by a single nuclear or extended family for a period of days rather than weeks.

Components 2 and 3. These components both contain considerably fewer artifacts than Component 1, and could not be subjected to a similar level of analysis. Thus, we know less about how these uses of the site were configured. In some ways, site use during these occupations was similar to Component 1. Floral data suggest occupation during the late summer or fall, and analysis of chipped stone artifacts showed that the production of large bifaces was also important during these periods of use. One of the greatest differences between these assemblages was in the amount of exotic materials represented. While exotics are common in all three occupations, Component 3 contains a much smaller percentage than the others. This could reflect directionality of movement, with the occupants of Components 1 and 2 moving away from the Jemez Mountains and the occupants of Component 3 moving in that direction. Unfortunately, this is impossible to determine with the data that are currently available.

However, there were also important differences between the occupations, even allowing for variation in data recovered. In particular, the types and sizes of features varied between Component 1 and Components 2 and 3. No evidence of a structure was found in Component 1, though the presence of an ephemeral shelter was postulated. Hearths tended to be small and shallow. While a great amount of debris was generated by this occupation, the data suggested that it was related to a single use by a small group of people. In contrast, possible structural remains or formal middens were encountered in Components 2 and 3, and the hearths found in Component 2 were much larger than those in Component 1. These features are more consistent with camps that were occupied for comparatively lengthy periods, or reoccupied in different years with earlier structures used for trash disposal.

In this case, artifact density and numbers are not a good reflection of occupational longevity. Component 1 reflects a main function as a workshop in which large bifaces were made for transport elsewhere. Whether that was to a winter camp in a zone lacking suitable materials for chipping or was in preparation for a seasonal switch from a foraging to a logistical subsistence system cannot be determined from a single site alone. However, either is feasible. It is likely that partly reduced obsidian cores or large flakes were obtained in the Jemez Mountains and transported to this location for manufacture into large bifaces. Whether procurement of those materials was embedded in other activities or was a separate logistical activity also cannot be determined from this single site. Again, either is possible. While bifaces were being manufactured, an array of other tasks including (probably) the procurement, processing, and consumption of floral and faunal foods; and wooden/bone tool manufacture or maintenance were also being accomplished.

Both later Archaic occupations (Components 2 and 3) seem to reflect longer periods of use that did not generate nearly as many artifacts as did the earliest component. In part, this may be due to the excavation of smaller areas for both of these occupations. However, it is also likely that while biface manufacture was important during those later uses, it was not a primary site function as it was in Component 1.

Whether these differences reflect major changes in the settlement and subsistence system between the Armijo phase and the early En Medio phase is uncertain. Of equal likelihood is the possibility that these differences simply reflect variation in the way this area was used. Pollen analysis indicated a general long-term warming and drying trend through the Late Archaic, which appears to have been interrupted by three periods of greater stability. Perhaps the later occupations reflect longer periods of use that were required by generally drier conditions. But then again, the Rio Grande is less than 2 km away, so this possibility does not make much sense. It may be that the periods of occupation were related to steady or increased flow of the nearby spring during periods of relative environmental stability. In that case, variation in the types of camps reflected may be evidence of actual changes in the settlement and subsistence pattern. Rather than switching to a logistically based system in the late fall or winter, the population may have been doing so by the late summer/early fall season during the later occupations.

The FH Site–LA 65013

While the possible structural remains and all visible features were excavated at this site, the area investigated was small when compared with LA 65006. However, the results of excavation were more easily comparable to the questions posed in the research design. LA 65013 closely fit the predicted pattern for a fieldhouse. Though no absolute dates were obtained for this site, associated ceramics suggest occupation during the Classic period, between ca. A.D. 1350 and 1550.

The type of structure present at this site was difficult to determine. The amount of rubble in the structural mound was not sufficient for full height walls, only a single corner was well preserved, and there was no evidence of a formal floor or foundation. If the structure consisted of a single room with a jacal superstructure, the nearby hearth and possible ash pit were probably interior features. However, the configuration and size of the cobble mound were not consistent with this possibility. Instead, it is more likely that the structural remains represent a low windbreak that was perhaps partly roofed to form a shelter from the sun. In this case the hearth and possible ash pit were extramural features.

Despite a rather large chipped stone assemblage for a site of this type, few activities other than lithic reduction were actually reflected. Other than a chopper, a hammerstone, and an early stage biface, only informal tools were found. The hammerstone was probably used for chipped stone reduction, and the chopper reflects an expediently manufactured formal tool. The biface was probably made elsewhere and transported to this location. The remaining array of tools suggests that tools associated with farming were either made or maintained at the site.

While this site was probably used repeatedly during one or more growing seasons, the number and extent of activities conducted there appear to have been quite limited. No residential function was evident, and it is likely that stays at this location were limited to overnight rather than intensive use during part or all of the growing season.

Comparison of the Sites

Five separate occupations are represented among the three sites investigated by this project. On the surface, they all represent similar uses of the area, though for quite variable purposes. If our interpretation of the Pedro Sánchez site is correct, all five occupations suggest temporary use of the area, and none are indicative of long-term residence in Los Alamos Canyon.

However, the area was used for different purposes during each occupational period. Temporary residence is indicated for the Late Archaic occupations, though differences were noted between the earliest occupation and the two later uses. Temporary use during the growing season is suggested for the Classic period remains, with adjacent areas being used as fields. Temporary use is also suggested for the Spanish Colonial remains, though the area was probably used for pastoral rather than agricultural purposes during this period. However, duration of the Spanish Colonial period uses was probably much longer than during the earlier occupations, and it is possible that one or more people were resident at the site for lengthy periods to tend livestock.

By simply examining these three sites, the Los Alamos Canyon area does not seem to have been used as a locus of primary occupation. While the Archaic components are indicative of residential use, those camps were not used for long periods of time and can be classified as limited base camps. Similarly, while the Spanish Colonial occupation was comparatively long term and may have involved long stays at the site, a residential site occupied by an entire family does not appear to be indicated. Thus, all of the occupations represented in our sites are rather transitory in nature, and suggest use of this area as a resource procurement zone rather than a long-term residential locality.

However, with other data added to the picture, a slightly different view emerges. Survey and testing prior to data recovery provided information on a larger array of sites (Moore and Levine 1987; J. Moore 1993), as do a few other projects from the general area (Biella 1992; Lent 1991; J. Moore 1990; Sullivan and Lent 1987; Wiseman 1987).

Archaic Occupation

Archaic use of Los Alamos Canyon seems mostly restricted to short-term residential sites, as suggested by data recovery. A projectile point indicative of Middle Archaic use was found at LA 65020 during survey, but all other diagnostics from this period suggest Late Archaic use during the Armijo and En Medio phases. Thus, it is possible that expanding populations during the Late Archaic made this upland zone an attractive location for camps, particularly during the late summer and early fall. Surface (and in some cases subsurface) indications suggest that mostly foraging sites are indicated, though possible logistical base camps are suggested for the En Medio occupations at the San Ildefonso Springs site.

The presence of numerous quarry sites in the canyon suggest that one of the resources extracted during the Archaic was raw materials for chipped stone reduction. Unfortunately, temporally diagnostic materials are lacking at these sites, and it is likely that they were used during multiple periods. Thus, we can assume that they were used during the Archaic, but cannot demonstrate the validity of this possibility. On the other hand, the presence of moderate percentages of materials procured from local gravel deposits at LA 65006, which were also used for biface production, shows that some local quarrying did occur.

Archaic sites used for comparatively long-term residence do not seem to occur in the canyon. However, excavation at LA 51912 several kilometers south of the Rio Grande along NM 502 suggests that this type of site does occur in the region. That site contained an En Medio phase structure and associated activity area, and appears to reflect a comparatively long-term use. It is also possible that similarly long-term occupations are reflected by the Component 2 and 3 remains at LA 65006, but that erosion has eradicated most evidence of this type of use.

If these components represent comparatively long-term occupations there may have been a more intensive use of the canyon for residential purposes during the En Medio phase. The occurrence of possible structural remains at a site adjacent to a spring suggests that the presence of a dependable water supply may have contributed to this type of use. However, the evidence currently available suggests that any residential use longer than a few days to weeks probably did not occur until the latter part of the Late Archaic period.

Pueblo Occupation

Los Alamos Canyon abuts the edge of the Pajarito Plateau, an area that remained mostly unoccupied during the early part of the Pueblo period. The Pajarito Plateau was not used for residence by Pueblo peoples until late in the Developmental period (Orcutt 1991). The population remained rather small in this area until the late Coalition period, when larger communities containing plaza-type or U-shaped villages were built (Crown et al. 1996). The Pajarito Plateau was again depopulated by the end of the Classic period, and most villages were abandoned by 1550, though a few held on until ca. 1600 (Orcutt 1991:316).

No evidence for use of Los Alamos Canyon before the Classic period was found during any of the various projects conducted in association with highway reconstruction. However, the presence of Developmental period remains at a small pithouse site on the west side of the Rio Grande across from San Ildefonso attest to an earlier Pueblo use of the general area (J. Moore 1990).

Several types of Classic period sites were found in Los Alamos Canyon. For the most part, they consist of artifact scatters and farming features. Artifact scatters may reflect use of the canyon as a foraging zone during the Classic period. However, it is more likely that they are the remains of fieldhouses that lack surface evidence of structures or contained ephemeral shelters that have completely deteriorated. Definite farming sites include areas containing water and soil control features (including gravel mulched fields) and fieldhouses. A small residential site containing perhaps five to seven rooms is located on a terrace top above and northwest of San Ildefonso Spring. Wiseman (1987) also found a small Classic period residential site during survey of an adjacent part of NM 502, but that structure is on the mesa top above the canyon.

Thus, there appears to have been very limited use of the canyon rim for residence during the Classic period, but the canyon bottom and low terraces along Totavi Creek appear to have functioned as a farming and resource extraction zone. Residence in that area seems to have been limited to the temporary use of fieldhouses during the farming season, and the Pueblo people who farmed in Los Alamos Canyon actually lived elsewhere. The Classic period village of Perage has been suggested as the probable main residence for those people. Tsankawi is also fairly near, but is sufficiently distant from our sites to suggest that they were not related.

Spanish Colonial Occupation

Use of the canyon during this period is fairly easy to discern. Only one site dating to the Spanish Colonial period was found, and it appears to represent a limited pastoral use of the canyon. While the site may have been occupied by one or more people for extended periods of time, it does not seem to have served as a family residence. Pertinent documents indicate that both the Sánchez family and the people of San Ildefonso Pueblo regarded Los Alamos Canyon as a livestock grazing zone. There is no evidence that the Sánchezes attempted to farm the area, and most of San Ildefonso's fields appear to have been adjacent to the Rio Grande at this time.

The main residence of the Sánchez family was at Santa Cruz de la Cañada near modern Española. Historic evidence suggests that Pueblo villages like San Ildefonso were probably not using fieldhouses or farmsteads during this period. The nearly continual threat of hostile Plains or Apache Indian attack simply made the use of these types of temporary residences too dangerous. Most fields were probably near enough the village so that farmers could quickly retreat when the situation warranted.

The Spanish residential pattern was different from that of the Pueblos during this period, and in many ways was somewhat more dangerous. Though residence in fortified plazas was the safest and often mandated pattern, many Spaniards continued to live on isolated ranchos. This pattern is evident in the nearby Chama Valley (Moore et al. n.d.). While the Sánchez Grant seems to have served in a pastoral capacity, a structure was probably necessary for several reasons. In particular, it was desirable to have one or more persons nearby while livestock was grazing on the grant to prevent their theft. At other times, such as when livestock were giving birth, it was probably necessary to remain on the grant for extended periods. In both cases, a nearby residence would be desirable if not necessary.

Conclusions and Recommendations

In a sense, our sites reflect the use of Los Alamos Canyon for residential purposes from the Late Archaic through the Spanish Colonial periods. In other ways, however, they reflect temporary nonresidential use. At this point, the argument becomes one of semantics. What constitutes a residential site? Is it a location where people once lived, no matter how long the duration of stay, or is it a place where people lived continuously for a long period of time? And what about group size? Do residential sites have to have been occupied by entire family groups, or does residence by a task-specific group also count? While a comprehensive answer to this question is not possible here, it is sufficient to say that there is a wide range of sites that can be considered residences of one sort or another.

Our sites reflect only temporary residential occupations of Los Alamos Canyon, and at least four different patterns of use are represented. Two patterns of Archaic use are represented by three components at LA 65006. The earliest use of that site is associated with a foraging pattern of subsistence, and represents a short-term occupation by a family group. Though the main activity reflected by these remains is the manufacture of large bifaces for use elsewhere, an array of other subsistence and manufacture/maintenance tasks were accomplished at the same time.

The two later components at LA 65006 are a bit more difficult to interpret, since erosion has damaged associated features and the arrays of cultural materials recovered were much smaller than in Component 1. However, differences in types and sizes of features between these occupations and Component 1 are evidence that a different type of occupation is represented. Components 2 and 3 could represent logistical base camps, perhaps occupied on more than one occasion by the same group. They could also be the remains of multiseason residences associated with a focus on farming by En Medio phase peoples. However, no evidence for such a function was recovered during data recovery, so the first possibility remains the most likely.

LA 65013 was a different type of residence. The remains at this site suggest use as a fieldhouse associated with a nearby village, probably Perage. It is likely that LA 65013 was mostly used on a daily basis by farmers while resting from their labors or eating a meal. However, the presence of at least one hearth may indicate some overnight stays, perhaps near or during the harvest season to protect crops from herbivore predation.

Still another type of residential pattern is represented by LA 65005. We were unfortunately not able to investigate the structural remains at this site, and since they were badly damaged during construction of an underground pipeline we could not even assess their surface expression. However, contemporary documents indicate that this was the location of a rancho built by the Sánchez family when they held a large grant of land west of San Ildefonso. Unfortunately, no detailed description could be located, so we do not know how substantial the structure was. Residence at this site was probably sporadic, and mostly for the purpose of preventing a different kind of predation–theft of livestock.

Each of the components defined at these sites represents only a small part of the settlement system it belonged to. Each also represents a temporary or sporadic occupation of Los Alamos Canyon. Other than a small Classic period pueblo, no evidence of full-time residential use of this area exists before the modern period. In the time periods represented, Los Alamos Canyon appears to have been a place where resources were extracted but was not amenable to full-time occupancy.

With the publication of this report, data recovery at LA 65005, LA 65006, and LA 65013 is complete, as are the improvements to NM 502 that initiated this project. Very little remains of LA 65013 outside project limits–only a sparse scatter of a few chipped stone artifacts. However, much more of both LA 65005 and LA 65006 exist outside project boundaries. Should further improvements outside the right-of-way limits examined during this project be planned in those areas, further work will probably be necessary at the latter two sites. All artifacts, field notes, and photographs collected or generated during this project are curated at the Museum of New Mexico in Santa Fe.

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