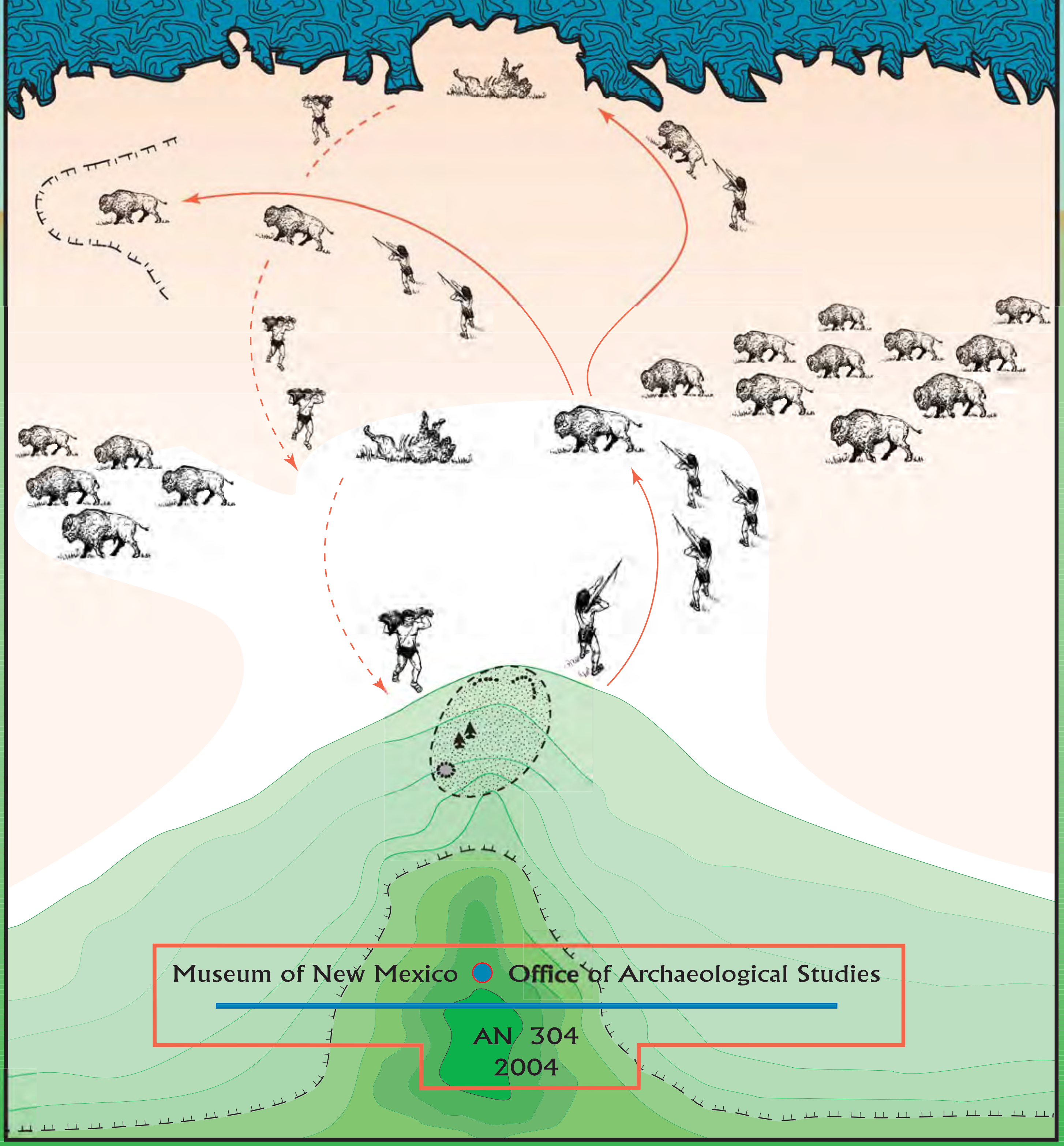
# A Good Place to Hunt

## Data Recovery and Site Stabilization at the La Vega Site (LA 9075), Cibola County, New Mexico

by
Stephen C. Lentz



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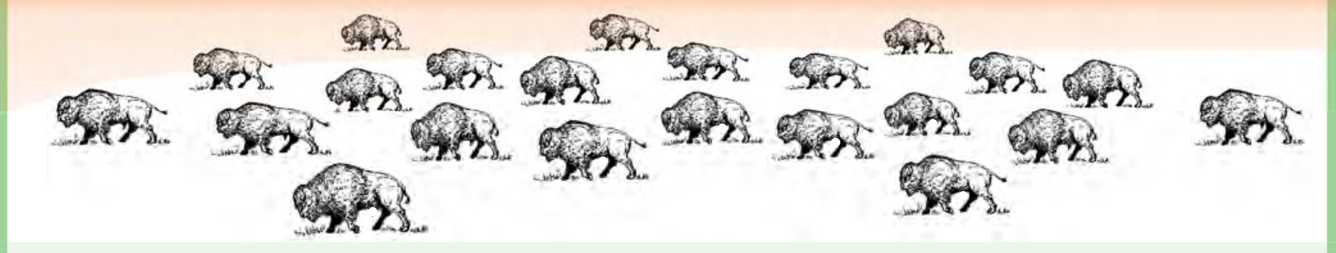

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BY

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# ADMINISTRATIVE SUMMARY

Between July 10 and August 19, 2000, the Archaeological Site Stabilization and Preservation Project (ASSAPP), Office of Archaeological Studies (OAS), Museum of New Mexico, conducted a site-stabilization program at LA 9075 (the La Vega site), a large multicomponent site along NM 53 in Cibola County, New Mexico, on private lands and highway right-of-way.

Subsequent to shoulder construction and improvement by the NMSHTD along NM 53, additional cultural resources were exposed within the Museum's project area. The OAS/ASSAPP program identified five major areas within the highway right-of-way at LA 9075 where cultural resources were threatened by erosion. These areas were targeted for stabilization. In conjunction with the NMSHTD, District 6, the OAS conducted a data-recovery program on the affected areas before stabilizing the site.

NMSHTD Project No. TPE-7700 (14), CN 9163
MNM Project No. 41.596 (Archaeological Site Stabilization and Protection Project)
CPRC Permit No. SE-159

Submitted in fulfillment of Joint Powers Agreement J0089-95 between the New Mexico State Highway and Transportation Department and the Office of Archaeological Studies, Museum of New Mexico.

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CHAPTER 1

# INTRODUCTION

The Environmental Section of the New Mexico State Highway and Transportation Department (NMSHTD) authorized the Archaeological Site Protection and Preservation Project (ASSAPP), Office of Archaeological Studies (OAS), Museum of New Mexico, to conduct a data-recovery and site-stabilization program at LA 9075 (the La Vega site) on NM 53 in Cibola County, NM, on private lands and NMSHTD easement (Fig. 1 and Appendix 6).

Work was performed in compliance with Section 106 of the National Historic Preservation Act (36 CFR 800), Executive Order 11593 (1972), and the National Environmental Policy Act of 1969 (91 Stat 852). LA 9075 is not listed on the *State Register of Cultural Properties* or the *National Register of Historic Places*, but may be eligible for inclusion in both of these lists on the basis of criterion D (34 CFR 60.4).

Funding for this project was provided through the Enhancement Program of the Intermodal Surface Transportation Efficiency Act of 1991 (NMSHTD Contract J00089; Project No. TPE-7700(14); MNM Project No. 41.596). Properties have been included in the ASSAPP based on recommendations from NMSHTD staff, land management agencies, and the public. Each property has been visited to determine if it qualifies for protection under applicable state or federal laws, and to determine whether any factors affecting preservation are within the control and responsibility of the NMSHTD. The ASSAPP is intended to deal with sites that pose ongoing problems and which are not part of planned construction or improvement projects. Treatment of cultural properties that are part of planned construction projects are coordinated through the normal NMSHTD environmental evaluation procedures.

LA 9075 underwent a program of data recovery in 1986 by the Research Section of the Laboratory of Anthropology, Museum of New Mexico, under the direction of Richard B. Sullivan. Sullivan's work was performed under contract with the NMSHTD (Project No. SP-ETS-1301(202) F00490).

On July 7, 1996, Dean Wilson of the OAS reported abundant cultural materials remaining within the right-of-way. The site was revisited by Stephen Lentz and John Ware of the OAS/ASSAPP on September 9, 1997. On July 1, 1999, Dorothy Zamora and Stephen C. Lentz, under the State of New Mexico Blanket Permit (Annual Survey Permit No. 99-027), conducted 35 auger tests within the right-of-way to determine the extent of subsurface deposition (NMCRIS No. 55173). It was concluded that cultural deposition did in fact exist up to 1.5 m below ground surface. On July 15, 1999, the OAS returned to transit-map the site and identify sensitive areas that had not been investigated. On December 1, 1999, Yvonne Oakes (principal investigator) and Stephen Lentz (project director) identified specific areas within the right-of-way in which cultural materials were destabilized through erosion. This report presents the results of that data recovery plan, the stabilization measures taken, and synthesizes data from past projects at LA 9075.

The Endangered Sites data recovery and stabilization project took place between July 10 and August 19, 2000, and is documented in this report. The crew consisted of Phil Alldritt and Dorothy Zamora (to whom I am indebted for their help in deciphering, organizing and presenting the lithic artifact data), and Stephen Lentz. My thanks to Jeff Boyer and to Richard Sullivan for their impressions of a site that has long since faded from normal human memory. I would also like to extend my appreciation to Yvonne Oakes and Pete Brown for their trenchant editing, and to Rob Turner for his fine graphics. —*SCL*

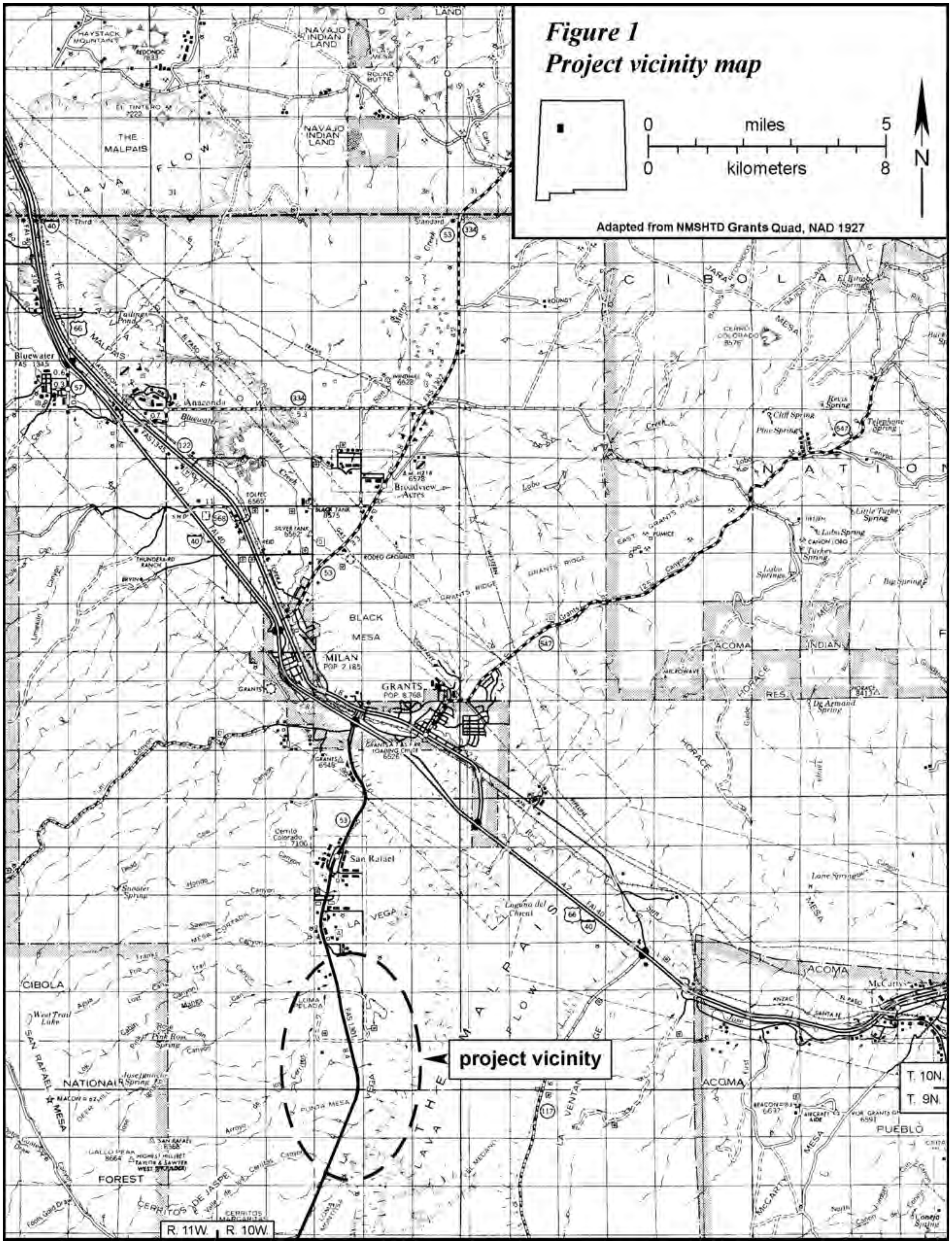


***Figure 1***
***Project vicinity map***

CHAPTER 2

# ENVIRONMENT

LA 9075 (the La Vega site) lies on a slightly sloping plain dominated by desert scrub. Lying to the north, east, and south of the project area is a sandstone/conglomerate outcrop rising 27 m (89 feet) above the road. Plant species found on this outcrop include one-seed juniper, some piñon, scrub oak, and various understory species. To the east is flat grassland known locally as La Vega (Spanish for pasture or meadow), which ranges from 1500 to 3700 m (5000 to 12,000 feet) wide in the site area, and is bordered to the east by malpais (recent vesicular basalt flow). Outside the right-of-way, west, southwest, and north of the site are limestone outcrops of the San Andres formation that contain nodules of Fingerprint chert. Numerous chert quarries in the outcrops indicate that this area is the primary source of the lithic raw material found at the site.

The project site is located in a physically and topographically diverse area called the Acoma culture province. As defined by Dittert (1959), the province is surrounded by Mt. Taylor to the north, the North Plains to the south, the Zuni Mountains to the west, and the Rio Puerco to the east. Cebolleta Mesa lies at the southeast boundary of the Colorado Plateau. The project area is characterized by two distinct geologic features: the McCarthy's lava flow to the west, and the Jurassic sandstone cliffs to the east. The McCarty's basalt is a relatively young flow (late Pleistocene). The source of this extrusion is a small lava cone 32 to 40 km (20 to 25 miles) southwest of Interstate 40; the lava flows northeast to the San Jose Valley, and eastward down a broad valley. The Malpais region was created by the lava flowing from this same source, southwestward for 9.7 km (6 miles) (Nichols 1946).

Cebolleta Mesa is more than 2,590 m (8,500 feet) above sea level and capped with a basaltic lava that extruded during the Ortiz geological period. Erosion has carved out this mesa from the original Ortiz surface, exposing strata that include the Mesaverde formation (just under the basalt cap) to the Mancos formation, Dakotas sandstone, Morrison formation, Todilto limestone, Wingate sandstone, and Chinle formation (Dittert 1959).

In general, the soils of the area can be classified in the Rockland-Travessilla association. These soils are widely distributed between the lava beds and the Rio Puerco. Both soil types occur on steep slopes on the sides of mesas or rolling upland areas and mesa tops. Rockland soils are shallow and rocky with small pockets of moderately deep to deep deposits on the escarpments in flatter areas (Maker et al. 1974). Travessilla soils are characterized by a fine sandy loam or stony fine sandy loam underlain by sandstone. The Penistaja, a deep, well-drained soil found in this association, occurs on the crests and side slopes of upland ridges and on alluvial fans. Small areas of unclassified alluvial soils also feature in the Rockland-Travessilla association. These deep alluvial soils occupy nearly level to gently sloping landscapes in narrow valley bottoms (Maker et al. 1974).

Soils in an area along the southern one-third of the McCarty's lava flow can be classified in the Lohmiller-San Mateo association. This association is located primarily in valley bottoms and on the floodplains and terraces along intermittent drainages. These gently sloping soils form in alluvium and derive from sedimentary formation. Today, plots of land in the Lohmiller-San Mateo association are under irrigation in the vicinity of Acoma, Laguna, and Cebolleta.

The project area characteristically falls within a semiarid climate; annual precipitation received in the general area is 12 to 17 inches (30 to 43 cm), but may be greater due to the orographic effect of Cebolleta Mesa, which lies in the path of major storms coming from the southwest or northeast (Beal 1976). Modern records for the area show a peak in moisture during July, August, and September. Nearly half of the average precipitation falls during this time as the result of brief thunderstorms. The rest of the annual precipitation falls from May to October, the warmer months of the year (Maker et al. 1974). The annual frost-free season for the project area fluctuates between 114 and 175 days, depending on the elevation and side of the mesa. Air temperature exhibits few extremes; afternoon solar radiation causes maximum temperatures to be higher on the west and south flanks of the mesa slopes (Tuan et al. 1973). The average temperature ranges between 33 degrees F (1 degree C) in January to 82 degrees F (28 degrees C) in July.

Vegetation in the project area is typical of the upper division of the Upper Sonoran Zone. The open valley bottom region (the lower division of the zone) is scattered with grasses, cacti, yucca, and low desert shrubs; vegetation in the upper division is piñon-juniper (Dittert 1959). The vegetation observed in the project area includes juniper, piñon, cholla, saltbrush, snakeweed, chamisa, blue grama grass, Indian rice grass, and various composite grasses.

CHAPTER 3

# PREVIOUS WORK

In 1882, A. F. Bandelier visited the study area. As part of his reconnaissance from McCarty to Zuni, in particular the Las Ventanas and Cebolleta canyons adjacent to the project area, he described large prehistoric sites along the edge of the Malpais. In 1913, Cebolleta Canyon was investigated by F. W. Hodge and J. L. Nusbaum, who conducted a small survey and performed minimal excavations. About the same time, N. C. Nelson was in the Los Pilares area, where he made a series of sherd collections used by Spier in his Zuni chronological studies. Between Nelson's visit in the early 1900s and 1948, when Dittert and Ruppé started their work in the Acoma and Cebolleta regions, archaeological work in the area was limited to surveys by Mera and Stubbs, and excavations of a few rooms by Simmons (Dittert 1959).

The first known investigation of LA 9075 was by Victor B. Brown, a local collector who reported the site to Stewart Peckham of the Museum of New Mexico. Peckham subsequently visited and recorded the site in 1969. Brown's collection (excluding the complete projectile points) was loaned to Peckham for analysis. The site was later tested by John Speth (Sullivan 1987:5) of the University of Michigan, who collected the surface assemblage from the Paleoindian component of the site and turned the collection over to the Museum of New Mexico in Santa Fe. Speth also reported that, in subsurface testing of the Paleoindian component, cultural remains were limited to 5 to 10 cm below the modern ground surface.

A site-file search at the Archeological Records Management Section (ARMS) revealed that extensive archaeological work has been conducted in and around the project area since the late 1970s. Large projects in the area have been conducted by Beal (1976), Broster (1982), Groody (1982, 1987), Clifton (1982, 1984), Amsden (1989), and Doleman (1990). The interested reader is referred to these reports for a more comprehensive discussion of the archaeology of the area.

The original State of New Mexico Archaeological Sites Inventory Form (1969) records the site size as 150 by 150 m. Multiple components were also recorded. Among the diagnostic artifacts recorded are Folsom points, Archaic Pinto-like points (Oshara Tradition, Bajada, and San Jose phases), Archaic Lobo points, Archaic Oshara Tradition points, Pueblo points, drills, gravers, microblades, bifaces, numerous flake tools, basin metates, and one-hand manos.

LA 9075 underwent a program of data recovery in 1986 by the Research Section, Laboratory of Anthropology, Museum of New Mexico, under the direction of Richard B. Sullivan. The results of that project are included in this report. On July 7, 1996, Dean Wilson of the OAS reported that abundant cultural materials were still present within the right-of-way. The site was revisited by Stephen Lentz and John Ware of the OAS/ASSAPP on September 9, 1997. On July 1, 1999, Dorothy Zamora and Stephen C. Lentz conducted 35 auger tests within the right-of-way to determine the extent of subsurface deposition (NMCRIS No. 55173). It was concluded that cultural deposition did in fact exist up to 1.5 m below ground surface. On December 1, 1999, Yvonne Oakes (principal investigator) and Stephen Lentz (project director) identified specific areas within the right-of-way in which cultural materials had been destabilized by erosion. On July 15, 1999, the OAS returned to transit-map the site and identify sensitive areas that had not been investigated.

## Traditional Cultural Properties Consultation

On June 17, 1999, revised regulations (36 CFR 800) governing Section 106 were implemented. The revisions call for expanded requirements for tribal consultations and participation. The NMSHTD currently operates according to a substitution agreement between the Advisory Council on Historic Preservation and the New Mexico State Historic Preservation Officer under 36 CFR 800.7.

The OAS/ASSAPP project area is on private land and NMSHTD right-of-way; it is not on land managed by the Bureau of Indian Affairs or any Indian tribe, nation, or pueblo. In the capacity of "interested party," the OAS/ASSAPP contacted five Native American groups to determine if there were any TCP concerns: Acoma, Laguna, Hopi, and Zuni Pueblos, and the Navajo Nation. No concerns were expressed by any of these Native American groups, and the project was fielded on July 10, 2000.

CHAPTER 4

# CULTURAL OVERVIEW

LA 9075 is a large multicomponent site dating between the Paleoindian period (9000 B.C.) and turn-of-the-century Euroamerican times.

## Paleoindian Period

As reported by Peckham and Speth (Sullivan 1987:7), a large Folsom component was present at LA 9075. Most of the Folsom period surface assemblage remaining after Brown's collection was recovered during Speth's field testing and given to the Museum of New Mexico for curation. Peckham also received a large collection of fragmentary Folsom points and associated artifacts from a local collector. Paleoindian materials were also recovered within the NMSHTD right-of-way during Sullivan's (1987) project.

Three major subdivisions of Paleoindian adaptation have been proposed, based primarily on the presence of diagnostic projectile point types: Clovis (10,000 to 9000 B.C.), Folsom (9000 to 8000 B.C.), and the terminal Paleoindian phase, which incorporates a number of distinctive technological traditions, including the Agate Basin (8300 to 8000 B.C.) and the Cody Complexes (6600 to 6000 B.C.) (Irwin-Williams and Haynes 1970; Judge 1973).

The recovery of Paleoindian artifacts in association with extinct forms of post-Pleistocene megafauna initially led to the conclusion that Paleoindian groups subsisted primarily on big-game hunting. In the study area, Folsom period occupations occurred during a time of decreased relative moisture; consequently, sites are close to major water resources. Irwin-Williams and Haynes (1970) suggest that, from Folsom times onward, late Paleoindian adaptive strategies centered on bison ecology, which involved bands of hunters following small, seasonally migrating herds.

While it is true that Clovis and Folsom materials have been found in association with extinct species of mammoth and bison, it is also believed that wild plants and small game animals formed an important component of the resource base. Few of these items, however, have been documented in the archaeological record. This has led to the hypothesis that there may have been a return to a more generalized hunting strategy during post-Folsom and terminal Paleoindian times, as evidenced by the use of less specialized projectile points (Tainter and Gillio 1980; Cordell 1984; Judge 1973, 1974, 1979).

## Archaic Period

The extent of the Archaic component at LA 9075 is not known, but at least a portion of the original Archaic cultural material is extant. During Sullivan's (1987) project, Archaic materials (including projectile points) were found in association with features within the NMSHTD right-of-way.

The Archaic component at LA 9075 consists of artifacts associated with the northern Oshara Tradition, specifically the Jay, Bajada, San Jose, and Armijo phases (Irwin-Williams 1973). The Oshara tradition was defined on the basis of excavation and survey carried out in the Arroyo Cuervo area of north-central New Mexico. Many sites of this tradition are found in areas of northwest and north-central New Mexico, south-central Colorado, and southeast Utah. The following is a brief summary of Archaic phases believed to be represented within the right-of-way, as derived from Irwin-Williams (1973) and Tainter and Gillio (1980).

### *Jay Phase*

The Jay phase (5500 to 4800 B.C.) corresponds with a period of decreased effective moisture occurring at the end of the Pleistocene. Sites typically consist of small base camps and isolated quarrying and hunting locales. The majority of the sites of this phase are situated in sheet sand deposits on cliff tops, in canyon head complexes, near playas, and on low sloping mesas. Excluding the Arroyo Cuervo region, two types of Jay phase sites have been found: hunting camps, and quarry-workshops near basalt outcrops. The Jay phase tool kit includes relatively large projectile points with small shoulders, usually made from basalt, and well-made bifacial knives and side scrapers. Milling equipment is absent.

*Bajada Phase*

The Bajada phase (4800 to 3000 B.C.) saw decreased effective moisture, and a slightly higher population. Settlement patterns are similar to the preceding Jay phase: sites occur in sheet sand atop cliffs, in canyon head complexes, on low sloping mesas, and near ephemeral ponds. Site types include base camps, foraging camps (usually within 8 km, or 5 miles, of a base camp), quarries, and isolated hunting sites. The Bajada tool kit includes projectile points that are slightly shouldered, and basally thinned with basal indentations. The kit also includes rare bifacial knives, large chopping tools, and flaked side scrapers.

*San Jose Phase*

The San Jose phase (3000 to 1800 B.C.) saw increased effective moisture, and is characterized by a settlement pattern similar to that of the Bajada phase: an increase in the number of sites, temporary structures, and large earth ovens filled with fire-cracked rock. Site types include base camps (more extensive than in the Bajada phase), specialized hunting sites, foraging sites, and quarries. The San Jose tool kit includes projectile points similar to those of the Bajada period but with marked serration. Shallow basin grinding slabs and simple cobble manos indicate an increase in the utilization of seeds and nuts (possibly related to a population increase). Also included in the tool kit are side scrapers, heavy choppers, and an occasional biface.

*Armijo Phase*

The Armijo phase (1800 to 800 B.C.) is characterized by a settlement pattern similar to those of preceding phases. There is also evidence of seasonal patterns of population aggregation, and of limited cultivation of maize near canyon head springs. Effective moisture fluctuates during this period; the overall amount is generally less than in the San Jose phase. Site types generally follow those of the preceding phases. The tool kit includes projectile points similar to the serrated San Jose style, but with the addition of short expanding stems (early variety) or side notching, with concave or straight bases. Other artifacts include small bifaces, flake scrapers, drills, and choppers.

*En Medio Phase*

The En Medio phase (800 B.C. to A.D. 400) marks the end of the Archaic sequence, and is usually viewed as a local manifestation of Basketmaker II. It is characterized by a full range of residential aggregations, shallow pit structures and above-ground structures, extended base camps, and logistical and special use sites. An increased reliance on cultigens appears to characterize the final stages. A distinctive, palmate shaped, corner-notched projectile point occurs as isolated occurrences and on sites.

## The Pueblo Period

The first important chronological framework for the Pueblo sequence of the Southwest was developed by Alfred V. Kidder (1927). It was expected to be useful for the entire Southwest as it was then understood archaeologically, but eventually it was agreed that it was applicable only to the Anasazi culture, particularly as it occurred along the San Juan drainage. The Pecos Classification was a simple division of the total span of the Anasazi culture into temporal units based primarily on architecture and pottery, since tree-ring dating had not yet been developed.

The following time periods were defined by Kidder (1927): Basketmaker II (A.D. 1 to 500) was agricultural, aceramic, and atlatl-using. Basketmaker III (A.D. 500 to 700) was characterized by pit-structure construction, pottery making (plain and decorated), and the introduction of the bow and arrow in the later stages. Pueblo I (A.D. 700 to 900) was marked by vessel neck corrugation, cranial deformation, and above-ground rectilinear masonry pueblos. In Pueblo II (A.D. 900 to 1100) there was widespread geographical population dispersal into small villages, and wide use of corrugated pottery. Pueblo III (A.D. 1100 to 1300) saw the development and elaboration of material culture, intensive local specialization, and the growth of large communities. During Pueblo IV (A.D. 1300 to 1400), there was a general contraction of occupied areas, and the gradual disappearance of corrugated wares. Finally, during Pueblo V (A.D. 1400 to 1600) the entire prehistoric system was irrevocably altered by the arrival of Spanish colonizers.

In the late 1940s and early 1950s, Alfred Dittert and Reynold Ruppé established a local prehistoric cultural and temporal sequence for the Cebolleta Mesa region. The project area is on the western fringe of this area, paralleling the McCarty's Lava flow, which makes up the northwestern boundary of the region. For heuristic purposes, LA 9075 is included in this cultural classification rather than in the Cibolan tradition, although the site may lay on the boundary of both culture groups, and, therefore, belong to a "frontier" area. It is likely that more research is needed before LA 9075 can be classified with certainty as belonging in either of these temporal schemes. The site does, however, fall within the geographical boundaries of the Acoma Area as defined by Dittert (1959). Moreover, at least two of the Pueblo structures at LA 9075 fall within Dittert and Ruppé's classification of Red Mesa phase sites; that is, a linear masonry roomblock situated on a low bench at the side of a canyon with Socorro Black-on-white pottery.

To summarize, Dittert (1959) and Ruppé (1953) developed a framework of eight ceramic groups and corresponding phases. Table 1 shows the Cebolleta Mesa ceramic cultural sequence and its relationship to Kidder's Pueblo Classification.

**Table 1. The Cebolleta Mesa ceramic cultural sequence.**

| Cultural Phase | Dates (A.D.) | Pecos Classification |
|---|---|---|
| White Mound | 700-800 | Basketmaker III |
| Kiatuthlanna | 800-870 | Pueblo I |
| Red Mesa | 870-950 | early Pueblo II |
| Cebolleta | 950-1100 | Pueblo II |
| Pilares | 1100-1200 | Pueblo III |
| Kowina | 1200-1400 | Pueblo III to Pueblo IV |
| Cubero | 1400-1600 | late Pueblo IV |
| Acoma | 1600-present | Pueblo V |

Source: Dittert 1959; Ruppé 1953.

*White Mound Phase (A.D. 700 to 800)*

White Mound phase sites are found in all topographic situations, but primarily on low benches that border drainages in the upper ends of canyons, on the southwest-facing slopes of large mesas, and in higher sand hills (Dittert 1959:523). Architecturally, this phase was characterized by pithouses accompanied by small surface structures. White Mound Black-on-white and Lino Gray are the dominant local ceramic types.

*Kiatuthlanna Phase (A.D. 800 to 870)*

Sites of the Kiatuthlanna phase are on secondary benches, mesa tops, and on the sandy slopes of tributary drainages. Some shelters were built against low cliffs in these tributaries. Pithouses were the dominant architectural form in the earlier period. Later, jacal surface structures came to be used more frequently, with crescentic structures built in a crescentic plan. Coursed masonry sandstone was used as foundations. Kiatuthlanna Black-on-white is the dominant pottery type, with Kana'a Gray and intrusive brown wares.

*Red Mesa Phase (A.D. 870 to 950)*

During the red Mesa phase, site locations concentrate on points above where the main canyons constrict. The typical settlement pattern is for sites to be situated on a low knoll or bench along the eastern or southern sides of a canyon. Other small units continue to be built against low cliffs in small, tributary canyons.

Dwellings were built of jacal walls with sandstone slab facings, or of other temporary materials. Later in the period, full-height walls of masonry blocks were built. Village form ranged from straight rows of rooms, sometimes two tiers deep, to L-shaped, to crescentic. Ruppé (1953:117) sees this architectural variability as evidence of site unit intrusion, probably from immigrant Mogollon groups.

The dominant pottery type for this period is Red Mesa Black-on-white, Socorro Black-on-white, Kana'a Gray, and Exuberant Corrugated.

*Cebolleta Phase (A.D. 950 to 1100)*

This period saw settlement of upland mountain meadows, flat-topped mesas, and canyon mouths. Architecturally, many sites consist of blocks of contiguous rooms with consistent north-south alignment. Plazas and kivas are generally on the east side. D-shaped rows of rooms are oriented to the north or east. Jacal structures are still used. Ruppé (1953: 120-126) believes that the Cebolleta phase witnessed considerable Mogollon intrusion, based on the occurrence of brown wares. Cebolleta Black-on-white is the dominant pottery type, with some Socorro Black-on-white and intrusive Mogollon and Cibolan wares.

*Pilares Phase (A.D. 1100 to 1200)*

During the Pilares phase, sites tend to shift from higher topographic situations to the mouths of canyons or to the eastern edge of the Northern Plains, with access to arable land. Towards the end of the phase, there was a settlement shift to flat-topped mesas. There is a marked decrease in the number of intrusive ceramic types, which suggests a de-emphasis on external trade relations, or demographic saturation.

Cebolleta Black-on-white, Tularosa Black-on-white, Socorro Black-on-white, St. Johns Polychrome, Pilares Banded, and Los Lunas Smudged characterize the ceramic assemblage from this period.

**Table 2. Significant dates in Pueblo-Spaniard relations.**

| | |
|---|---|
| 1535 | Cabeza de Vaca learns of Rio Grande pueblos. |
| 1540-1542 | Coronado expedition into New Mexico. |
| 1581 | Chamuscado-Rodríguez expedition. |
| 1582 | Espejo expedition. |
| 1598 | Oñate's colony of San Gabriel founded at San Juan Pueblo. |
| 1600 | Siege of Acoma. |
| 1610 | Pedro de Peralta moves capital to Santa Fe. |
| 1630 | Father Benavides reports on conditions among the Pueblos. |
| 1680 | Pueblo Revolt. |
| 1681-1682 | Otermín's attempted reconquest; burns all pueblos south of Cochiti. |
| 1692 | Vargas's Reconquest. |
| 1696 | Second revolt of the Pueblos. |

### *Kowina Phase (A.D. 1200-1400)*

The Kowina phase was a period of major cultural change, as indicated by the increase of large sites situated on flat-topped mesas and in upper wooded areas. The lowlands appear to have been exploited only seasonally. The beginning of the Kowina phase is marked by population aggregation into large villages of up to 300 rooms. Great kivas are present during this period. Except for the seasonal sites, the Cebolleta Mesa appears to have been abandoned at this time. Concomitantly, the areas around Acoma and the Rio San Jose show sudden increases in population. Populations from the San Juan Basin, indicated by the presence of Mesa Verde Black-on-white pottery, may have also entered the area.

The dominant pottery types for the Kowina phase are Acoma and Tularosa varieties of Tularosa Black-on-white, Kowina Black-on-white, Kowina Indented, St. John's Polychrome, North Plains Black-on-red, North Plains Polychrome, Kowina Black-on-red and Polychrome, Pilares types, Pinnawa and Wallace polychromes, and a host of types form the western Mogollon highlands.

### *Cubero Phase (A.D. 1400 to 1600)*

The major settlement at this time was Acoma Pueblo. Small shelters were built against the low cliffs along the Rio San Jose. Some small settlements dating to this period have also been found overlooking confluences between the Rio San Jose and its tributaries.

The major pottery types for the Cubero phase were Pinnawa Glaze-on-white and Glaze-Polychrome, Kwakina Glaze-Polychrome, Acoma glaze wares, Northern Gray Corrugated, Kowina indented, indented brown wares, intrusive Matsaki Polychrome, and early Rio Grande glaze wares.

### *Acoma Phase (A.D. 1600 to Present)*

Settlement during this phase continued at Acoma Pueblo, with the maintenance of agricultural centers along the Rio San Jose. The dominant ceramic types for the Acoma phase were Hawikuh Glaze-on-red and Glaze Polychrome, Ashiwi Polychrome, and modern Acoma Polychromes. Zuni, Tewa, Laguna and Dinetah types show up as intrusives.

Sites of on the *National Register of Historic Places* in the vicinity of NM 53 include Kowina phase Cienega Ruins (LA 425, LA 426), Cebolleta Ruin (LA 424; late Pilares-Kowina), Pueblo de los Muertos (LA 5536, PII-PIV), and Gigantes Ruin (LA 1551; PIII-PIV).

## The Historic Period

Native groups underwent numerous changes in lifestyle, social organization, and religion after the Spanish settlement of New Mexico (Table 2). The introduction of new crops and livestock contributed to major changes in subsistence, as did mission programs, which taught new industries (Simmons 1979:181). Incursions by Plains groups caused the abandonment of many pueblos, and constricted the region they occupied (Chavez 1979; Schroeder 1979). During the centuries following Spanish colonization, several factors contributed to a significant decrease in pueblo populations (Dozier 1970; Eggan 1979): new diseases against which Pueblo people had no natural defenses, intermarriage, conflict arising from the Pueblo Revolt of A.D. 1680-1692, and the abandonment of traditional lifestyles.

With the goals of missionization, territorial expansion, and mineral wealth, the colonizing expedition of Don Juan de Oñate arrived at San Juan Pueblo (Oke Owinge) on July 11, 1598, and proclaimed it the capital of the province. Soon, New Mexico was divided into seven missionary districts.

The earliest record of European contact with local Pueblo groups in the area is in the early 1580s (Brugge 1983:491). In January 1599, in retaliation for the death of Juan de Zaldivar (one of Oñate's two nephews), 70 of Oñate's men attacked Acoma Pueblo. After a three-day battle, the Spanish troops prevailed. In retribution, 500 Acoma prisoners over the age of 25 had one foot severed and were sentenced to twenty years of hard labor in the mines of Zacatecas, Mexico. The Acoma women were forced into prostitution, and the remaining population over 12 years of age was enslaved (Spicer 1962:157). It was during that time that Oñate inscribed his name on Inscription Rock at El Morro.

In 1676, a series of events began that ultimately led to the Pueblo Revolt of 1680. Santa Fe was besieged by an alliance of Pueblo forces, and on August 21, 1680, Governor Otermín was forced to surrender and evacuate the city (Hackett 1942:56-57). The Pueblos held firm to their independence for 12 years. Taking advantage of inter-Pueblo factionalism, the definitive reconquest was initiated in 1692 by Don Diego de Vargas (Dozier 1970:61; Simmons 1979:186).

With the signing of the Treaty of Cordova on August 24, 1821, Mexico secured its independence from Spain, and New Mexico became part of the Mexican nation. That year brought the opening of the Santa Fe Trail, and expanded trade networks brought new settlers and goods for industrial manufacture. By the Treaty of Cordova, all Indians residing in New Mexico were granted full Mexican citizenship (Jenkins and Schroeder 1974:34-37).

Following the short-lived Mexican period, General Stephen Kearny accepted the surrender of Acting Governor Juan Bautista Vigil y Alaríd. The U.S. flag was run up over the Palace of the Governors in Santa Fe on August 18, 1846. By the Treaty of Guadalupe Hidalgo, which ended the Mexican War, United States dominion was established in New Mexico. In 1850, New Mexico was officially made a territory of the United States. During the Territorial period, under United States laws, Pueblo Indians were tacitly afforded the same rights as all U.S. citizens.

It is possible that some of the historic features recorded at LA 9075 are historic Navajo in origin. There is no consensus as to the date of arrival of the early Athapaskans. However, it is likely that early Navajo groups were north of the Navajo Reservoir District as early as A.D. 1400, and became visible by the 1480s (Ron Towner, pers. comm., 2002). Opinions vary as to when the Navajos entered the study area, but the first mention of groups who were apparently Navajo indicates the assignment of missionaries to the region "with indigenous peoples." Following the destruction of Acoma in 1599, old captives from Acoma were placed with the Navajo (Brugge 1983). In 1748, attempts to relocate Navajos who had settled at the base of Mt. Taylor at a mission in Cebolleta were unsuccessful due to the failure of the church to deliver promised supplies (Tainter and Gillio 1980:131). The Navajos farmed and herded sheep in the project area both before and after the Bosque Redondo phase (1868 to 1880), although there were many conflicts between the Lagunas and the U.S. military forces. After the 1930s stock reductions, substantial numbers of Navajos settled in Grants, and they now rely on the Euroamerican economy for subsistence.

Historic foundations were recorded within the project limits. This *rancho* may have its origins in the turn-of-the-century Hispanic pastoralist adaptations of the area. Since the introduction of sheep by Oñate's colonizing expedition, sheepherding has played an important role in the economy of the Hispanic people. In an effort to manage large herds, rich landowners *(ricos)* developed the *partidario* system, whereby sheep were lent to individual sheepherders, who undertook to return to the landowner an agreed number of lambs. Although this system potentially allowed individual sheepherders to start their own flocks and become independent, it usually led to perpetual debt and promoted an inequitable class system. After the reconquest (between 1692 and 1821), the Spanish government granted free title tracts of land to colonists to encourage resettlement of the New Mexico province. By 1696 northern New Mexico was reoccupied, and the Hispanic colonists lived on approximately 140 land grants. The pueblos were granted their own "Pueblo Leagues," but these were frequently encroached upon by the Spanish colonists, and later, Anglo-American settlers. Beginning in 1768, the Baca land grant was the primary Hispanic land grant in the area, although it was well known that the Baca family had encroached on land assigned to Laguna Pueblo. These lands were claimed by the Bacas until 1939 (Tainter and Gillio 1980:131).

The military post of Fort Cebolleta was established in 1850 and abandoned a year later, largely due to the desertion of its commanding officer. The first Fort Wingate was established in 1862 and abandoned in 1868. It was rebuilt at its current location as a munitions depot and a school. It is currently reverting from the Department of Defense to the Navajo Nation. The land on which LA 9075 is located is currently owned by the Mirabal family.

## CHAPTER 5

# FEATURE DESCRIPTIONS

Most information on features excavated during the La Vega 1986 season is incomplete. OAS staff have tried, largely unsuccessfully, to reconstruct missing data files (apparently misplaced by previous investigators). For this reason, this report includes only the data that could be extrapolated from the field notes, which provided in most cases only fractional descriptions. An attempt has been made, however, to include as much as could be resurrected, along with some *ex post facto* interpretations. In the feature descriptions, words or sentences in brackets [thus] are taken verbatim from notes compiled by Sullivan or his field crew.

Features were originally called "loci." After close examination, these appear indistinguishable from what are commonly defined as archaeological features. These features were also located according to a north-south grid system.

Although specific areas are illustrated on the site map (Fig. 2; in addition, a site overview is shown in Fig. 3), the grid system could not be reconstructed with the available information. Although grid coordinates are given in the field notes as locational information, they are omitted because they could not be referenced back to the map. Figure 4 shows Sullivan's (1987) distribution of Features 1 through 34 within the NMSHTD right-of-way at LA 9075.

**Feature 1** (2 m by 7 m) consists of an area of fire-cracked ground stone, fire-cracked rock, lithic artifacts, and historic purple glass. Apparently, some excavations were performed, but no record exists.

**Feature 2** (0.5 m by 0.5 m) has fragmentary ground stone and fire-cracked rock; it was outside of the right-of-way and was not tested.

**Feature 3** consists of a small concentration of fire-cracked ground stone (1.0 m by 0.5 m) and lithic artifacts. An area measuring approximately 20 square meters was surface stripped (Level 1), and yielded approximately 50 flakes. Level 2 (no depth given) had [30-40 flakes].

**Feature 4** is an area of fire-cracked rock, lithics and historic trash measuring 2 m by 4 m. Level 1 had approximately 20 flakes per square meter, and Level 2 (no depth given) had [30-40 flakes per square meter].

**Feature 5** is a concentration of fire-cracked rock and lithic artifacts in a 1-by-1-m area. There was an unspecified amount of flakes recovered from the surface (Level 1).

**Feature 6** is a mechanically disturbed charcoal-stained area about 50 cm in diameter. A [half-dozen flakes] were recovered from Level 1, and 10 or 12 flakes from Level 2 (no depths recorded). Apparently, this feature became a posthole of unknown temporal affiliation.

**Features 7, 8 and 9** were combined (possibly after excavation); each consisted of areas of what seem like fire-cracked rock and some lithic artifacts contained within a 5-m radius. Seven levels were excavated. Data are scanty and no depths are reported. According to Sullivan's field notes, Level 1 contained [sandstone and limestone rocks, and some lithic artifacts], Level 2 [some flakes], Level 3 [gravel lenses with angular chert and calcified chert cores], and Levels 4-7 [lithics mixed with gravels].

**Feature 10**, consisting of a scatter of fire-cracked rock and lithic artifacts, was excavated in two levels. No dimensions are available. In the first level, there was some fire-cracked rock, abundant lithic debris, ground stone, and a possible hearth composed of three or four large cobbles and a piece of ground stone. At Level 2, it was discovered that the "possible" hearth was not a feature at all. The rocks had disappeared, as had the charcoal and artifacts. There were still [many lithic artifacts].

**Feature 11** is a concentration of obsidian flakes in a 3-by-6 m area (Fig. 5). The artifact density is highest in the northern grids, and decreases towards the southern grids. It was excavated in three levels. A large metate was found at the base of Level 2 in the southern part of the feature. Several tools were present, including three Archaic points (one undetermined Archaic, one Bajada, one San Jose), a scraper, a graver, and a notched tool.

**Feature 12** consists of several pieces of fire-cracked rock in a 1-by-1-m area. Lithic artifacts are present. Two levels were excavated, and it was determined that the feature was surficial.

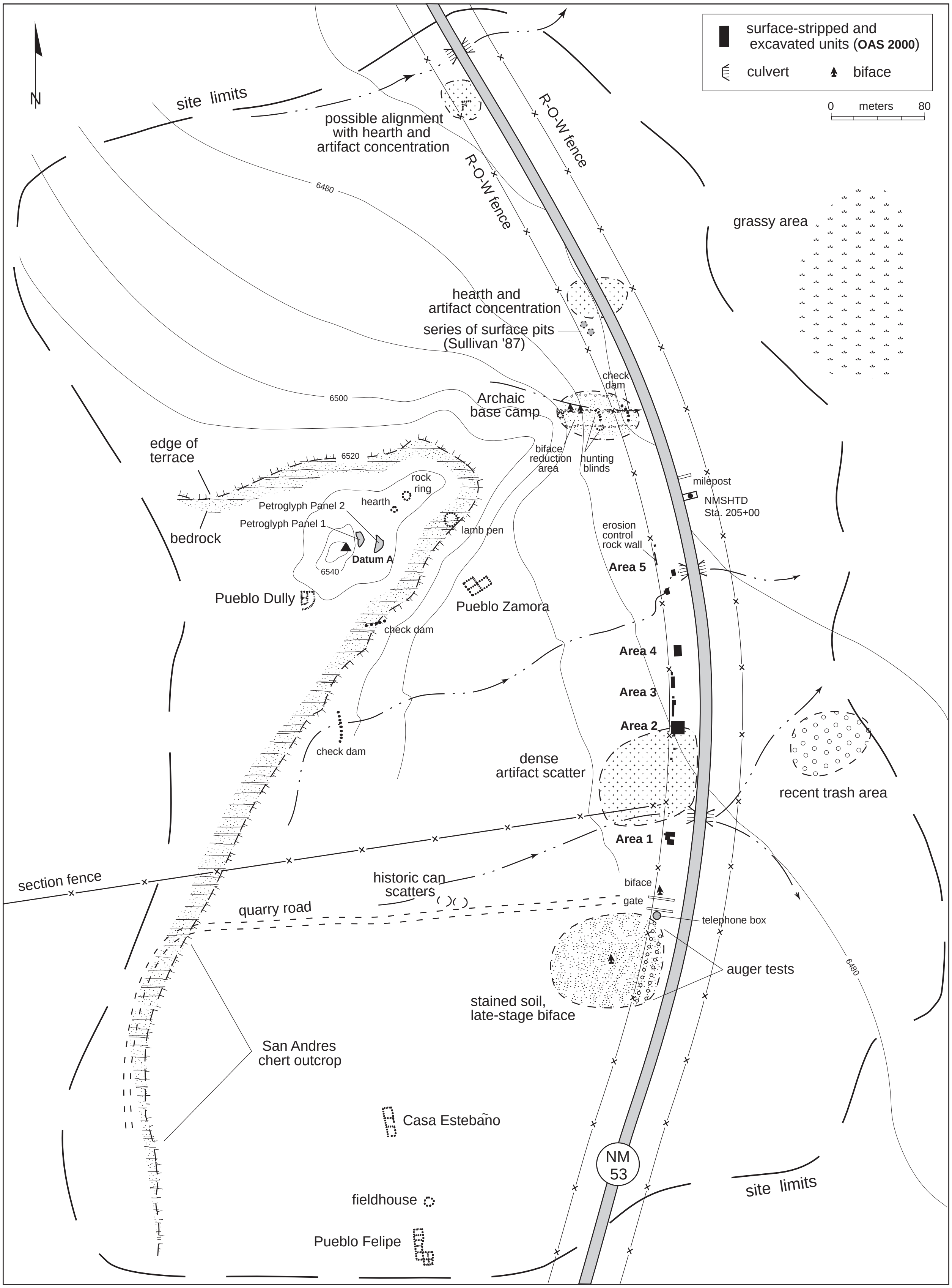


*Figure 2a. LA 9075 site map.*

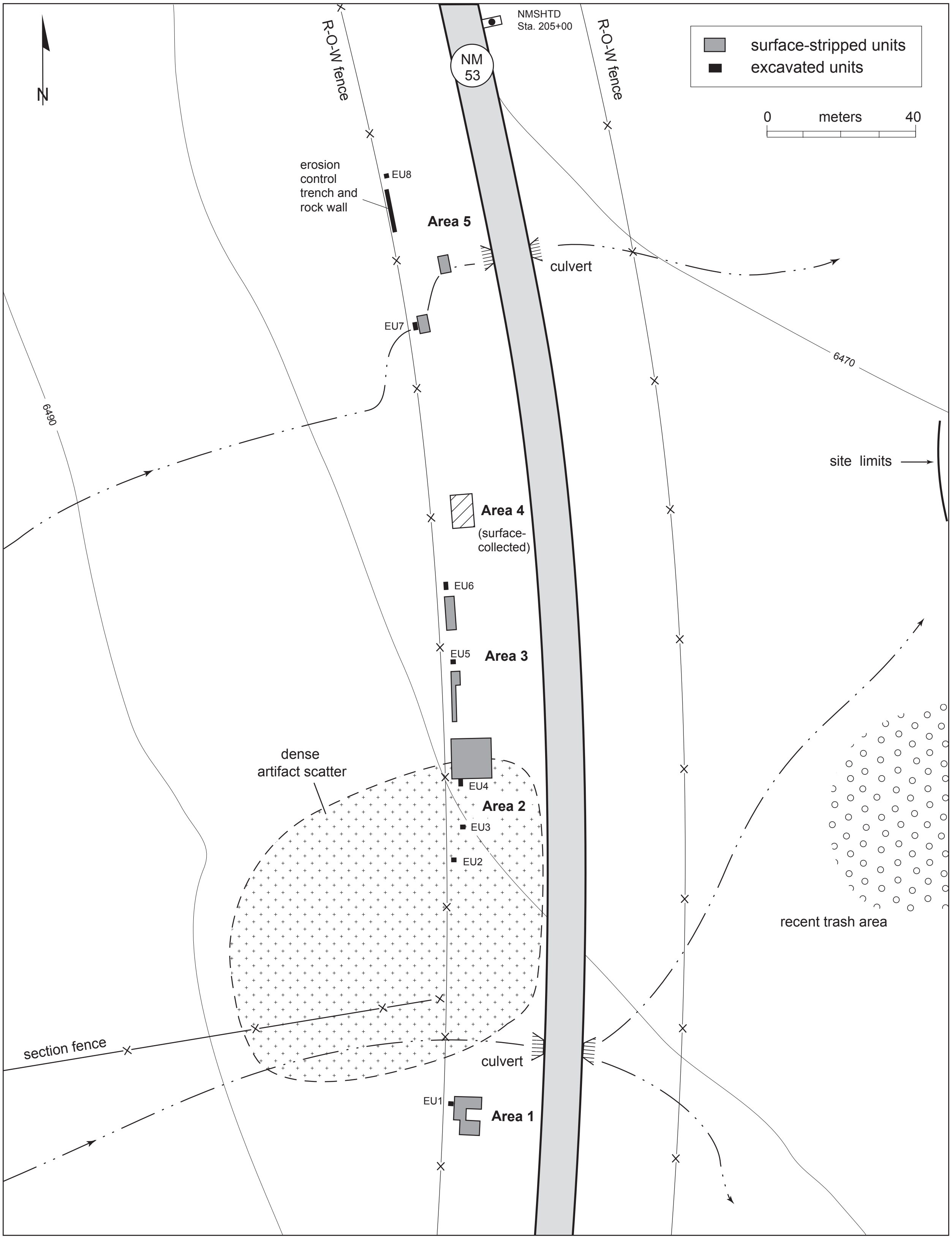


*Figure 2b. LA 9075 site map (detail).*

*Figure 3. Overview of La Vega with a view of Datum A, looking west from NM 53.*

**Feature 13** is a concentration of fire-cracked rock, fire-cracked ground stone, and lithic artifacts in an area of 10 square meters. Three levels were excavated, and yielded [one or two lithics] per level.

**Features 14 and 15** were apparently combined after excavation. They are described as two scatters of fire-cracked rock and lithic artifacts. Area 1 measures 1 m by 2 m, and Area 2 measures 3m by 3 m; they are separated by a distance of approximately 5 m. At some point, the rocks were interpreted as belonging to a [tipi ring], and there was [considerable charcoal staining]. After excavating one level, however, it was determined that the feature was not a tipi ring. A few lithic artifacts, ground stone, and a sherd were recovered.

**Feature 16** contains historic and prehistoric components in a 4-by-6-m area (Fig. 6). A possible rock alignment was uncovered along the western side of the excavated area at the bottom of Level 1. Also exposed in the north-central portion of the area was a possible burned posthole. Two additional (possible) burned postholes and a possible burned post were found at approximately 20 cmbd in grid 10N/11E. A thin, discontinuous ash stain was present throughout the northern two-thirds of the area, as were small areas of thin, packed soil (surface?). A possible exterior activity area might have been present in this feature. It was speculated that the posts, cobbles and surface/activity might have represented a structure. However, the architectural data were so ephemeral that the exact composition of this structure eluded definition. The recovery of a fragment of sheep shear suggests a historic function for this feature—either Navajo or Hispanic herding. However, other artifacts (a fragmentary mano, five metate fragments, a drill and a Jay phase Archaic projectile point) also suggest a prehistoric component.

**Feature 17** was originally interpreted as a concentration of fire-cracked rock in a 1-by-1-m area (Fig. 7), but when investigated was found to be a surficial collection of ten ground stone fragments from a single slab metate. The adjacent southern grid contained two mano fragments and a single white ware sherd, and a small proportion of lithic artifacts. It is remotely possible that this area may have once served as an activity area (milling) with a thermal feature.

**Feature 18** was originally described as a concentration of ground stone and lithic artifacts in a 1.5-by-2.5-m area (Fig. 8). Excavation exposed four additional ground stone fragments, one San Pedro projectile point, a core, lithic debitage and a shallow pit. The pit, which extended from the base of Level 2 into Level 3, was 65

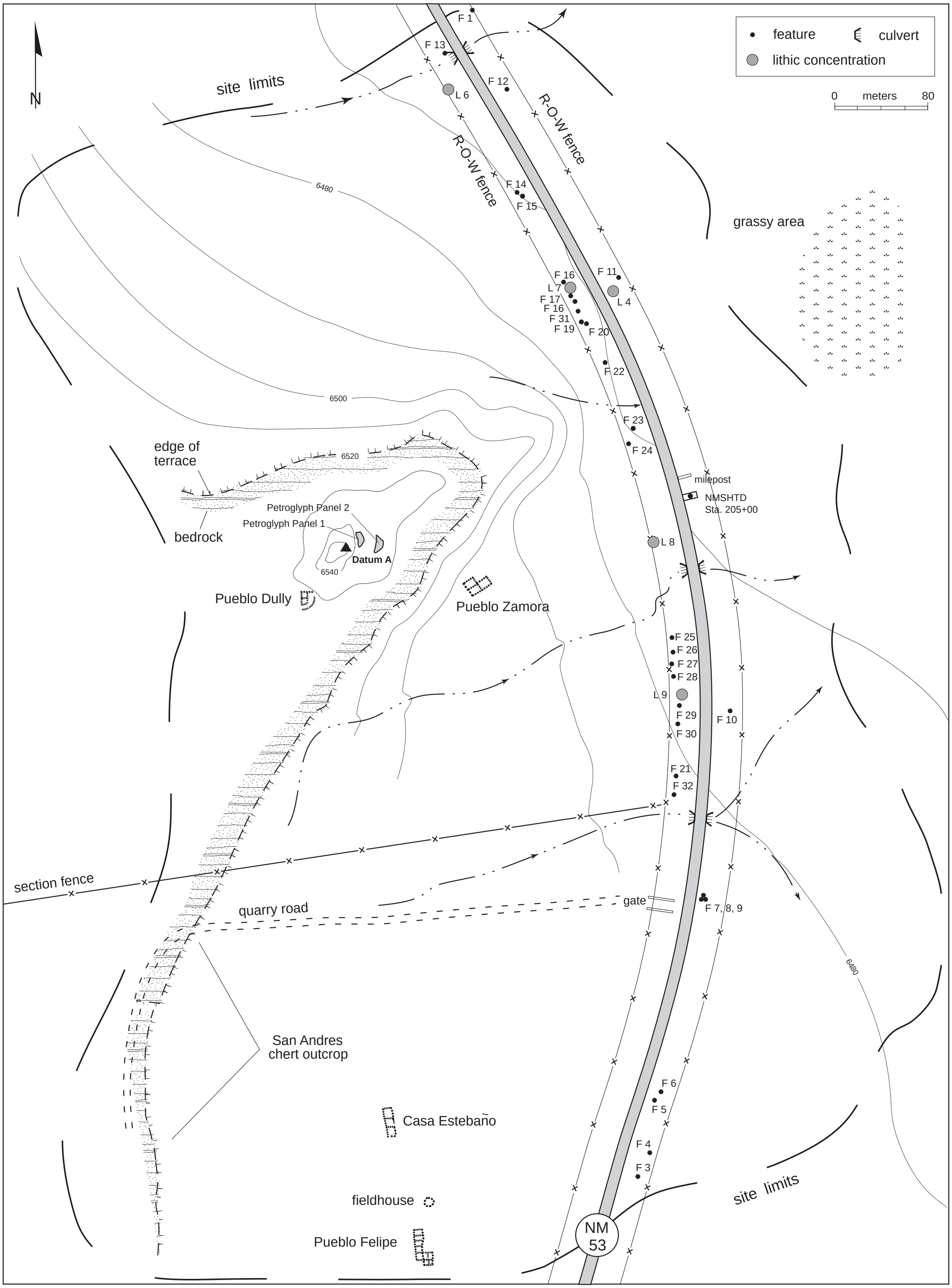


*Figure 4. Location of Sullivans's 1987 features.*

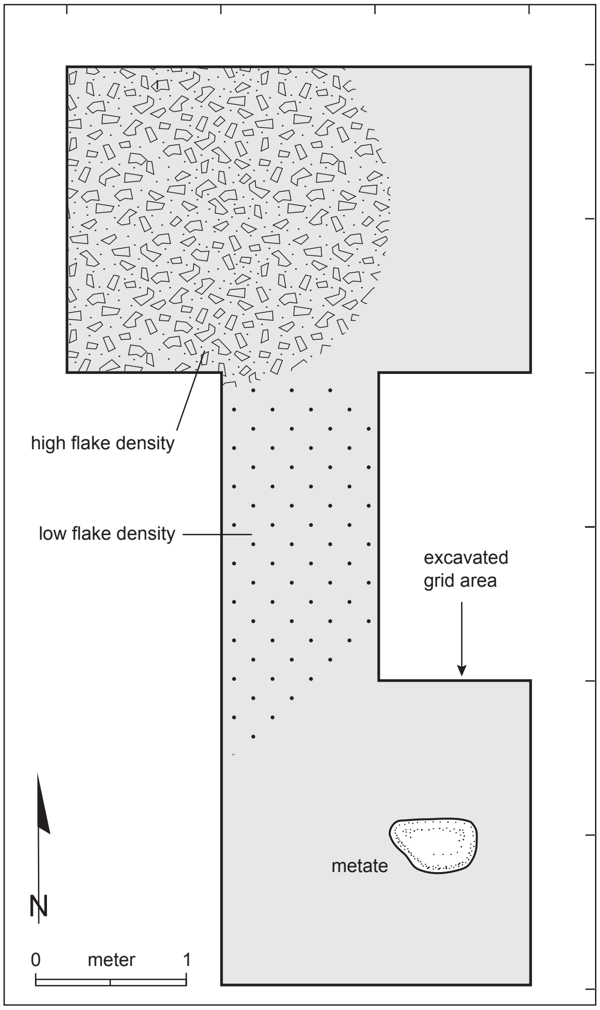


*Figure 5. Plan of Feature 11.*

cm by 50 cm by 15 cm deep. It was recorded as a fire pit, although, lacking oxidation, its actual function is unknown. The feature contained some (possibly) ashy fill. No associated activity area was present.

**Feature 19** consists of a series of 10 associated pit features (Features 19a1, 19a2, 19a3, 19b, 19c, 19d1, 19d2, 19e, 19f, and 19g). The little information available on Feature 19 is summarized in Table 3 and in Figs. 9 through 14. A synthesis of Feature 19 suggests that it is a series of possible fire and storage pits. Features 19a1 and 19a2 yielded a radiocarbon date (by accelerated mass spectrometry; AMS) of 4665 ± 60 B.C. (Appendix 5). One mid-Archaic (3200 to 1800 B.C.) projectile point was recovered from this feature. Given the context, the extreme antiquity suggested by the results of the carbon-14 dating is highly unlikely, especially in view of the diagnostic artifact.

**Feature 25** was defined as a lithic concentration of possible fire-cracked rock in a 1-by-2-m area (Fig. 15) When excavated, it was concluded that this feature was essentially surficial, with artifacts restricted to Level 1 (surface strip). However, where the feature extended into grid 12N/10E, it was excavated to Level 5 (96 to 98 cmbd). In this grid, there was an increase in artifacts from Level 2 to Level 3, and a high proportion of artifacts in Level 4. Artifacts decreased in Level 5. Levels 3 and 4 consisted of a dark reddish-brown sandy loam with a high density of (apparently) water-born gravels and artifacts overlaying red-brown clayey, sandy soil with a few artifacts (Level 5). The soil comprising Levels 3 and 4 may represent secondary alluvial deposition.

**Feature 26** is a 1-by-1-m area of fire-cracked rock with associated lithic artifacts; [Level 1=lithics].

**Feature 27**, although small (0.5 by 0.5 m), yielded a large collection of lithic debitage, primarily recovered during the surface collection. Apparently, the artifacts were restricted to the surface and Level 1 (surface strip), although some artifacts came from Levels 2 and 3. The soil in Levels 2 and 3 was gravelly, clayey sand, which may have represented secondary alluvial deposition, similar to that suggested for Feature 25.

**Feature 28** is a [2-by-2-m scatter of fire-cracked rock and associated lithics]. A [few lithics were recovered from Level 1, 2 and 3].

**Feature 29** consists of a 1-by-1-m concentration of fire-cracked rock and associated lithic artifacts. Level 1 exposed a [flat semi-circle of stones]. Lithic artifacts were present, some described as angular debris, or perhaps natural. At Level 2, the [circular sandstone has a beveled bottom, and lithics]. Levels 3 and 4 [had some lithics].

**Feature 30** is described as a 1-by-3-m scatter of fire-cracked rock, fire-cracked ground stone, and associated lithic artifacts. At level 1, there were [secondary and tertiary chert flakes, fence wire staples, baling wire, WCF and .44 gauge cartridges]. (*WCF probably stands for Winchester Center Fire—ed.*)

**Feature 31** was initially defined as a concentration of fire-cracked rock and debitage associated with three charcoal stains in an area of 5.5 m by 6 m (Fig. 16). Excavations exposed a pit of unknown function, another possible pit, fire-cracked rock, and several ground stone fragments. Two fragmentary manos, two metate fragments, and an unidentifiable ground stone fragment were collected from the surface and the surface stripping. Eight mano fragments and three metate fragments were obtained from Level 1 in the grids adjacent to the pit feature. The pit in Feature 31 is roughly oval, approximately 1.06 m north-south by 66 cm east-west by 60 to 90 cm deep, defined in Level 3. The pit was apparently clay-lined, with a dark loamy fill that contrasted with the surrounding sandy soil. The fill included small pieces of charcoal. No artifacts were encountered in the first 20 cm below Level 3, after which the fill included many chert and obsidian microflakes. A rodent hole was present in the southwest corner of the pit, apparently coinciding with the location of an earlier auger test hole. The presence of fire-cracked rock on the surface and in Level 2 suggests that the feature was a

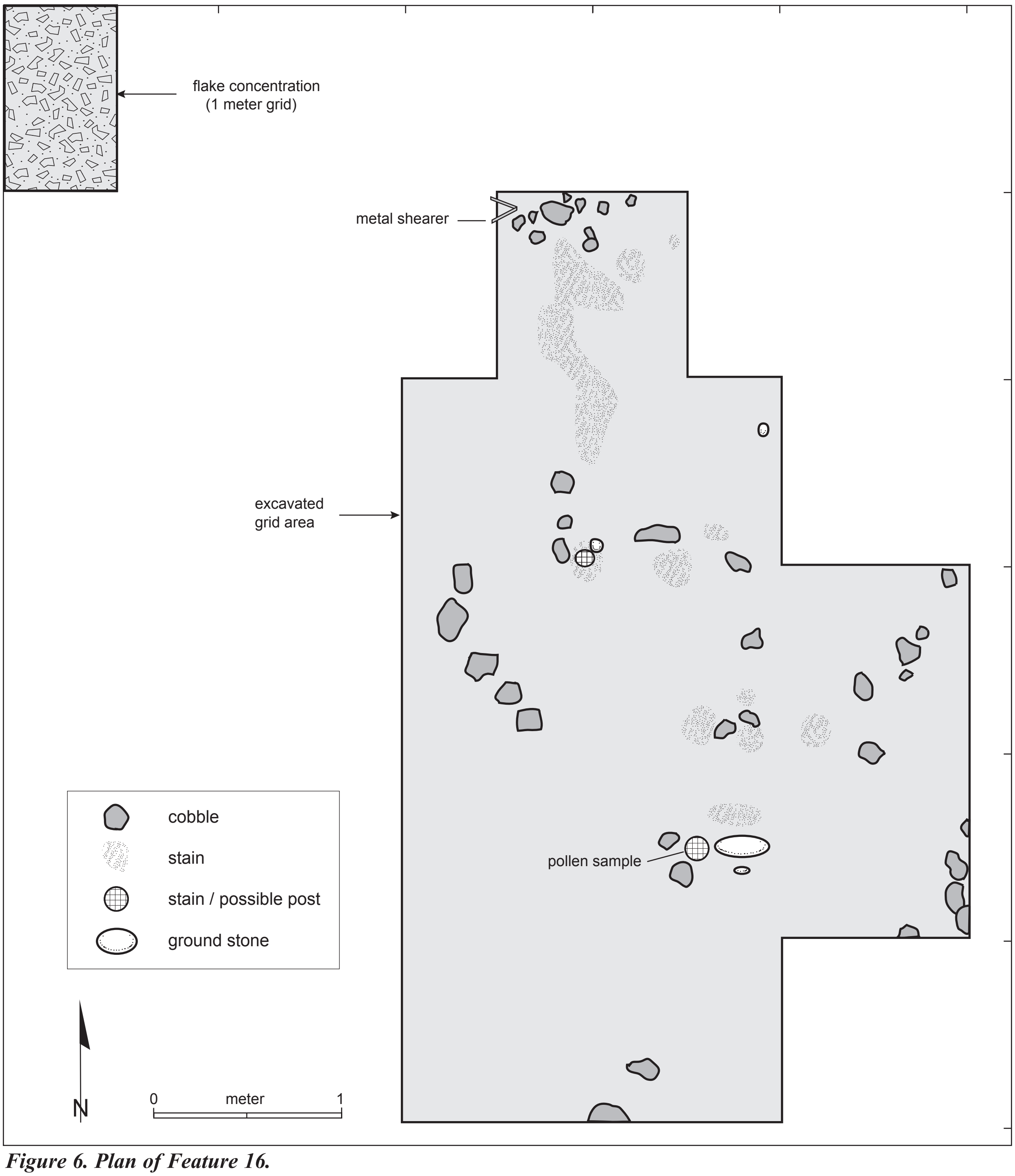


*Figure 6. Plan of Feature 16.*

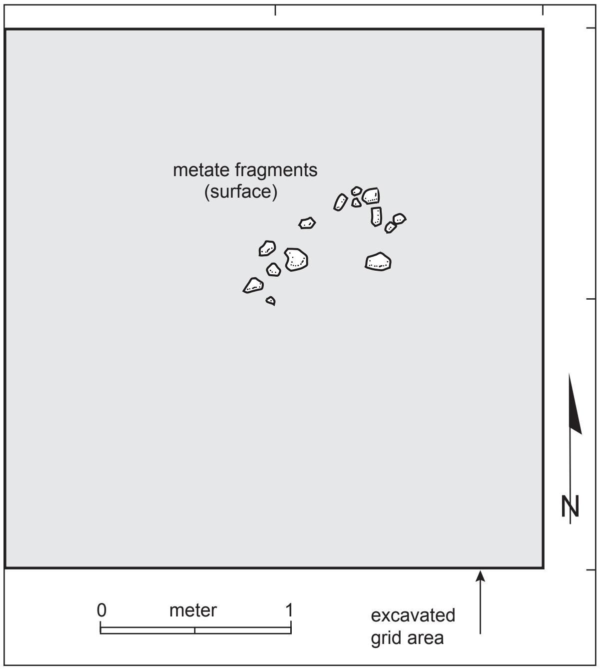


*Figure 7. Plan of Feature 17.*

roasting pit (although the field notes do not indicate that the clay lining was burned). Alternatively, a storage function may be ascribed to the pit based on the presence of the ground stone. Another possible pit was identified immediately southwest of the roasting or storage pit. A charcoal stain was found about 27 cmbd. The stain was sectioned and the east half excavated to 33 cmbd. No artifacts were found and the feature remained undefined. A radiocarbon sample was recovered, which dated to (AMS) 8830 ± 70 B.P. Given the context, this very early date seems highly unrealistic.

**Feature 32** consisted of a concentration of fire-cracked rock and associated lithic artifacts. There were some lithic artifacts in Level 1. In the field notes, the excavator speculates whether these are angular debris or natural gravels. A burned area was exposed which appeared to be a late historic campfire with burned plastic and glass.

**Feature 33** is [a possible semicircular rock alignment, apparently natural]. There were fewer than five lithic

**Table 3. Summary of Feature 19 data.**

| Feature Number | Description | Dimensions (cm) | Comments |
|---|---|---|---|
| 19a1 | bell-shaped, partly clay-lined (Fig. 7) | 45 EW, 58 NS, 68 deep | 19a1 and 19a2 are contiguous; associated with possible mealing area |
| 19a2 | clay-lined at base, bell-shaped pit (Fig. 7) | 46 EW, 46 NS, 76 deep | 19a1 and 19a2 are contiguous; associated with possible mealing area |
| 19a3 | bell-shaped pit: no further information; profile not available | 80 NW, 46 SW, depth unknown | associated with possible mealing area and 19a1-19a2 |
| 19B | pit (storage?) (Fig. 7) | 72 EW, 74 NS, 92 deep | rodent and insect disturbed |
| 19C | pit (storage?) (Fig. 7) | 88 NE, 70 EW, 54 deep | cryoturbation |
| 19D1 | pit (Fig. 7) | 50 NS, 80 EW, depth unknown | fill mottled with caliche |
| 19D2 | pit (Fig. 7) | 33 NS, 27 wide, depth unknown | |
| 19D3 | shallow pit (Fig. 7) | 23 NS, 19 wide, depth unknown | feature status problematical |
| 19E | pit (Fig. 7) | irregular shape: 43 NS, 61 EW, 57 deep | portions may be clay-lined; rodent disturbed |
| 19F | pit | basin-shaped: 100 diameter, 18 deep | associated with 19G |
| 19G | possible thermal feature | 110 NS, 155 EW, 43 deep | burned soil at edges and in top fill |

artifacts per square meter. In Level 2, [there were very few lithics].

**Feature 34** was not described beyond: [Level 1 had few lithics, two ground stone fragments].

The above feature descriptions are summarized from Sullivan's 1986 field notes. Feature 19 seems to have the most complete information. Below, the OAS 2000 ASSAPP project provides descriptions of several pueblos and Archaic features inside and outside of the right-of-way at LA 9075.

*Pueblo Dully*

This pueblo roomblock consisted of a rubble mound and was located 210 degrees and 40 m southwest of Datum A (see Figs. 2 and 3). Two contiguous rooms of approximately 3 m by 3 m are partly enclosed by masonry, a portion of which may be historic (Figs. 17 and 18). The north room has a pothole at its center. The total architectural component measures 8 m by 10 m. A very light scatter of ceramic and lithic artifacts extends to the northeast beyond the wall. Within the wall, there may have been a kiva or plaza area. The size of the rocks on

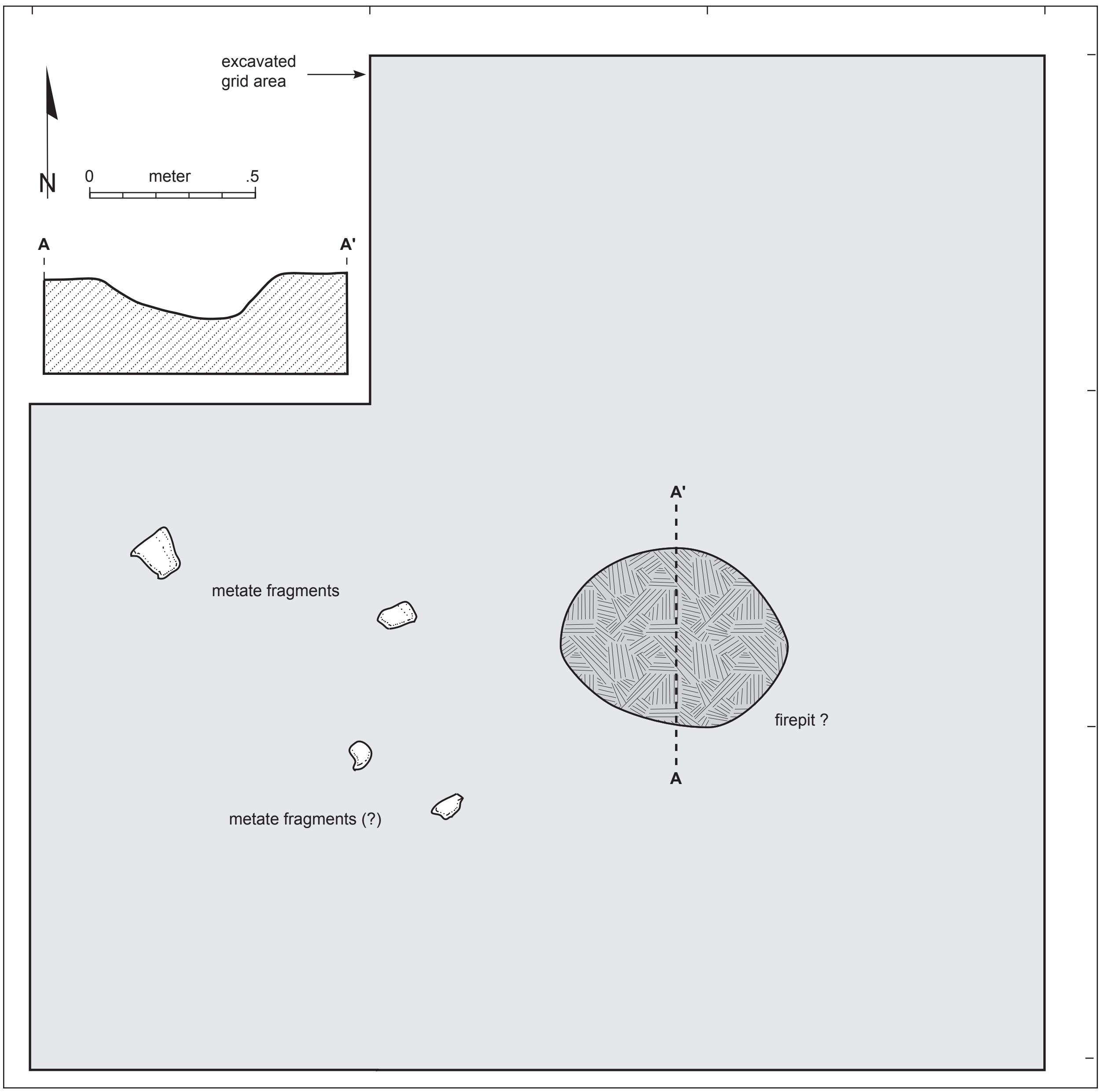


***Figure 8. Plan of Feature 18.***

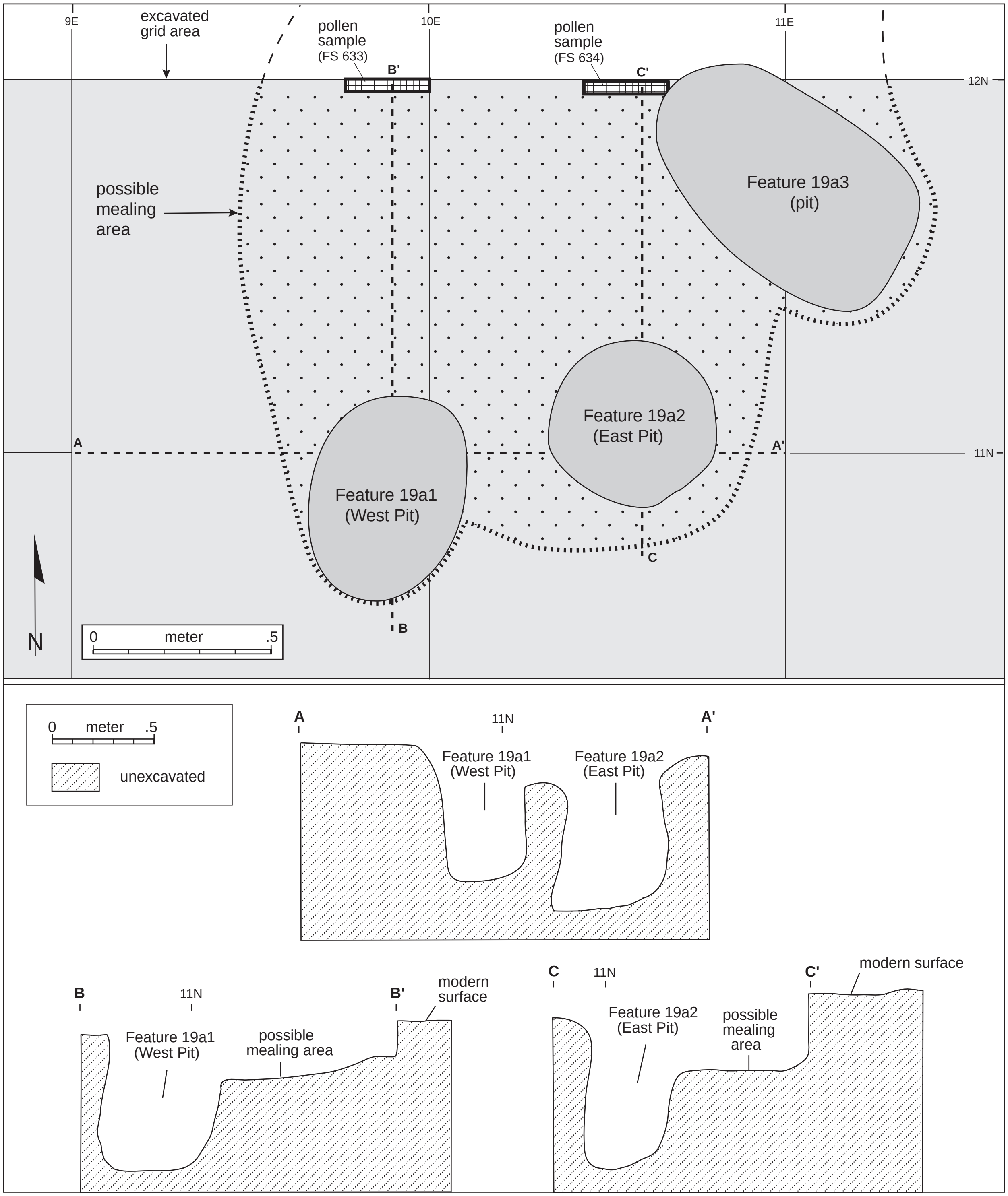


***Figure 9. Plans and profiles of Features 19a1 (West Pit), 19a2 (East Pit), and 19a3.***

the east side suggests some modification using heavy equipment. A nearby check dam, also manufactured from massive elements, would support this conjecture—perhaps sheepherders occupying Casa Estebaño (see below) altered the pueblo for a corral or some other feature. Associated ceramic artifacts indicate late to middle Pueblo II (see Tables 4 and 5).

*Pueblo Zamora*

This small three-room pueblo is located almost due east of Datum A (see Figs. 2 and 3). The outline of the rooms is very ephemeral, and the site could have been stone-robbed. It measures 10 m by 6 m (Fig. 19). Artifacts are sparse, and consist primarily of ceramic artifacts that would place it in the late Pueblo II or possibly transitional PII-PIII period (see Tables 4 and 5).

*Casa Estebaño*

This structure consists of three contiguous masonry rooms (Figs. 20 and 21). The rooms are bigger than typically expected in Anasazi architecture, so the structure has been assigned to the historic period. There are a few lithic artifacts in the vicinity, and no diagnostic historic trash other than modern green glass. It is possible that this is a remodeled pueblo roomblock. It has been argued that Hispanics also used lithic artifacts, but substantive differences between prehistoric and historic chipped stone are difficult to discern (except the obvious—a gunflint, for example). The structure is 17 m north-south and 2.5 m east-west. It could be related to Feature 16 (historic, see above) and various other historic features around the site (check dam, component at Pueblo Dully, sheepherding features), with the probable exception of the can scatters, which are from the 1950s.

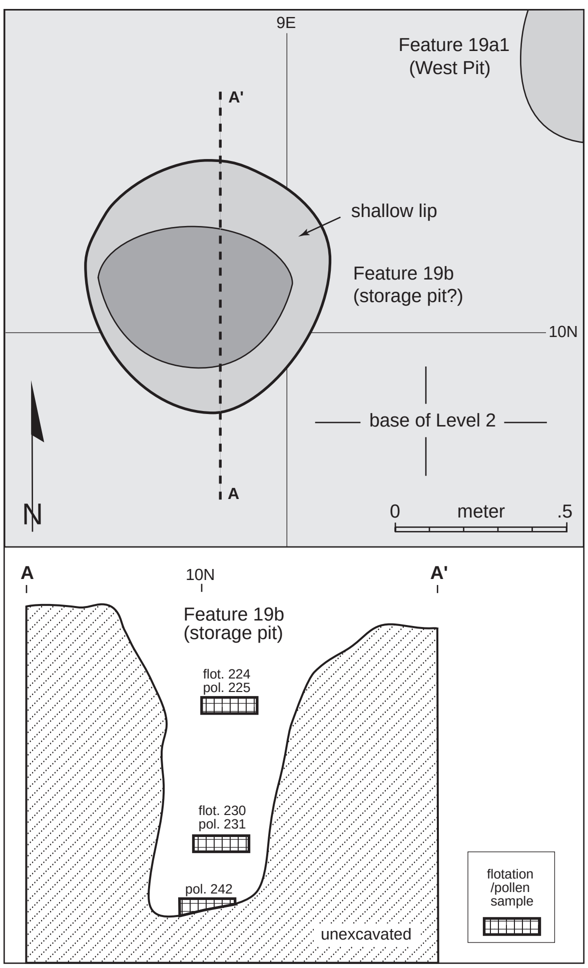


***Figure 10. Plan and profile of Feature 19b.***

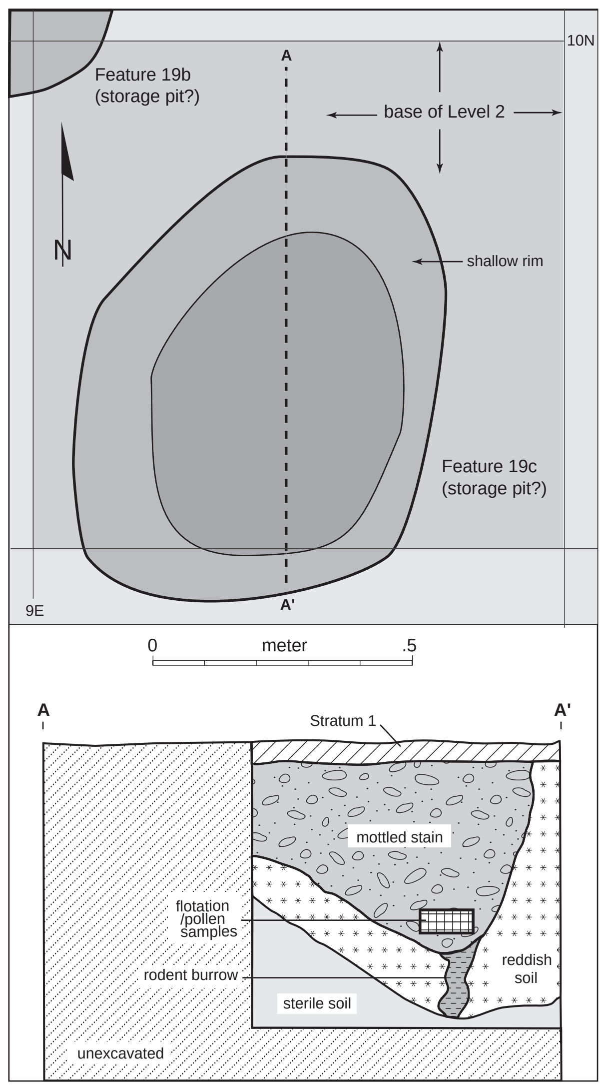


***Figure 11. Plan and profile of Feature 19c.***

*Pueblo Félipé*

This structure is the largest of the pueblos at LA 9075 (Figs. 22 and 23), consisting of nine contiguous masonry rooms and an associated fieldhouse (Fig. 24). Its long axis is 18 m north-south, with a possible plaza or activity area facing east. A short distance to the north-northeast is an oblong rubble mound, interpreted as being a fieldhouse approximately 2 m in diameter. As this structure was curiously placed at the debouchment of a drainage, there were no visible artifacts. However, this drainage may have developed postoccupationally. The association between the pueblo and the fieldhouse is presumptive, but there is little reason to doubt that they are contemporaneous. As with other prehistoric structures at the site, this one also reflects a Pueblo II affiliation, based on Puerco, Escavada and Gallup ceramic types (see Table 4 in Chapter 6).

*Archaic Base Camp*

A San Jose/En Medio phase base camp is located near the toe of the formation at LA 9075, in a flat *vega* between outcrops. Its dimensions are 57 m north-south by 90 m east-west (Fig. 25). The camp's main features are two rock alignments (probably hunting blinds), a large rock ring (probably a hearth or roasting pit; Fig. 26), two dense concentrations of lithic artifacts, and a check dam. Two whole San Jose projectile points and an En Medio projectile point are located within the site boundaries. Both hunting blinds afford a good overlook of the drainage and are well situated for spotting herd movements. Blind 1 (Fig. 27) is oriented northeast-southwest, and is constructed of large dry-laid unmodified clasts of igneous and limestone materials. It resembles a subrectangular room, with a bedrock outcrop forming the northwest wall. The size of some of the ele-

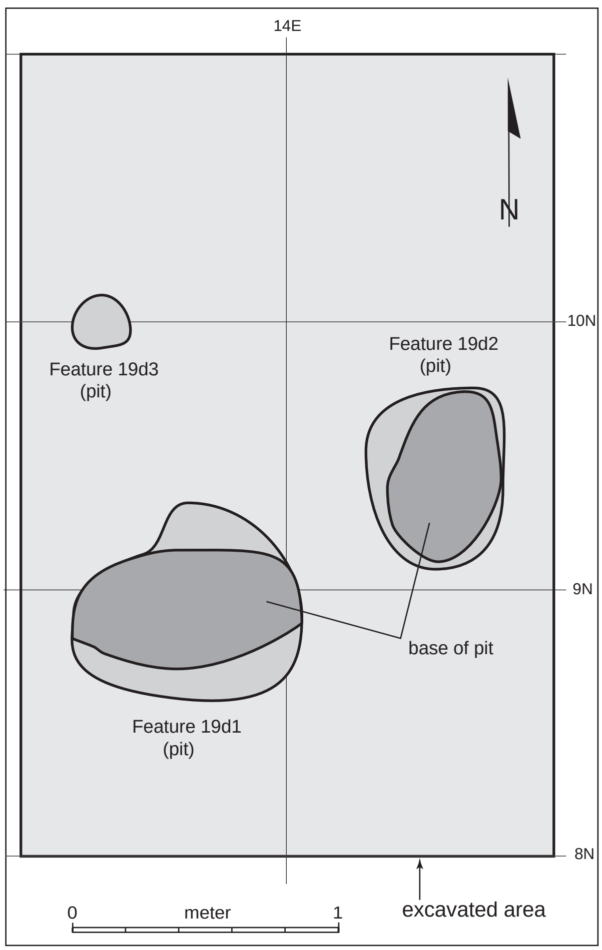


*Figure 12. Plan of Features 19d1 and 19d2.*

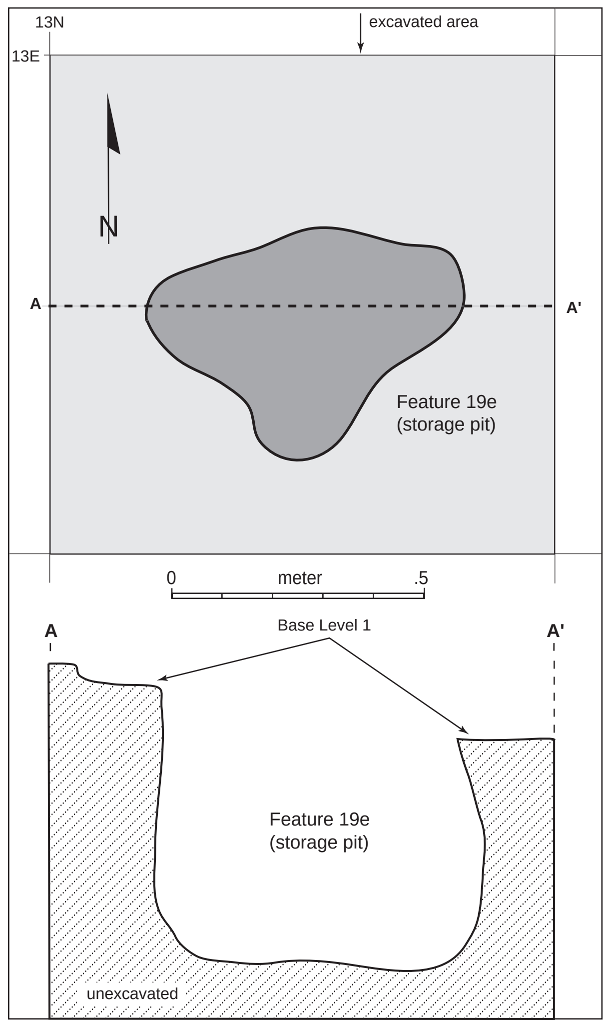


*Figure 13. Plan and profile of Feature 19e.*

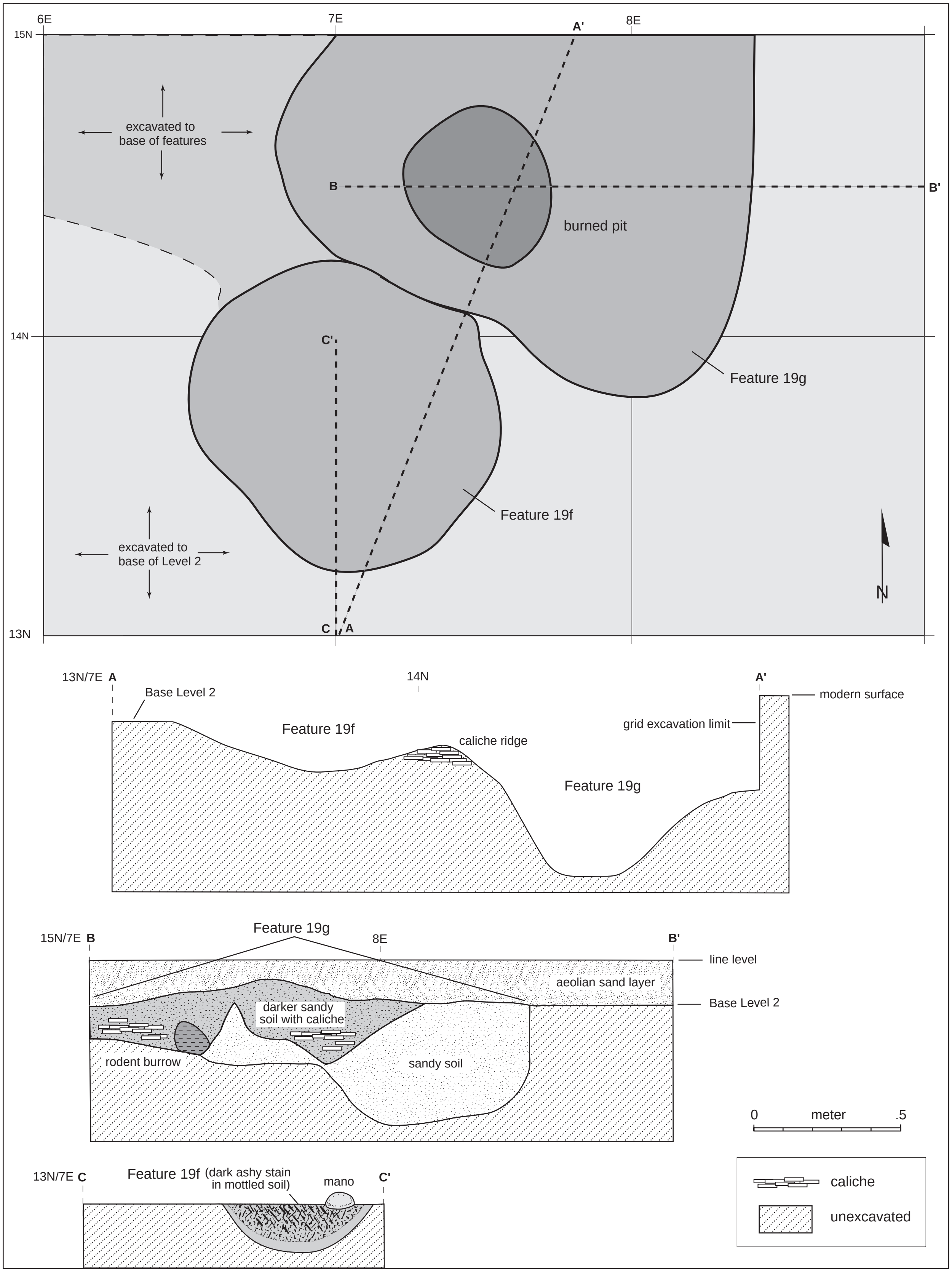


*Figure 14. Plans and profiles of Features 19f and 19g.*

ments comprising the walls suggests some historic remodeling, and this feature may have been reused as a sheep or lamb pen. Its situation, however, suggests that it originally functioned as a hunting blind. Blind 2 (Fig. 28) is simply a 2-m-long rock alignment oriented north-south. Other than shielding the hunter from view, this feature could have also served as a windbreak. Its construction is similar to Blind 1 with the exception of the construction of the masonry, which is smaller. An En Medio projectile point was cached in an interstitial space midway along the wall.

Two concentrations (Scatter A and Scatter B) of chipped stone were also recorded by the OAS. A sample of Scatter A included a Washington Pass/Narbona chert biface flake, two Grants obsidian core flakes, a Jemez obsidian biface flake, an opalized chert biface flake, an opalized chert biface fragment, a tan chert biface flake, a red chert biface flake, two San Andres biface flakes, a San Andres biface fragment, and a San Andres expended core.

The in-field analysis clearly suggests that Scatter A represents a biface reduction area (Fig. 29), with all stages of reduction present. It is not difficult to imagine a flintknapper sitting on a bedrock outcrop and manufacturing or resharpening tools and projectile points. Another dense area of chipped stone is associated with the thermal feature. This hearth or roasting pit is a circular construction of large oxidized cobbles 1.5 m in diameter. To the east of this feature extends a dense scatter of chipped stone artifacts (Scatter B). Time constraints precluded documenting a sample, but the material types observed were similar to those present at Scatter A, with less obvious biface reduction. Biface fragments were also present, including a San Jose projectile point. This activity area was eroding to the east along a small rill and some spatial integrity may have been compromised. This is a familiar pattern in Archaic sites, where lithic reduction is occurring in the vicinity of a thermal feature. Combining the functional and intraspatial aspects of the features at this site suggests a hunting focus. Game may have been scouted from the blinds, procured, and returned to this locale for processing (see Chapter 11 for the model of a proposed hunting system at LA 9075).

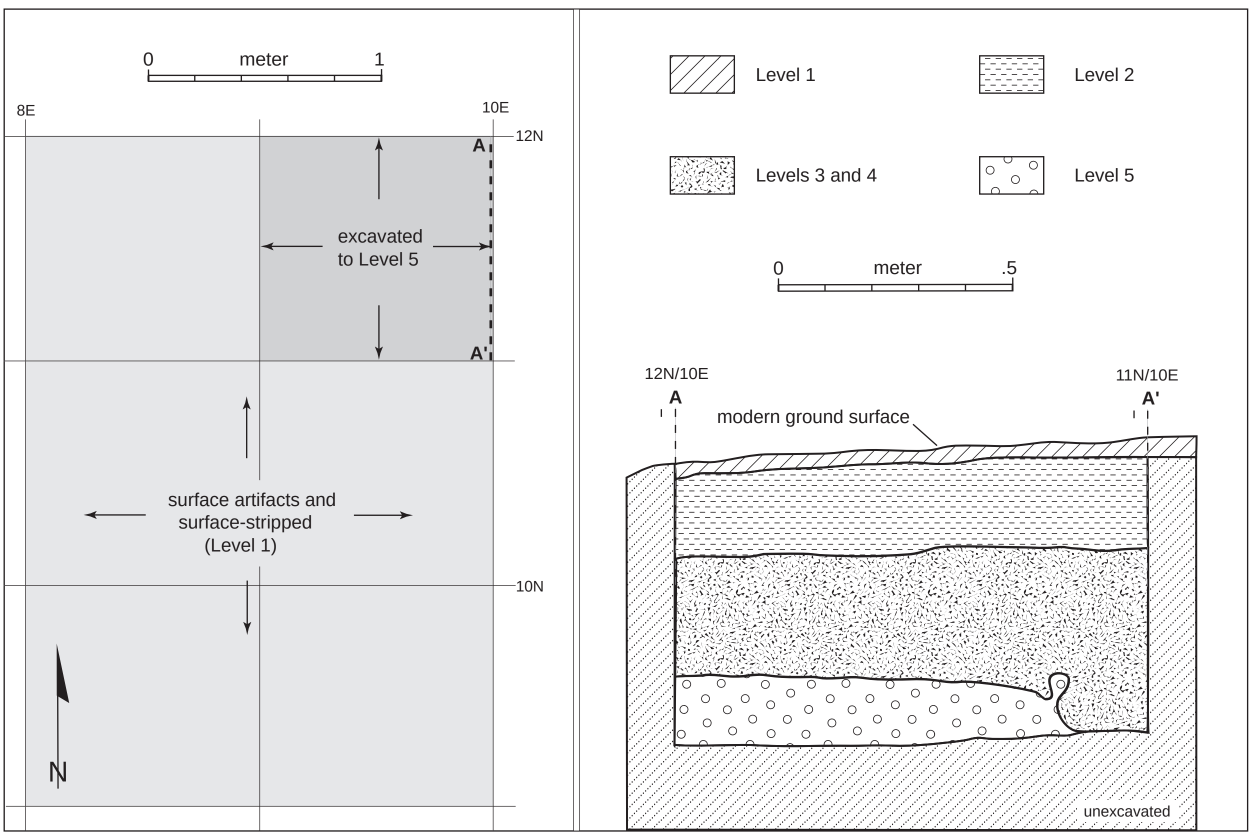


*Figure 15. Plan and profile of Feature 25.*

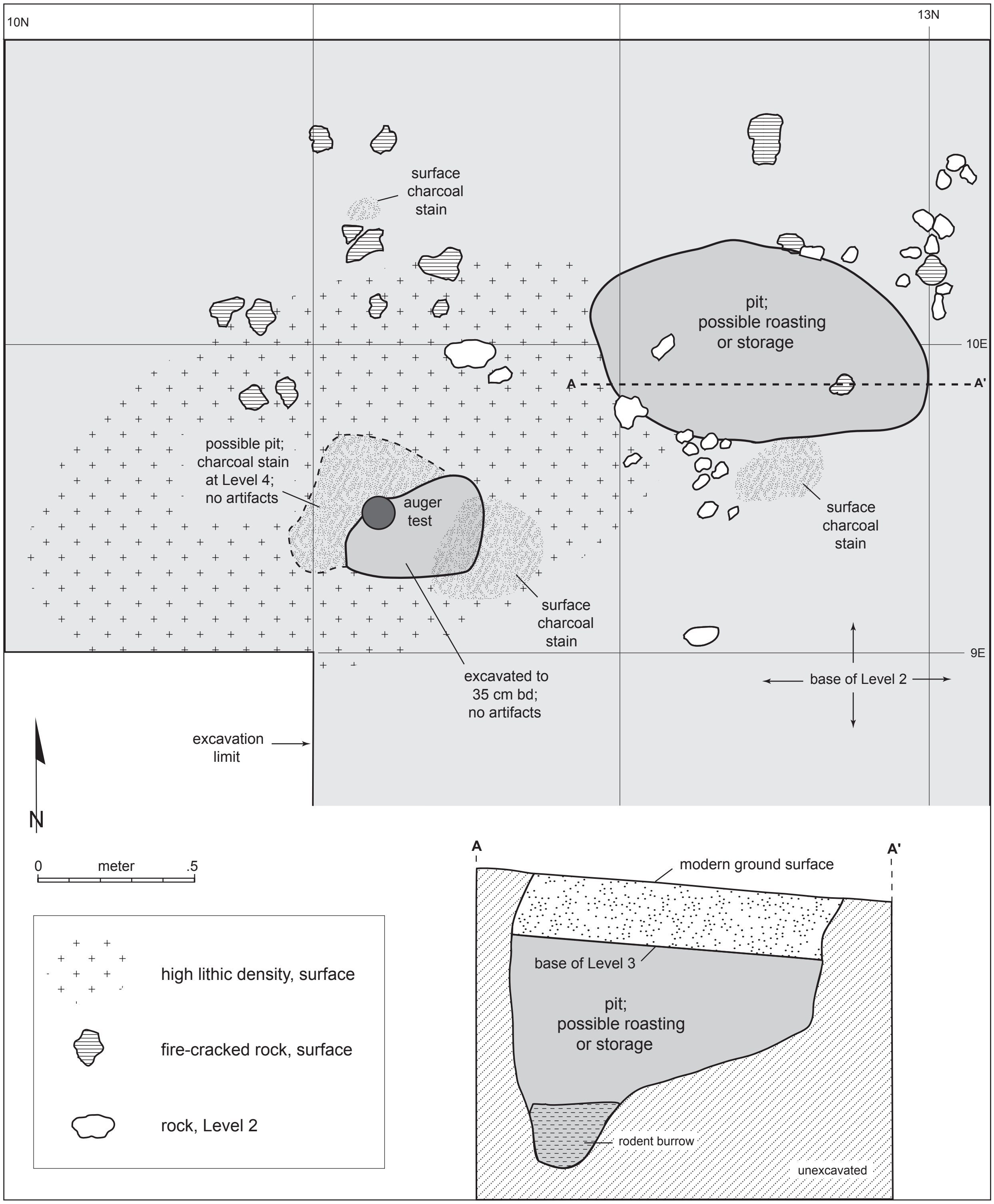


*Figure 16. Plan of Feature 31; profile of pit in Feature 31.*

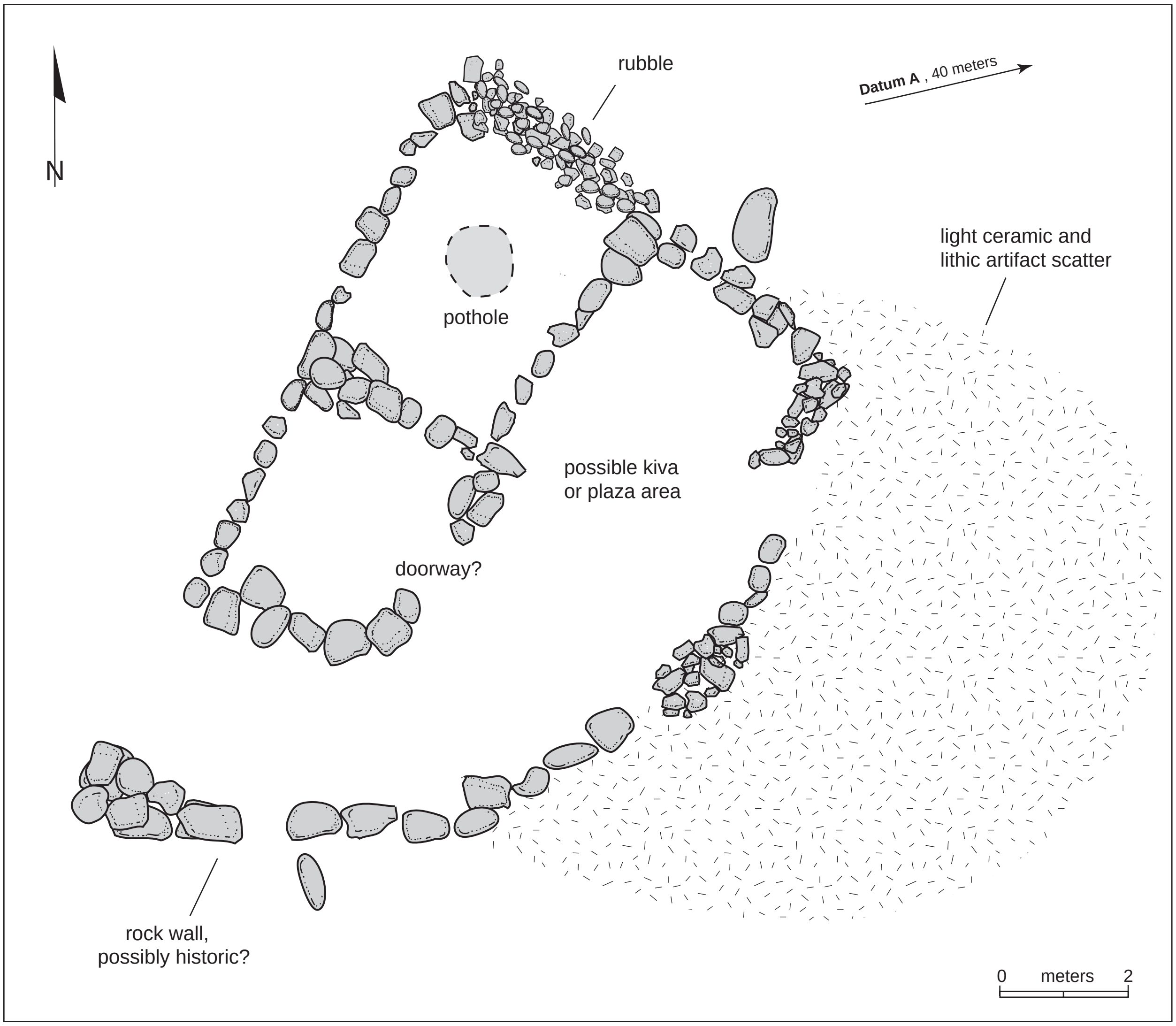


*Figure 17. Plan of Pueblo Dully.*

*Figure 18. View of Pueblo Dully, looking south.*

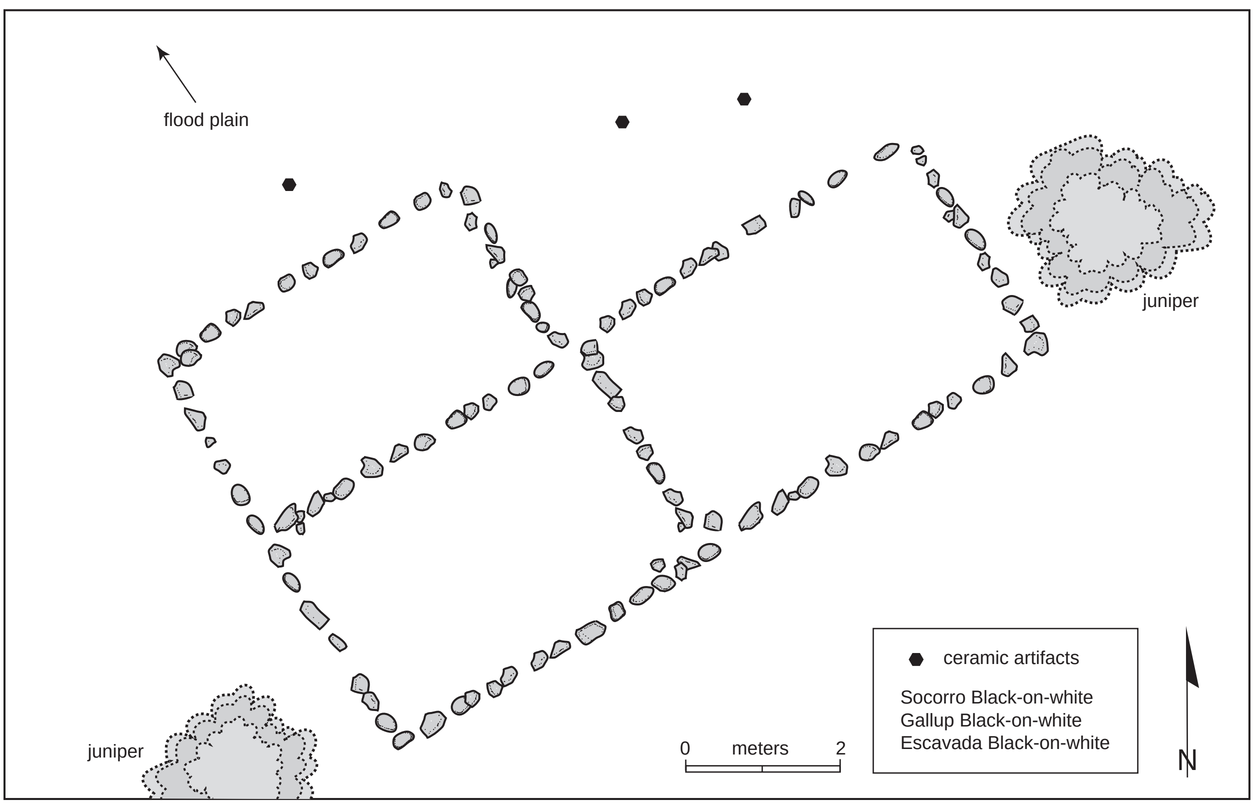


*Figure 19. Plan of Pueblo Zamora.*

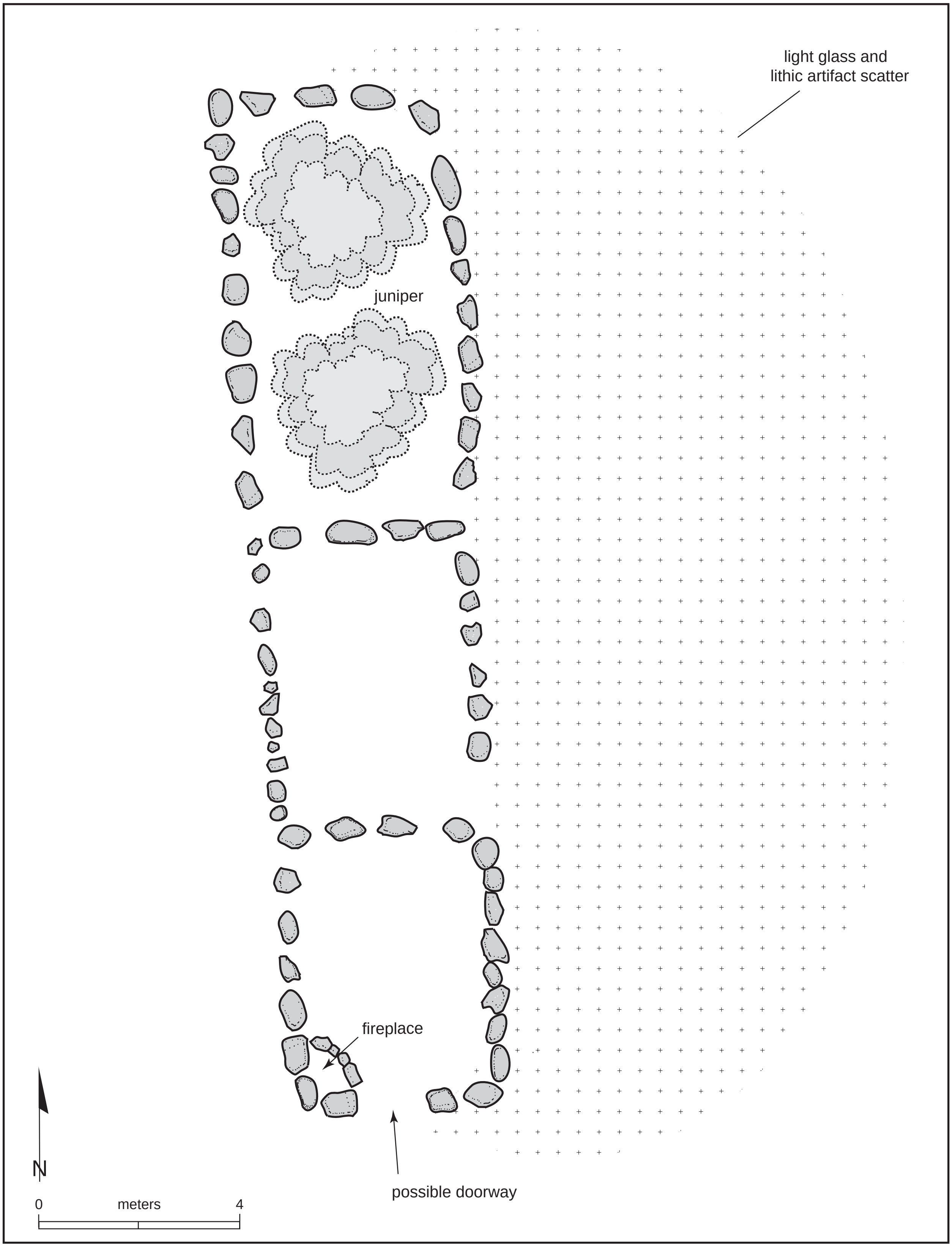


*Figure 20. Plan of Casa Estebaño.*

*Figure 21. View of Casa Estebaño, looking north.*

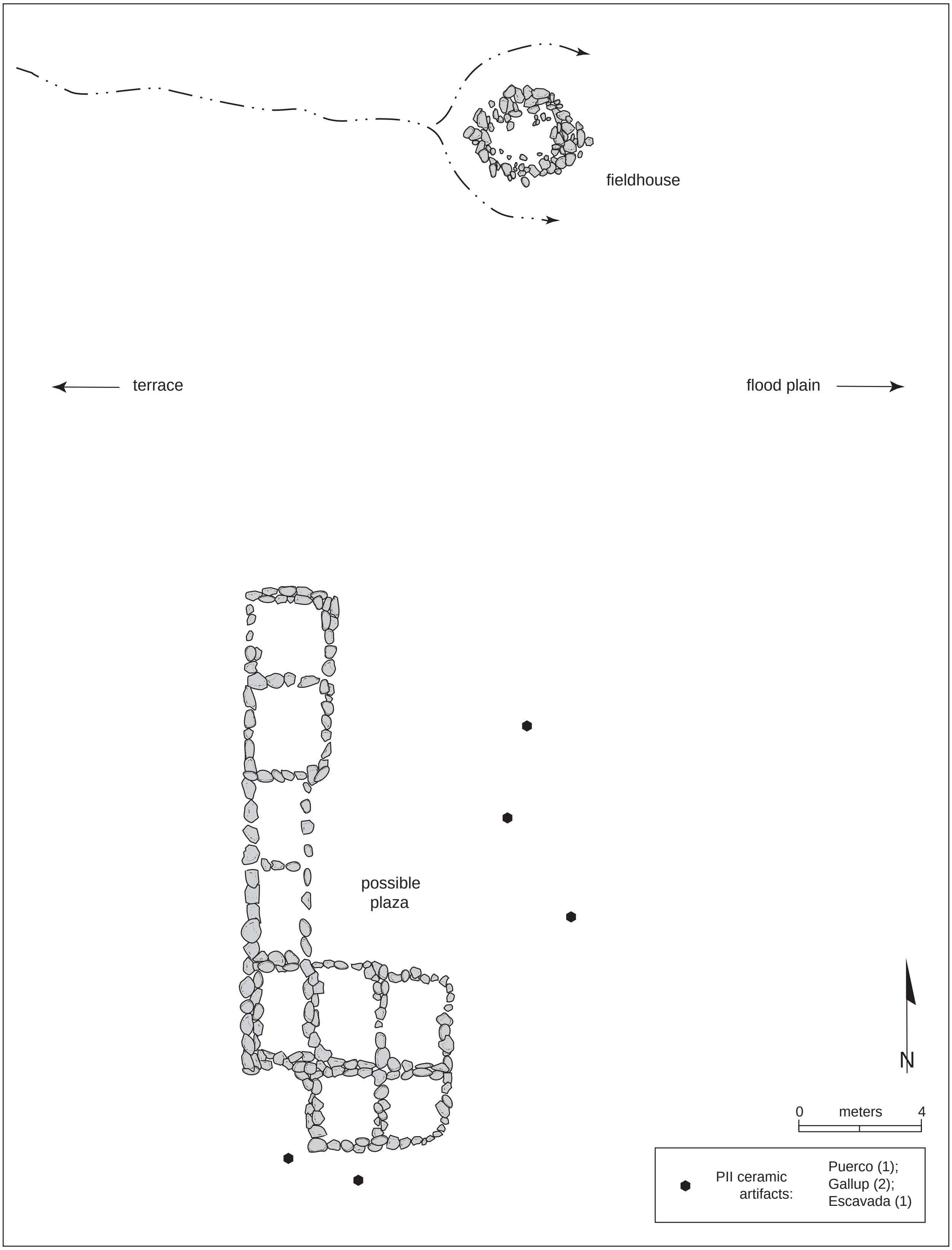


*Figure 22. Plan of Pueblo Félipé.*

*Figure 23. View of Pueblo Félipé, looking west.*

*Figure 24. View of fieldhouse associated with Pueblo Félipé, looking west.*

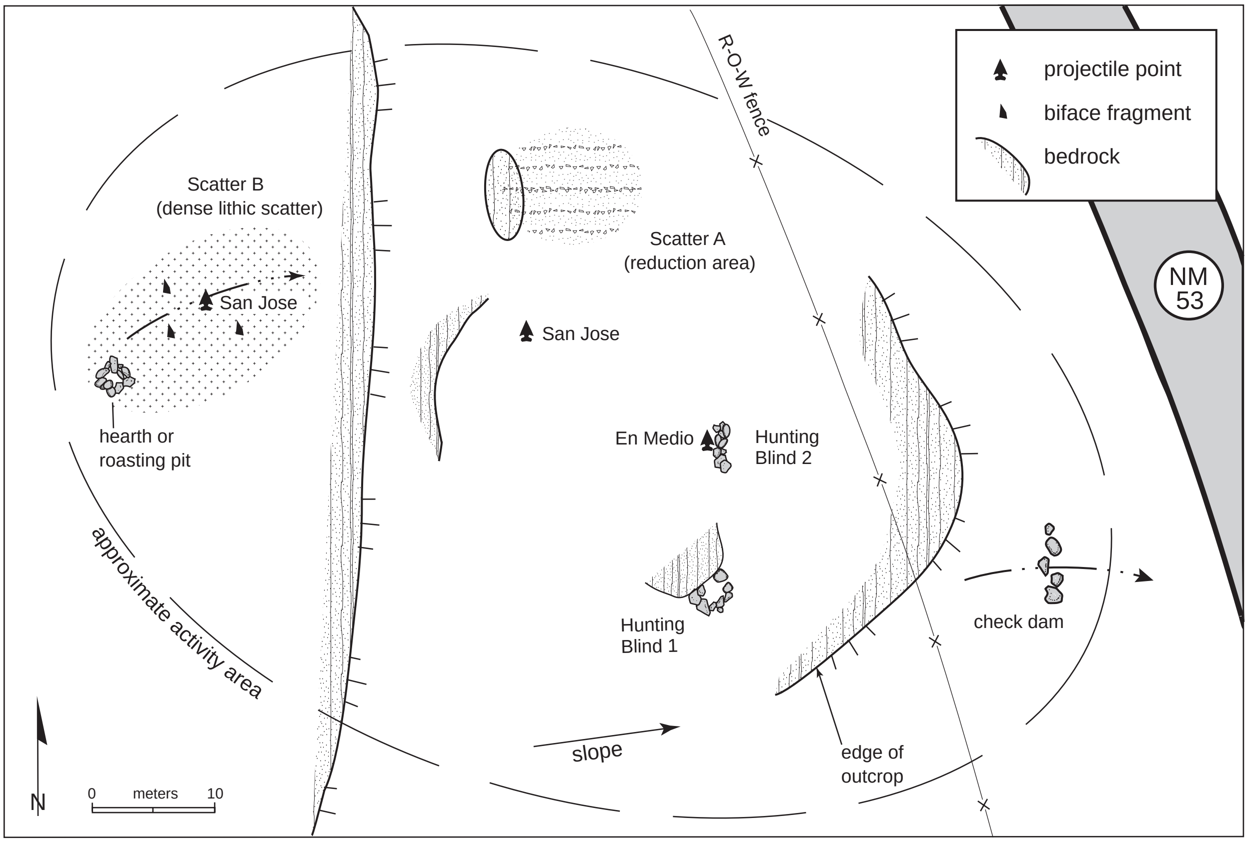


*Figure 25. Archaic base camp with hunting component.*

***Figure 26. Hearth or roasting pit in Archaic base camp.***

***Figure 27. Blind 1 in Archaic base camp.***

*Figure 28. Blind 2 in Archaic base camp.*

*Figure 29. Biface reduction area in Archaic base camp.*

CHAPTER 6

# CERAMIC ARTIFACTS

Ceramic artifacts were collected during Brown and Sullivan's projects (Table 4). During the OAS 2000 project, the landowner requested that no artifacts be removed from his property. For this reason, ceramic artifacts were monitored in the field. Several unrecorded types from Pueblo Dully are documented in Table 5. Although Sullivan recorded several Lino Gray sherds, we would still argue that La Vega is a Pueblo II site.

The small sample of ceramic artifacts recorded in the field during the Sullivan (1987) and OAS (2000) projects both show a preponderance of Pueblo II ceram-

**Table 4. Ceramic types and proveniences from the La Vega site (Sullivan 1987).**

| | | Provenience | | | | |
|---|---|---|---|---|---|---|
| Type | Vessel | Brown Collection[1] | Sullivan Collection[2] | Sullivan Excavation | Pueblo Dully | Total |
| Lino Gray | Jar | - | 1 | - | - | 1 |
| | Bowl | 1 | - | - | - | 1 |
| | Indeterminate | 1 | - | 4<br>Locus 19-1<br>Locus 24-1<br>Locus 33-2 | 1 | 6 |
| Gray ware | Jar | 1 | - | - | - | 1 |
| | Indeterminate | - | - | 1 | - | 1 |
| Corrugated | Jar | 1 | - | - | - | 1 |
| | Indeterminate | - | - | - | 1 | 1 |
| White ware | Jar | 5 | 1 | 2<br>Locus 33 | - | 8 |
| | Indeterminate | - | - | 1 | 1 | 2 |
| Red Mesa Black-on-white | Jar | 2 | - | - | - | 2 |
| | Bowl | - | 1<br>Locus 16 | - | - | 1 |
| Socorro Black-on-white | Jar | 1 | - | - | - | 1 |
| Red ware | Jar | - | 1 | - | - | 1 |
| Gallup Black-on-white | Jar | 1 | - | - | 2 | 3 |
| Escavada/Puerco Black-on-white | Indeterminate | - | - | - | 4 | 4 |
| P II-P III Corrugated | Indeterminate | - | - | - | 3 | 3 |
| Wide Neckbanded | Jar | - | - | - | 1 | 1 |
| Total | | 13 | 4 | 8 | 13 | 38 |

[1]Not provenienced.
[2]Surface; not provenienced except as noted.

ics. The earliest ceramic type is Basketmaker III period Lino Gray; and the latest are the transitional Pueblo II-III types. However, many ceramic artifacts have been removed from the site. It might legitimately be surmised that the site was occupied during the time when Chaco Canyon and other large Anasazi aggregations flourished, and a general Pueblo II expansion was seen throughout much of the Southwest.

**Table 5. Ceramic types and proveniences from the La Vega site (OAS 2000).**

| | | Provenience | | | |
|---|---|---|---|---|---|
| Type | Vessel | Pueblo Félipé | Pueblo Zamora | Pueblo Dully | Total |
| Escavada Black-on-white | bowl | 1 | 1 | - | 2 |
| Gallup Black-on-white | bowl | 2 | 1 | - | 3 |
| Puerco Black-on-white | bowl | 1 | - | 4 | 5 |
| White ware (unidentified) | bowl | - | - | 1 | 1 |
| Black-on-white (unidentified) | bowl | - | - | 1 | 1 |
| Socorro Black-on-white | bowl | - | 1 | - | 1 |
| Red Mesa Black-on-white | jar | - | - | 1 | 1 |
| P II Corrugated | jar | - | - | 1 | 1 |
| Chupadero Black-on-white | jar | - | - | 1 | 1 |
| Total | | 4 | 3 | 9 | 16 |

CHAPTER 7

# FAUNAL ANALYSIS

No bone was present in the Speth, Brown or OAS 2000 collections. During Sullivan's 1986 project, 59 individual items from 30 discrete proveniences were tallied (Table 6). Three of these items were animal teeth. Fourteen items (24%) of the total assemblage were, for varying reasons (preservation, size), unidentifiable. The majority of the fauna (n=39; 66%) was from medium to large mammals, and was recovered from Feature 19, a large pit that probably functioned as a storage facility. Whether these items were stored in this feature or introduced later is not known. It is highly probable that some of the bones were the result of rodent activity; i.e., rodents burrowing into the organic feature fill and dying there. Also, as the feature was accumulating deposition, it may have entrained extraneous bone from the surface. Whatever their origin, it is not likely that many faunal items were deliberately stored in the feature. Although some bones were prob-

**Table 6. Summary of La Vega faunal analysis.**

| Provenience[1] | FS[1] | Item(s) | Species | Comments |
|---|---|---|---|---|
| F3, 10N/10E, S | 458 | long bone | rodent | unidentified |
| F11, 6N/10E, S | 532 | bone fragment | medium mammal | - |
| F14, 11N/10E, S | 7 | long-bone shaft fragment | rodent | unidentified |
| F16, 10N/11E, Level 3 | 153 | bone fragment | medium to large mammal | - |
| F17, 11N/9E, S | 19 | 3 bone fragments | - | unidentified |
| F17, Level 4 | 66 | bone fragment | - | unidentified |
| F18, 12N/10E, S | 48 | bone fragment | - | unidentified |
| F18, 10N/10E, Level 1 | 18 | (a) 3 skull fragments<br>(b) 2 long-bone fragments | (a) large mammal<br>(b) rodent | -<br>unidentified |
| F18, 11N/9E, S | 3 | bone fragment | - | unidentified |
| F19, 11N/9E and 11N/10E, Level 3 | 45 | 3 small bone fragments | - | unidentified |
| F19, 14N/6E, Level 6 | 761 | long-bone fragment | rodent | unidentified |
| F19, 12N/11E, S | 113 | bone fragment | medium to large mammal | unidentified |
| F19, East pit, full cut | 210 | (a) proximal end and shaft<br>(b) partial mandible | (a) prairie dog<br>(b) kangaroo rat | -<br>- |
| F19, 15N/11E | 733 | bone fragment | medium to large mammal | - |
| F19, 11N/10E, S | 73 | canine tooth | dog-size | - |
| F19a, 13N to14N, full cut | 708 | tooth fragments | artiodactyl | one appears partly fossilized |
| F19a, 12-13N/11-12E, full cut | 673 | (a) proximal end of ulna<br>(b) 6 large skull fragments | (a) prairie dog<br>(b) large mammal | -<br>unidentified |
| F19, 9N/11E, Level 5 | 757 | 4 fragments of long-bone shaft | small mammal (rabbit?) | - |
| F19, 9N/11E, Level 5 | 744 | bone fragment | - | unidentified |
| F19d, 10N/13-14E, upper fill | 695 | 6 long-bone fragments | medium mammal | - |
| F19, full cut | 207 | 2 bone fragments | mammal | unidentified |
| F19h, general fill | 750 | 5 skull fragments | large mammal | unidentified |
| F19b, 11N/9-10E, full cut, east half | 223 | proximal end of femur | prairie dog | - |
| F19, 12N/11E, Level 2 | 150 | bone fragment | - | unidentified, burned |
| F19F, 15N/7E, Level 2 | 688 | bone fragment | probably coyote | - |
| F19, 1N/6E, Level 1 | 666 | long-bone fragment | medium to large mammal | - |
| F25, 12N/10E, Level 4 | 371 | tooth fragment | artiodactyl | sheep-size |
| F31, 12N/11E, Level 4 fill | 217 | bone fragment | medium or large mammal, probably longhorn | burned |
| F31, 13N/11E, Level 4 | 241 | (a) bone fragment<br>(b) long-bone fragment | small mammal<br>- | burned<br>- |
| F32, 13N/11E, S | 91 | scapula fragment | rodent (rabbit?) | burned |

[1]F = feature number; FS = field sample number; S = surface.

ably the result of natural rodent activity, others were burned (n=3, 5%; one in Feature 19). Such cultural modification is probably not accidental, and suggests on-site food processing. Because of a number of variables (location, character of lithic assemblage, etc.), it has been suggested that hunting was an important function at the site, and that LA 9075 served as a logistical base camp for hunters.

# CHAPTER 8

# LITHIC ANALYSIS

Four lithic artifact assemblages from the La Vega site (LA 9075) are summarized and compared; 10,831 chipped stone artifacts were classified. Analysis was hampered by incomplete data sets. Sullivan's 1986 lithic artifact section was never completed; Speth's 1988 surface collection was unprovenienced; and Brown, a pothunter, focused entirely on tools and projectile points (of these, only the incomplete projectile points remain, the rest having disappeared, along with Brown, somewhere in Oklahoma). For this reason, only three debitage data sets will be examined, although facially retouched tools are represented to varying degrees in all four assemblages. In this chapter an attempt is made to remodel and account for the missing data, and to draw some tentative conclusions from these disparate collections. All chipped stone tools are identified in Table 7 (see also Appendix 4). The ground stone artifacts are analyzed and discussed in Chapter 9.

## Results

The following section was written in 2001-2002; Sullivan's field project was conducted in 1986, followed shortly thereafter by the analysis. In the intervening years, many key personnel have moved on, and much of the interpretation has had to be extrapolated from either the raw data or from field notes. Hence, the lithic artifact synthesis is organized primarily on an assemblage basis, except for those data that could be associated with Features 19 and 31. Moreover, there are some important differences between the analytical techniques used in 1987 and the current methods used: *Standard Lithic Artifact Analysis: Attributes And Variable Code Lists* (OAS 1994b). Vierra and Anschuetz's (1985:55-68) methods include categories no longer used under the current OAS standard analysis. For example, the material type "chalcedony" is now subsumed under "chert." During the time of the analysis, however, the category "chalcedony" was still in use, and it is referred to in the text. Lithic materials from all collections total 11020 (Table 7). The following sections examine the data sets individually; they are then discussed collectively.

### *Sullivan's Data*

A total of 8720 chipped stone artifacts were analyzed during Sullivan's project (see Table 7). These included debitage (n=8620), cores (n=20,) projectile points (n=23), and formal tools (n=51).

**Debitage.** The debitage category included core flakes, biface flakes, flakes from tools, and undifferentiated flakes. These totaled 8620 individual items, and are identified in Table 7. A total of 4234 core flakes were analyzed. Sullivan's interpretation of the core flake category followed Vierra and Anschuetz's definition (1985:55): flakes exhibiting a striking platform, a dorsal and ventral surface, a bulb of percussion, an éraillure, lines of force, and proximal and distal ends. Angular debris was defined as pieces of material incidentally broken off during core reduction. They do not exhibit flake morphology. Large angular debris was defined as more than 40 g (see also Chapman and Schutt 1977).

**Material selection and lithic artifact type.** The dominant material type used in lithic production was San Andres chert (n=7970, 91.4% of the total) (Table 7). This was followed by Grants obsidian (n=263, 3.0%) and chalcedony (n=252, 2.9%). Nonlocal categories include Jemez obsidian (n=57, 0.7%), Washington Pass/Narbona chert (n=28, 0.3%) and Chinle Chert (n=5, 0.1%).

A total of 8620 items of debitage were analyzed (Table 7). Core flakes are the dominant artifact type (n=4234, 49.2%), followed by undifferentiated flakes (those that could not be confidently assigned to the core-flake or flake-detached-from-a-tool category; see Vierra and Anschuetz 1985:57) (n=3993, 46.3%), then by undetermined tool flakes (n=186 or 2.2% ), and biface flakes (n=113, 1.3%). The frequency of small angular debris (n=51, 0.6%) supports these values, since angular debris is often the by-product of core reduction and core-flake production.

**Biface flakes.** At the La Vega site, biface flakes account for 3.0 percent of the overall assemblage (Table 7). In view of the presumed emphasis on quarrying, this is an appreciable amount. Biface flakes are generally interpreted as suggesting manufacture and production of

## Table 7. Lithic Artifacts for Sullivan Excavations, Speth's Collection, OAS Stabilization, and Brown Collection.

| | CHT | TEC | WNC | SAC | CHC | BBC | DDC | OLC | SWD | CSW | ZWD | CDY | OBN | JZO | PVO | GSO | IGN | BAS | RHY | GRA | LIM | SIL | QTZ | SSS | Row Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SULLIVAN EXCAVATIONS** | | | | | | | | | | | | | | | | | | | | | | | | | |
| Core flake | - | 1 | 11 | 3894 | 1 | 2 | - | 1 | 4 | 6 | - | 128 | - | 16 | - | 105 | 1 | 23 | 1 | - | 9 | - | 15 | 16 | 4234 |
| Biface flake | - | - | 2 | 86 | 1 | - | - | - | - | - | - | 5 | - | 6 | - | 12 | - | - | - | 1 | - | - | - | - | 113 |
| Scraper flake | - | - | 1 | 39 | 1 | 1 | - | - | - | - | - | 2 | - | 4 | - | 2 | - | - | - | - | - | - | - | - | 50 |
| Undetermined tool flake | - | - | - | 144 | - | - | - | - | - | - | - | 9 | - | 9 | - | 24 | - | - | - | - | - | - | - | - | 186 |
| Undetermined core/tool flake | - | - | 1 | 36 | 1 | - | - | - | - | - | - | 3 | - | - | - | 2 | - | - | - | - | - | - | - | - | 43 |
| Cobble uniface flake | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| Undifferentiated flake | - | - | 10 | 3706 | - | 2 | - | - | 2 | 4 | - | 99 | - | 16 | - | 108 | - | 23 | - | - | 8 | - | 12 | 3 | 3993 |
| **Total debitage** | 0 | 1 | 25 | 7906 | 4 | 5 | 0 | 1 | 6 | 10 | 0 | 246 | 0 | 51 | 0 | 253 | 1 | 46 | 1 | 1 | 17 | 0 | 27 | 19 | 8620 |
| Large angular debris | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| Folsom point | 1 | - | - | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | 4 |
| Cody Complex | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | 1 |
| Jay point | - | - | - | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | 2 |
| Bajada point | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | 1 | - | - | - | - | - | - | 2 |
| Augustin | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | 1 |
| San Jose | 1 | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | 3 | - | - | - | - | - | - | - | - | 5 |
| Armijo | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| San Pedro | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | 1 |
| En Medio | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| Indeterminate Paleoindian | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| Indeterminate Archaic | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | 1 |
| Indeterminate projectile point | - | - | - | 1 | - | - | - | - | - | - | - | 3 | - | - | - | - | - | - | - | - | - | - | - | - | 4 |
| Biface | - | - | - | 15 | 1 | - | - | - | - | - | - | 1 | - | 1 | - | 1 | - | 1 | - | - | - | - | 1 | - | 21 |
| Uniface | - | - | - | 7 | - | - | - | - | - | - | - | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - | 10 |
| Scraper | - | - | 1 | 10 | - | - | - | - | - | - | - | - | - | - | - | 2 | - | - | - | - | - | - | 1 | - | 14 |
| Graver | - | - | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| Notched tool | - | - | 1 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 4 |
| Drill | - | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | 3 |
| Core | - | - | - | 20 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 20 |
| Column total | 5 | 1 | 28 | 7970 | 5 | 5 | 0 | 1 | 7 | 10 | 0 | 252 | 0 | 57 | 0 | 263 | 1 | 48 | 1 | 1 | 17 | 0 | 29 | 19 | 8720 |
| **SPETH COLLECTION** | | | | | | | | | | | | | | | | | | | | | | | | | |
| Angular debris | 662 | - | 52 | 27 | - | - | - | - | - | - | - | - | - | - | - | 13 | - | 2 | 4 | - | 2 | - | 4 | - | 766 |
| Core flake | 59 | - | 41 | 5 | - | - | - | - | - | - | - | - | - | 1 | - | 10 | - | 1 | 1 | - | - | 1 | - | - | 119 |
| Biface flake | 3 | - | 4 | - | - | - | - | - | - | - | - | - | - | - | - | 2 | - | - | - | - | - | - | - | - | 9 |
| Drill | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | 1 |
| Column total | 724 | 0 | 97 | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 26 | 0 | 3 | 5 | 0 | 2 | 1 | 4 | 0 | 895 |
| **BROWN COLLECTION** | | | | | | | | | | | | | | | | | | | | | | | | | |
| Angular debris | 23 | - | 4 | 2 | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | 1 | - | - | - | 31 |
| Utilized angular debris | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| Core flake | 105 | - | 10 | 8 | 1 | - | - | - | - | - | - | 1 | - | 4 | - | 13 | - | 2 | - | - | - | - | 1 | - | 145 |
| Utilized flake | 22 | - | 1 | 3 | - | - | - | - | - | - | - | - | - | - | - | 4 | - | - | - | - | - | - | - | - | 30 |
| Utilized biface flake | 6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 6 |
| Blade | 2 | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 4 |
| Channel flake | 13 | - | - | 1 | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | 15 |
| Utilized channel flake | 4 | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 5 |
| End scraper | 3 | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | 3 | - | 1 | - | - | - | - | - | - | 8 |

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Side scraper | 12 | - | 1 | 5 | - | - | - | - | - | - | - | - | - | 3 | 1 | 4 | - | 1 | - | - | - | - | - | - | 27 |
| End/side scraper | 10 | - | 1 | 1 | - | - | - | - | - | - | - | - | - | 2 | - | 9 | - | - | - | - | - | - | - | - | 23 |
| Thumbnail scraper | 6 | - | - | 2 | - | - | - | - | - | - | - | - | - | 1 | - | 3 | - | - | - | - | - | - | - | - | 12 |
| Drill | 17 | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | 2 | - | 1 | - | - | - | - | - | - | 21 |
| Chopper | 4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | 5 |
| Graver | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 | - | - | - | - | - | - | - | - | 8 |
| Scraper/graver | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| Unidentified projectile point | 14 | - | 4 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | 8 | - | - | - | - | - | - | - | - | 28 |
| Multidirectional core | 8 | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 10 |
| Utilized uniface flake | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| Uniface | 39 | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 41 |
| Biface | 50 | - | 6 | 1 | 1 | - | - | - | - | - | - | - | - | 1 | - | 17 | - | 4 | - | - | - | - | 1 | - | 81 |
| Folsom base | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| Folsom point | 1 | - | - | 8 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 9 |
| Merserve point | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| Plainview point | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| Cody Complex | - | - | - | - | - | - | - | - | - | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| Archaic point | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | 1 |
| Jay | 1 | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - | 1 | - | 1 | - | - | - | - | - | 2 | 7 |
| Jay/Bajada | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | 1 | 2 |
| Bajada point | 1 | - | - | - | - | - | - | - | - | - | - | - | - | 2 | - | 9 | - | 1 | - | - | - | - | - | - | 13 |
| Bajada/San Jose | 1 | - | - | 6 | - | - | - | - | - | - | - | - | - | - | - | 1 | - | 1 | - | - | - | - | - | - | 9 |
| San Jose point | 1 | - | - | 17 | - | - | - | - | - | - | - | 1 | - | 1 | - | 20 | - | 1 | - | - | - | - | - | - | 41 |
| San Jose/Armijo | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | 1 |
| Armijo | - | - | - | 13 | - | - | - | - | - | - | - | - | - | 2 | - | 9 | - | - | - | - | - | - | - | - | 24 |
| Chiricahua | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | 1 |
| En Medio point | 2 | - | - | 10 | - | - | - | - | - | - | - | 5 | - | 3 | - | 3 | - | 2 | - | - | - | - | - | - | 25 |
| En Medio/San Jose | - | - | - | - | - | - | - | - | - | - | - | - | - | 4 | - | 3 | - | - | - | - | - | - | - | - | 7 |
| San Augustin point | 1 | - | - | - | - | - | 1 | - | - | - | - | - | - | 4 | - | 1 | - | - | - | - | - | - | - | - | 7 |
| Basketmaker III | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 | - | 1 | - | - | - | - | - | - | - | - | 3 |
| Anasazi | - | - | - | 10 | - | - | - | - | - | - | - | 5 | - | 7 | - | 8 | - | - | - | - | - | - | - | - | 30 |
| Column total | 355 | 1 | 29 | 99 | 3 | 0 | 1 | 0 | 0 | 0 | 1 | 14 | 0 | 36 | 1 | 125 | 0 | 17 | 0 | 0 | 1 | 1 | 2 | 3 | 689 |
| **OAS STABILIZATION** | | | | | | | | | | | | | | | | | | | | | | | | | |
| Angular debris | 541 | - | 3 | 28 | - | - | - | - | - | - | - | - | - | - | - | 2 | - | - | 11 | - | - | - | 2 | - | 587 |
| Core flake | 94 | - | 4 | 10 | - | - | - | - | - | - | - | - | 2 | - | - | 1 | - | - | 3 | - | - | - | - | - | 114 |
| Biface flake | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | 3 |
| Bidirectional core | 3 | - | - | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 6 |
| Multidirectional core | 1 | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| End scraper | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| Unidentified projectile point | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | 1 |
| Plainview-like projectile point | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| San Jose projectile point | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | 1 |
| Column total | 642 | 0 | 7 | 43 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 5 | 0 | 0 | 14 | 0 | 0 | 0 | 2 | 0 | 716 |
| Grand total | 1726 | 2 | 161 | 8144 | 8 | 5 | 1 | 1 | 7 | 10 | 1 | 266 | 2 | 95 | 1 | 419 | 1 | 68 | 20 | 1 | 20 | 2 | 37 | 22 | 11020 |

**Key to ground stone abbreviations**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CHT | Chert | DDC | dendritic chert | OBN | obsidian | RHY | rhyolite |
| TEC | Tecolote chert | OLC | oolitic chert | JZO | Jemez obsidian | GRA | granite |
| WNC | Washington Pass/Narbona chert | SWD | silicified wood | PVO | Polvadera obsidian | LIM | limestone |
| SAC | San Andres chert | CSW | chalcedonic silicified wood | GSO | Grants obsidian | SIL | siltstone |
| CHC | Chinle chert | ZWD | Zuni wood | IGN | igneous | QTZ | quartzite |
| BBC | Brushy Basin chert | CDY | chalcedony | BAS | basalt | SSS | silicified sandstone |

facially retouched tools. According to Sullivan's notes from the lithic analysis (Sullivan n.d.), tertiary debitage occurs subsurface in the vicinity of Feature 19 in significant numbers (n=31). Level 1 of Feature 19 also yielded five bifaces, one uniface, four scrapers, three bifaces, two projectile points, and a drill. Level 2 of Feature 19 contained three bifaces, one uniface, and three scrapers.

Table 8 presents the distribution of facially retouched chipped stone according to Sullivan's feature areas (loci). Analysis of Sullivan's raw data shows that 70% of all biface flakes come from this area, which is the northern, or Sullivan's "non-contaminated-by-quarrying," area; 181 artifacts were associated with this area.

**Scraper/uniface flakes.** These are defined by Vierra and Anschuetz (1985:57) as "retouch flakes that have been detached from a unifacially retouched artifact." Marginal retouch is defined as retouch that extends over less than one-third of the surface of an artifact (Chapman and Schutt 1977). According to Sullivan's analysis, scraper flakes have the same characteristics as biface flakes, with the exception that retouch flakes from scrapers exhibit a unidirectionally retouched platform, and a platform angle of 60 to 90 degrees. As noted, these are certainly similar to "rejuvenation" flakes in other typologies (see Chapman and Schutt 1977). This artifact category accounts for 0.6% (n=50) of the assemblage overall. It can be adduced from Sullivan's lithic notes (Sullivan n.d.) that six artifacts of this type occur in or in the vicinity of Feature 19. Moreover, other flakes of this general category (undetermined tool flake, undetermined core/tool flakes) combine for an additional 229 artifacts (a total of 279 tool-derived artifacts). This is a fairly robust figure, and suggests activities other than quarrying. Based on these data, it might be legitimately surmised that a good deal of biface curation, tool production, and possibly resource processing occurred in the vicinity of the cluster of 11 pits that comprise Feature 19.

**Edge damage**. Table 9 lists type of edge damage recorded on debitage form Sullivan's project. These types of artifacts are typically referred to as "informal tools." A total of 780 edges were examined. Of 8227 debitage pieces evaluated, 726 (8.8%) displayed some form of edge damage. Sixty of the examined edges showed no edge damage ("absent"). The predominant type of damage was unidirectional scarring (n=366, 50.4%) followed by bidirectional scarring (n=281, 38.7%). San Andres chert was the dominant material type. It was not possible to determine the distribution of these artifacts over the site. However, retouched and/or utilized debitage accounts for 9% of the total assemblage, which is a relatively significant value.

**Edge angles on informal tools.** The angle of all modified edges—that is, utilized and/or retouched debitage, or "informal tools"—was recorded to the nearest five degrees (Table 10). Whole core flakes had a mean edge angle of 50.5 degrees (n=259), proximal core flake fragments had a mean edge angle of 49.4 degrees, (n=207), and other core flakes 49.3 degrees (Table 11). These data strongly suggest that core flakes were being selected for use as expedient tools. Contemporary flintknappers affirm that the edge of a freshly detached flake is far sharper than a bifacial tool. Moreover, the edge angles for core flakes cluster around 50 degrees, the edge angle most frequently associated with cutting. However, the overall edge-angle increment for all flakes is slightly higher, as illustrated in Fig. 30, where the 55 degree category was the most frequently recorded, followed by 40 degrees and 35 degrees. Gould et al. (1971) note that sharp-edged tools, with angles of 19 to 59 degrees, are associated with cutting activities, and that steep-edged tools, with angles of 40 to 89 degrees, are associated with scraping activities. Vierra (1980) found a similar bimodal distribution of edge angles selected for use, with 20 to 50 degrees for the first group (sharp; cutting) and 60 to 90 degrees for the second group (steep; scraping). In the combined collections, edge angles range from 20 to 90 degrees. The range of 35 to 45 degrees is typically associated with cutting soft materials; 50 to 55 degrees with cutting hard materials; and 60 to 70 degrees with scraping (Hayden 1979; Wilmsen 1968). Since these categories are well represented in the assemblages, it is reasonable to postulate the occurrence of activities involving cutting and scraping. If the distribution of these flakes had been plotted with greater accuracy, inferences could have been made concerning

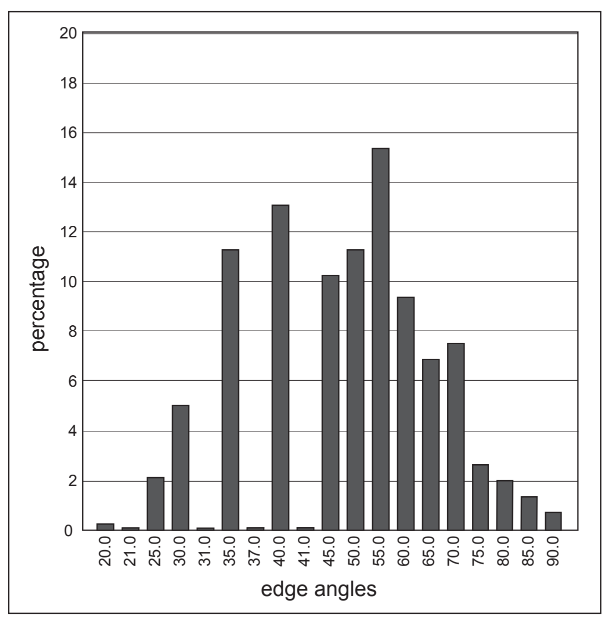


***Figure 30. Bar graph of debitage edge angles.***

**Table 8. Distribution of facially retouched tools, cores, cobble tools, large angular debris by collection/test loci.**

| | | Facially Retouched | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Tools | | Projectile Points | | | | | |
| Locus[1] | Level | n | Type | n | Type | Core | Large Angular Debris | Unidentified | Total |
| 3 | 0 | | | 1 | Folsom | 1 | | | 2 |
| 4 | 0 | | | | | | | 1 | 1 |
| 5 | 0 | 1 | scraper | 1 | indeterminate | | | | 2 |
| 7 | 1 | 1 | graver | | | | | | 1 |
| | 7 | 1 | scraper | | | | | | 1 |
| 8 | 0 | | | | | 1 | | | 1 |
| 10 | 0 | | | | | | | 1 | 1 |
| | 1 | | | | | | 1 | | 2 |
| 11-F | 0 | 1 | scraper | | | | | | 1 |
| | | 1 | graver | | | | | | 1 |
| | 1 | | | 1 | indeterminate | | | 1 | 2 |
| | | | | 1 | Bajada | | | 4 | 5 |
| | | | | 1 | San Jose | | | | 1 |
| | | 1 | notched tool | | | | | | 1 |
| 12 | 0 | | | | | | | 1 | 1 |
| 13 | 1 | | | | | | | 1 | 1 |
| 15 | 0 | 1 | uniface | | | | | | 1 |
| 16-F | 1 | 1 | drill | 1 | Jay | | | 1 | 3 |
| | | | | | | | | 3 | 3 |
| | | | | | | | | 1 | 1 |
| | 2 | | | | | | | 2 | 1 |
| 17-F | 0 | | | | | | | 10 | 10 |
| | 1 | | | | | | | 1 | 1 |
| 18-F | 0 | | | | | | | 2 | 2 |
| | 1 | | | 1 | San Pedro | 1 | | 2 | 4 |
| 19-F | 0 | | | | | | | 1 | 1 |
| | | | | | | | | 4 | 4 |
| | 1 | 5 | biface | 1 | indeterminate | 6 | 1 | 1 | 14 |
| | | 1 | uniface | 1 | San Jose | | | 2 | 4 |
| | | 4 | scraper | | | | | 12 | 16 |
| | | 1 | drill | | | | | 1 | 2 |
| | 2 | 3 | biface | | | 3 | | 6 | 12 |
| | | 1 | uniface | | | | | 1 | 2 |
| | | 3 | scraper | | | | | | 3 |
| 22 | 0 | | | | | | | 1 | 1 |
| | 1 | 1 | uniface | | | | | | 1 |
| | 2 | | | 1 | Armijo | | | | 1 |
| 23 | 0 | | | 1 | San Jose | | | 1 | 2 |
| 24 | 0 | 1 | biface | 1 | Jay | | | | 2 |
| | 1 | 1 | biface | 1 | En Medio | | | | 2 |
| | 2 | | | 1 | indeterminate | | | | 1 |
| 27 | 1 | 1 | scraper | | | | | | 1 |
| 29 | 0 | 2 | biface | | | 2 | | | 4 |
| | 1 | | | | | | | 1 | 1 |
| 30 | 0 | | | | | 1 | | | 1 |
| | 1 | | | | | | 1 | | 1 |
| 31-F | 0 | 1 | biface | | | | | 1 | 2 |
| | | | | | | | | 2 | 2 |
| | | | | | | | | 1 | 1 |
| | | | | | | | | 1 | 1 |
| | 1 | | | | | 1 | | 8 | 9 |
| | | | | | | | | 2 | 2 |
| | | | | | | | | 1 | 1 |
| | 2 | | | | | 1 | | | 1 |
| | 4 | 1 | uniface | | | | | | 1 |
| 33 | 0 | 1 | uniface | | | | | | 1 |
| | | 1 | notched tool | | | | | | 1 |
| | 1 | | | | | 1 | | | 1 |
| 34 | 0 | | | 1 | Folsom | | | | 1 |
| | 1 | | | | | | | 1 | 1 |
| 35 | 0 | | | 1 | Augustine | | | | 1 |
| 36 | 0 | | | 1 | Bajada | | | | 1 |
| 37 | 0 | | | 1 | indeterminate | | | | 1 |
| | | 1 | notched tool | | | | | | 1 |
| 38 | 0 | 3 | biface | 1 | Folsom | | | | 4 |
| | | 1 | uniface | 1 | indeterminate | | | | 2 |
| 39 | 0 | 1 | biface | | | | | | 1 |
| | | 1 | notched tool | | | | | | 1 |
| 40 | 0 | 1 | drill | | | | | | 1 |
| 41 | 0 | | | 1 | San Jose | | | | 1 |
| 42 | 0 | 1 | biface | | | | | | 1 |
| 43 | 0 | 1 | biface | | | 1 | | | 2 |
| | | 2 | scraper | | | | | | 2 |
| 44 | 0 | | | 1 | San Jose | | | 1 | 2 |
| 45 | 0 | | | | | | | 1 | 1 |
| 46 | 0 | | | | | | | 1 | 1 |
| 47 | 0 | 1 | biface | | | | | 1 | 2 |
| 53 | 0 | 1 | uniface | | | | | | 1 |
| 54 | 0 | 1 | biface | | | 1 | | 1 | 3 |
| 57 | 0 | | | 1 | Cody Complex | | | | 1 |
| Totals | | 51 | | 23 | | 20 | 3 | 84 | 181 |

## Table 9. Type of edge damage to debitage.

| **Material** / *Flake portion* / Flake source / damage | Total |
|---|---|
| **San Andres chert** | |
| *Whole flake* | |
| Core | |
| absent | 26 |
| unidirectional scarring | 113 |
| bidirectional scarring | 79 |
| unidirectional rounding | 4 |
| bidirectional rounding | 7 |
| bidirectional scarring and rounding | 2 |
| unidirectional scarring and rounding | 2 |
| Scraper/uniface | |
| unidirectional scarring | 1 |
| bidirectional scarring | 2 |
| bidirectional scarring and rounding | 2 |
| Undetermined tool | |
| unidirectional scarring | 5 |
| bidirectional scarring | 5 |
| unidirectional scarring and rounding | 1 |
| bidirectional rounding | 1 |
| bidirectional scarring and rounding | 3 |
| unidirectional scarring and rounding | 2 |
| Drill | |
| absent | 1 |
| Graver | |
| bidirectional scarring | 2 |
| *Proximal fragment* | |
| Core | |
| absent | 12 |
| unidirectional scarring | 86 |
| bidirectional scarring | 75 |
| bidirectional rounding | 4 |
| bidirectional scarring and rounding | 2 |
| Biface | |
| bidirectional scarring | 1 |
| Undetermined tool | |
| unidirectional scarring | 3 |
| bidirectional scarring | 6 |
| bidirectional rounding | 1 |
| Drill | |
| unidirectional rounding | 1 |
| Graver | |
| absent | 1 |
| unidirectional scarring | 1 |
| *Other flake* | |
| Undifferentiated | |
| absent | 15 |
| unidirectional scarring | 87 |
| bidirectional scarring | 53 |
| unidirectional rounding | 3 |
| bidirectional rounding | 5 |
| bidirectional scarring and rounding | 2 |
| unidirectional scarring and rounding | 1 |
| Scraper/uniface | |
| bidirectional scarring | 1 |
| Undetermined core/tool | |
| absent | 1 |
| Undetermined tool | |
| unidirectional scarring | 2 |
| unidirectional rounding | 1 |
| bidirectional rounding | 2 |
| bidirectional scarring and rounding | 4 |
| Undetermined core/tool | |
| absent | 1 |
| Graver | |
| absent | 1 |
| unidirectional scarring | 1 |
| bidirectional scarring | 1 |
| **San Andres chert (continued)** | |
| *Whole blade* | |
| Core | |
| unidirectional scarring | 3 |
| *Small angular debris* | |
| Undifferentiated | |
| absent | 5 |
| unidirectional scarring | 26 |
| bidirectional scarring | 22 |
| unidirectional rounding | 1 |
| bidirectional rounding | 1 |
| bidirectional scarring and rounding | 3 |
| unidirectional scarring and rounding | 1 |
| Drill | |
| bidirectional scarring | 3 |
| bidirectional scarring and rounding | 3 |
| Graver | |
| unidirectional rounding | 1 |
| **Chert** | |
| *Whole flake* | |
| Biface | |
| battered | 1 |
| *Proximal fragment* | |
| Biface | |
| battered | 1 |
| **Washington Pass/Narbona Pass chert** | |
| *Whole flake* | |
| Core | |
| absent | 1 |
| unidirectional rounding | 1 |
| unidirectional scarring and rounding | 1 |
| Scraper/uniface | |
| unidirectional scarring | 1 |
| Graver | |
| absent | 1 |
| *Proximal fragment* | |
| Core | |
| unidirectional scarring | 1 |
| **Silicified wood** | |
| *Small angular debris* | |
| Undifferentiated | |
| unidirectional scarring | 1 |
| **Chalcedonic silicified wood** | |
| *Whole flake* | |
| Core | |
| unidirectional scarring | 1 |
| *Proximal fragment* | |
| Core | |
| bidirectional scarring | 1 |
| **Chalcedony** | |
| *Whole flake* | |
| Core | |
| unidirectional scarring | 1 |
| bidirectional scarring | 3 |
| *Proximal fragment* | |
| Core | |
| unidirectional scarring | 2 |
| Biface | |
| unidirectional scarring | 1 |
| Undetermined tool | |
| absent | 1 |
| unidirectional scarring | 2 |
| *Other flake* | |
| Undifferentiated | |
| unidirectional scarring | 2 |
| bidirectional scarring | 1 |
| **Chalcedony (continued)** | |
| *Other flake (continued)* | |
| Biface | |
| unidirectional scarring | 1 |
| *Small angular debris* | |
| Undifferentiated | |
| unidirectional scarring | 1 |
| **Basalt** | |
| *Other flake* | |
| Undifferentiated | |
| bidirectional scarring | 1 |
| **Obsidian** | |
| *Medial flake* | |
| Biface | |
| battering | 1 |
| **Grants obsidian** | |
| *Whole flake* | |
| Core | |
| absent | 1 |
| unidirectional scarring | 6 |
| bidirectional scarring | 6 |
| Biface | |
| unidirectional scarring | 2 |
| unidirectional scarring and rounding | 1 |
| Undetermined tool | |
| unidirectional scarring | 1 |
| *Proximal fragment* | |
| Core | |
| unidirectional scarring | 8 |
| bidirectional scarring | 7 |
| Undetermined tool | |
| unidirectional scarring | 1 |
| Graver | |
| bidirectional scarring | 1 |
| *Other flake* | |
| Undifferentiated | |
| unidirectional scarring | 3 |
| bidirectional scarring | 1 |
| Undetermined tool | |
| bidirectional scarring | 3 |
| *Small angular debris* | |
| Undifferentiated | |
| unidirectional scarring | 2 |
| bidirectional scarring | 1 |
| **Jemez obsidian** | |
| *Proximal fragment* | |
| Core | |
| bidirectional scarring | 1 |
| Scraper/uniface | |
| bidirectional scarring | 2 |
| Undetermined tool | |
| bidirectional scarring | 1 |
| *Other flake* | |
| Undifferentiated | |
| unidirectional scarring | 1 |
| bidirectional scarring | 1 |
| **Silicified sandstone** | |
| *Whole flake* | |
| Core | |
| bidirectional rounding | 1 |
| **Total** | 780 |

## Table 10. Edge angles on informal tool flakes.

| Material / *Flake portion* / Flake source / angle (°) | projection | Total |
|---|---|---|
| **San Andres chert** | | |
| *Whole flake* | | |
| Core | | |
| 20 | absent | 1 |
| 25 | absent | 5 |
| 30 | absent | 10 |
| 35 | absent | 25 |
| 40 | absent | 30 |
| 45 | absent | 26 |
| 50 | absent | 34 |
| 55 | absent | 45 |
| 60 | absent | 19 |
| 65 | absent | 13 |
| 70 | absent | 13 |
| 75 | absent | 4 |
| 80 | absent | 5 |
| 85 | absent | 2 |
| 90 | absent | 2 |
| Graver | | |
| 45 | graver | 1 |
| 55 | graver | 1 |
| 60 | graver | 1 |
| 65 | graver | 1 |
| 75 | graver | 1 |
| Scraper/uniface | | |
| 55 | absent | 1 |
| 60 | absent | 1 |
| 65 | absent | 1 |
| 70 | absent | 2 |
| Drill | | |
| 55 | drill | 1 |
| 70 | drill | 1 |
| Undetermined tool | | |
| 25 | absent | 1 |
| 30 | absent | 1 |
| 35 | absent | 3 |
| 40 | absent | 1 |
| 45 | absent | 2 |
| 50 | absent | 3 |
| 55 | absent | 2 |
| 60 | absent | 1 |
| 65 | absent | 2 |
| 75 | absent | 1 |
| *Proximal fragment* | | |
| Core | | |
| 25 | absent | 4 |
| 30 | absent | 12 |
| 35 | absent | 26 |
| 40 | absent | 27 |
| 45 | absent | 21 |
| 50 | absent | 18 |
| 55 | absent | 24 |
| 60 | absent | 14 |
| 65 | absent | 11 |
| 70 | absent | 11 |
| 75 | absent | 4 |
| 80 | absent | 7 |
| 85 | absent | 1 |
| 90 | absent | 1 |
| Biface | | |
| 40 | absent | 1 |
| Undetermined tool | | |
| 20 | absent | 1 |
| 30 | absent | 2 |
| **San Andres chert (continued)** | | |
| *Proximal fragment (continued)* | | |
| Undetermined tool (continued) | | |
| 35 | absent | 2 |
| 40 | absent | 4 |
| 55 | absent | 1 |
| *Other flake* | | |
| Undifferentiated | | |
| 25 | absent | 5 |
| 30 | absent | 7 |
| 35 | absent | 18 |
| 40 | absent | 16 |
| 45 | absent | 23 |
| 50 | absent | 22 |
| 55 | absent | 22 |
| 60 | absent | 12 |
| 65 | absent | 14 |
| 70 | absent | 13 |
| 75 | absent | 6 |
| 80 | absent | 3 |
| 85 | absent | 4 |
| 90 | absent | 1 |
| Scraper/uniface | | |
| 50 | absent | 1 |
| Undetermined tool | | |
| 30 | absent | 2 |
| 35 | absent | 1 |
| 45 | absent | 1 |
| 50 | absent | 1 |
| 60 | absent | 4 |
| Undetermined core/tool | | |
| 35 | absent | 1 |
| Graver | | |
| 50 | graver | 2 |
| 60 | graver | 1 |
| *Whole blade* | | |
| Core | | |
| 40 | absent | 1 |
| 65 | absent | 2 |
| *Small angular debris* | | |
| Drill | | |
| 60 | drill | 1 |
| 65 | drill | 1 |
| 70 | drill | 3 |
| 85 | drill | 1 |
| Graver | | |
| 60 | graver | 1 |
| Undifferentiated | | |
| 40 | absent | 6 |
| 45 | absent | 2 |
| 50 | absent | 2 |
| 55 | absent | 13 |
| 60 | absent | 11 |
| 65 | absent | 4 |
| 70 | absent | 11 |
| 75 | absent | 4 |
| 80 | absent | 1 |
| 85 | absent | 3 |
| **Washington Pass/Narbona Pass chert** | | |
| *Whole flake* | | |
| Core | | |
| 55 | absent | 1 |
| 60 | absent | 1 |
| 70 | absent | 1 |
| **Washington Pass/Narbona Pass chert (continued)** | | |
| *Whole flake (continued)* | | |
| Graver | | |
| 60 | graver | 1 |
| Scraper/uniface | | |
| 40 | absent | 1 |
| *Proximal fragment* | | |
| Core | | |
| 40 | absent | 1 |
| Biface | | |
| 40 | absent | 1 |
| **Chert** | | |
| *Proximal fragment* | | |
| Core | | |
| 40 | absent | 1 |
| Biface | | |
| 30 | absent | 1 |
| *Whole flake* | | |
| Biface | | |
| 20 | absent | 1 |
| **Silicified wood** | | |
| *Small angular debris* | | |
| Undifferentiated | | |
| 60 | absent | 1 |
| **Chalcedonic silicified wood** | | |
| *Whole flake* | | |
| Core | | |
| 35 | absent | 1 |
| *Proximal fragment* | | |
| Core | | |
| 35 | absent | 1 |
| **Chalcedony** | | |
| *Whole flake* | | |
| Core | | |
| 40 | absent | 1 |
| 50 | absent | 1 |
| 55 | absent | 2 |
| *Proximal fragment* | | |
| Core | | |
| 30 | absent | 1 |
| 70 | absent | 1 |
| Biface | | |
| 60 | absent | 1 |
| Undetermined tool | | |
| 35 | absent | 2 |
| 40 | absent | 1 |
| *Other flake* | | |
| Undifferentiated | | |
| 30 | absent | 2 |
| 50 | absent | 1 |
| Biface | | |
| 45 | absent | 1 |
| *Small angular debris* | | |
| Undifferentiated | | |
| 50 | absent | 1 |
| **Basalt** | | |
| *Other flake* | | |
| Undifferentiated | | |
| 55 | absent | 1 |
| **Obsidian** | | |
| *Medial flake* | | |
| Biface | | |
| 35 | absent | 1 |
| **Grants obsidian** | | |
| *Whole flake* | | |
| Core | | |
| 30 | absent | 1 |
| 35 | absent | 1 |
| 40 | absent | 5 |
| 55 | absent | 1 |
| 60 | absent | 1 |
| 65 | absent | 2 |
| 70 | absent | 2 |
| Biface | | |
| 35 | absent | 1 |
| 55 | absent | 1 |
| Undetermined tool | | |
| 35 | absent | 1 |
| *Proximal fragment* | | |
| Core | | |
| 30 | absent | 1 |
| 35 | absent | 3 |
| 40 | absent | 4 |
| 50 | absent | 2 |
| 55 | absent | 2 |
| 60 | absent | 2 |
| 75 | absent | 1 |
| Undetermined tool | | |
| 30 | absent | 1 |
| Graver | | |
| 65 | graver | 1 |
| *Other flake* | | |
| Undifferentiated | | |
| 25 | absent | 2 |
| 65 | absent | 1 |
| 70 | absent | 1 |
| Undetermined tool | | |
| 40 | absent | 1 |
| 45 | absent | 1 |
| 50 | absent | 1 |
| *Small angular debris* | | |
| Undifferentiated | | |
| 55 | absent | 1 |
| 60 | absent | 1 |
| 65 | absent | 1 |
| **Jemez obsidian** | | |
| *Proximal fragment* | | |
| Core | | |
| 35 | absent | 1 |
| Scraper/uniface | | |
| 35 | absent | 1 |
| 40 | absent | 1 |
| Undetermined tool | | |
| 40 | absent | 1 |
| *Other flake* | | |
| Undifferentiated | | |
| 45 | absent | 2 |
| **Silicified sandstone** | | |
| *Whole flake* | | |
| Core | | |
| 55 | absent | 1 |
| **Total** | | 782 |

Table 11. Summary of edge angles.

| Flake type | Number | Minimum | Maximum | Mean | Std. Dev. |
|---|---|---|---|---|---|
| Whole core flakes | 259 | 20 | 90 | 50.5 | 12.97 |
| Whole biface flakes | 2 | 35 | 55 | 45.0 | 14.14 |
| Whole scraper/uniface flakes | 3 | 40 | 70 | 58.3 | 16.07 |
| Whole undetermined tool flakes | 14 | 25 | 75 | 47.1 | 13.69 |
| Proximal core fragments | 207 | 25 | 90 | 49.4 | 14.24 |
| Proximal biface fragments | 4 | 31 | 60 | 43.0 | 12.19 |
| Proximal scraper/uniface fragments | 2 | 35 | 40 | 37.5 | 3.54 |
| Proximal undetermined tool fragments | 12 | 20 | 55 | 35.8 | 8.48 |
| Other core flakes | 138 | 25 | 85 | 49.3 | 13.65 |
| Other biface flakes | 1 | 45 | 45 | 45.0 | - |
| Other scraper/uniface flakes | 1 | 50 | 50 | 50.0 | - |
| Other undetermined tool flakes | 8 | 30 | 60 | 47.5 | 12.82 |
| Other undetermined core/tool flake | 1 | 35 | 35 | 35.0 | - |
| Small angular debris | 1 | 40 | 40 | 40.0 | - |

site structure. However, there is sufficient evidence from the edge-angle data to adduce that specialized activities, characterized by activity areas, were probably occurring in the north area of the site. Given the assumption that there seems to be a strong hunting focus, it might also be speculated that large- and medium-bodied mammals were being processed in at least one component of the site.

**Cortex.** Continuous cortex data were monitored on a sample of 4620 lithic artifacts (53% of total debitage count). Cross-tabulating debitage type with cortex data (Table 12) showed that a total of 857 pieces out of 4620 exhibited some cortical increment; artifacts were noncortical. The highest frequency of cortex was found on the platforms of proximal flakes (n=232), followed by partial cortex on whole flakes (n=192), and cortex on platforms (n=132). The table indicates one instance of cortex located on the platform and dorsal portion of angular debris. This is undoubtedly a coding mistake since angular debris, by definition, does not display flake attributes. As data files were lacking, corrections could not be made. Presumably, high degrees of cortex are associated with quarry sites, where it is expected that testing for material suitability and primary decortication occurs. This appears to not be the case with Sullivan's La Vega lithic data. Approximately half (49.1%) of the items were noncortical, and only small amounts of dorsal cortex were recorded (n=25, 11%).

**Facially retouched lithic artifacts.** Table 13 identifies the facially retouched artifacts recovered during Sullivan's project; 77 (mostly fragmentary) items were evaluated, including projectile points (n=23, 29.9%). A wide range of temporal intervals is represented by the diagnostic types. The earliest type is Folsom (9000 to 8000 B.C.) (Fig. 31). These were from San Andres chert, and, considering the channel flake data below, were probably manufactured locally. A Cody Complex (6400 to 4999 B.C.) Eden-style projectile point base (made from Jemez obsidian) was also recovered during the project. Another possible Paleoindian fragmentary projectile point was analyzed. This was also made from San Andres chert, although whether from the local source or elsewhere was not determined. Dominating the assemblage, however, were projectile point types from the Archaic period, including Jay, Bajada, San Jose, Armijo and En Medio phases of the Oshara tradition. These range from approximately 5000 B.C. to A.D. 400 (Table 13). Among the lithic tools were 21 bifaces, followed by 14 scrapers, and 10 unifaces. San Andres chert accounted for 70% of the raw materials used to produce tools. Figure 32 illustrates the use of material types associated with projectile points through time. Although a small sample (n=23), it is possible to discern certain trends over a long period of time. For example, the use of basalt and other materials is restricted to the Early Archaic. The greatest use of basalt and Grants obsidian is in the Early Archaic, after which the use of both materials declines considerably. Also, a few unidentified Archaic points are manufactured from Grants obsidian. The presence of Jemez obsidian is consistent from Paleoindian times through to the Late Archaic, after which it disappears. Projectile points made from local San Andres chert peak

**Table 12. Cortex by debitage.**

| Cortex | Debitage Type: Whole | Proximal | Other | Whole Blade | Small Angular Debris | Total Row Percent Column Percent |
|---|---|---|---|---|---|---|
| Absent | 1855 | 1721 | 145 | 2 | 41 | 3764 |
| | 49.3% | 45.7% | 3.9% | 0.1% | 1.1% | 100.0% |
| | 81.7% | 80.0% | 94.2% | 100.0% | 97.6% | 81.5% |
| Platform only | 132 | 232 | 2 | - | - | 366 |
| | 36.1% | 63.4% | 0.5% | - | - | 100.0% |
| | 5.8% | 10.8% | 1.3% | - | - | 7.9% |
| 100% dorsal | 16 | 9 | - | - | - | 25 |
| | 64.0% | 36.0% | - | - | - | 100.0% |
| | 0.7% | 0.4% | - | - | - | 0.5% |
| Platform and partial dorsal | 66 | 45 | 2 | - | 1 | 114 |
| | 57.9% | 39.5% | 1.8% | - | 0.9% | 100.0% |
| | 2.9% | 2.1% | 1.3% | - | 2.4% | 2.5% |
| Platform and 100% dorsal | 10 | 6 | - | - | - | 16 |
| | 62.5% | 37.5% | - | - | - | 100.0% |
| | 0.4% | 0.3% | - | - | - | 0.3% |
| Partial dorsal | 192 | 138 | 5 | - | - | 335 |
| | 57.3% | 41.2% | 1.5% | - | - | 100.0% |
| | 8.5% | 6.4% | 3.2% | - | - | 7.3% |
| Total | 2271 | 2151 | 154 | 2 | 42 | 4620 |
| Row percent | 49.2% | 46.6% | 3.3% | 0.04% | 0.9% | 100.0% |
| Column percent | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

**Table 13. Facially retouched artifacts recovered during Sullivan's project.**

| Artifact type | Material Type: GSO | JZO | SAC | CDY | BAS | CHT | WNC | CHC | QZT | SWD | QUZ | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Folsom | - | - | 2 | - | - | 1 | - | - | - | - | - | 3 |
| Cody Complex | - | 1 | - | - | - | - | - | - | - | - | - | 1 |
| Jay | - | 1 | 1 | - | - | - | - | - | - | - | - | 2 |
| Bajada | 1 | - | - | - | 1 | - | - | - | - | - | - | 2 |
| Augustine | 1 | - | - | - | - | - | - | - | - | - | - | 1 |
| San Jose | 3 | - | - | - | - | 1 | - | - | - | 1 | - | 5 |
| Armijo | - | - | 1 | - | - | - | - | - | - | - | - | 1 |
| San Pedro | - | 1 | - | - | - | - | - | - | - | - | - | 1 |
| En Medio | - | - | 1 | - | - | - | - | - | - | - | - | 1 |
| Indeterminate Paleoindian | - | - | - | - | - | 1 | - | - | - | - | - | 1 |
| Indeterminate Archaic | 1 | - | - | - | - | - | - | - | - | - | - | 1 |
| Indeterminate projectile point | - | - | 1 | 3 | - | - | - | - | - | - | - | 4 |
| Biface | 1 | 1 | 15 | 1 | 1 | - | - | 1 | - | - | 1 | 21 |
| Uniface | - | 1 | 7 | 2 | - | - | - | - | - | - | - | 10 |
| Scraper | 2 | - | 10 | - | - | - | 1 | - | 1 | - | - | 14 |
| Graver | - | - | 1 | - | - | - | 1 | - | - | - | - | 2 |
| Notched tool | - | - | 3 | - | - | - | 1 | - | - | - | - | 4 |
| Drill | 1 | - | 2 | - | - | - | - | - | - | - | - | 3 |
| Total | 10 | 5 | 44 | 6 | 2 | 3 | 3 | 1 | 1 | 1 | 1 | 77 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Key to material type abbreviations** | GSO | Grants obsidian | BAS | basalt | CHC | Chinle chert |
| | JZO | Jemez obsidian | CHT | Chert | QZT | quartzite |
| | SAC | San Andres chert | WNC | Washington Pass/ Narbona chert | SWD | silicified wood |
| | CDY | chalcedony | | | QUZ | quartz |

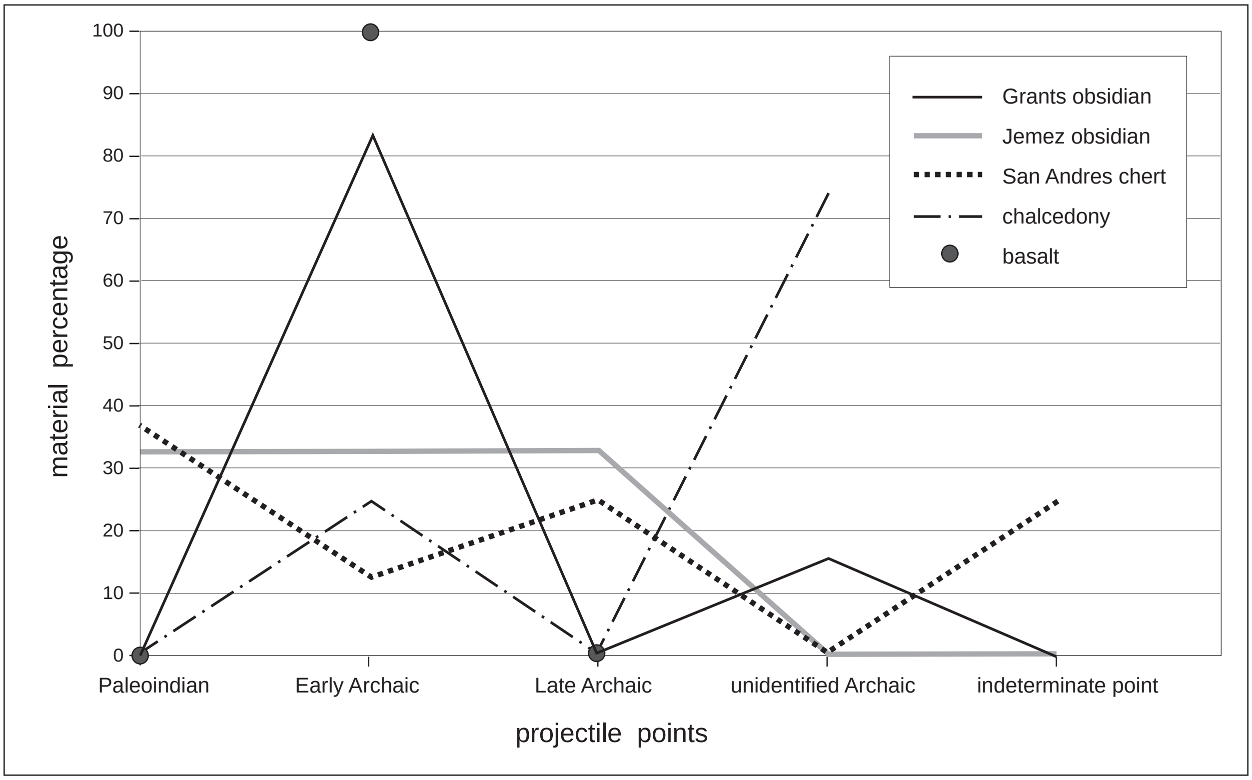


*Figure 31. Projectile point material types from Sullivan's excavation.*

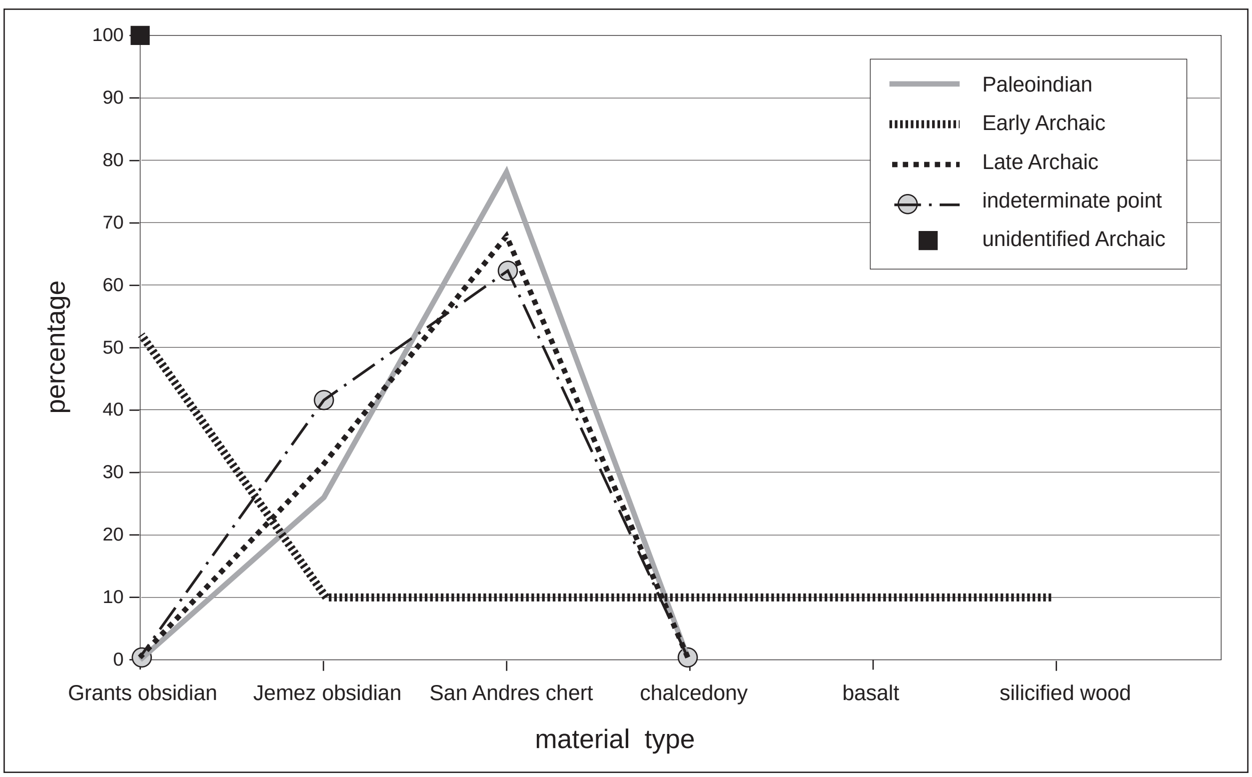


*Figure 32. Projectile points from Sullivan's excavations.*

during the Paleoindian period, followed by Late Archaic and points from the indeterminate period. Chalcedony appears to experience the highest usage for indeterminate point types, followed by a small peak during the Early Archaic. A comparison between the indeterminate point types with the Brown collection suggests that this category probably corresponds to either Late Archaic or Pueblo point types. The pattern for Paleoindian points is similar, with greater use of local chert over Jemez obsidian.

### Discussion and Conclusions of Sullivan's 1987 Lithic Analysis

Evidence of quarrying of lithic raw materials for lithic artifact manufacture is prominent in Sullivan's collection, and is certainly due to the presence on-site of a San Andres chert outcrop. Local raw material procurement is not as pronounced, however, as would be expected from a site that was exclusively reserved for quarrying. Lower frequencies of noncortical debris, biface flakes, and formal and informal tool production indicate activities other than simple quarrying. Apart from some fragmentary information from Features 19 and 31, most locational data were unavailable from the earlier La Vega excavations. The initial expectation that the south side of the site would be dominated by quarrying, and that the north side would reflect a greater array of activities is, however, borne out by Sullivan's lithic artifact data. These data afford a glimpse of what might have been occurring at this site, bearing in mind that both before and after Sullivan's project, substantial impacts were made to the surface distribution of lithic artifacts. In the following section, the remaining lithic artifact assemblages will be discussed, starting with Victor Brown's collection.

### The Brown Collection

Brown's collection consisted exclusively of facially retouched lithic artifacts (projectile points, tools, and the like), which made it impossible to compare debitage categories. However, the fragmentary projectile point and tool collection (Fig. 33; whole points remained with Brown) was analyzed during both Sullivan's 1986-1987 project, and during the OAS 2000 project.

#### *Projectile Points*

Projectile points from Brown's collection are identified in Table 14, and compared chronologically and by material type. A total of 211 fragmentary projectile points were classified according to standard OAS morphological characteristics (Table 14). Only the temporally diagnostic points were classified. There were 28 unidentified projectile points in Brown's collection. Temporally, there are some readily identifiable patterns that originate in the Early Archaic and continue through the Basketmaker and Pueblo periods. This trend is marked by a decreasing use of Grants obsidian in earlier times and an increased use of Jemez obsidian and local San Andres chert in later times. Anasazi points are mostly manufactured from nonlocal or "exotic" materials. The Paleoindian projectile points resemble Basketmaker points in their considerably greater use of local chert and Jemez obsidian (Table 14, Fig. 34). It is useful to compare Brown's and Sullivan's projectile points because, in the absence of Brown's debitage set, diagnostic projectile point types provide the only information-bearing data available.

#### *Channel Flakes*

Of great theoretical and practical value are the channel flakes that were present in the collection. A channel flake is a flake removed during the basal thinning of a fluted point, which is considered to be the penultimate stage in manufacture; the final stage is retouching the finished point (Callahan 1979:155). Channel flakes—large biface flakes, basically—are long in relation to their width, and thin with slight or no ventral curvature. Platforms (when present) are heavily modified, and dorsal flake scars are essentially perpendicular to the long axis of the flake except at the platform. Fifteen flakes of this variety were identified in Brown's collection by Dan Amick in 1991. After examining the entire collection, he noted (pers. comm., 1991; see also Amick 1997:1-3): "While Victor Brown may have gotten the 'keepers', these artifacts indicate a lot of point production from the local material." Some of these channel flakes are shown in Figure 35. He also identified several Paleoindian points broken in manufacture, which might be interpreted at first sight as evidence of point production. Figure 36 shows a Folsom point broken in manufacture (Art. No. 00-0-58; overshot during the first fluting attempt).

### Comparison of Brown's and Sullivan's Lithic Data

Brown collected 183 diagnostic projectile points and 28 undetermined types (n=211). Sullivan collected 23 including three of the indeterminate variety for a combined total of 234. Figure 37 shows the chronological distribution of projectile points by material type from both Sullivan's 1987 analysis, and from the Brown collection. According to this graph, early Paleoindian projectile points are manufactured exclusively from San Andres chert and chalcedony. Middle to late Paleoindian sees increased use of Jemez obsidian and chalcedony, which may have been introduced to the site from elsewhere. The Early Archaic witnesses the highest use of basalt, peaking in Bajada times. This is followed by nonlocal "other" materials, which reach their height in the San Jose period. The use of different types of obsidian or local chert is lower and occurs in almost equal proportions. The Middle Archaic sees the highest use of Grants obsidian and other nonlocal materials. San Andres chert reaches its maximum usage during Armijo times, when there is an increased use of local chert; but the lowest use of Grants obsidian of all Archaic periods. The Late Archaic appears to be a period of high lithic resource diversity, with the greatest use of local chert and Jemez obsidian, and the second highest use of chalcedony, basalt, and Grants obsidian. During Basketmaker III, local chert and Jemez obsidian predominate. There appears to be a general preference for projectile points made from chalcedony and Jemez obsidian during Pueblo times (Table 15).

## OAS 2000 La Vega Project

Lithic materials from the OAS 2000 project were analyzed according to the methods developed in *Standard Lithic Artifact Analysis: Attributes And Variable Code Lists* (OAS 1994b). Analysis and data entry were performed by Phillip Alldritt. A caveat should be added to the data recovery plan: as explained in the introduction to this report, the intent of the OAS 2000 excavations

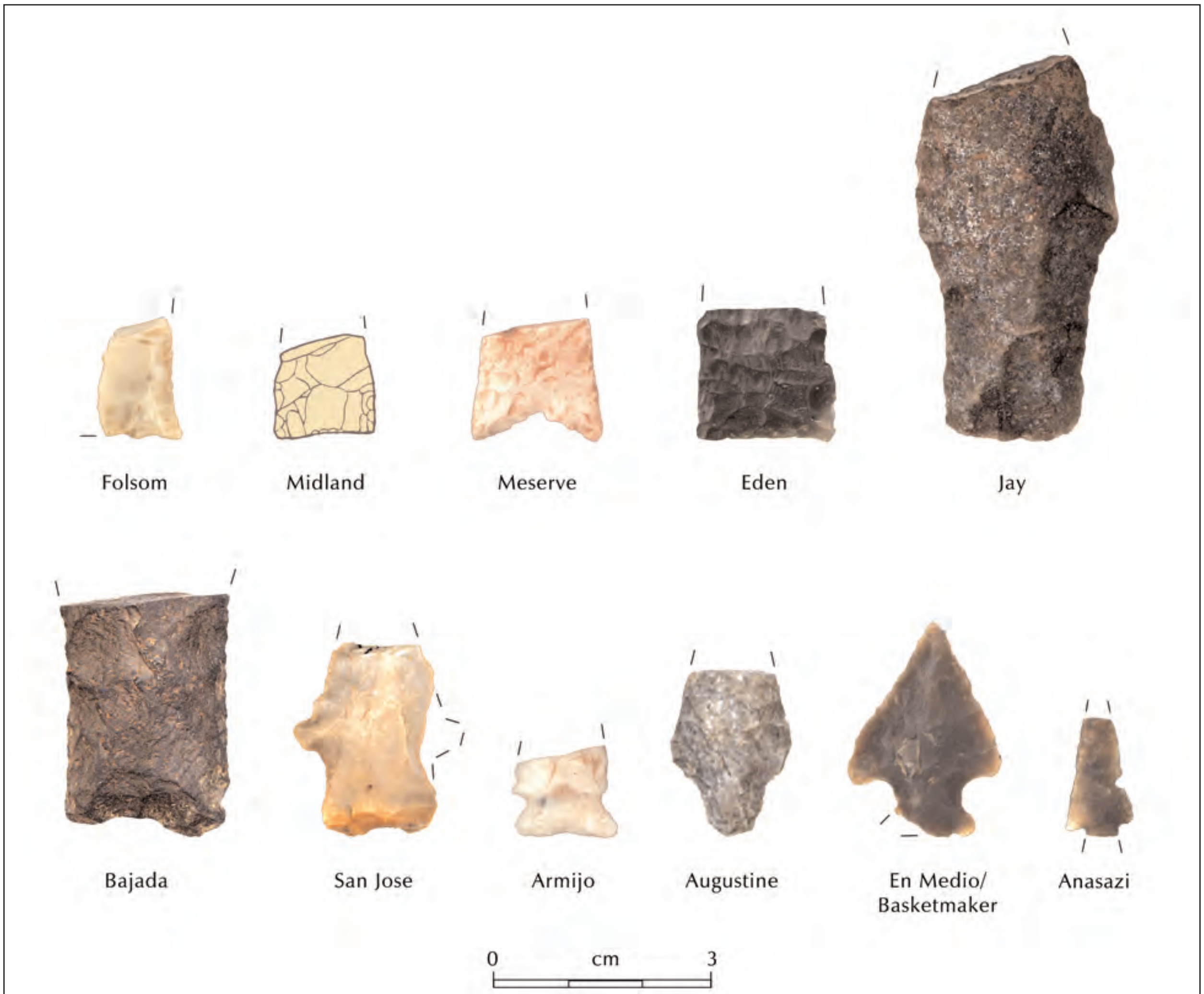


***Figure 33. Projectile point sequence from the La Vega site.***

**Table 14. Projectile points from the Brown collection.**

| | Material Type | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Artifact function | GSO | JZO | SAC | CHC | CDY | BAS | SSS | OTH | Total |
| Folsom | - | - | 8 | - | - | - | - | 1 | 9 |
| Merserve | - | - | 1 | - | - | - | - | - | 1 |
| Plainview | - | - | 1 | - | - | - | - | - | 1 |
| Cody Complex | - | - | - | - | 2 | - | - | - | 2 |
| Archaic | - | - | - | - | - | - | - | 1 | 1 |
| Jay | 1 | - | 2 | - | - | 1 | 2 | 1 | 7 |
| Jay/Bajada | - | - | - | - | - | 1 | 1 | - | 2 |
| Bajada | 9 | 2 | - | - | - | 1 | - | 1 | 13 |
| Bajada/San Jose | 1 | - | 6 | - | - | 1 | - | 1 | 9 |
| San Jose | 20 | 1 | 17 | - | 1 | 1 | - | 1 | 41 |
| San Augustin | 1 | - | 4 | - | - | - | - | 1 | 6 |
| San Jose/Armijo | 1 | - | - | - | - | - | - | - | 1 |
| Armijo | 9 | 2 | 13 | - | - | - | - | - | 24 |
| Chiricahua | 1 | - | - | - | - | - | - | - | 1 |
| En Medio | 3 | 3 | 10 | - | 5 | 2 | - | 2 | 25 |
| En Medio/San Jose | 3 | 4 | - | - | - | - | - | - | 7 |
| Basketmaker III | 1 | 2 | - | - | - | - | - | - | 3 |
| Anasazi | 8 | 7 | 10 | - | 5 | - | - | - | 30 |
| Unidentified projectile point | 8 | - | 1 | 1 | - | | | 18 | 28 |
| Total | 66 | 21 | 73 | 1 | 13 | 7 | 3 | 27 | 211 |

| | | | | |
|---|---|---|---|---|
| **Key to material type abbreviations** | GSO | Grants obsidian | CDY | chalcedony |
| | JZO | Jemez obsidian | BAS | basalt |
| | SAC | San Andres chert | SSS | silicified sandstone |
| | CHC | Chinle chert | OTH | other material |

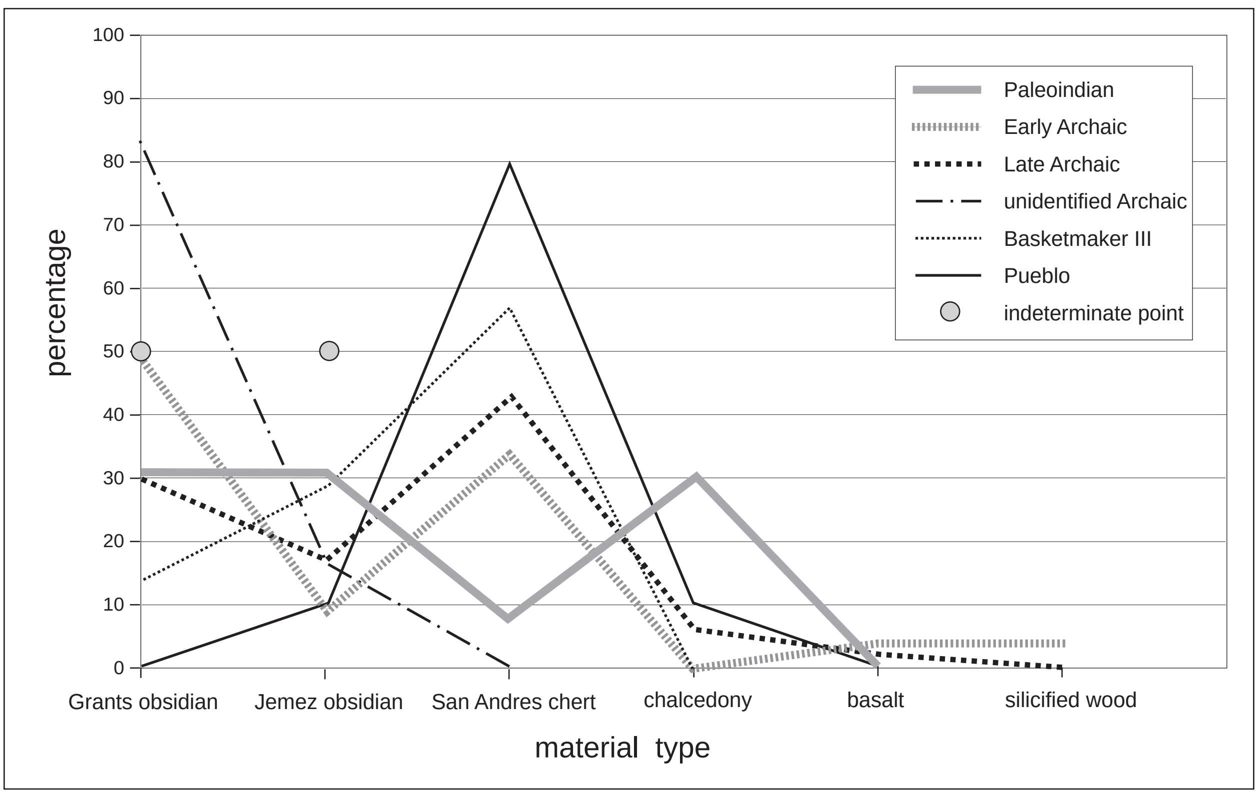


*Figure 34. Projectile points from the Brown collection.*

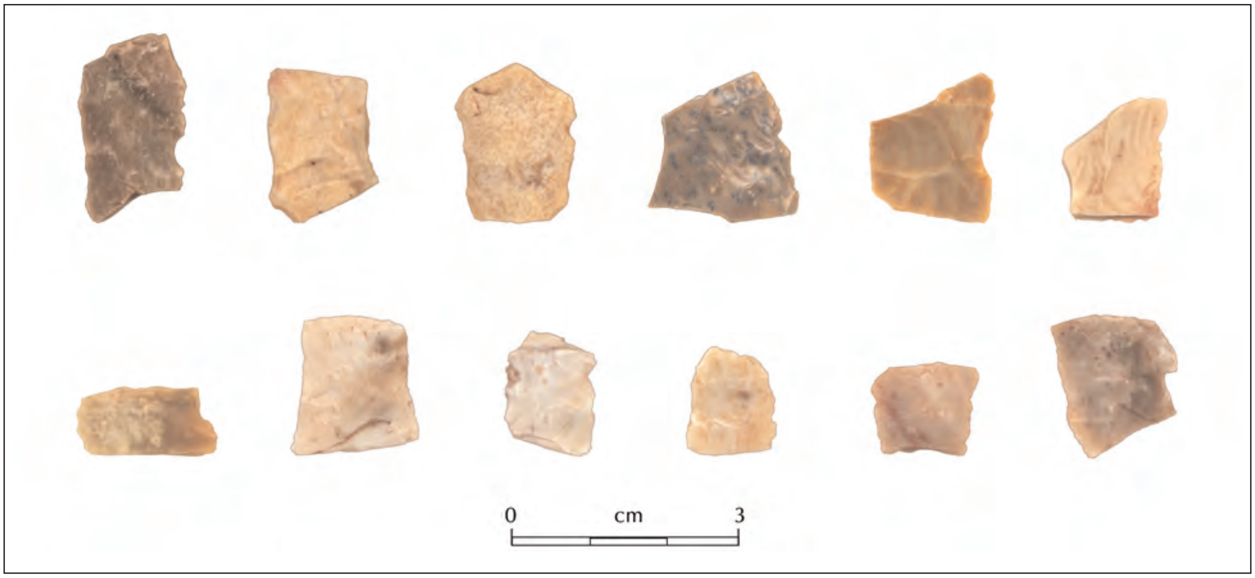


*Figure 35. Channel flakes from the Brown collection.*

**Table 15. Projectile points from the Brown and Sullivan collections combined.**

| | Material Type | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Projectile point type | GSO | JZO | SAC | CHC | CDY | BAS | OTH | Total |
| Folsom | - | - | 10 | - | - | - | 1 | 11 |
| Plainview | - | - | 1 | - | - | - | - | 1 |
| Merserve | - | - | 1 | - | - | - | - | 1 |
| Cody Complex | - | 1 | - | - | 2 | - | - | 3 |
| Archaic | - | - | - | - | - | 1 | 1 | 2 |
| Jay | 1 | 1 | 3 | - | - | 1 | 3 | 9 |
| Jay/Bajada | - | - | - | - | - | 1 | 1 | 2 |
| Bajada | 10 | 2 | - | - | - | 2 | 1 | 15 |
| Bajada/San Jose | 1 | - | 6 | - | - | 1 | 1 | 9 |
| San Jose | 23 | 1 | 17 | - | 1 | 1 | 3 | 46 |
| San Augustin | 2 | - | 4 | - | - | - | 1 | 7 |
| San Jose/Armijo | 1 | - | - | - | - | - | - | 1 |
| Armijo | 9 | 2 | 14 | - | - | - | - | 25 |
| Chiricahua | 1 | - | - | - | - | - | - | 1 |
| En Medio | 3 | 3 | 11 | - | 5 | 2 | 2 | 26 |
| San Pedro | - | 1 | - | - | - | - | | |
| En Medio/San Jose | 3 | 4 | - | - | - | - | - | 7 |
| Basketmaker III | 1 | 2 | - | - | - | - | - | 3 |
| Anasazi | 8 | 7 | 10 | - | 5 | - | - | 30 |
| Unidentified projectile point | 8 | - | 1 | 1 | - | - | 18 | 28 |
| Indeterminate projectile point | - | - | 1 | - | 3 | - | - | 4 |
| Indeterminate Archaic point | 1 | - | - | - | - | - | - | 1 |
| Indeterminate Pueblo point | - | - | 1 | - | - | - | - | 1 |
| Total | 72 | 24 | 80 | 1 | 16 | 9 | 32 | 233 |

**Key to material type abbreviations**

| | | | |
|---|---|---|---|
| GSO | Grants obsidian | CDY | chalcedony |
| JZO | Jemez obsidian | BAS | basalt |
| SAC | San Andres chert | OTH | other material |
| CHC | Chinle chert | | |

was not to perform data recovery with the goal of augmenting preexisting data, but to ensure that no cultural remains were destabilized during the Endangered Sites (ASSAPP) remediation program. Only eroded areas that were to be stabilized were excavated, therefore, instead of identifying areas that would add to scientific information from previous projects.

A total of 720 lithic artifacts were recovered from the OAS 2000 excavations. They are classified by material type and artifact type in Table 16.

*Material Type*

Chert is the dominant material type (n=644, 89.4%), followed by San Andres chert (n=43, 6%) and rhyolite (n=14, 1.9%). The remaining material types occur in nominal quantities, the highest being Washington Pass chert (n=7, 1.0%). It is likely, given the presence of a quarry on the site (Fig. 38), that the undifferentiated chert probably contains San Andres chert, but was not coded as such. This may have been due to the broad variability within this material type, which does not always carry the distinctive whorl-like "fingerprint" pattern. Chert is the most selected for material type among the largest artifact categories: angular debris (n=541, 84.0%), and core flakes (n=94, 14.3%). The local San Andres chert also appears in both of these categories, in smaller amounts (n=28, 65.1% for angular debris; n=10, 23.3% for core flakes). Rhyolite is also represented (n=11, 78.6%; n=3, 21.4%). Other types (Washington Pass chert, obsidian, and quartzite) occur in only negligible quantities.


***Figure 36. Folsom point broken in manufacture (from the Brown collection).***

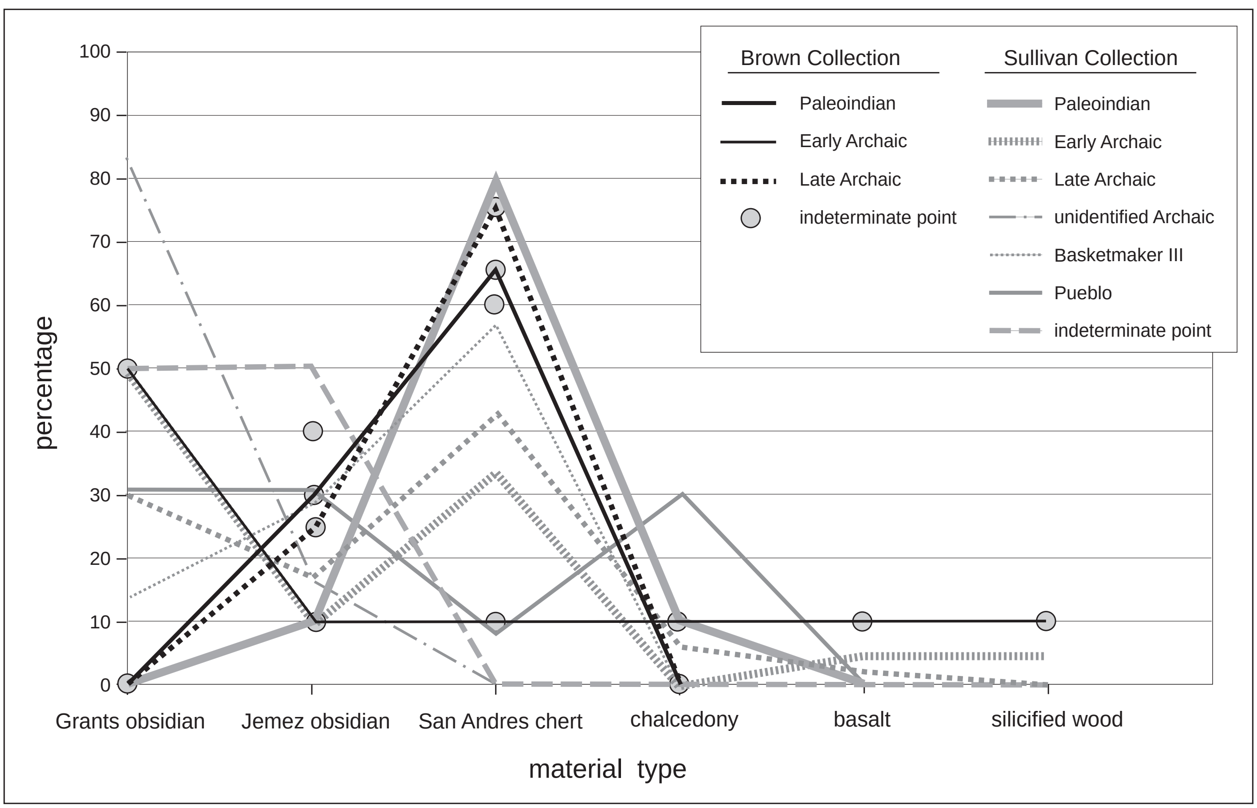


***Figure 37. Chronological distribution of projectile points by material type (Sullivan and Brown).***

*Artifact Type*

The most dominant artifact type was unutilized angular debris (n=587, 81.5%) followed by unutilized core flakes (n=114, 15.8%). Other artifact types occur in much smaller amounts: six bidirectional cores, four bifaces, five projectile points (Table 16). The Paleoindian point, although listed as unidentified, appears to correspond closely to post-Clovis/Folsom types originating in the western plains, e.g., Plainview-type—Midland, Milnesand, Meserve, etc., which date to approximately 7000 to 4000 B.C. A San Jose (3000 to 1800 B.C.) projectile point, manufactured from Jemez obsidian, was also recovered. Several cores of San Andres chert indicate the procurement and reduction of local materials from the quarry location.

## The Speth Collection

Dr. John Speth (University of Michigan) made a brief reconnaissance of the La Vega site in the summer of 1976, when he and some colleagues and students were surveying the Southwest for some likely Paleoindian localities; they made some surface collections and cursory excavations. The testing, which consisted of two 1-x-1-m test pits on each side of the outcrop, revealed an absence of significant stratigraphy. Because of the lack of information potential (at least partly the result of Brown's collections), Speth moved on, finally settling on the Garnsey site near Roswell (John Speth, pers. comm., 2001). In the collection from La Vega were two boxes simply labeled "Speth." Because there apparently was no analysis of these materials, and the proveniencing consisted of notations on the bags referring to "whole site," the OAS undertook to examine the artifacts. A sample was selected, equivalent to a little over 10% of the Sullivan (1987) assemblage (n=895; see Table 7).

*Material Type*

The dominant material type was chert (n=724, 80.9%), distantly followed by Washington Pass chert (n=97, 10.8%), and San Andres chert (n=32, 3.6%). Also repre-

**Table 16. All lithic artifacts recovered during OAS 2000 project.**

| | Artifact Morphology | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Material type | Angular Debris | Core Flake | Biface Flake | Bidirectional Core | Multi-directional Core | End Scraper | Biface | Early-Stage Biface | Unidentified Projectile Point | Unidentified Paleoindian Projectile Point | San Jose Point | Late-Stage Biface | Row Total Row Percent Column Percent |
| Chert | 541 | 94 | 2 | 3 | 1 | - | - | 1 | - | 1 | - | 1 | 644 |
| | 84.0% | 14.6% | 0.3% | 0.5% | 0.2% | - | - | 0.2% | - | 0.2% | - | 0.2% | 100.0% |
| | 92.2% | 82.5% | 66.7% | 50.0% | 50.0% | - | - | 100.0% | - | 100.0% | - | 50.0% | 89.4% |
| Washington Pass chert | 3 | 4 | - | - | - | - | - | - | - | - | - | - | 7 |
| | 42.9% | 57.1% | - | - | - | - | - | - | - | - | - | - | 100.0% |
| | 0.5% | 3.5% | - | - | - | - | - | - | - | - | - | - | 1.0% |
| San Andres chert | 28 | 10 | - | 3 | 1 | 1 | - | - | - | - | - | - | 43 |
| | 65.1% | 23.3% | - | 7.0% | 2.3% | 2.3% | - | - | - | - | - | - | 100.0% |
| | 4.8% | 8.8% | - | 50.0% | 50.0% | 100.0% | - | - | - | - | - | - | 6.0% |
| Obsidian | - | 2 | 1 | - | - | - | - | - | - | - | - | - | 3 |
| | - | 66.7% | 33.3% | - | - | - | - | - | - | - | - | - | 100.0% |
| | - | 1.8% | 33.3% | - | - | - | - | - | - | - | - | - | 0.4% |
| Jemez obsidian | - | - | - | - | - | - | - | - | - | - | 1 | 1 | 2 |
| | - | - | - | - | - | - | - | - | - | - | 50.0% | 50.0% | 100.0% |
| | - | - | - | - | - | - | - | - | - | - | 100.0% | 50.0% | 0.3% |
| Grants obsidian | 2 | 1 | - | - | - | - | 1 | - | 1 | - | - | - | 5 |
| | 40.0% | 20.0% | - | - | - | - | 20.0% | - | 20.0% | - | - | - | 100.0% |
| | 0.3% | 0.9% | - | - | - | - | 100.0% | - | 100.0% | - | - | - | 0.7% |
| Rhyolite | 11 | 3 | - | - | - | - | - | - | - | - | - | - | 14 |
| | 78.6% | 21.4% | - | - | - | - | - | - | - | - | - | - | 100.0% |
| | 1.9% | 2.6% | - | - | - | - | - | - | - | - | - | - | 1.9% |
| Quartzite | 2 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| | 100.0% | - | - | - | - | - | - | - | - | - | - | - | 100.0% |
| | 0.3% | - | - | - | - | - | - | - | - | - | - | - | 0.3% |
| Column total | 587 | 114 | 3 | 6 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 720 |
| Row percent | 81.5% | 15.8% | 0.4% | 0.8% | 0.3% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.3% | 100.0% |
| Column percent | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

*Figure 38. View of San Andres Chert quarry, looking northeast to Mt. Taylor*

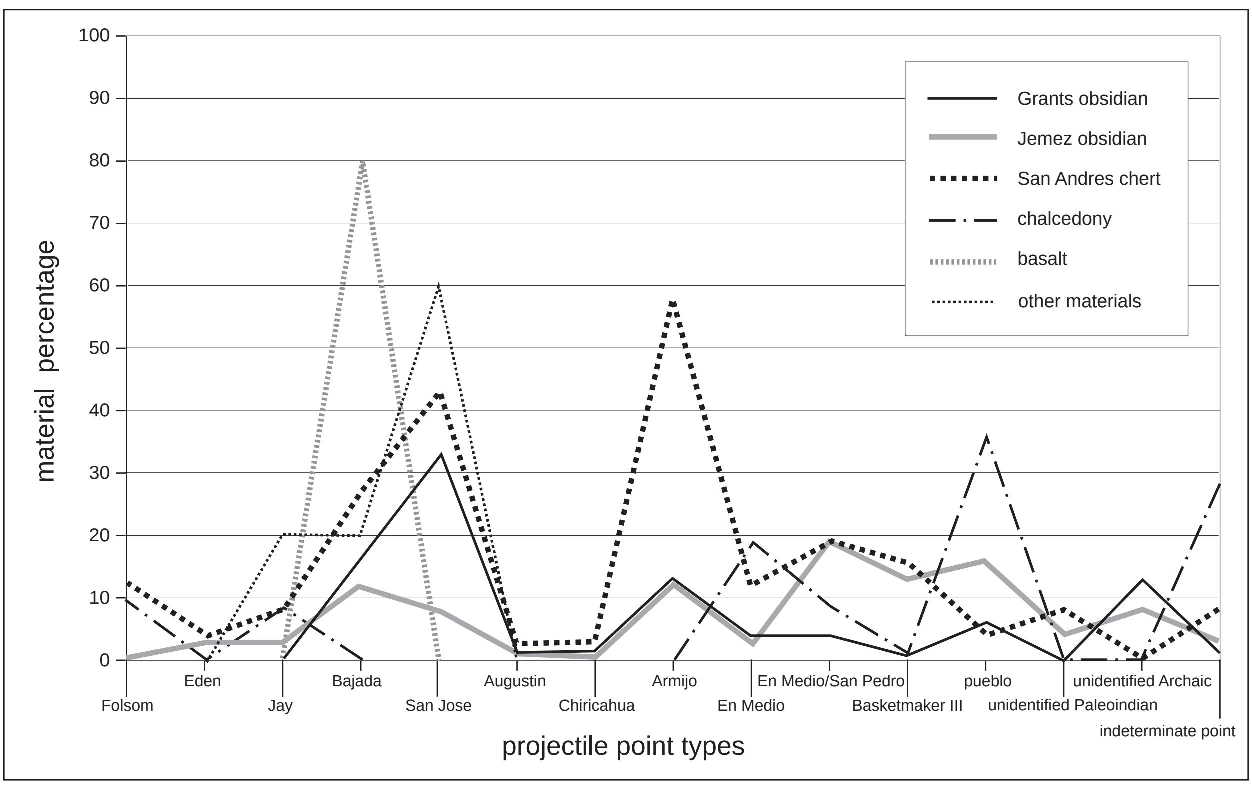


*Figure 39. Material types through time for all projectile points from La Vega.*

sented were Grants obsidian (n=26, 2.9%) and a single item of Jemez obsidian (see Table 7).

### *Artifact Type*

The most frequent artifact type recorded in the Speth collection is angular debris (n=766, 85.6%), followed by core flake (n=119, 13.3%), and biface flake (n=9, 1.0%) (see Table 7).

Data from the Speth collection indicate that material selection is mostly confined to local materials. Possible "exotics" include Jemez obsidian and Washington Pass chert, although it has not been concluded whether the Washington Pass chert present at La Vega is readily accessible in the nearby Zuni Mountains, or is of the Washington Pass/Narbona variety, which is at some greater distance. Material or artifact selection may also reflect selective collection practices, although, purportedly (John Speth, pers. comm., 2001) the site was 100% surface collected. No projectile points were collected.

## Conclusions of the Lithic Analysis

Implicit in the lithic analysis is the assumption that material remains on an archaeological site reflect the range of activities on that site. Conversely, it has been convincingly argued that only a partial picture is provided. There is usually an inverse relationship between the importance of an item—as measured by the frequency with which it is carried—and its occurrence as an item remaining on the site (Binford 1983). Due to the absence of good stratigraphic context on the majority of the lithic artifacts recovered during these projects, spatial analysis has been foregone in favor of assemblage-based inferences, and some general trends have been identified. The projectile point, core, and biface flake data rank as the most informative, and it is they that are considered first.

No projectile points were present in Speth's assemblage. The projectile points from the Sullivan, OAS 2000, and Brown collections were compared on the basis of chronology and material type (Sullivan n=23, Brown n=211, OAS n=3, total n=237). Figure 39 illustrates the use of material types through time for all projectile points from La Vega.

For the purposes of this analysis, Grants obsidian is considered a local material, chiefly because Mount Taylor is so clearly visible from the site, although it is still a least a day's walk away. The following patterns in the use of material types through time could be identified.

The highest use of basalt and Grants obsidian is in the Early Archaic, after which the use of both materials declines considerably. The use of basalt spikes dramatically during Bajada times. The highest use of Jemez obsidian and local San Andres chert is during the Late Archaic.

There are two peaks in the use of chalcedony—the Late Archaic (specifically En Medio and San Pedro) and Pueblo times. Most indeterminate points are chalcedony, which may place them in the Late Archaic or Pueblo intervals. There is a modest peak in the use of Jemez obsidian during Pueblo times. Paleoindian points are mostly manufactured from San Andres chert, with some made from Jemez obsidian and chalcedony. There is an increase in the use of Grants obsidian from the Early to Middle Archaic, then a decrease to Late Archaic and a further decrease to BM III. Pueblo use of Grants obsidian is greater than during Basketmaker III, approaching the quantities seen during the Late Archaic. There is a decrease in the use of Jemez obsidian from Early to Middle Archaic and then a steady increase through the Pueblo period.

Local San Andres chert is most common for Late Archaic Basketmaker points, but less so for middle/late Paleoindian and Early/Middle Archaic, and only rarely used for Pueblo points. Chalcedony and chert are almost exclusively used for Pueblo and Late Archaic period points, except for a single Paleoindian point.

From Early Archaic through Basketmaker times, use of Grants obsidian decreases, and use of Jemez obsidian and local San Andres chert increases. Pueblo or Anasazi peoples apparently preferred "exotic" materials for their projectiles. Materials during Paleoindian times resemble those from Basketmaker times in the considerably greater use of local chert and Jemez obsidian.

To conclude, material used during early Paleoindian times seems almost exclusively local San Andres chert. Middle to late Paleoindian raw materials suggest an increased use of Jemez obsidian which is either imported or traded in. The Early Archaic period sees the highest use of basalt, and second highest use of nonlocal "other materials" and chalcedony. The exploitation of Grants obsidian and other nonlocal materials is seen during the Middle Archaic. During this interval, there is an increase in local chert for point manufacture; this period also sees the lowest use of Jemez obsidian for Archaic projectile point production. The Late Archaic appears to be the time of highest resource diversity, with the highest use of local chert and Jemez obsidian, and the second highest use of chalcedony, basalt and Grants obsidian. The dominant material types during Basketmaker III are local chert and Jemez obsidian. Pueblo production seems to favor chalcedony and Jemez obsidian.

Several options are suggested by these data: (1) lower mobility, and higher trade in Paleoindian times;

(2) higher mobility, and decreased trade during the Early Archaic; or (3) lower mobility, and higher trade during the Late Archaic, Basketmaker and Anasazi, with a possible trend towards increasingly lower mobility and higher trade from Late Archaic to Anasazi. Because of sampling error and inadequate chronometric data, it is impossible to confidently select any of these. Some educated guesses are discussed below.

*Discussion*

The initial conclusion (bearing in mind the lack of data on intrasite patterning) might be that local materials and evidence of on-site manufacture during Paleoindian times suggest lower mobility and an occupation of some duration during Paleoindian times, particularly Folsom. This conclusion is supported by the presence of manufacturing debris such as channel flakes, fluted points broken in manufacture, and the preponderance of local materials. Evidence of fluting, the penultimate stage of manufacture (Callahan 1979:155), indicates that the full range of manufacturing stages took place. Other Paleoindian cultures apparently frequented the site, probably within a context of higher mobility than Folsom. Projectile points affiliated with other Paleoindian cultures (such as Eden, Midland, and Meserve) are manufactured mostly from exotic materials, which suggests a temporary logistical game strategy at this location. Many of the Archaic points are broken, with the base remaining. Broken points can be viewed as connected to rearmament in a hunting context, where the tips of the points have been broken off, either in misses (dart throwers frequently miss) or embedded in the game. The foreshaft, a prized piece of technology because of the scarcity of straight wood (indispensable to accuracy), is retained with the base still attached. The broken bases are discarded and replaced with new or refurbished points. The Archaic groups may have lingered there a little longer, in view of the higher frequencies at the base camp of tools made from local materials, and of biface flakes and curated points. However, some mobility or trade is indicated by the exotic materials from which their projectiles are manufactured. The Archaic period is characterized as a period of high mobility, so it is probable that La Vega served as a logistical component in an overall system of resource procurement.

Notwithstanding their respective temporal intervals, the data sets reflect only a fragment of the settlement system. For the hunters and gatherers, LA 9075 is only one component of a site system that includes base camps, limited base camps, and logistical sites. Due to the lack of spatial information, the kind of site that it is still remains unclear, although a great preponderance of the evidence suggests, at least during hunting and gathering times, that LA 9075 served repeatedly as a logistical site. Of true value is convincing evidence for in situ Paleoindian projectile point manufacture, particularly during the Folsom period. The fact that Brown inadvertently turned over the artifacts he considered inconsequential was actually fortunate for archaeological research. This tantalizing glimpse into the early processes of fluted point manufacture comes as a welcome surprise.

The original research design (Sullivan 1987:10) called for the use of chronometric dating techniques "in order to establish a chronological sequence of lithic artifact typologies," but the bleak results from the radiocarbon and obsidian samples made this impossible. Alternatively, a chronological sequence can be developed by seriating the temporally diagnostic artifacts recovered form the site, which is what has been undertaken in this section. While the research design initially focused on Paleoindian and Archaic components, artifacts from the Basketmaker and Anasazi components represent equally important adaptations.

Chronologically, the presence of temporally sensitive lithic materials suggests the following occupational sequence of the site.

All groups utilizing the La Vega site location availed themselves of the nearby San Andres chert quarry. The founding population at La Vega was probably the Paleoindian of the Folsom period. Evidence of projectile point manufacture (use of local materials, channel flakes, broken bifaces, broken and discarded projectiles, rejuvenation and biface debitage) is plentiful, suggesting a lengthy period of continued occupation. However, whether this occupation was permanent, intermittent or seasonal may vary in relation to the needs of a specific group. Cody complex, Meserve and Plainview Paleoindian projectile point types were also present, suggesting trade, interaction or occupation by these groups. Transitional diagnostic artifacts include Jay and Bajada projectile points.

The Archaic period enjoyed a long tenure at LA 9075, from early San Jose times through Armijo. Again, as in Paleoindian times, evidence of stone tool manufacture and refurbishing activities is abundant. Several items of ground stone, whose exact temporal interval is unknown, may have been used by Archaic groups for the processing of wild foods. A single Desert culture Chiricahua point of the Chiricahua-Cochise tradition was recorded. Some Basketmaker III and Pueblo I materials were noted. These temporal intervals were followed by a pronounced Pueblo II occupation, characterized by the expedient use of local materials, diagnostic projectile points, bifacial tools, specialized tools and ground stone. After a hiatus during the late prehistoric and the early historic periods, the site was reoccupied by Euroamerican populations, who may have used stone tools. These occupations are discussed in greater detail in the concluding section of this report.

CHAPTER 9

# LA VEGA GROUND STONE

DOROTHY A. ZAMORA

## INTRODUCTION

The ground stone assemblage from LA 9075 (La Vega) is fairly small: 88 artifacts were recovered. Sullivan's excavations in 1986 collected 84 ground stone items; three were collected by Lentz in 2000 during the testing and stabilization of the La Vega site for the Endangered Sites program; and one by Speth during testing in 1976. The three artifacts collected by Lentz and the one collected by Speth were analyzed using a standardized manual produced by the Office of Archaeological Studies (1994a). The Sullivan collection was incorporated into the assemblage data but was not reanalyzed .

Because the botanical and palynological analyses were negative, and no pollen washes were done for any of the ground stone artifacts, it is very difficult to determine what was being processed with the recovered ground stone artifacts.

## METHODS

Several variables were monitored in the analysis; they are listed below.

| | |
|---|---|
| Field specimen number | Plan view outline form |
| Material type | Flaked surface or margin present |
| Material texture | Heat |
| Preform morphology | Use number |
| Production input | Portion |
| Shaping | Function |
| Length | Ground surface cross section |
| Width | Ground surface sharpening |
| Thickness | Primary wear |
| Weight | Secondary wear |
| Ground surface measurement | Alterations |
| Mano cross section | Adhesions |
| Metate depth | Striations |

Although each artifact was measured and weighed, only the ground surfaces of the whole manos were measured—in order to categorize the grinding surfaces of these artifacts and compare them with Hard's agricultural dependency models (Hard 1994; Hard and Nickels 1994). The ground surface measurements were taken using a template in 1-cm increments—by placing it over the ground surface of the artifact and counting each square.

**Table 17. Ground stone artifacts from La Vega.**

| Artifact | Material Type | | | | | Count |
|---|---|---|---|---|---|---|
| | Basalt | Vesicular Basalt | Sandstone | Quartzite | Quartzitic Sandstone | Row Percent |
| Indeterminate | - | - | 15 | - | - | 15 |
| | - | - | 100.0% | - | - | |
| | - | - | 20.0% | - | - | 17.0% |
| Indeterminate mano | - | 1 | - | 7 | - | 8 |
| | - | 12.5% | - | 87.5% | - | |
| | - | 33.3% | - | 100.0% | - | 9.1% |
| One-hand mano | 1 | 2 | 5 | - | 2 | 10 |
| | 10.0% | 20.0% | 50.0% | - | 20.0% | |
| | 100.0% | 66.7% | 6.7% | - | 100.0% | 11.4% |
| Indeterminate metate | - | - | 22 | - | - | 22 |
| | - | - | 100.0% | - | - | |
| | - | - | 29.3% | - | - | 25.0% |
| Trough metate | - | - | 1 | - | - | 1 |
| | - | - | 100.0% | - | - | |
| | - | - | 1.3% | - | - | 1.1% |
| Slab metate | - | - | 32 | - | - | 32 |
| | - | - | 100.0% | - | - | |
| | - | - | 42.7% | - | - | 36.4% |
| Count | 1 | 3 | 75 | 7 | 2 | 88 |
| Column percent | 1.1% | 3.4% | 85.2% | 8.0% | 2.3% | 100.0% |

## ARTIFACT DESCRIPTIONS

The ground stone assemblage (Table 17) consists of three different categories of items: manos, metates, and indeterminate ground stone. Only one whole trough metate was recovered from the La Vega site during the 1986 excavation; three whole one-hand manos were recovered by Lentz (n=2) and Speth (n=1).

### *Manos*

Of the 18 manos analyzed from all three excavations at the La Vega site, 10 were identified as one-hand types and the others were indeterminate. The definition used in this report for a one-hand mano is a hand stone that is small enough to fit in one hand comfortably. It may exhibit wear on one or both surfaces. Sometimes they are fully shaped, or they can be cobbles in their natural form that are used for grinding or processing food. All but three of the manos were fragmented.

The complete manos are small sandstone and basalt artifacts that have been fully shaped by grinding (both sandstone and vesicular basalt are available from outcrops on the site). The sandstone manos are oval in shape and have wear on opposing surfaces. The striations on both surfaces are width-wise, giving the surfaces a convex shape. A circular wear pattern would be expected for this type of mano, especially because it has been recovered from the Archaic component on site. The vesicular basalt mano has one ground surface, and grinding along the sides from shaping. The surface does not show extensive wear, but has a sheen. One indeterminate mano fragment was recovered that could not be placed into the one-hand or two-hand categories.

### *Metates*

There are several metate fragments and whenever possible the pieces were fitted together and counted as one. After this was done a total of 55 metate artifacts were counted. Only one, a trough metate, was whole—the rest were fragments. Of these 55 items, 32 were slab metate fragments which were distinguishable by their thickness and tabular look; the rest were indeterminate small pieces. All the metate artifacts were collected during the 1986 excavations.

### *Indeterminate Ground Stone*

These are very small fragments that have a small ground area making it difficult to determine their function. Sullivan (1987) referred to them as manuports or milling stones, but in reality they are indeterminate ground stone fragments.

## Mano Size and Corn Dependency

At La Vega, it may be impossible to utilize this data in the debate over corn dependency and mano size (Lancaster 1984; Hard 1990; Hard and Nickels 1994; Mauldin 1993; Diehl 1996). These authors believe that mano size is a good indicator of corn dependency by prehistoric people. Adams (1999), on the other hand, states that mano size is more relevant to tool configuration and processing strategies.

No pollen washes were taken from the ground surfaces of the artifacts. The pollen (Appendix 3) and flotation (Appendix 1) samples collected were from the features that did not contain any ground stone, and the analytical results were negative with no prehistoric botanical or palynological remains. This makes it virtually impossible to know what food was being processed.

Mean mano length was used to see how the whole manos would fit into Hard's (1990) model (if one mano had two use surfaces, both were used in the calculations). Mean mano length is 10.74 cm (n=5) with a standard deviation of 1.99 cm, and mean ground-surface area is 59.0 square centimeters with a standard deviation of 16.96 square centimeters. Both these parameters fall short of Hard's (1996) standard for corn dependency of 15 cm for the mean length, and 152 to 175 square centimeters for the ground-surface area, implying that the site occupants were not using corn. Along with the fact that both the botanical and palynological analyses were negative, it can only be suggested that these manos were used to process wild food resources.

Adams (1999), Wright (1993), and Stone (1994) all argue that ground stone morphology is not a good predictor of subsistence strategies. They believe that processing strategies and differing techniques are the reasons for variation in manos and metates through time. Some utilization of corn by site occupants cannot, therefore, be ruled out.

## Conclusions

The ground stone from La Vega is a very small assemblage (n=88), which includes only three whole manos and one whole trough metate. Because La Vega is a multicomponent site ranging from Paleoindian to Pueblo, more variety of ground stone would be expected, especially from the Pueblo period. The small amounts of ground stone in these assemblages could be due to the fact that the Sullivan (1987) and Lentz (2000) excavations were restricted to the highway right-of-way. The 1976 surface collections by Speth near the rock outcrops were too restrictive to recover much ground stone from the site, much less a variety of these artifacts. Most of Sullivan's (1987) ground stone was collected from either the surface (n=39) or just below it in the stripping (n=37); eight ground stone fragments were found in Level 2.

Given the insufficient data and absence of botanical and palynological samples, the question still remains as to what was being processed at La Vega. The one-hand manos suggest wild food resources, whereas the trough metate implies that two-hand manos were also present. This is, however, all hypothetical. According to the approach of Adams (1999), Wright (1993), and Stone (1994), which asserts that morphology is not a reliable predictor of subsistence strategies, the ground stone should show different processing strategies along with differing techniques through time because this is a multicomponent site. There are, however, not enough whole ground stone artifacts in the La Vega collection to test these models.

CHAPTER 10

# TEST RESULTS AND STABILIZATION PROGRAM

On December 1, 1999, Yvonne Oakes (principal investigator) and Stephen Lentz (project director) identified specific areas within the right-of-way in which cultural materials were destabilized through erosion (see Fig. 2). These materials, exposed during highway shoulder improvement, consisted primarily of concentrations of lithic artifacts. All stages of reduction are present, including formal and informal tools, and local and exotic material types. Five specific areas were identified. At the conclusion of the excavation portion of the project, the site was transit mapped.

## Area 1

Area 1 is within the NMSHTD right-of-way, approximately 10 m south of the southernmost culvert. It consists of an artifact concentration threatened by braided erosion channels washing downslope from the east. It measures 10 m by 12 m (120 square meters, or 1,292 square feet). Area 1 was tested by means of a 1-by-1-m excavation unit (EU-1) and surface stripping.

**Excavation Unit 1.** This 1-by-1-m unit was excavated at 134N/200E parallel to the right-of-way fence, and 1.08 m east. It was placed at the head of an east-flowing arroyo (see Fig. 2). EU 1 was excavated in three arbitrary levels. Sterile soil was encountered at 44 cm below ground surface (bgs). Three major strata were defined (Fig. 40). The fill was characterized by 5YR 5/4 reddish-brown clayey loam with small to medium-sized gravels. A small quantity of lithic artifacts was encountered throughout the fill. The base of the pit was augered to a depth of 64 cm bgs before bedrock was encountered.

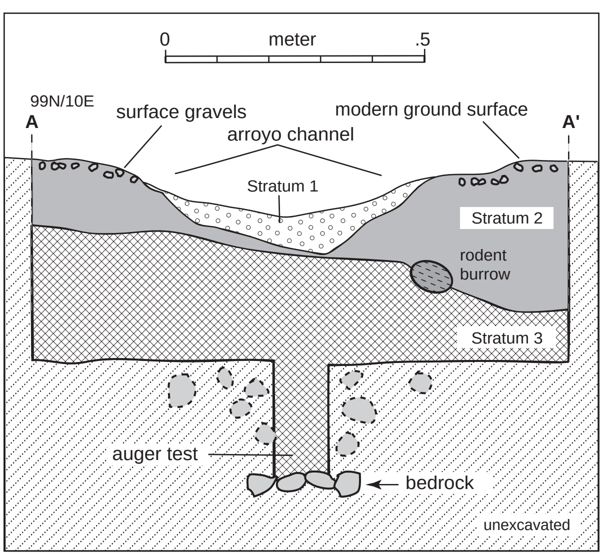


*Figure 40. Profile of Excavation Unit 1.*

**Surface stripping.** Thirteen 2-by-2-m units were used to test the surface for cultural remains. A grid was excavated from 127N 207E to 135N 207E (see Fig. 2). The amount of lithic artifacts recovered ranged from n=0 to n=47 per unit. The soil was 5YR 5/4 reddish-brown sandy clay with gravels. No features or artifact concentrations were encountered.

## Area 2

Area 2 (see Fig. 2) is 50 m north of the southernmost culvert. There is a lithic artifact concentration in this location that is threatened by a west-flowing erosional channel. This area measures 6 m by 10 m (60 square meters, or 646 square feet). Two 1-by-1-m and one 1-by-2-m excavation units, and a series of 2-by-2-m surface excavations were used to evaluate this area.

**Excavation Unit 2.** This 1-by-1-m unit was placed at 200N/200E in an area of localized erosion (Fig. 41);

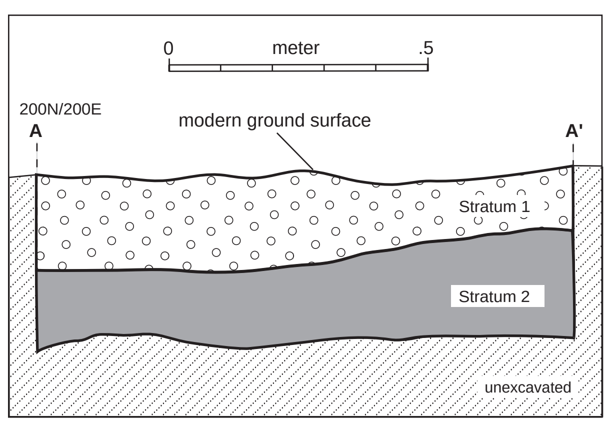


*Figure 41. Profile of Excavation Unit 2.*

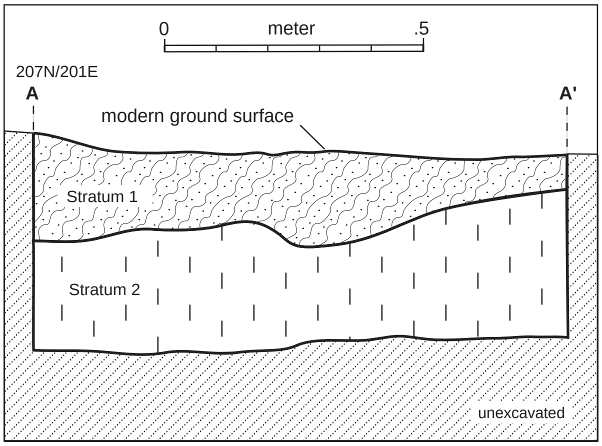


*Figure 42. Profile of Excavation Unit 3.*

it was 1.6 m east of, and parallel to, the right-of-way fence, and was excavated in three arbitrary levels. Artifacts were only encountered in the first level (n=3). The fill consisted of 5YR 5/4 reddish-brown sandy clayey loam with small to medium-sized gravels. Sterile soil was encountered at 50 cm bgs; the base of the pit was augered to 90 cm bgs.

**Excavation Unit 3.** EU-3 was placed at 208N/203E in an area of sheet wash (Fig. 42); it was 4.0 m east of, and parallel to, the right-of-way fence. This unit was excavated in four arbitrary levels to 60 cm bgs. No cultural materials were encountered.

**Excavation Unit 4.** This 1-by-2-m excavation unit was placed at 218N/203E, at the head of a small arroyo that is beginning to downcut the right-of-way shoulder. It was 2.6 m east of, and parallel to, the right-of-way fence. The unit was excavated in three arbitrary levels to a depth of 50 cm bgs. The fill was composed of compacted sandy loam with clay, increasingly compact towards the bottom of the pit, where it was characterized by highly compacted pinkish nodules containing less than 1% gravels. Munsell readings for the first two levels were 5YR 5/4 reddish-brown, and 5YR 7/4 hard pink for the third level (Fig. 43). Lithic artifacts increased towards the base of the unit. Eleven artifacts were recovered from Level 1, fourteen artifacts from Level 2, and 23 artifacts from Level 4.

**Surface stripping.** An area measuring 11 m by 11 m, parallel to the fence and extending north from 218N to 209E, was surface stripped to 10 cm bgs (see Fig. 2). The surface stratum was composed of loose topsoil and vegetation overlying compact sandy 5YR 5/4 reddish-brown sandy clay with small to medium-sized gravels. The artifact count was generally low, with a maximum of 34 lithic artifacts recovered from grid 228N/201E. A fragmentary item of ground stone was recovered from 229N/208E. The easternmost grids contained six or fewer artifacts. No features or artifact concentrations were encountered.

### Area 3

Area 3 is 90 m north of the southernmost culvert (see Fig. 2). It consists of a lithic artifact scatter threatened by erosion. The total area of the concentration is approximately 10 m by 14 m (140 square meters, or 1,507 square feet). Data recovery at Area 3 consisted of excavating one 1-by-1-m and one 1-by-2-m excavation units, and surface stripping two areas measuring 9 m by 2 m.

**Excavation Unit 5.** This 1-by-1-m unit was placed at the head of a small drainage at 253N/202E (see Fig. 2). Located 2.6 m east of the right-of-way fence, EU 5 was excavated in three arbitrary levels, ending at 50 cm bgs. The soil was characterized, in the upper two levels,

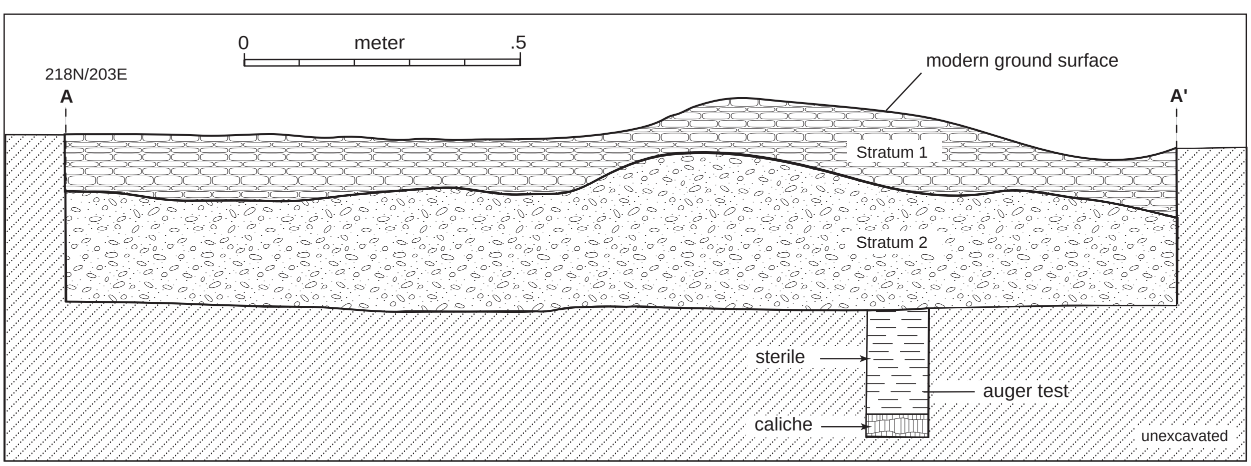


*Figure 43. Profile of Excavation Unit 4.*

as compact silty sand (5YR 5/4 reddish-brown), ending in a very hard sandy clay with caliche inclusions (5YR 7/4 pink) (Fig. 44). Lithic artifacts were present throughout the unit.

**Excavation Unit 6.** This 1-by-2-m unit was located at the head of a small drainage at 273N/201E (see Fig. 2). Located 1.48 m from the right-of-way fence, EU 6 was excavated in three arbitrary levels to 50 cm bgs (Fig. 45). All three levels were characterized by compact sandy clay (5YR 5/4 reddish-brown) with small to medium-sized gravels. No artifacts were encountered in this unit.

**Surface stripping.** Two areas were surface stripped in Area 3. The southernmost area was excavated in a single horizontal 10-cm level from 234N/202E to 247N/202E (see Fig. 2), and consisted of 18 contiguous 1-by-1-m grids. The soil was characterized by 5YR 5/4 reddish-brown loose topsoil with occasional vegetation. Artifact densities varied from zero to seven. No features or artifact concentrations were encountered.

The north area was excavated in a single horizontal 10-cm level from 262N/202E to 271N/202E and, like the south area, also contained 18 contiguous grid units (see Fig. 2). Reddish-brown 5YR 5/4 soil was encountered with sparse vegetation. Artifact densities were very low (zero to two). No features or artifact concentrations were encountered.

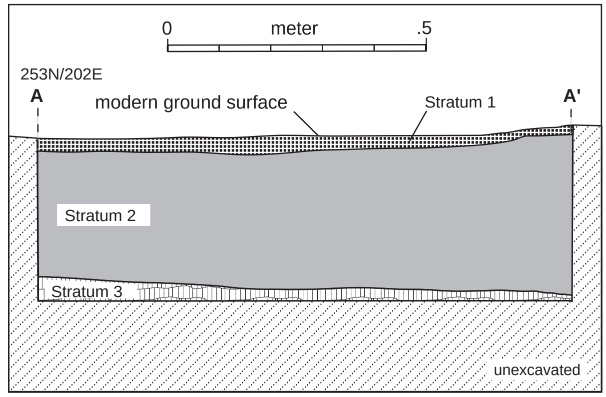

*Figure 44. Profile of Excavation Unit 5.*

### Area 4

Area 4 is a short distance to the south of the culvert near the middle of the site; it measures 6 m by 10 m (60 square meters, or 646 square feet), and consists of a concentration of lithic artifacts that are actively eroding within the right-of-way (see Fig. 2). Area 4 was surface collected only. The collected area ranged from 289N/200E to 297N/200E and 296N/205E. Only four grids contained lithic artifacts: 295N/202E had four, and the remainder three.

### Area 5

In Area 5, although there were only a few artifacts observed within the affected area (500 square meters, or 5382 square feet), the potential erosion is such that it will soon threaten adjacent areas of high artifact concentration (see Fig. 2). Area 5 was tested by means of one 1-by-2-m and one 1-by-1-m excavation units, and by surface stripping.

**Excavation Unit 7.** This 1-by-2-m unit was placed at the head of an arroyo at 345N/197E, parallel to and

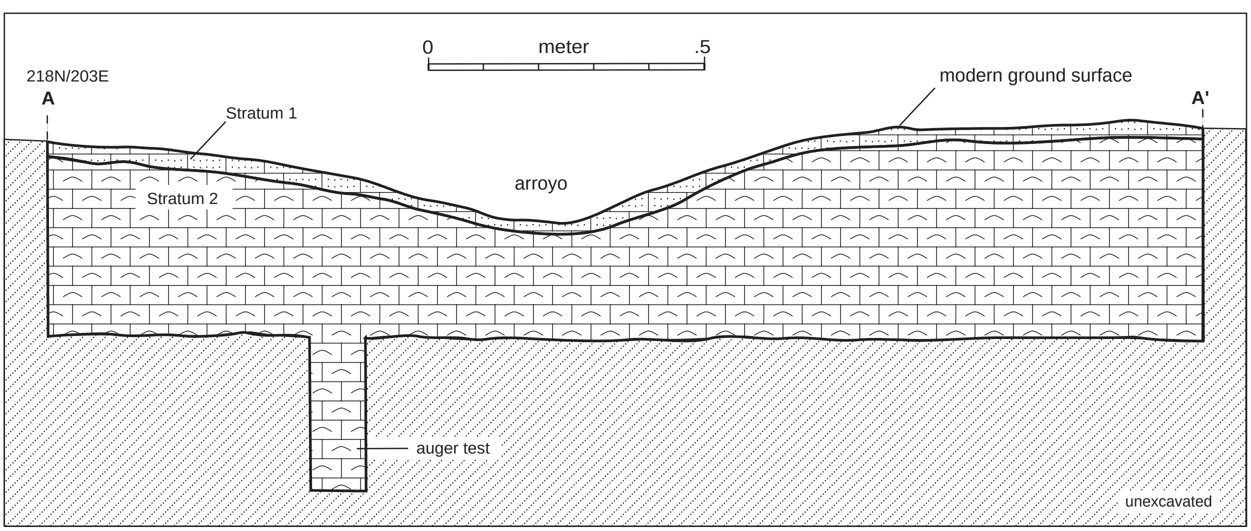

*Figure 45. Profile of Excavation Unit 6.*

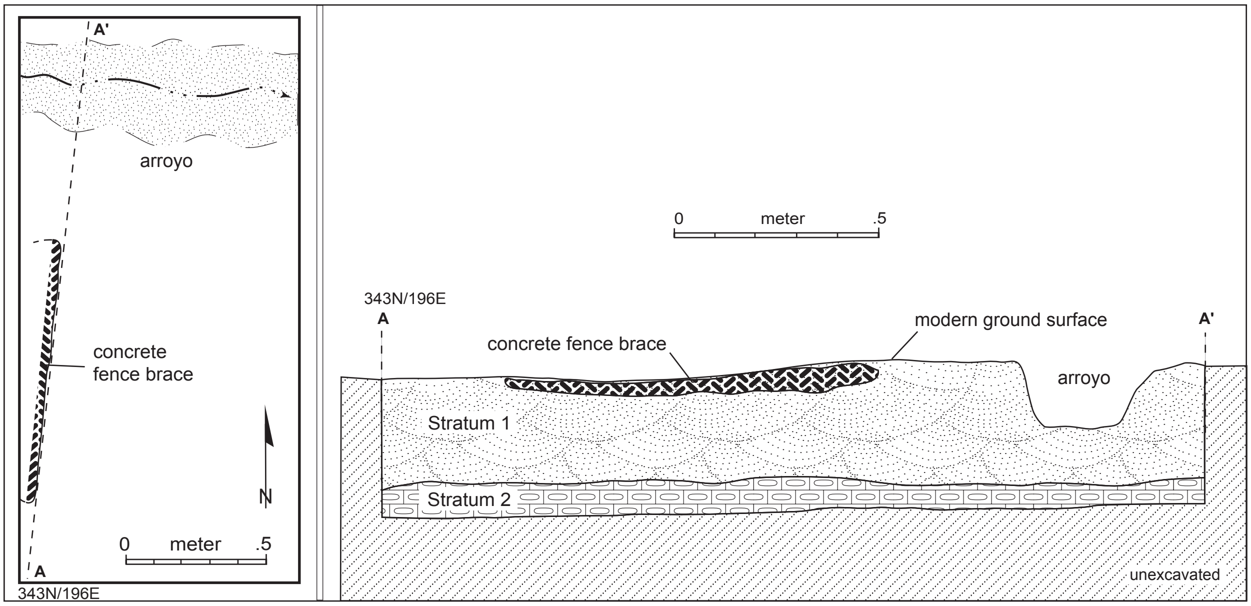


*Figure 46. Profile of Excavation Unit 7.*

1.3 m east of the right-of-way fence (see Fig. 2). EU 7 was excavated in three arbitrary levels to 45 cm bgs (Fig. 46). Two strata were defined: a sandy loam with clay (5YR 4/6 reddish-brown); and a culturally sterile, highly compacted soil with caliche inclusions (5YR 5/6 brown). Artifacts were relatively abundant throughout all levels (n=43 in Level 1; n=34 in Level 2).

**Excavation Unit 8.** This 1-by-1-m excavation unit was placed across an erosional area at 386N/189E, and was excavated in four arbitrary levels; the base was augered to 70 cm bgs (Fig. 47). A total of 45 lithic artifacts were recovered throughout the levels. The fill was composed of sandy clay with loam (5YR 5/4 reddish-brown), ending in sterile compact sandy clay (5YR 6/4 light reddish-brown).

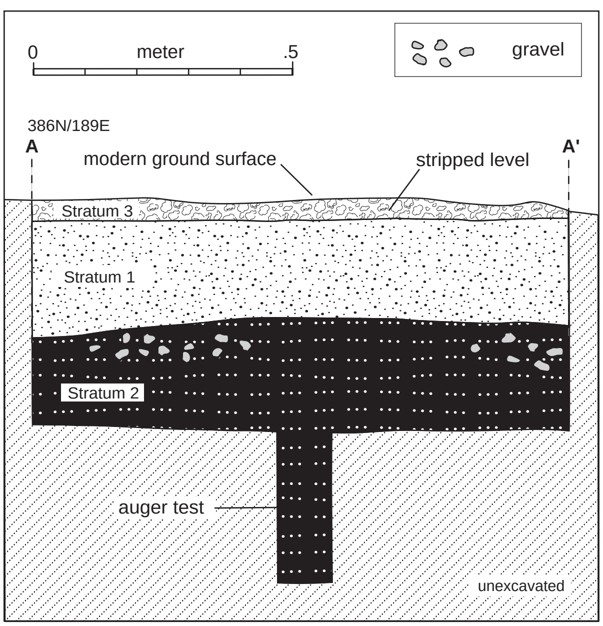


*Figure 47. Profile of Excavation Unit 8.*

**Surface stripping.** Eight square meters (86 square feet), starting at 342N/199E to 347N/199E and contiguous with EU 7, were surface stripped (see Fig. 2). The first 10 cm of topsoil (5YR 5/4 reddish-brown) was scraped, and 66 lithic artifacts were recovered. A second area, starting at 354N/200E and ending at 359N/199E, was surface stripped. Twenty-eight noncontiguous grids were excavated, and 15 lithic artifacts were recovered. A third area was surface stripped to the north: a 1-by-12-m area starting at 370N/191E and ending at 379N/191E. Nine lithic artifacts were recovered. No features or artifact concentrations were encountered.

## Erosion Control Measures

As outlined in the data recovery plan (Lentz 2000), the purpose of the La Vega project was to stabilize specific areas within the right-of-way that were threatening to disturb the archaeological integrity of LA 9075.

As described above, excavation units were purposively placed at the head of, or across, erosional channels, and then backfilled with straw bales. At the request of the environmental section of District 6, Milan, only straw free of noxious weeds was used. The straw-filled pits were then capped with backdirt. The 1-by-12-m trench at 191E/379N was filled with several yards of rock, and a porous wall was constructed to form a check dam against further arroyo downcutting (Fig. 48).

Nonvegetated areas were raked and seeded with a plant prescription recommended by Grady Stem, NMSHTD landscape architect. The seeding consisted of species indigenous to the area, including blue grama, sideoats grama, Indian ricegrass, alkali sacaton, and galleta grasses. The areas were raked, broadcast-seeded by hand, covered with straw (noxious-weed-free) mulch, and watered.

*Figure 48. Site stabilization at La Vega.*

CHAPTER 11

# SUMMARY AND CONCLUSIONS

Archaeological investigations at LA 9075 (La Vega) produced data pertaining to a large multicomponent site with a lengthy occupational history. Through time, the site has kindled the interest of amateur and professional archaeologists alike. Among these were Victor Brown, a pothunter; John Speth, from the University of Michigan; the Research Section of the Museum of New Mexico; and the Office of Archaeological Studies. Brown made unauthorized collections; Speth, searching for a stratified Paleoindian site, collected and performed limited testing; Sullivan, from the Research Section, recovered data in advance of NMSHTD shoulder improvements; and the OAS listed it as an endangered site and undertook remedial stabilization work.

It is worth reiterating that the intent of the OAS 2000 excavations was not to perform data recovery with the goal of augmenting preexisting data, but to ensure that no cultural remains were further destabilized. This fell under the aegis of the Endangered Sites (ASSAPP) remediation program. Instead of identifying areas that would add to scientific information from previous projects, only eroded areas earmarked for stabilization were excavated. Although both Brown and Speth collected artifacts, and Speth excavated two shallow test pits on either side of the outcrop, all of the Museum's work was confined to the NMSHTD right-of-way, and no artifacts were removed from outside of the highway corridor. Therefore, only limited inferences can be made about the features and, by extension, site function outside of the right-of-way.

## Summary

Artifacts from all four activities were analyzed and are summarized in this report. A synthesis of the data analysis suggests that:

- Specialized analyses generated little substantive information. Obsidian and X-ray fluorescence analysis (Appendix 2) of the projectile points from both Paleoindian and Archaic periods produced inconclusive results, save for the fact that several material sources were identified. These included obsidian and tachylite specimens obtained both locally and from as far as Las Cruces and Colorado. The pollen analysis failed to yield evidence of cultivated plants, or to provide objective evidence of prehistoric use of the features involving noncultivated plants. The same is true of the macrobotanical analysis of the floral data, which gave no evidence of prehistoric plant utilization. Radiocarbon data were limited to two highly unreliable dates.

- The largest artifact category on this site was the lithic assemblage, and, therefore, it received the greatest scrutiny. The ceramic analysis revealed a strong Pueblo II component, to which Pueblo Dully, Pueblo Félipé and Pueblo Zamora belong. This was, to an extent, expected, because Pueblo II was a time of general population expansion throughout the Southwest. The faunal analysis showed that most of the bone came from medium- to large-sized mammals. Several items were burned and concentrated in a pit affiliated with the Archaic (San Jose) component of the site. The ground stone analysis was particularly intriguing. Ground stone is presumptively cited as evidence of maize processing. However, Zamora's analysis contradicts this interpretation, and suggests that the morphology of these items is better suited to processing wild foods. The assumption that Pueblo populations were exclusively agriculturalists was again questioned, and raises the possibility that settlement during that period may not have been determined by variables other than suitability for agriculture.

- LA 9075 was reoccupied repeatedly through time for approximately the same two principal reasons: quarrying and hunting. Given this, it could be expected that the different groups occupying the same locale would leave similar archaeological deposits. This is, for the most part, confirmed by the data. The presence of Puebloan and historic groups could also be explained by many of the same factors. The importance of procuring raw materials from the San Andres chert quarry is demonstrated statistically in the lithic data: all of the expended cores (n=20) are from local San Andres chert.

- The abundance of manufacturing debris, particularly during the hunting and gathering component—e.g., broken and discarded bifaces, rejuvenation and biface flakes, and projectiles broken in manufacture—suggests gearing-up activities typically associated with a logistical base.

- The founding population at La Vega was probably the Paleoindian of the Folsom period (9000 to 8000 B.C.). Cody Complex, Plainview and Meserve are also present. Plainview is early in the Paleoindian sequence, whereas Meserve is relatively late. Many view Midland and Meserve points simply as unfluted Folsom points (see Judge 1973 and others). As has been mentioned repeatedly, nearly all of the Paleoindian artifacts were removed from the site by Victor Brown, who later returned the fragmentary artifacts to the Museum of New Mexico. The largest data set containing diagnostic early materials was Brown's. Because they were out of context, interpretation of these artifacts was limited to morphological attributes and speculation with regard to function. However, this narrow range of analysis still proved informative. For example, artifacts from intermediate-stage biface and projectile point production supplied information on manufacturing trajectories. Discarded points, projectiles broken in manufacturing (particularly during the fluting process), and reworked artifacts provide data on this little known aspect of early lithic technology. The quantity of artifacts from this period suggests extended residency time for that group. In this collection, Paleoindian projectile points are manufactured almost exclusively from San Andres chert and local chalcedony, although one Folsom point originated in the Jemez Mountains. Middle to late Paleoindian material types are made from Jemez obsidian and chalcedony.

- The Paleoindian occupation was succeeded by Archaic populations. Transitional projectiles include Jay and Bajada point forms. During the Bajada phase, the projectile points are made primarily from basalt, although one Bajada point was sourced to the Jemez Mountains, one to Cochetopa, Colorado, and another to the Las Cruces area. Artifacts from the San Jose period represent a sizable component at La Vega. This stands to reason because the San Jose period was a time of exponential population growth and expansion—a widely dispersed adaptation stretching from New Mexico to southern Colorado, south to the Mogollon Mountains and as far west as California. This Middle Archaic adaptation is widely distributed, stretching from New Mexico to southern Colorado, south to the Mogollon Mountains, and as far west as California. The material types used to produce San Jose projectile points can be attributed to a wide variety of sources, including the Jemez Mountains and the Las Cruces area. Contemporaneous with San Jose are the San Augustin projectile points, most of which seem locally manufactured from either San Andres chert or Grants obsidian. The Middle Archaic sees the highest use of Grants obsidian and other nonlocal materials. San Andres chert reaches its maximum usage during Armijo times. The Late Archaic appears to be the period of highest lithic resource diversity, with the greatest use of local chert and Jemez obsidian, and the second highest use of chalcedony, basalt and Grants obsidian.

- No projectile points were collected by Speth. His data indicate that material selection is mostly confined to local cherts and igneous types. Possible "exotics" include Jemez obsidian and Washington/Narbona Pass chert. Faunal data associated with putatively Archaic storage pits suggest the hunting of medium and small game (see Chapter 7). Ground stone, some of which is tabular, may indicate the processing of wild plant resources, such as Indian rice grass, or weedy plants from the goosefoot and amaranth families.

- The Archaic occupation at LA 9075 was followed by ephemeral Basketmaker III and Pueblo I occupations. Basketmaker III lithic artifacts consist primarily of three projectile points and Lino Gray sherds. Pueblo I artifacts are confined to pottery (primarily Red Mesa Black-on-white) and several possible arrow points. Pueblo II artifacts include projectile points, associated lithic debitage, and pottery. This small sample of ceramic artifacts was monitored in the field during the Sullivan and the OAS 2000 projects. A strong emphasis on Pueblo II ceramics is present in both data sets. The earliest ceramic type is Basketmaker III period Lino Gray, and the latest are the transitional Pueblo II-III types, such as Socorro Black-on-white and later Gallup Black-on-white. The ceramic artifact data suggest that the site was occupied during Pueblo II/Chaco Canyon times, when a general Pueblo expansion was seen throughout major portions of the

Southwest. The projectile points associated with the Pueblo component are of the typical side-notched variety, which are effective in hunting small- and medium-sized game.

## Settlement Patterns at La Vega: A Good Place to Hunt

### *The Hunter and Gatherer Occupation*

Location, setting, and functional artifact categories point to a hunting focus for a major component of LA 9075. In fact, the setting is truly optimal for hunting game. A natural corridor is provided by the La Vega floodplain. The Malpais lava flow to the east and the Zuni Mountains to the west form a natural "funnel" for migratory game. The La Vega outcrop extends further into the drainage and is higher than any of the adjacent formations, providing a perfect lookout for hunters seeking to exploit large herd migrations. Several hunting stands or blinds strategically placed within the outcrop testify to the opportunistic use of the natural terrain (see Fig. 25).

Typical hunting blinds and observation stands can consist of natural outcrops, tree platforms, brush, and dry-laid rock walls (Binford 1978; Gould 1968; Gould et al. 1971; Yellen 1976). At least two walls are present at LA 9075 that afford a view of the floodplain to the east; the summit of the outcrop, at Datum A, is one of the highest points in the area (see Figs. 1, 2, and 3). Raptors would frequently perch there, and observe the movements of potential prey. The site appears to have been consistently used as a logistical hunting locus by a number of groups, the earliest being Folsom (9000 to 8000 B.C.) and continuing through historic times. The Folsom component at LA 9075 is reflected in the projectile point assemblage (as adduced by those fragmentary items that were not carried off by Brown), and channel flakes. Folsom points were also being manufactured on-site from local materials (see Fig. 36).

### *Man as Predator*

With the loss of Pleistocene megafauna during the end of Clovis times, Folsom and later populations increasingly directed themselves to the hunting of migratory game, particularly *Bison antiquus*. With smaller game, traps, snares and poison can be used. However, different strategies must be used to hunt large game. These are numerous, and vary with the environment, type of game, and available technology. For example, in the classic ambush strategy, a hunter lies hidden near a place where game congregates—usually a water source or a trail—and bushwhacks his prey. Another tactic has been named encounter/intercept (Binford 1978:169-171). In this hunting technique, a wide area is reconnoitered for herds or individual animals and information is gathered on the best time and location from which to launch an intercept. Other strategies include lighting fires or stampeding herds towards the hunters or off a cliff or steep arroyo (the so-called "bison jumps"). In game drives, hunters surround the herd, which is then funneled into a natural cul-de-sac, game traps, or pounds. This was the case at a Folsom type site (LA 8121) in northeastern New Mexico, where the end of a large arroyo was barricaded with large rocks. A herd of bison was stampeded down the arroyo and, unable to exit, they milled around or were "mired" (Steen 1955). This provided the opportunity for a band of Folsom hunters to kill approximately 32 animals by atlatl darts or thrusting spears (Agogino 1985; Lentz 2002; Meltzer et al. 2002; Steen 1955). This was no minor accomplishment, considering that a mature *Bison antiquus* weighs 3500 lb and can be 7.5 feet high at the shoulder. Compare this with the modern Plains buffalo (*Bison bison*) the biggest of which is a foot shorter and a 1000 lb lighter. It is no wonder that Paleoindian hunters, on foot and armed with stone weaponry, resorted to a variety of ruses to ensure success.

In a effort to apply ethnographic analogy to prehistoric big-game hunting, Reher (1977) provides data on buffalo hunting in historic times by Plains Indians groups. He reasons that hunting large herds required a great deal of intragroup cooperation and scheduling. However, several individuals could also kill a buffalo by pursuit on horseback or, if dismounted, by tracking and stalking. Judge (1973:128) reports that many of the settings found suitable for game traps were a function of the volcanic activity found in his research area of the central Rio Grande Valley:

> As a result of this activity, there are numerous lava flows which terminate in "tongues", forming small, semi-circular enclosures. Although predating the Paleoindian occupation, these lava flows are not old enough to have eroded significantly, and still exhibit steep sides with prominent lava boulders. It would have been relatively easy to contain animals in any of these numerous enclosures, where they could have been killed from either above or below with minimal effort.

With the Malpais lava flow to the east, Paleoindian hunters at LA 9075 could have employed tactics similar to those described above. Hunters at La Vega are well positioned to have access to herds migrating in both directions (i.e., at the beginning of the migration, and at the return).

Steward (1955) has argued that those who hunt large game in migratory herds consist of composite bands. At the very least, it is a communal effort that involves active cooperation between hunters who must work together and participate in a previously conceived plan. George Frison (1978) has demonstrated that an arroyo bison kill, such as the one at Folsom, minimally requires one set of hunters to round up and drive the animals, and another set to be in position to kill them. This may also be done with some ritual, as evidenced by the red zigzag design painted on a bison skull found at the Folsom period Cooper bison kill site in northwest Oklahoma (Bement et al. 1997). Kill sites, butchering camps, logistical sites, and base camps are commonly associated with these hunting groups. However, lest we think that Paleoindian populations were exclusively organized around meat-eating, it is important to recall the generalized nature of their subsistence strategy, which also included a substantial reliance on foraging and collecting wild plant foods (Binford 1978; Gould 1968; Judge 1978; Stuart and Gauthier 1981; Yellen 1976).

As Speth noted, La Vega was surficial, and many artifacts were systematically removed. As a result, the OAS was left only a limited amount of information on site structure, and was obliged to rely on materials from surface collections. Yet these refractory data are not without explanatory value, and have led to some useful observations. For example, it is likely that the Folsom points broken in manufacture (Fig. 36), channel flakes, and rejuvenation flakes all reflect the activities taking place while the hunters attended their lookouts. As described at Eskimo hunting sites (Binford 1983) and hunting sites in the Jemez Mountains of New Mexico (Lentz et. al. 1986), hunters, during their long vigils, frequently engage in auxiliary activities. Among hunting groups, maintaining weapons and tools is a recurrent undertaking. At LA 9075, manufacturing projectiles, reworking broken points, hafting projectiles, whittling shafts—in short, the full range of repair and maintenance—was apparently thriving. The storage pits (Features 19-31) are most probably Archaic, and no bison bone was found in the small faunal assemblage. Although the Folsom period lithic assemblage and task-specific features only provide a fragmentary picture of the local adaptation, they nonetheless suggest some of the earlier uses of the La Vega area.

At the end of the Paleoindian period, Archaic populations emerge as groups that manipulated higher life zones, were broad-spectrum, opportunistic hunters and gatherers, and eventually intensified food production. It seems as if Archaic populations developed in situ from the local Paleoindian adaptations, if Jay and Bajada points, which are arguably transitional, are any index. These types are present in the La Vega collection, and the majority are manufactured from local materials.

Demographically, Archaic groups tend to be organized in band populations. Larger macrobands are frequently associated with seasonal or semipermanent base camps, whereas smaller microbands utilized base camps of a more specialized or logistical nature. At La Vega, a probable base camp or special-use/logistical site was recorded, tucked away in flat areas between outcrops (see Fig. 25). Based solely on survey data, it is difficult to determine whether these locales constitute extended base camps, limited base camps, or other site types of the more logistical variety. During data recovery, the OAS study area was limited to the highway right-of-way. However, because the site extended outside of the right-of-way, it became possible to obtain some limited data on intrasite patterning. Among the recorded features were hearth rings, a roasting pit, diagnostic lithic artifacts, and debitage reduction areas, primarily from the San Jose and En Medio periods of the Oshara Tradition—roughly between 5500 B.C. and A.D. 400 (Irwin-Williams 1973). Debitage reduction areas are located on or just above bedrock, with limited depositional potential. Since diagnostic materials were removed postoccupationally, it is possible that some Paleoindian materials are intermingled with artifacts of other periods, forming a palimpsest.

Although significant qualitative differences exist between Paleoindian and Archaic subsistence strategies, analogous activities, particularly with respect to game hunting, were prevalent at this site. Whether earlier blinds or stands were reused or remodeled during the Archaic or later is impossible to determine. These features may in fact have been newly constructed, or extensively remodeled. More to the point, however, are the activities implied by these features. Activity areas were not immediately visible for the Folsom component; however, the distribution of observation loci and processing areas during the Archaic appears more promising. It has been noted (Binford 1978; Gould 1968; Yellen 1976) that butchering and processing of game typically occur away from, or out of sight of the main herd for fear of spooking the other animals. If this is in fact the case, then the relationships at La Vega between the blinds, kill sites, and butchering and processing locations are consistent with this model.

*The La Vega Hunting Model*

In formulating a hypothetical model of the structure of a hunting system at LA 9075 (Fig. 49), a six-stage process

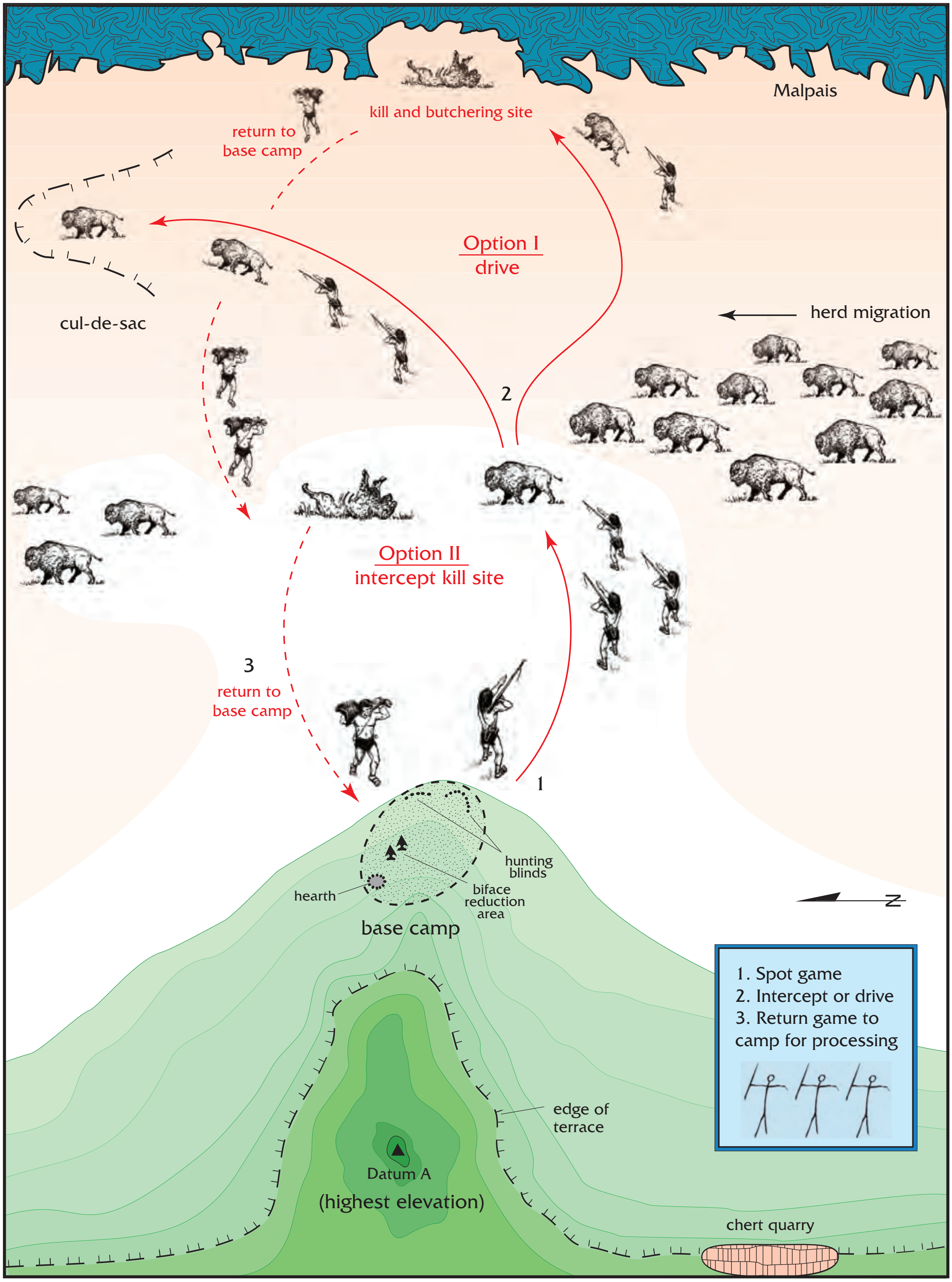


*Figure 49. Structure of hunting system at La Vega.*

was defined, with several alternative strategies or options:

(1) locating the best hunting spot,
(2) preparing and maintaining or curating the necessary weaponry (may include quarrying materials to manufacture new tools),
(3) detecting game from the observation loci,
(4) engaging the game,
(5) butchering the game, and
(6) processing the game.

In the initial stages (1-2), base camps and lookouts are set up, and weaponry is readied. When game is spotted (3), the hunt begins. Depending on whether a drive or an intercept strategy is used, butchering could take place at the kill location, or game could be partly butchered and processed at a base camp (see Fig. 25). In Option I, used with a drive strategy, the animals are driven onto the lava flow or into a trap, dispatched, then dismembered for transport to the base camp. Option II describes the intercept strategy, in which the target is encountered, felled, and transported (either fully or partly disarticulated) back to the base camp in "meat packages"or "filleted meat masses." During this initial stage of butchering, the animals were cut open, and the favorite pieces removed (tongues, brains, and stomach contents), along with the major meat parts (probably forequarters, hindquarters, and backstraps). At the Folsom site, the butchers were very selective, leaving behind the rib sections, for example, where many projectile points were lodged. As stages 1-3 depict, each involves movement to and from the objective, and calculated logistical displacement. During the final stage (6) the game is processed for consumption and usable elements are extracted from the animal (hides, tendons and ligaments, bones for tools, etc.). The first step is probably to cut apart the animal and separate the major parts. The front and rear legs are separated from the carcass at the joints. It is typical to cut the meat into strips and hang it up to dry. Long bones and the crania are usually smashed for marrow extraction, or to remove the tongue and brains.

During their long tenure at La Vega, Archaic hunters apparently emulated their earlier counterparts in systematic repair and maintenance activities. This is reflected in the lithic assemblage, in which broken projectiles, biface flakes, rejuvenation flakes, and reworked points are prominent. Recycling projectile points seems to be the hallmark of most hunting groups. Reusing a found tool makes intuitive sense—the raw material has already been selected and prepared. Creating "knock-offs" may simply be a matter of skillful flake removal. At LA 9075, other signs of hunting activities include burned bone present in the faunal data, and storage facilities. These pit features could not be directly dated, but are probably Middle Archaic, from the San Jose phase.

Characteristic of mobile groups is the tendency to transport curated lithic raw materials to manufacture tools and projectiles. By implication, mobility can be inferred by the presence of exotic material types in the Paleoindian and Archaic assemblages, and in the Cody Complex materials. This characteristic "mapping onto" the landscape would suggest that the occupants of La Vega tended to schedule their activities to coincide with herd movements. Embedded in this strategy is the incentive of the San Andres chert quarry, an on-site source for restocking lithic materials (Fig. 50; and see Fig. 38). A similar strategy was noted for the Archaic residents of the Otowi site (LA 51912), where part of the seasonal round involved late summer to early fall hunting in the Jemez Mountains, in combination with lithic procurement at the Jemez obsidian quarries (Lentz 1991:65).

Site location and the distribution of features and artifacts at LA 9075 suggest that the site was selected by diverse Paleoindian and Archaic groups to hunt game and to quarry lithic materials. The location of the La Vega outcrop, which juts into the floodplain (and presumably the migration corridor), provides an optimal spot for scouting and hunting medium and large game. The observation features, stands, and blinds recorded at LA 9075, although not prescriptively Paleoindian or Archaic, were most certainly used for this purpose. A number of variables combine to support a hunting focus, including setting and location, and the specialized nature of many of the features and activity areas. By comparing these data to the ethnographic record, it seems that a fairly wide range of hunting activities and tactics are indicated. As described earlier, these may include ambush and encounter, or organized drives onto the Malpais lava flow.

### *The Pueblo Component*

Prehistoric Pueblo groups are well represented at LA 9075, particularly the Pueblo II period and perhaps early Pueblo III period (A.D. 900 to 1300). Pueblo I sherds are present on the site, but are nonaggregated except for a small concentration north of Casa Estebaño (see Fig. 2). A possible basketmaker component may be present along the eastern site margins, but this has not been verified. However, a hiatus during Basketmaker-Pueblo I times seems to be prevalent on many Anasazi sites with long occupational sequences.

Ceramic artifacts from Pueblo Dully, Pueblo Félipé, and Pueblo Zamora all suggest a mineral paint, middle to late Pueblo II occupation. This would conform with

***Figure 50. View from quarry of plain past Datum A, looking northeast to Mt. Taylor.***

the settlement system postulated for that period, in which the expansion of San Juan Basin populations was at its height, although the motives for this particular site location are uncertain, and may involve a preference for hunting over farming. It is likely that several of the geometric and anthropomorphic petroglyphs east of Datum A are associated with this occupation (Fig. 51).

The agricultural focus of Pueblo groups is well documented, but it is possible that the Pueblo lifestyle has been over-stereotyped, and that corn-dependency of pueblo dwellers has been emphasized to the exclusion of other pursuits. All other things being equal, there is no compelling evidence to suggest that, at LA 9075, the Anasazi were less mobile than their predecessors, while they practiced limited horticulture or agriculture or both. The evidence includes a possible fieldhouse associated with Pueblo Félipé, and reasonably arable land in the vicinity. For heuristic purposes, however, suppose there was actually **no** evidence of agriculture in the Anasazi sites at LA 9075. Considering a hypothetical alternative presumes that Pueblo II groups settled at the La Vega location for approximately the same reasons as the preceding Paleoindian and Archaic populations—access to lithic resources and game. This concept is rooted in the ecologically driven assumption that, given identical variables, most populations, whether sedentary or agricultural, will behave similarly. These expectations were tested at sites considered nondiagnostic lithic scatters along a 216-mile corridor from Bernalillo to Clovis, New Mexico. The assumption tested was that Archaic sites would demonstrate a "curated" or efficient technology and that Pueblo sites would present an "expedient" technology (Bamforth 1986, 1989; Kelly 1988, among others). This hypothesis was shown to be, at least in this study, unreliable. Under similar conditions (in this case the critical variable was mobility) the lithic assemblages of both the hunting and gathering and sedentary study groups were isomorphic (Harlan et al. 1986). In this study, it was inferred that sedentary agriculturalists, placed in a hunter-gatherer context, behave as hunter-gatherers. This is not to suggest that behavior is independent of culture. Behavior, modified by biology (or the other way around), is the primary ingredient of culture. Yet subsistence practices tend to operate outside of the cultural framework, and can therefore be amenable to the types of generalizations preferred by social science. At LA 9075, whether the cultigens were an important part of the Pueblo component or not, it is reasonable to surmise that hunting played an important economic role. Ethnographic studies, artifact assemblages at Pueblo sites, and even petroglyphs, stress the central role of hunting in prehistoric societies. There are significant selective advantages to the sudden infusion of high-biomass protein into a diet dominated by plants. But it is not our intention to debate the relative merits of hunting versus farming. In the La Vega model, the presumptive nature of domesticated crop dependency by Pueblo groups is questioned. This speculation probably overreaches the limits of the data to make a point—incomplete excavation data makes it impossible to calculate the extent of their reliance on agriculture. Let us conclude by assuming that hunting played an important role during the Pueblo period at LA 9075, as evidenced by the probable reuse of hunting-oriented features, projectile points, and related lithic technology recovered during the project.

### *The Historic Period*

The historic period at LA 9075 dates from sometime before the turn of the century to the present. The most

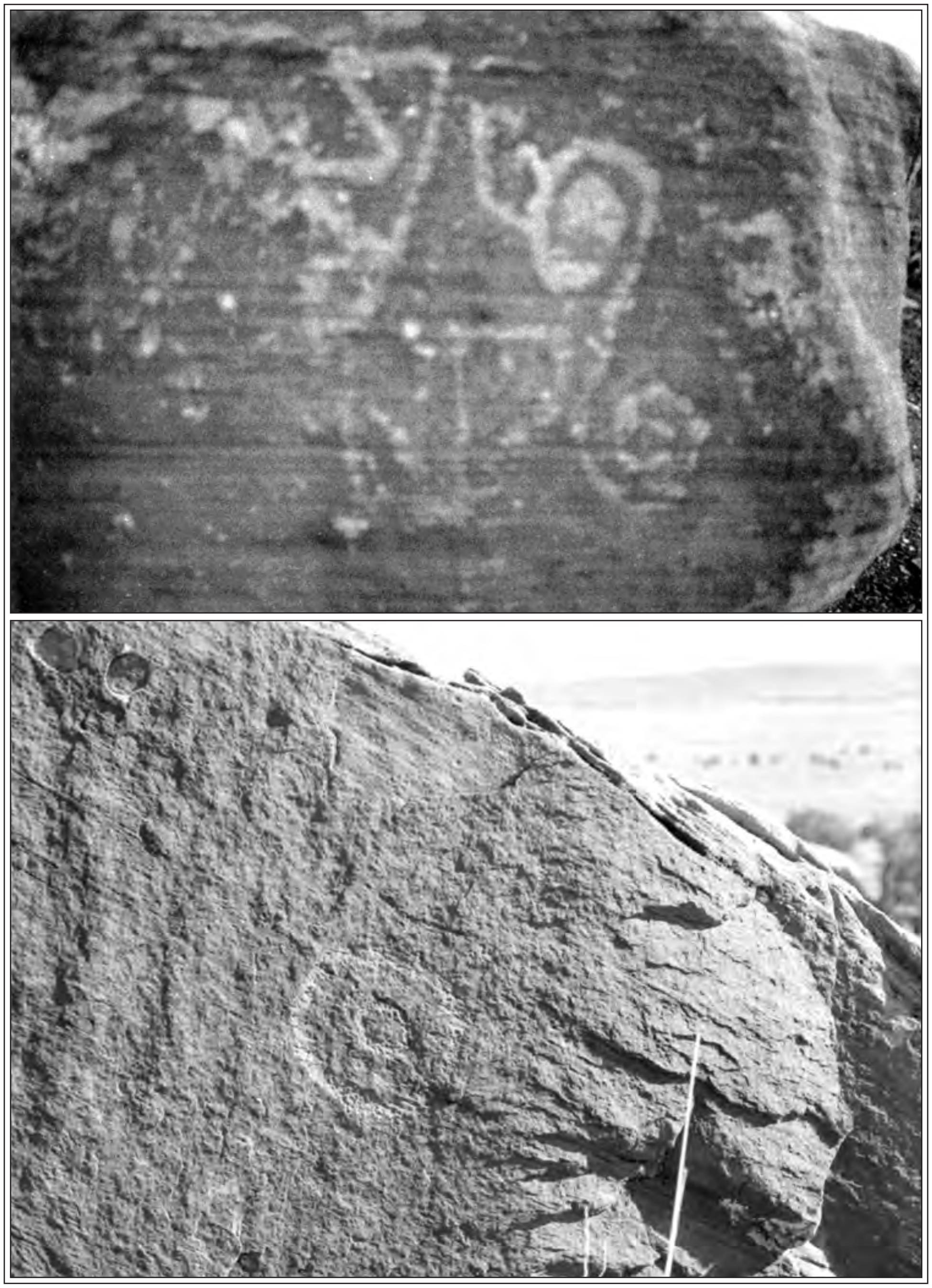

***Figure 51. Petroglyphs associated with Pueblo II occupation of La Vega.***

conspicuous historic feature is the foundation of a probable *rancho*, dubbed Casa Estebaño (Figs. 20 and 21). The absence of excavation data makes it impossible to determine whether or not this structure was a remodeled pueblo. Its temporal affiliation is based primarily on room size, the size of the construction elements in the foundation (large), and the placement of a distinctly Hispano-European style corner hearth. Modifications may have been made to the immediate catchment system (the check dam made of boulders), the possible corral at Pueblo Dully, and petroglyphs depicting a train-tank hybrid, and letters of the alphabet ("A" and "D") recorded east of Datum A.

Again, it would not come as a great surprise if the Spanish sheepherders or Anglo settlers were shooting game from the shelter of the outcrop—numerous expended rifle cartridges litter the site. Some of the construction elements at the lowermost blind appear to have a historic appearance, and this feature may have doubled as a sheep or lamb pen. No shells were found in the vicinity of these features. Can scatters from the 1950s, and more recent dumping episodes, testify to the ongoing use of this location.

## Conclusions

When all the elements from the numerous La Vega projects assembled, a picture emerges that is, in many respects, consistent with many of the earlier evaluations (Stewart Peckham, pers. comm. 1995; Curtis Schaafsma, pers. comm. 1994; John Speth, pers. comm. 1996; Richard Sullivan, pers. comm, 1987). The initial expectation that the site is dominated by quarrying, and that the features would reflect a greater array of activities, is generally borne out by the artifact data.

The original methodological framework proposed by Sullivan (1987)—dividing the site into two large activity areas—could not be implemented in the field and only partly addressed in the findings. Principally, the OAS studies were confined to the right-of-way. Lack of controlled provenience data compelled us to analyze the lithic data as a homogeneous unit, and it was not possible to identify any consistent spatial patterning within a dominant artifact category. Luckily, the data recovery plan, as it was initially conceptualized, conformed surprisingly well to the methodology needed for this assemblage-based analysis. Initially, this perfunctory overview of the site suggested two broad activity areas—one associated with the San Andres chert quarry, the other with the outcrop and related residential and logistical loci. A general trend was identified that suggested three principal activities were occurring repeatedly at this site: quarrying, hunting, and horticulture. Later, during the historic period, activities tended to concentrate around sheepherding and hunting.

The composite record at La Vega shows a pattern of systematic use and abandonment over an extensive period. This lengthy occupational history at La Vega provides a unique opportunity to document diachronic change through time at a specific site location, and the extent to which different cultures manipulated similar environments. The proposed chronological sequence at La Vega mirrors a timeline that is replicated in many other northern Anasazi sites with similarly lengthy occupational sequences. The very early Paleoindian populations, such as Clovis, are rarely visible, leaving Folsom as the first major founding population. Next, a light Cody Complex (primarily Eden) is followed by a strong San Jose and En Medio presence (during this major time of Archaic expansion). There is little Basketmaker III and Pueblo I, but high frequencies of Pueblo II (during this period of Pueblo expansion), and few Pueblo III-V materials. Later, historic sheepherding is seen, spreading from the margins of the Navajo reservation, the Acoma province, and the growing Spanish-American pastoralist community. Finally, there occurs a light veneer of historic and modern materials. Although activities may have shifted through time (hunter and gatherer base camp, Pueblo residential site, and historic rancho), La Vega remained a good place to hunt.

Perhaps the most important contribution of the La Vega data is the information on prehistoric settlement and subsistence patterns, particularly early hunting systems, extractive activities, and data on fluted-base projectile point manufacture. Of equal importance was the opportunity provided to the OAS to recover substantial data from a site that seemed, at first, moribund. Multicomponent sites such as LA 9075 have the potential to provide important insights into the dynamics of prehistoric economic systems as they express themselves through time at a single site location.

Finally, there is a maxim in the profession that holds that archaeology is essentially a destructive process. Certainly, that is the case of irresponsible archaeology. La Vega is a vivid example of the danger of unsystematic artifact removal, by both unauthorized collectors and unconcerned archaeologists. The shopworn term "fragile and irreplaceable resources" is acutely appropriate in this project where, in many instances, critical information was lost. We hope that we have, by combining and reconstructing large portions of the missing data, taken some measures towards reconciling the issue, and that this work will stimulate further research in the field of conservation and stabilization.

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APPENDIX 1

# FLOTATION ANALYSIS

FLOTATION FROM LA VEGA (LA 9075), A LARGE MULTICOMPONENT SITE

SOUTH OF GRANTS, NEW MEXICO

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February 15, 1988

CASTETTER LABORATORY FOR ETHNOBOTANICAL STUDIES, TECHNICAL SERIES #220

Excavations in the right-of-way of NM State Highway 53, between San Rafael and Zuni south of Grants, investigated an extensive site with Paleo-Indian, Archaic, Basketmaker, Anasazi, and historic components. Although 56 collection or testing loci were identified, few of these areas contained actual features. Flotation samples were collected from Loci 16, 18, 19, and 31, with the hope of identifying which features were cultural, and what their function may have been. To complicate our ability to answer these questions, we know that the Highway Department practiced burning for weed control along the road margins. Ordinarily, carbonization is one of the few reliable clues as to affiliation of botanical remains with cultural activity, in shallow, disturbed sites.

The 18 soil samples collected during excavation were processed at the Laboratory of Anthropology by the simplified "bucket" version of flotation (see Bohrer and Adams 1977). No record can be located of the volume of soil processed for each sample, but it presumably averaged about one liter. Each sample was immersed in a bucket of water, and a 30-40 second interval allowed for settling out of heavy particles. The solution was then poured through a fine screen (about 0.35 mm mesh) lined with a square of "chiffon" fabric, catching organic materials floating or in suspension. The fabric was lifted out and laid flat on coarse mesh screen trays, until the recovered material had dried. Each sample was sorted using a series of nested geological screens (4.0, 2.0, 1.0, 0.5 mm mesh), and then reviewed under a binocular microscope at 7-45x. Heavy materials that sunk to the bottom of the bucket were dried and saved; these were also examined under the microscope, for each sample.

None of the flotation samples contained sufficient charcoal for identification of a 20 piece sample. Five samples of charcoal were collected during excavation for carbon-14 dating; each was first examined as to taxonomic composition, in order to distinguish wood species with C-3 or C-4 metabolic pathways. Each piece was snapped to expose a fresh transverse section, and identified at 45x.

## RESULTS

The La Vega flotation samples were remarkably unproductive of botanical remains, cultural or otherwise. Locus 16 was the only sampled provenience to produce any floral materials whatever. The area of this rock alignment with postholes harbored both very old and very recent artifacts: an early Archaic projectile point (Jay phase, 5500 - 4800 BC) and part of a pair of Navajo sheep shears. Floral remains in sample #141 included seeds of two species of goosefoot, and seeds and a capsule lid of Russian thistle (Table 1). We know that the burned material at Locus 16 derives from relatively recent activity rather than the Archaic because several of the Russian thistle seeds are completely carbonized, and this plant was not introduced to this part of the Southwest till sometime in the late 19th century. Burning at Locus 16 could result from a Navajo sheepherder (who was fond of old projectile points), or from recent weed clearance. A single piece of charcoal from this provenience was coniferous (Table 2), consistent with the surrounding vegetation.

Locus 18 was a possible fire pit containing no diagnostic artifacts and no charcoal suitable for dating. The two flotation samples (#54, 55) held no seed remains.

Table 1. Flotation Results, La Vega (LA 9075).

| Sample | Chenopodium sp. | Chenopodium berlandieri | Salsola kali | TOTAL SEEDS |
|---|---|---|---|---|
| #141 Locus 16 | 3 | 4 | 5* | 12 |
| #54 Locus 18 Burned pit | 0 | 0 | 0 | 0 |
| #55 Locus 18 Burned pit | 0 | 0 | 0 | 0 |
| #192 Fea. 19a1 Mealing bin | 0 | 0 | 0 | 0 |
| #194 Fea. 19a2 Storage bin | 0 | 0 | 0 | 0 |
| #669 Fea. 19a3 Storage bin | 0 | 0 | 0 | 0 |
| #224 Fea. 19b Storage bin | 0 | 0 | 0 | 0 |
| #230 Fea. 19b Storage bin | 0 | 0 | 0 | 0 |
| #648 Fea. 19c Storage bin | 0 | 0 | 0 | 0 |
| #701 Fea. 19d2 Pit | 0 | 0 | 0 | 0 |
| #638 Fea. 19e Storage bin | 0 | 0 | 0 | 0 |
| #692a Fea. 19f Shallow basin | 0 | 0 | 0 | 0 |
| #692b Fea. 19f Shallow basin | 0 | 0 | 0 | 0 |
| #692c Fea. 19f Shallow basin | 0 | 0 | 0 | 0 |
| #719 Fea. 19g Burned pit | 0 | 0 | 0 | 0 |
| #720 Fea. 19g Burned pit | 0 | 0 | 0 | 0 |
| #754 Fea. 19h Shallow basin | 0 | 0 | 0 | 0 |
| #726 Fea. 19h Shallow basin | 0 | 0 | 0 | 0 |
| #235 Fea. 31 Unburned pit | 0 | 0 | 0 | 0 |
| #159 Fea. 31 Unburned pit | 0 | 0 | 0 | 0 |

* Some seeds burned; unburned capsule lid also present.

Table 2. Taxonomic Composition of Charcoal Samples, LA 9075 (La Vega).

| | | Pinus edulis | | Undetermined conifer | |
|---|---|---|---|---|---|
| FS | Locus | # | % | # | % |
| #70 | 16 | | | 1 | 100% |
| #195 | 19a | | | 5 | 100% |
| #636 | 19e | 6 | 29% | 15 | 71% |
| #216 | 31 | 1 | 11% | 8 | 89% |

Locus 19 contained several features designated as fire or storage pits, as well as an Archaic projectile point dating to the San Jose phase (3200 - 1800 BC). Flotation samples were examined from a mealing bin (#192), storage bins (#194, 669, 224, 230, 648, and 638), a burned pit (#719 and 720), and pits or basins of undetermined function (#701, 692, 754, and 726), but none contained any identifiable floral remains. Charcoal from the mealing bin and one of the storage bins was coniferous (#195), and a second storage bin had coniferous charcoal that included pinyon (#636).

Two flotation samples (#235 and 159) were examined from Locus 31, thought to be a storage pit. No seeds or other floral materials were found in either sample. Charcoal from this provenience (#216) included pinyon and undetermined conifer.

## SUMMARY

Flotation remains from this shallow, disturbed roadside site provided no direct evidence of prehistoric plant utilization activities assignable to the Paleo-Indian, Archaic, Basketmaker, or Anasazi components thought to be represented. A single provenience, Locus 16, contained unburned goosefoot and burned Russian thistle remains that may belong to a Navajo occupation, or may be recent contamination (given the practice of weed control by burning). Charcoal collected at this site is all coniferous, including some pinyon, consistent with the arboreal vegetation at this elevation (1972-1975 m).

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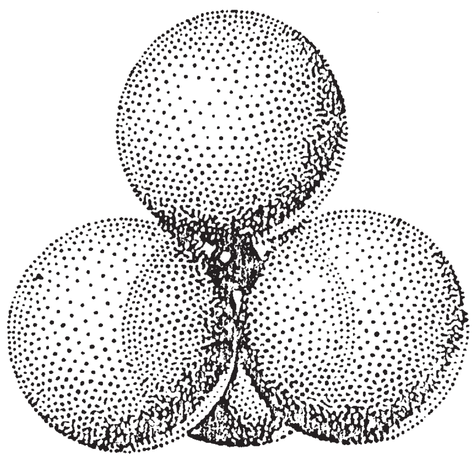
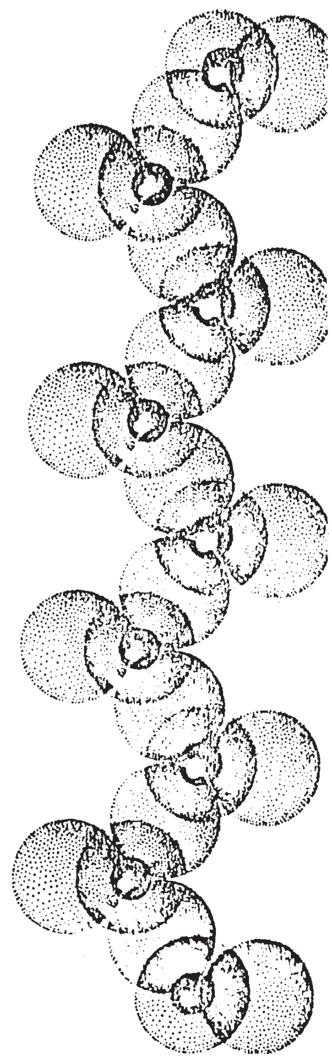
APPENDIX 2

# X-RAY FLUORESCENCE AND OBSIDIAN ANALYSIS

**EASTERN NEW MEXICO UNIVERSITY OBSIDIAN HYDRATION LABORATORY**
Portales, New Mexico

**REPORT ON X-RAY FLUORESCENCE AND OBSIDIAN HYDRATION ANALYSES OF LA 9075 (LA VEGA) OBSIDIAN SAMPLES**





*Prepared for:*

Museum of New Mexico
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Villa Rivera, Room 207
Santa Fe, New Mexico 87503

June 1989

*Prepared by:*

Dr. John L. Montgomery
and
Kathleen M. Bowman

**ENMU-OHL Technical Report 88-04**

EASTERN NEW MEXICO UNIVERSITY OBSIDIAN HYDRATION LABORATORY
Portales, New Mexico

# REPORT ON X-RAY FLUORESCENCE AND OBSIDIAN HYDRATION ANALYSES OF LA 9075 (LA VEGA) OBSIDIAN SAMPLES

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## ABSTRACT

The Museum of New Mexico, Research Section (MNM) submitted 125 artifacts to Eastern New Mexico University's Obsidian Hydration Laboratory (ENMU-OHL) for sourcing and obsidian hydration analysis. Many of these artifacts were projectile points and it was to develop a chronology though the obsidian hydration analysis. During the course of sample preparation, it was observed that most of the artifacts were tachylite, not obsidian. In consultation with the MNM, it was decided to only work with 49 of the samples (34 obsidian and 15 tachylite).

The 49 samples were sent to Mr. Chris Mckee, New Mexico Bureau of Mines and Mineral Resources, for x-ray fluorescence analysis (XRF). The results of the XRF analysis were used to source the samples through the statistical procedure of discriminant function analysis. The discriminant analysis results show that the 49 samples were derived from seven sources: Jemez (New Mexico), Grants Ridge (New Mexico), Rio Grande Pleistocene Terrace Gravels, Cochiti, Las Cruces, and Los Lunas Vicinities (New Mexico), Cochetopa (Colorado), and Beaver Creek (Colorado).

The 49 samples were also prepared for obsidian hydration rim measurements. Due to the optical properties of tachylite (i.e., it is not as translucent as obsidian) rim measurements could not be obtained for the 15 tachylite samples. Of the remaining 34 obsidian samples, rim measurements were obtained for 29. The other 5 were prepared several times each and no measurable hydration rim was observed. No relative age determinations are possible, as most of the artifacts were from unknown time periods and are not associated with other radiometric dates. Obsidian hydration dates could only be determined for the 12 samples deriving from the Jemez source, as this source has a published hydration rate. The calculated dates do not correspond well with published dates for the projectile point types in the sample.

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## X-RAY FLUORESCENCE ANALYSIS OF LA 9075 (LA VEGA) OBSIDIAN SAMPLES

### *Introduction*

Geochemical characterization of known and unknown samples was carried out using rapid XRF at the trace elemental level. XRF analysis is a non-destructive, yet powerful and rapid method for determining chemical characterization of materials (Hoffer 1985; Lister 1975). An extensive literature indicates that XRF provides a rapid and economic way of isolating distinct obsidian sources (Jack 1976; Ericson et al. 1976; Stross et al. 1976; Reeves and Ward 1976; Dixon 1976). Rapid XRF can detect the presence of trace elements as infrequent as 10 parts per million. This degree of resolution distinguishes sources that are otherwise similar in major elemental or compound composition. Other investigations of geochemical characterization of obsidians have resulted in similar conclusions (Jack 1976; Ericson et al. 1976; Stross et al. 1976; Reeves and Ward 1976; Dixon 1976; Michels and Tsong 1980). In addition to a fine-grained examination of samples, representative and thorough sampling of source areas is necessary to increase the probability of accurate classification.

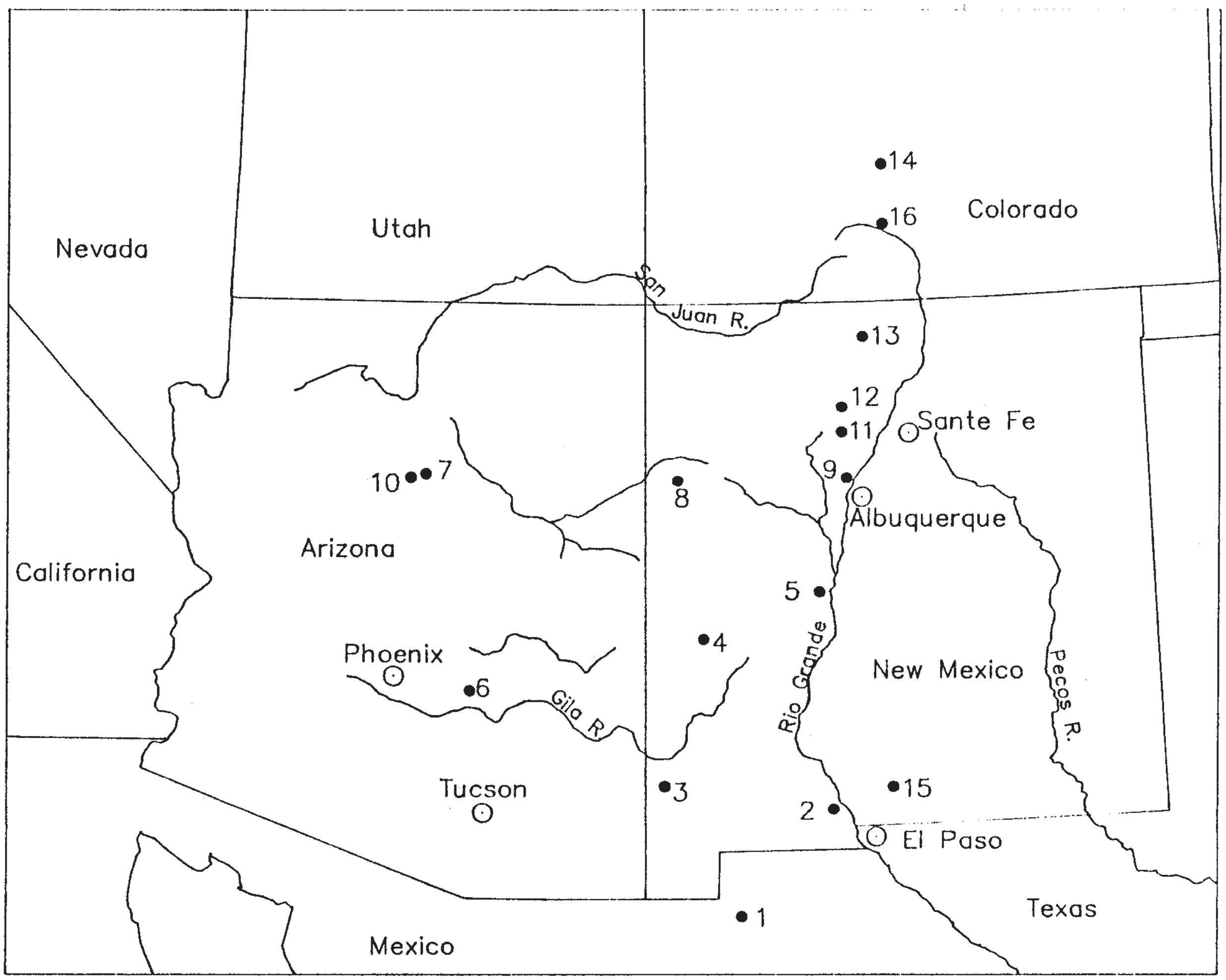
Source areas characterized by ENMU-OHL prior to this project are shown in Figure 1. Many of these samples are subsamples of obsidian used as standards at the Idaho Micro-probe Laboratory (Sappington and Cameron 1981), while others were collected by Dr. Phillip Shelley, Department of Social and Behavioral Sciences, Eastern New Mexico University. In all instances, those samples submitted for XRF characterization were selected because they are considered to be macroscopically representative of a particular geologic deposit or flow. Further, except for the Tularosa Basin source, no source was characterized with fewer than five samples. Many sources were sampled more extensively because of their macroscopic variability and their spatial and/or temporal extent.

Several other investigators have attempted to define obsidian sources in the New Mexico region. Some of these are more successful than others, and some provide data that cannot be easily compared to the results of this report. Most of these research endeavors are programmed along the methodology outline by Ward (1974). But all have flaws that limit their usefulness. For example, the sourcing research reported by Newman and Neilsen (1985) uses only one example from a source and examines the chemical composition of obsidian for 10 elements. They note that two of these elements (Sr and K) are poor contributors to source discrimination. Tripolar graphs, chi-square analysis, and cluster analysis are the analytical techniques used to assign artifacts to particular sources. While useful in several ways, this research is hindered primarily by the fact that the variability <u>within</u> a source is not described.

### *Methods*

All obsidian artifacts submitted by the Museum of New Mexico to ENMU-OHL were subsampled for x-ray fluorescence analysis. Sub-sampling of the samples was accomplished by sawing. After sawing, the samples were cleaned, labeled, and submitted for XRF analysis. In addition, it was noted that many of the samples were not obsidian, but tachylite. Therefore, not all of the samples were submitted for XRF. Only 49 samples were sent, 34 obsidian and 15 tachylite.

All samples were powdered prior to XRF analysis to homogenize them and their concomitant XRF values. In addition, powdering provides a relatively uniform target area for x-rays. Consequently this procedure minimizes any variation caused by




1. Cave Creek, Northern Old Mexico
2. Rio Grande Terrace Gravels, Southcentral N.M.
3. Mule Creek, Southwest N.M. (3540)
4. Red Hill, Western N.M.
5. Sante Fe Formation Gravels Dalles–Puerco Siding(3511)
6. Superior, Southeastern Arizona (3602)
7. San Francisco Mts. Northcentral Arizona
8. Grants Ridge, Northwest N.M. (3510)
9. Rio Grande Terrace Gravels, Central N.M.
10. Government Mt.,Northeast Arizona
11. Jemez Mts., Northcentral N.M.(3520–26)
12. Polvadera Peak, Northern N.M.(3530)
13. San Antonio Mt.,Northern N.M.
14. Cochetopa, Central CO.
15. Tularosa Basin, Southcentral N.M.
16. Beaver Creek, Southcentral CO.

**Figure 1. Map illustrating sources characterized by ENMU-OHL.**

geochemical changes in the hydrated zone and the underlying material, as well as differences in x-ray values caused by subtle variations in the geometry of the target areas. The XRF data generation was carried out by Mr. Chris McKee, of the New Mexico Bureau of Mines and Mineral Resources. The data is presented in Table 1. All data is *ppm*.

*Discriminant Function Analysis*

Rather than attempting to compare the geochemistry of known and unknown samples using frequencies of a few "key" elements or a few of the major chemical compounds, comparisons were accomplished using a multivariate statistic, discriminant function analysis. It is capable of classifying unknown observations into known populations considering all known variables and their range of variation within and between groups, in this case, source areas of obsidian. Statistical analyses of XRF data were conducted with an IBM 4331 and SAS DISCRIM programs with the default parameters.

An excellent discussion of the different ways to "fingerprint" obsidian to particular sources is found in Hughes (1986). He notes that ternary diagrams (which depict the relative frequency of three elements of a group of samples) often cannot clearly distinguish sources with overlapping plots. These diagrams also are complicated by "the fact that specimens from the same source will not plot in the same location on the graph if different measurement units are employed" (Hughes 1986:53). Multivariate techniques, specifically discriminant analysis procedures, have long been used to more clearly determine sources for lithic materials (cf. Ericson 1981; Ward 1974; Nelson and Holmes 1979; Luedtke 1979). While also noting in detail the statistical assumptions of discriminant analysis, Hughes summarizes the strengths of using this procedure:

> Discriminant analysis, then, accomplishes two objectives: first, it describes or identifies groups of objects on the basis of distinctive combinations of discriminating variables; and second, it predicts group membership or classifies ungrouped cases into one or another of the groups in the sampling universe on the basis of mathematical equations derived from known groups. Thus, the descriptive aspect of discriminant analysis simply derives allocation rules to characterize the differences between obsidian sources on the basis of major, minor, trace, or rare earth elements. Once this step has been accomplished, discriminant analysis can be employed to classify cases of unknown origin (these are usually obsidian artifacts) on the basis of allocation rules derived from the analysis of known obsidian sources [1986:56-57].

Discriminant function analysis uses either the discriminant variable scores or the canonical discriminant functions to predict the source to which a particular sample most likely belongs. In multivariate space, this procedure compares the unknown sample's position to each source group's centroid to determine the source most similar to the unknown sample. In this case, classification of known sources by discriminant function analysis resulted in a 98.7% correct solution (Table 2). Only one sample was misclassified.

Table 1. X-Ray Flurorescence Data (in ppm).

| Sample No. | Element | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Rb | Zr | Y | Sr | $TiO_2$ | $Fe_2O_3$-T | MgO | CaO | $SiO_2$ | $Al_2O_3$ | $Na_2O$ | $K_2O$ | MnO | $P_2O_5$ |
| 00-0-101 | 69 | 219 | 17 | 53 | 360 | 5945 | 0 | 858 | 356703 | 57683 | 35092 | 42091 | 1007 | 0 |
| 00-0-107 | 111 | 187 | 37 | 65 | 480 | 8812 | 0 | 1358 | 359975 | 55566 | 33163 | 46491 | 775 | 0 |
| 00-0-11 | 243 | 194 | 24 | 26 | 480 | 15806 | 0 | 4574 | 362780 | 58741 | 33163 | 29140 | 620 | 0 |
| 00-0-15 | 160 | 168 | 0 | 18 | 899 | 8043 | 0 | 3716 | 378675 | 59270 | 24409 | 27480 | 465 | 0 |
| 00-0-20 | 207 | 176 | 0 | 69 | 899 | 14687 | 0 | 7004 | 359508 | 54508 | 31308 | 41510 | 542 | 2706 |
| 00-0-21 | 118 | 195 | 9 | 65 | 779 | 11820 | 0 | 2501 | 361845 | 57154 | 31605 | 40016 | 465 | 0 |
| 00-0-25 | 107 | 171 | 45 | 44 | 1139 | 26437 | 0 | 3216 | 361378 | 53978 | 31457 | 47321 | 1007 | 0 |
| 00-0-30 | 222 | 137 | 0 | 70 | 719 | 10491 | 0 | 4217 | 362313 | 65092 | 34424 | 28725 | 852 | 0 |
| 00-0-31 | 286 | 226 | 50 | 74 | 420 | 14827 | 0 | 3502 | 358105 | 58741 | 38356 | 39435 | 1007 | 131 |
| 00-0-32 | 316 | 150 | 0 | 60 | 659 | 13498 | 0 | 4503 | 364650 | 65092 | 34424 | 27231 | 775 | 0 |
| 00-0-33 | 227 | 248 | 39 | 79 | 360 | 6085 | 0 | 1787 | 366988 | 59800 | 34202 | 38521 | 620 | 0 |
| 00-0-36 | 202 | 184 | 0 | 28 | 420 | 10351 | 0 | 2930 | 359508 | 62446 | 37446 | 38770 | 852 | 0 |
| 00-0-37 | 280 | 159 | 0 | 50 | 240 | 9512 | 0 | 3359 | 356235 | 60858 | 37095 | 41344 | 1549 | 0 |
| 00-0-38 | 309 | 237 | 45 | 73 | 240 | 9372 | 0 | 1715 | 352028 | 61916 | 37985 | 42257 | 1394 | 0 |
| 00-0-42 | 228 | 144 | 29 | 103 | 480 | 9652 | 0 | 3502 | 352495 | 57154 | 29379 | 45412 | 697 | 393 |
| 00-0-45 | 178 | 214 | 0 | 86 | 1139 | 9931 | 0 | 4360 | 357170 | 56624 | 35463 | 38521 | 852 | 0 |
| 00-0-46 | 181 | 65 | 0 | 97 | 480 | 8603 | 0 | 1572 | 356703 | 52761 | 36872 | 46989 | 775 | 87 |
| 00-0-51 | 323 | 235 | 47 | 103 | 360 | 10351 | 0 | 2859 | 357638 | 59270 | 37095 | 34287 | 852 | 0 |
| 00-0-52 | 237 | 200 | 35 | 107 | 420 | 11960 | 0 | 4717 | 372598 | 62446 | 29750 | 23910 | 775 | 0 |
| 109 | 117 | 189 | 16 | 46 | 420 | 7833 | 0 | 4574 | 358573 | 52444 | 30641 | 41925 | 697 | 3055 |
| 111 | 140 | 126 | 0 | 17 | 659 | 10281 | 0 | 2359 | 375870 | 58741 | 30195 | 41427 | 542 | 0 |
| 114 | 204 | 148 | 50 | 90 | 420 | 9372 | 0 | 4145 | 365585 | 56095 | 35537 | 36529 | 852 | 916 |
| 116 | 192 | 181 | 6 | 18 | 180 | 7344 | 0 | 858 | 362313 | 49268 | 34202 | 44665 | 1162 | 436 |
| 119 | 210 | 184 | 41 | 90 | 899 | 15946 | 0 | 2716 | 366053 | 54508 | 32866 | 40099 | 620 | 0 |
| 11-0-1 | 101 | 204 | 58 | 63 | 959 | 15177 | 0 | 7290 | 370728 | 52761 | 27376 | 28476 | 542 | 306 |
| 11-0-2 | 235 | 207 | 0 | 74 | 659 | 6155 | 0 | 3359 | 369793 | 54508 | 30195 | 39351 | 542 | 0 |
| 11-0-3 | 201 | 169 | 0 | 39 | 839 | 13009 | 0 | 2359 | 367455 | 53449 | 31605 | 39850 | 542 | 0 |
| 11-0-4 | 228 | 224 | 17 | 106 | 779 | 14338 | 0 | 3216 | 365118 | 54508 | 27228 | 41012 | 542 | 0 |
| 11-1-550 | 268 | 185 | 26 | 68 | 480 | 11400 | 0 | 3073 | 360910 | 62446 | 35018 | 36280 | 852 | 0 |

Table 1. (Continued).

| Sample No. | Element | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Rb | Zr | Y | Sr | $TiO_2$ | $Fe_2O_3$-T | MgO | CaO | $SiO_2$ | $Al_2O_3$ | $Na_2O$ | $K_2O$ | MnO | $P_2O_5$ |
| 124 | 14 | 142 | 23 | 76 | 719 | 9931 | 0 | 1429 | 349690 | 58212 | 36427 | 48733 | 852 | 0 |
| 126 | 192 | 209 | 8 | 81 | 719 | 14897 | 0 | 4145 | 355300 | 58741 | 33089 | 46657 | 620 | 0 |
| 129 | 256 | 184 | 0 | 100 | 899 | 16506 | 0 | 3145 | 365118 | 55037 | 31457 | 41676 | 620 | 44 |
| 18-1-76 | 19 | 221 | 27 | 0 | 719 | 7763 | 0 | 3859 | 377273 | 53978 | 30418 | 37525 | 620 | 0 |
| 19-f-79 | 226 | 219 | 35 | 142 | 779 | 7553 | 0 | 4002 | 370260 | 54508 | 28637 | 39767 | 620 | 0 |
| 19-f-80 | 155 | 118 | 0 | 44 | 480 | 10071 | 0 | 1930 | 354833 | 53449 | 34647 | 41759 | 852 | 742 |
| 19-f-82 | 158 | 145 | 14 | 62 | 959 | 16436 | 0 | 4574 | 366053 | 53449 | 32273 | 39933 | 697 | 873 |
| 19-f-83 | 210 | 222 | 26 | 12 | 540 | 12379 | 0 | 2716 | 359040 | 66150 | 33089 | 31216 | 697 | 0 |
| 31-4-44 | 275 | 123 | 0 | 78 | 959 | 13359 | 0 | 2787 | 372130 | 52126 | 28192 | 38770 | 542 | 0 |
| 31-4-45 | 274 | 227 | 20 | 86 | 480 | 14338 | 0 | 3073 | 376805 | 62975 | 34498 | 27729 | 775 | 0 |
| 31-4-46 | 223 | 248 | 0 | 83 | 420 | 5246 | 0 | 929 | 363248 | 56624 | 32273 | 41427 | 620 | 175 |
| 31-4-47 | 259 | 198 | 28 | 96 | 659 | 12100 | 0 | 4074 | 357637 | 62975 | 34424 | 29306 | 775 | 0 |
| 37-0-1 | 241 | 181 | 53 | 95 | 600 | 13149 | 0 | 4431 | 360910 | 62446 | 35166 | 29306 | 852 | 0 |
| 37-0-2 | 265 | 207 | 46 | 96 | 839 | 7693 | 0 | 4217 | 368390 | 56095 | 27154 | 39102 | 542 | 44 |
| 37-0-3 | 215 | 257 | 28 | 73 | 839 | 22171 | 0 | 2287 | 355300 | 55566 | 33682 | 44416 | 1084 | 0 |
| 37-0-4 | 101 | 189 | 61 | 98 | 1019 | 11540 | 0 | 2716 | 360910 | 58741 | 30195 | 30385 | 465 | 0 |
| 37-0-5 | 261 | 127 | 0 | 86 | 1379 | 15806 | 0 | 3716 | 364183 | 59270 | 27599 | 30551 | 465 | 0 |
| 37-0-642 | 162 | 164 | 45 | 56 | 839 | 12589 | 0 | 2859 | 362780 | 56095 | 32124 | 42755 | 620 | 0 |
| 39-0-65 | 142 | 257 | 34 | 62 | 659 | 10071 | 0 | 1858 | 364650 | 53449 | 32347 | 43170 | 697 | 0 |
| 57-0-1 | 227 | 190 | 73 | 131 | 600 | 9371 | 0 | 1787 | 364183 | 52655 | 34795 | 41427 | 852 | 0 |

KEY to Tables 2 and 3

| | |
|---|---|
| RG1 | Rio Grande Pleistocene Terrace Gravels, Cochiti Vicinity |
| C | Cochetopa, Colorado |
| BB | Burns, Oregon |
| BC | Beaver Creek, Colorado |
| GR | Grants Ridge (3510)[1] |
| J | Jemez (3520-26)[2] |
| RG3 | Rio Grande Pleistocene Terrace Gravels, Las Cruces Vicinity |
| RG2 | Rio Grande Pleistocene Terrace Gravels, Los Lunas Vicinity |
| MC | Mule Creek (3540)[1] |
| MM | Mineral Mountain, Utah |
| MO | Modena, Utah |
| PP | Polvadera Peak (3530)[1] |
| RH | Red Hill (3550)[2] |
| SA | San Antonio/No Agua Mountain |

Numbers in parentheses are source numbers used by Warren:

[1]Warren (1977:26-27)

[2]Warren (1979:31)

Table 2. Statistical Classification Results for Known Sources.

| Known Group | Classified Group | RG1 | C | BB | BC | GR | J | RG3 | RG2 | MC | MM | MO | PP | RH | SA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Known Sources | | | | | | | | | | | | | |
| RG1 | RG1 | 0.9752 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0247 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| RG1 | RG1 | 0.9250 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0749 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| RG1 | RG1 | 0.9728 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0264 | 0.0008 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| RG1 | RG1 | 0.9898 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0102 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| RG1 | RG1 | 0.9791 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0209 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| BB | BB | 0.0000 | 0.0000 | 0.6777 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0458 | 0.0000 | 0.0000 | 0.2765 | 0.0000 | 0.0000 |
| BB | BB | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| BB | BB | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| BB | BB | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| BB | BB | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| GR | GR | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| GR | GR | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.9998 | 0.0000 | 0.0000 | 0.0002 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| GR | GR | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| GR | GR | 0.0000 | 0.0000 | 0.0000 | 0.0030 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| GR | GR | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| J | J | 0.0344 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.9656 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| J | J | 0.1359 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.8641 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| J | J | 0.0613 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.9381 | 0.0007 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| J | J | 0.0015 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.9982 | 0.0003 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| J | J | 0.0213 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.9777 | 0.0010 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| RG3 | RG3 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| RG3 | RG3 | 0.3424 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.3090 | 0.3486 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| RG3 | RG2 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1264 | 0.8736 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| RG3 | RG3 | 0.0390 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0545 | 0.9065 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| RG3 | RG3 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0003 | 0.9996 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| RG2 | RG2 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| RG2 | RG2 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| RG2 | RG2 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| RG2 | RG2 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| RG2 | RG2 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

Table 2. (Continued).

| Known Group | Classified Group | RG1 | C | BB | BC | GR | J | RG3 | RG2 | MC | MM | MO | PP | RH | SA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Known Sources | | | | | | | | | | | | | |
| MC | MC | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| MC | MC | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| MC | MC | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| MC | MC | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| MC | MC | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| PP | PP | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 |
| PP | PP | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 |
| PP | PP | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 |
| PP | PP | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 |
| PP | PP | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 |
| RH | RH | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 |
| RH | RH | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0016 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.9984 | 0.0000 |
| RH | RH | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 |
| RH | RH | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 |
| RH | RH | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 |
| SA | SA | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 |
| SA | SA | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 |
| SA | SA | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 |
| SA | SA | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 |
| SA | SA | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 |
| MM | MM | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| MM | MM | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| MM | MM | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| MM | MM | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| MM | MM | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| MO | MO | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 |
| MO | MO | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 |
| MO | MO | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 |
| MO | MO | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 |
| MO | MO | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 |

Table 2. (Continued).

| Known Group | Classified Group | RG1 | C | BB | BC | GR | J | RG3 | RG2 | MC | MM | MO | PP | RH | SA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Known Sources | | | | | | | | | | | | | |
| BC | BC | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| BC | BC | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| BC | BC | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| BC | BC | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| BC | BC | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| C | C | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| C | C | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| C | C | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| C | C | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| C | C | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| C | C | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| C | C | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0003 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| C | C | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| C | C | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

9

*Sources and Assumptions*

Results of the XRF and discriminant function analysis (Table 3) are interpreted as indicating that the 49 obsidian samples were derived from five New Mexico sources: Grants Ridge; Jemez; Rio Grande Pleistocence Terrace Gravels, Cochiti Vicinity; Rio Grande Pleistocene Terrace Gravels, Las Cruces Vicinity; Rio Grande Pleistocene Terrace Gravels, Los Lunas Vicinity; as well as two Colorado sources: Beaver Creek and Cochetopa (Figure 1 illustrates the general locations of these sources).

The obsidian source analysis indicates that obsidian procurement was to the north, south, and east of LA 9075. No apparent patterning of obsidian procurement could be seen through time. Archaic age samples were found in all but two of the sources. However, the actual number of samples associated with chronometric data is small and many of the analyzed samples were associated with unknown time periods. In addition, the number of obsidian artifacts in this sample does not allow one to make absolute statements or interpretations of the data. If anything, the results of this study should be tested as other data are obtained and analyzed.

## OBSIDIAN HYDRATION ANALYSIS OF LA 9075 (LA VEGA) OBSIDIAN SAMPLES

*Methods*

All samples were prepared using the methods outlined by Michels and Tsong (1980) and Michels and Bebrich (1971). The first step in the procedure was to apply isotropic epoxy to the surface of the obsidian sample. The obsidian was then heated in a kiln at 140$^{o}$F (60$^{o}$C) for two hours to insure maximum cure. It has been demonstrated that the epoxy protects the hydration surface of the obsidian during sawing (Katsui and Kondo 1976).

Next, a wedge was cut from each sample by making two parallel cuts perpendicular to the edge of the artifact. An oil-cooled Raytech Trimsaw with a 4-inch diamond-edged blade was used. The wedge is then removed from the artifact. The wedge was cleaned with soap and ethyl alcohol to remove any remaining traces of oil.

The initial grinding phase was begun by mounting the wedge onto a glass microscope slide. Lakeside thermoplastic (quartz) cement was used as the mounting medium. The catalog number of the sample was etched onto the slide to protect provenience. The wedge was ground to approximately half of its original thickness using a slurry of water and fine-grained (400) corundum grit. All grinding was done by hand on a glass plate using a "Figure-8" motion.

After the wedge was ground halfway, the slide was cleaned to remove traces of grit, a pencil line was drawn on the wedge to mark the hydrated surfaces of the piece, and the wedge was now ground (in the same manner as described above) to an approximate thickness of .003 inch. This maximizes the optical qualities of the obsidian under the microscope.

The final stage of sample preparation was the application of the cover slip. All cover slips were applied using heated Canada Balsam instead of the Lakeside thermoplastic (quartz) cement. The mounting medium was changed at this point simply because it was found that fewer and smaller air bubbles are created using the

Table 3. Statistical Classification Results for Archaeological Samples.

| Sample No. | Classified Source | RG1 | C | BB | BC | GR | J | RG3 | RG2 | MC | MM | MO | PP | RH | SA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Known Sources | | | | | | | | | | | | | |
| 00-0-101 | J | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.9997 | 0.0003 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 00-1-107 | J | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.9991 | 0.0009 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 00-0-11 | RG3 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 00-0-15 | C | 0.0000 | 0.9947 | 0.0000 | 0.0053 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 00-0-20 | RG1 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 00-0-21 | J | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.8187 | 0.1813 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 00-0-25 | RG3 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0006 | 0.9994 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 00-0-30 | GR | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.9999 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0001 | 0.0000 |
| 00-0-31 | RG3 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 00-0-32 | GR | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.9895 | 0.0000 | 0.0000 | 0.0105 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 00-0-33 | J | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.8125 | 0.1875 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 00-0-36 | RG3 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 00-0-37 | RG3 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 00-0-38 | RG3 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0004 | 0.9996 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 00-0-42 | RG3 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0097 | 0.9793 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 00-0-45 | C | 0.0000 | 0.7865 | 0.0000 | 0.2135 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 00-0-46 | J | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 00-0-51 | RG3 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0669 | 0.9331 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 00-0-52 | GR | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 109 | RG1 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 111 | RG3 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1203 | 0.8797 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 114 | RG1 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 116 | J | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 119 | J | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.9997 | 0.0003 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 11-0-1 | RG1 | 0.9032 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0968 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 11-0-2 | BC | 0.0000 | 0.0002 | 0.0000 | 0.9998 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 11-0-3 | J | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.9999 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 11-0-4 | RG3 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1272 | 0.8728 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 11-1-550 | RG3 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 124 | J | 0.0000 | 0.0000 | 0.0047 | 0.0000 | 0.0000 | 0.9934 | 0.0018 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

Table 3. (Continued).

| Sample No. | Classified Source | Known Sources | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | RG1 | C | BB | BC | GR | J | RG3 | RG2 | MC | MM | MO | PP | RH | SA |
| 126 | RG3 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 129 | RG3 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0381 | 0.9619 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 18-1-76 | J | 0.0000 | 0.0019 | 0.0000 | 0.0000 | 0.0000 | 0.9981 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 19-f-79 | BC | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 19-f-80 | RG1 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 19-f-82 | RG1 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 19-f-83 | RG3 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1449 | 0.0000 | 0.8398 | 0.0152 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 31-4-44 | J | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 31-4-45 | RG2 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0971 | 0.0000 | 0.0073 | 0.8956 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 31-4-46 | J | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.9992 | 0.0008 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 31-4-47 | GR | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.9753 | 0.0000 | 0.0245 | 0.0002 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 37-0-1 | RG3 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0021 | 0.0028 | 0.9086 | 0.0173 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 37-0-2 | BC | 0.0000 | 0.0001 | 0.0000 | 0.9999 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 37-0-3 | RG3 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 37-0-4 | J | 0.0011 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.9845 | 0.0000 | 0.0000 | 0.0010 | 0.0000 | 0.0000 | 0.0135 | 0.0000 | 0.0000 |
| 37-0-5 | BC | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 37-0-642 | J | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.9999 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 39-0-65 | J | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 57-0-1 | J | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

Canada Balsam during cover slip application. The clarity of the slide was greatly improved using Canada Balsam.

All hydration rims were observed and measured using a Nikon Labophot POL petrographic microscope with a polarized light source (X-Nichols) and a 1/4 wave/red tint plate at 600 diameters. The tint plate creates a dark background upon which the hydration rim appears blue due to the difference in biorefringence. This helps to differentiate the interior of the hydration rim, thus making measurements more accurate.

All measurements were done with a filar eyepiece interfaced with a TI-50 calculator for automatic data recording. At the beginning of each day, the optics of the microscope were calibrated against a standard to compensate for any changes in barometric pressure and temperature. Measurements were taken by two independent observers. Exterior sides of the samples were scanned to find the widest and narrowest portions of the hydration rim. Each observer made five measurements at five different locations. The ten measurements were then averaged and the depth of the hydration rim (in microns) and the standard deviation were calculated. The two observers worked no more than four consecutive hours to reduce the chance of error due to eye strain. In cases where neither observer could identify a rim, a third independent observer was asked to examine the slide. If no rim was found by the third observer, a second slide was prepared and the procedure repeated. If no rim was observed on the second slide, it was assumed there was none present on the sample.

All measurements and calculations were recorded on ENMU-OHL data sheets. Other notable optical observations (i.e., hydration rims along cracks, quality of hydration rim, etc.) also were recorded.

*Results*

Of the 49 samples analyzed through XRF, rim measurements were obtained on only 29. This is because 15 of the items were tachylite and lack the translucency necessary for reading rims. The remaining five were each prepared twice and no measurable hydration rim was obtained for any of them. Table 4 presents the rim measurements obtained for each sample grouped by source. One general statement about the measurements is that there are some very large rim measurements present and in a relative sense this could indicate the presence of an old component at the site. The artifacts are discussed by source below.

*Beaver Creek.* Four of the artifacts sourced as Beaver Creek obsidian and have rim measurements ranging from 5.5 to 6.3 microns. This is a relatively tight cluster of larger rim measurements (Figure 2). But, all of these artifacts are from an unknown time period and the hydration rate for this source is not known. Therefore, no definitive interpretations can be offered.

*Cochetopa.* Only one artifact with a rim measurement sourced to Cochetopa. The artifact is a Bajada point fragment and has a rim depth of 7.0 microns. No interpretations can be made on the basis of this one artifact.

*Rio Grande Pleistocene Terrace Gravels, Cochiti Vicinity.* Of the four artifacts with rim measurements sourcing to this group, one has a depth of 3.2 microns and the others 6.1, 7.5, and 8.8 respectively. These artifacts are all from an unknown time period, but there does appear to be a cluster of larger (perhaps indicating greater age)

Table 4. Rim Measurements for Archaeological Samples.

| Sample No. | Source | Rim Depth (in microns) | Standard Deviation |
|---|---|---|---|
| 19-f-79 | Beaver Creek, CO | 5.5 | 0.5 |
| 37-0-2 | Beaver Creek, CO | 5.8 | 0.6 |
| 11-0-2 | Beaver Creek, CO | 6.2 | 0.7 |
| 37-0-5 | Beaver Creek, CO | 6.3 | 0.5 |
| 00-0-15 | Cochetopa, CO | 7.0 | 0.6 |
| 119 | Jemez | 3.0 | 0.2 |
| 00-0-101 | Jemez | 3.3 | 0.6 |
| 18-1-76 | Jemez | 3.6 | 0.3 |
| 124 | Jemez | 3.7 | 0.5 |
| 11-0-3 | Jemez | 4.3 | 1.0 |
| 116 | Jemez | 4.6 | 0.5 |
| 39-0-65 | Jemez | 4.6 | 0.4 |
| 57-0-1 | Jemez | 4.6 | 0.6 |
| 37-0-4 | Jemez | 5.3 | 0.3 |
| 31-4-46 | Jemez | 5.4 | 0.3 |
| 00-0-21 | Jemez | 5.5 | 0.2 |
| 00-0-46 | Jemez | 5.7 | 0.6 |
| 109 | Rio Grande Pleistocene Terrace Gravels, Cochiti Vicinity | 3.2 | 0.4 |
| 19-f-80 | Rio Grande Pleistocene Terrace Gravels, Cochiti Vicinity | 6.1 | 0.3 |
| 00-0-20 | Rio Grande Pleistocene Terrace Gravels, Cochiti Vicinity | 7.5 | 0.6 |
| 11-0-1 | Rio Grande Pleistocene Terrace Gravels, Cochiti Vicinity | 8.8 | 0.5 |
| 126 | Rio Grande Pleistocene Terrace Gravels, Las Cruces Vicinity | 2.1 | 0.3 |
| 111 | Rio Grande Pleistocene Terrace Gravels, Las Cruces Vicinity | 3.4 | 0.6 |
| 129 | Rio Grande Pleistocene Terrace Gravels, Las Cruces Vicinity | 4.6 | 0.4 |
| 00-0-42 | Rio Grande Pleistocene Terrace Gravels, Las Cruces Vicinity | 4.6 | 0.3 |
| 37-0-3 | Rio Grande Pleistocene Terrace Gravels, Las Cruces Vicinity | 5.8 | 0.5 |
| 00-0-25 | Rio Grande Pleistocene Terrace Gravels, Las Cruces Vicinity | 6.3 | 0.6 |
| 11-0-4 | Rio Grande Pleistocene Terrace Gravels, Las Cruces Vicinity | 6.8 | 0.4 |
| 00-0-11 | Rio Grande Pleistocene Terrace Gravels, Las Cruces Vicinity | 7.3 | 0.6 |

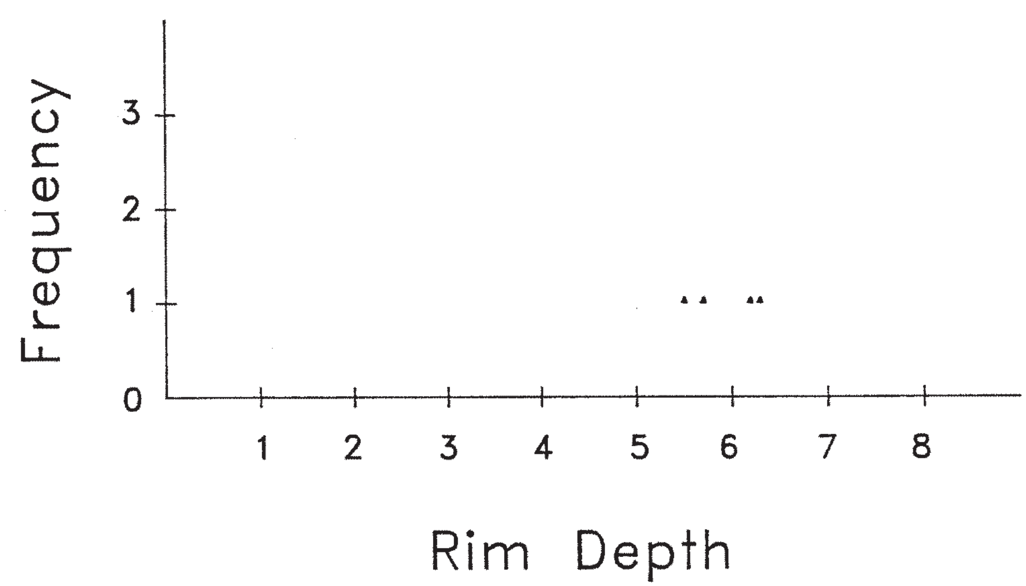



Figure 2. Graph of rim depth by frequency for the Beaver Creek artifacts.

rim measurements (Figure 3). The hydration rate for this source is not known and so no absolute dates can be determined for these artifacts.

*Rio Grande Pleistocene Terrace Gravels, Las Cruces Vicinity.* These artifacts have a more general distribution of rim measurements ranging from 3.1 to 7.3 microns (Figure 4). All but two of these artifacts are from an unknown time period. The other two are a San Jose point fragment and a Bajada point fragment. The older Bajada point does have a larger rim depth than the San Jose point which makes sense culturally (cf. Irwin-Williams 1973). The hydration rate for this source is not known and no absolute dates can be determined for these artifacts. Michels (1983, 1984a, 1984b, 1984c, 1984d, 1984e, 1986) has several hydration rates for Rio Grande gravel groups, but it is not possible to be sure which of his groups, if any, are the same as ENMU-OHL gravel groups.

*Jemez.* Twelve artifacts with rim measurements sourced as Jemez. They have rim depths ranging from 3.0 to 5.7 microns and appear to be somewhat randomly distributed around the median of 4.6 (Figure 5). Four samples are associated with point types and the remaining 8 are from unknown time periods. Sample 39-0-65 is a possible Folsom fragment, 57-0-1 is a possible Eden fragment, 00-0-46 is an Armijo fragment, and 00-0-21 is a Bajada fragment. However, there is no relative pattern to the rim depths for these four points. The Folsom and Eden artifacts have the same rim depth (4.6) which is smaller than either the Armijo (5.7 microns) or Bajada (5.5 microns) artifacts.

Dates were obtained for these samples using Michels' (1987) Cerro del Medio (Jemez Mtn.) hydration rate. These dates are presented in Table 5. These dates do not associate very well with the known (i.e., published) dates for the point types. This may be due to several reasons. The hydration rims were difficult to measure on many of the samples (as seen by the high standard deviations and possibly due to weathering of the surface artifacts) and could affect accuracy. Also, given the great variability within obsidian flows, it is difficult to base a hydration rate on just a few samples (as Michels' Cerro del Medio rate is). Michels' samples may derive from a different flow than ENMU-OHL's Jemez source and therefore the hydration rate he determined may not.

## SUMMARY

Results of XRF and discriminant analysis of the 49 artifacts indicates that they are derived from several sources. Five of these are New Mexico sources and two are from Colorado obsidian sources. It was not possible to discern obsidian procurement patterns through time based on this sample and the information known about the artifacts. Although many of the original 125 artifacts submitted by MNM were projectile points, only a few of these were actually obsidian and could be used for analysis. As a result many of the sourced artifacts were from unknown time periods.

For various reasons, mentioned previously, rim measurements were obtained for only 29 of the 49 sourced artifacts. There did not appear to be any relative relationship between rim measurements for the most part. Most of the artifacts were flakes and debitage not associated with any specific time period.

Obsidian hydration dates were calculated for the 12 artifacts that sourced as Jemez. These dates did not correlate well with published dates for the known

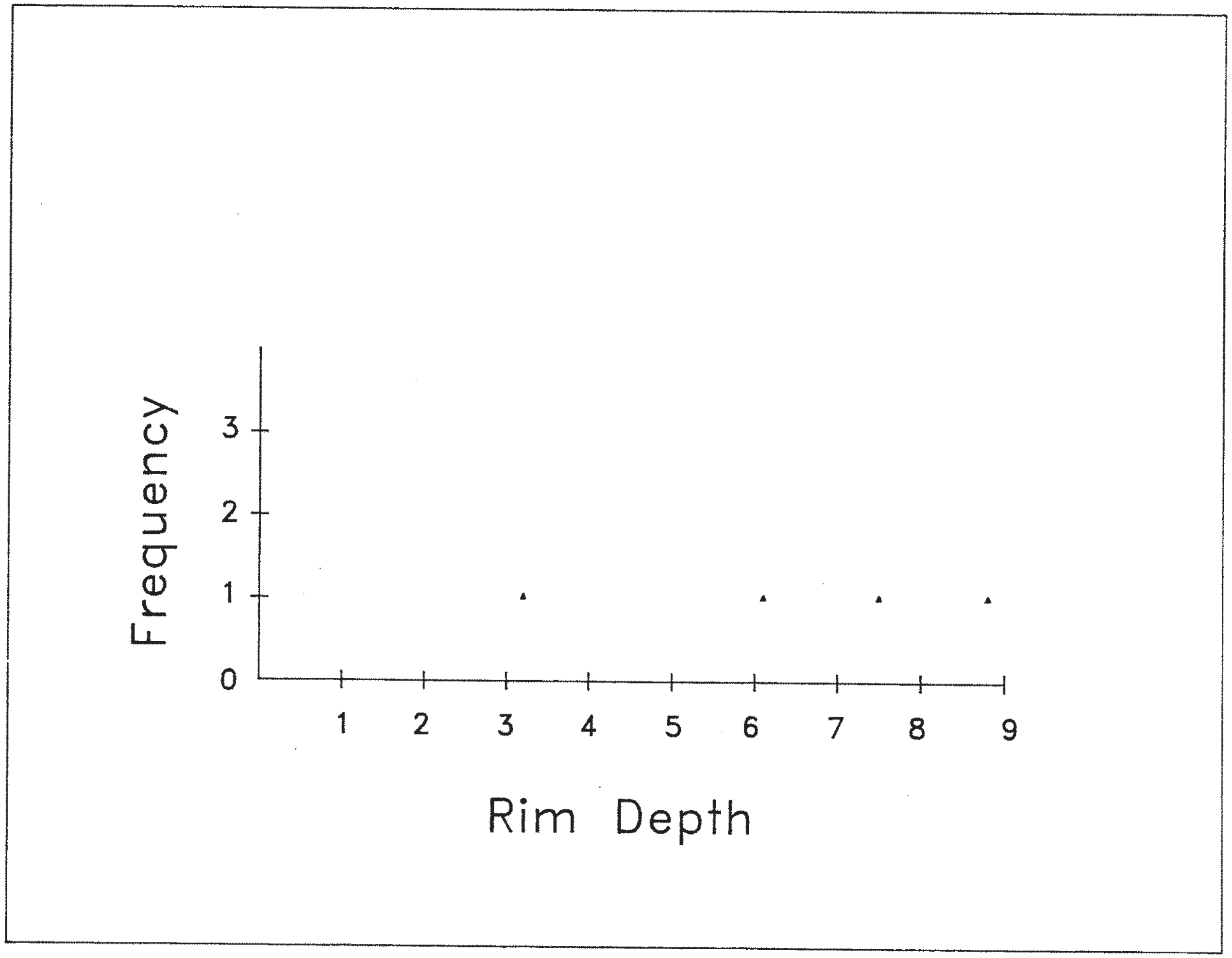



Figure 3. Graph of rim depth by frequency for the Rio Grande Pleistocene Terrace Gravels, Cochiti Vicinity artifacts.

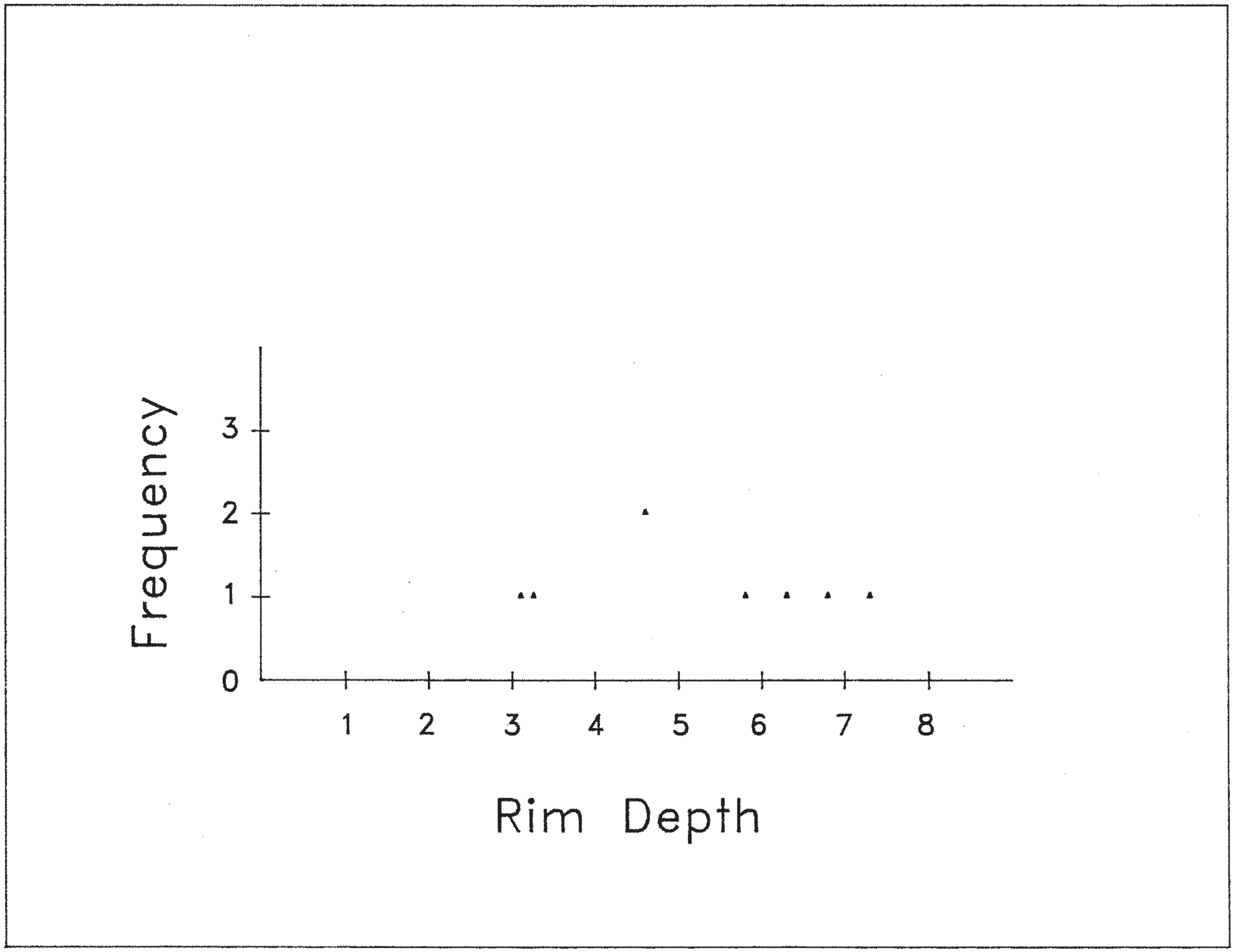



Figure 4. Graph of rim depth by frequency for the Rio Grande Pleistocene Terrace Gravels, Las Cruces Vicinity artifacts.

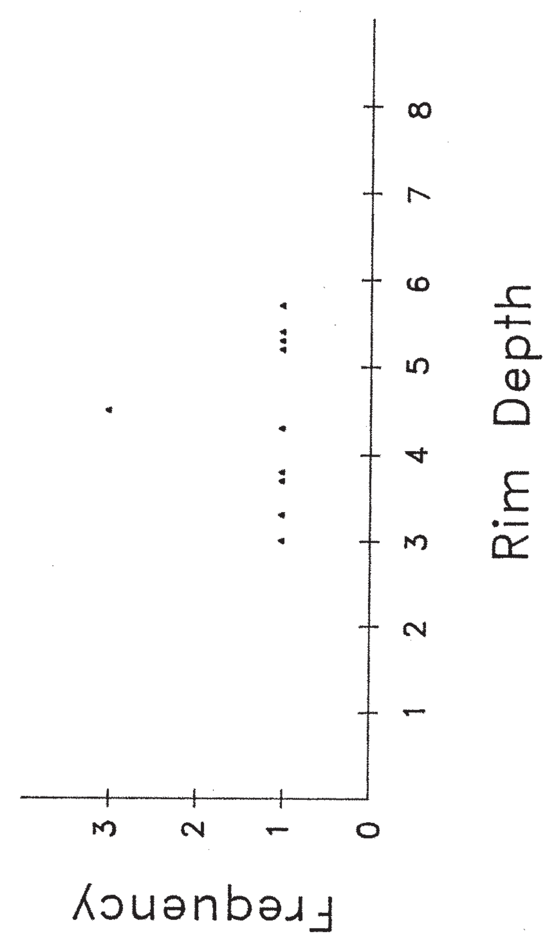



Figure 5. Graph of rim depth by frequency for the Jemez artifacts.

Table 5. Obsidian Hydration Dates for Jemez Archaeological Samples.

| Sample No. | Obsidian Hydration Date |
|---|---|
| 119 | 2535 B.P. +/- 350 |
| 00-0-1-1 | 3067 B.P. +/- 1218 |
| 18-1-76 | 3651 B.P. +/- 634 |
| 124 | 3856 B.P. +/- 1113 |
| 11-0-3 | 5208 B.P. +/- 2705 |
| 116 | 5961 B.P. +/- 1367 |
| 39-0-65 | 5961 B.P. +/- 1081 |
| 57-0-1 | 5961 B.P. +/- 1656 |
| 37-0-4 | 7912 B.P. +/- 922 |
| 31-4-46 | 8214 B.P. +/- 938 |
| 00-0-21 | 8521 B.P. +/- 631 |
| 00-0-46 | 9152 B.P. +/- 2028 |

projectile point types in the sample. Several factors could account for this discrepancy. On many of the artifacts, hydration rims were very variable and hard to measure (as evidenced by the high standard deviations and possibly due to surface weathering of the samples). An inaccurate rim measurement would affect the obtained date. Another possibility is that the hydration rate established by Michels (1987) for the Cerro del Medio (Jemez Mtn.) source does not apply to ENMU-OHL's Jemez source. There is great geochemical variability in obsidian flows and it is difficult to establish hydration rates based on only a few samples (as Michels does). It is possible that our Jemez source samples are from a different flow and may have a different hydration rate.

In summary, this study has shown that several different obsidian sources were utilized by the occupants of LA 9075. If other chronometric data exists for the site and can be correlated with the obsidian samples, it may be possible for MNM to chart obsidian procurement patterns through time. This would be an excellent way to study prehistoric exchange systems.

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# APPENDIX 3

# POLLEN ANALYSIS

POLLEN ANALYSIS OF ARCHEOLOGICAL SAMPLES FROM
SITE LA 9075, LA VEGA,
NEAR GRANTS, VALENCIA COUNTY, NEW MEXICO

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## 2
## INTRODUCTION

Archeological excavations were conducted by the Laboratory of Anthropology (LA), Museum of New Mexico, at a large multi-component site in the State Highway 53 right-of-way south of Grants, New Mexico. Diagnostic artifacts indicate Paleo-Indian, Archaic, Basketmaker, and Anasazi components (Jeff Boyer, letter 27 January 1988). Under the general direction of Richard Sullivan, numerous pit features were excavated and sampled for pollen and macrobotanical analyses in March and April of 1987. Eighteen of the pollen samples sent to the Castetter Laboratory of Ethnobotanical Studies (CLES), University of New Mexico, were analyzed and are reported here. Proveniences of the analyzed samples are listed in Table 1. I have not visited the site area.

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TABLE 1: PROVENIENCES OF SAMPLES ANALYZED FOR POLLEN CONTENT, SITE LA 9075, LA VEGA, VALENCIA COUNTY, NEW MEXICO

| CLES NO. | LA NO. | PROVENIENCE |
|---|---|---|
| *Locus 19 features* | | |
| 88045 | 634 | Fill at base of F-19a, mealing area? |
| 88044 | 633 | Fill at base of F-19a associated with F-19a1 |
| 88056 | 191 | Fill at base of F-19a1, storage bin |
| 88047 | 190 | Clay liner of F-19a1, storage bin |
| 88040 | 225 | Fill 30 cm BS of F-19b, storage bin |
| 88049 | 231 | Fill 67 cm BS of F-19b, storage bin |
| 88048 | 242 | Clay liner at base of F-19b, storage bin |
| 88042 | 651 | Fill at base of F-19d1, pit |
| 88043 | 650 | Clay liner at base of F-19d1, pit |
| 88046 | 700 | Fill at inferred base of F-19d2, pit |
| 88053 | 681 | Fill of W 1/2 of F-19f, shallow basin |
| 88041 | 678 | Fill at base of F-19f, shallow basin |
| 88055 | 717 | Darkest fill of F-19g, burned pit |
| 88054 | 755 | Darkest fill of F-19h, shallow basin |
| 88052 | 725 | Fill at base of F-19h, shallow basin |
| *Other features* | | |
| 88057 | 53 | Fill at base of F-18, burned pit |
| 88050 | 146 | Fill (Level 2) of F-31, unburned pit |
| 88051 | 236 | Fill at base of F-31, unburned pit |
| 88058 | 705 | Modern surface pollen sample taken 22 April 1987 |

Results of the pollen analysis will be presented by groups of features, following a discussion of laboratory techniques and pertinent analytical considerations.

## Laboratory Techniques: Pollen Samples

Chemical extractions of the pollen samples were performed by CLES personnel using a procedure designed for arid Southwest sediments. This process involves chemical dissolution of carbonates and silicates, chemical acetolysis of organics and cellulose, and mechanical removal of fine charcoal by centrifuge-assisted washes with dilute methanol. The process is described in detail as follows:

1) Each sample was passed through a tea strainer (mesh openings of about 2 mm) into a beaker to a total screened weight of 25 grams. The sediments were dry. Each screened sample was "spiked" with three tablets of pressed Lycopodium (clubmoss) spores (batch 201890, Dept. Quat. Geol., Lund, Sweden), for a total addition of 33,900 +/- 400 marker grains.

2) Concentrated hydrochloric acid (38%) was added to remove carbonates, and the samples were allowed to sit overnight.

3) Distilled water was added to the samples, and the acid and dissolved carbonates washed out by repeated centrifugation at 2,000 RPM in tapered 50 ml tubes. The concentrated residues were transferred back into numbered beakers and more distilled water was added. The water-sediment mixture was swirled, allowed to sit 10 seconds, and the fines decanted off of the settled heavy residue into another beaker. This process, essentially similar to bulk soil flotation, differentially floated off light materials, including pollen grains, from heavier non-palynological matter. The fine "floated" fractions were concentrated by centrifugation at 2,000 RPM; the heavy fraction remaining in the beakers was discarded.

4) The fine fractions were transferred back into numbered plastic beakers and mixed with 48% hydrofluoric acid to remove smaller silicates. This mixture was stirred occasionally and allowed to sit overnight.

5) Distilled water was added to dilute the acid-residue mixture, which was transferred to the 50-ml centrifuge tubes again. Centrifugation and washing of the compacted residue with distilled water was repeated as above to remove acid and dissolved siliceous compounds.

6) Trisodium phosphate (5% solution), a wetting agent, was mixed with the residue and centrifuged. Repeated centrifuge-assisted rinses with distilled water subsequently removed much fine charcoal and small organic matter. Remaining residues were washed with glacial acetic acid to remove remaining water in preparation for acetolysis.

7) Acetolysis mixture (9 parts acetic acid anhydride to 1 part concentrated sulfuric acid) was added to the residues in the plastic centrifuge tubes to destroy small organic particles. The tubes were heated in a boiling water bath for 5 minutes, followed by cooling in another water bath for about 5 minutes. The residues were compacted by centrifugation and the acetolysis mixture poured off. Multiple centrifuge-assisted washes with distilled water followed to remove remaining traces of acid and dissolved organic compounds. Total exposure of the residues to acetolysis mixture was about 15 minutes.

8) The samples were washed in warm dilute methanol, and small silicates, organic material, and charcoal were differentially floated off of the palyniferous residues by centrifugation at 2,000 RPM for time periods varying from 60 to 90 seconds. Remaining residues were stained with Saffranin O, mixed with liquid glycerol, and stored in 3-dram stoppered vials.

Microscope slides were made using liquid glycerol as the mounting medium under 22 x 22 mm cover slips sealed with fingernail polish. The liquid mounting medium allowed the grains to be turned over during microscopy, facilitating identifications. The slides were counted using a Nikon Alphaphot microscope at a magnification of 400X. Identifications were made to the family or genus level, as possible. Grains which could not be identified despite well-preserved morphological details were tallied as "Unknowns." Pollen grains too degraded (corroded or crumpled) to identify further were tallied as "Unidentifiable." Grains which occurred as clumps were counted as a single occurrence (one grain), and notes were made of the number of grains visible in each clump.

The artificial category of juniper/cottonwood (Juniperus/Populus) reflects uncertainties in the identification of individual grains due to similarities of size and surface details. A flattened spherical grain with faint speckles on its surfaces could be either a degraded cottonwood or juniper grain, or even a spore. The presence of spores in all of the pollen samples prompted caution in identifications of questionable grains, and the combination of juniper and cottonwood pollen grains in this analysis was thought to be a more useful compromise than counting the ambiguous grains among the Unidentifiables.

The degree of preservation of the spines present on grains from the Compositae is also crucial to their identification. Grains bearing spines 2.5µ or lower are classed as Low-Spine Composites, with the working assumption that these were produced by the primarily wind-pollinated genera of the family. Grains bearing spines longer than 2.5µ are classed as High-Spine Composites, with the working assumption that these were produced by the primarily insect-pollinated genera of the family. Problems enter when the spines are normally 2.5µ long, as for primarily insect-pollinated snakeweed (Xanthocephalum/Gutierrezia). In the present study, grains of snakeweed are probably included with the Low-Spine Composites because of the shortness of the spines.

Only nineteen pollen types were recognized from the modern and archeological pollen samples, as listed in Table 2. Preservation of the pollen grains was generally fair to poor, with from 3% to a high of 40% of the total count in the pollen-sufficient archeological samples being unidentifiable due to severe degradation.

Five of the 18 archeological samples contained pollen grains too poorly preserved to warrant extensive counting, either because of low numbers of pollen grains (samples 190, 650, 651, and 700), or a very high percentage of Unidentifiable grains (14 out of 31 pollen grains, sample 236). The slides of all 18 archeological samples were completely scanned at 200X, following the regular count, in search of the larger pollen grains of cultivated plants. None was seen in any of the slides.

## Limitations of Pollen Data

Two related but separate statistical considerations should be considered in order to evaluate the pollen data reported here. The first consideration is the "200-grain count" derived from the work of Barkley (1934), and expanded by Martin (1963: 30-31). Counting pollen grains to a total of 200 per sample allows the microscopist to produce results with a 0.90 coefficient of reliability. Taxa occurring in numbers too low to be seen at this level of accuracy are considered too minor to affect the analytical utility of the count. Counting more than 200 grains would increase the accuracy or "statistical validity" of the analysis, but at the expense of greatly increased time at the microscope. Fewer grains than 200 can

TABLE 2: POLLEN TYPES IDENTIFIED IN SAMPLES FROM SITE LA 9075, LA VEGA, VALENCIA COUNTY, NEW MEXICO

| TAXON | COMMON NAME |
|---|---|
| Pinaceae | saccate genera of the Pine family |
| Picea | Spruce |
| Pinus | Pine |
| Juniperus/Populus | Juniper (Juniperus) and Cottonwood (Populus) types, combined here due to uncertain identification of individual grains |
| Quercus | Oak |
| Ulmus | Elm |
| Alnus | Alder |
| Cheno/Am | genera of the Goosefoot family (Chenopodiaceae) and species of the genus Amaranthus (pigweed) |
| Sarcobatus | Greasewood |
| Ephedra | Mormon Tea |
| Gramineae | genera of the Grass family |
| Typha | Cattail, here seen as single grains as well as in groups of 2, 3, and 4 grains |
| Low-Spine Compositae | wind-pollinated genera of the Sunflower family |
| Artemisia | Sagebrush |
| High-Spine Compositae | insect-pollinated genera of the Sunflower family |
| Cichorieae | insect-pollinated genera of the Chicory tribe of the Sunflower family |
| Sphaeralcea | Globemallow |
| Eriogonum | Wild Buckwheat |
| Onagraceae | genera of the Evening Primrose family |

certainly be counted, but with a sharp decline in accuracy in terms of the kinds of pollen present in the sample.

The second consideration is the "1000-grain-per-gram" rule summarized by Hall (1981: 202) and used as an indicator of the degree of pollen destruction in sediment samples from rockshelter contexts. An estimate of the number of pollen grains present in a gram of sample is determined by the addition of known numbers of marker grains ("spike") to the sample at the beginning of the processing procedure (Benninghoff 1962; Maher 1981). Separate tallies are then kept of the spike grains and pollen grains counted under the microscope, allowing the proportion of available pollen grains actually seen to be estimated by means of a mathematical equation. Pollen grains can be recovered in the tens of thousands per gram in well-preserved sediments; amounts fewer than 1000 per gram are a signal to the analyst that the forces of degradation have been at work, or that the potential natural pollen rain has been restricted in some way.

A further refinement of this observation is a categorization of the degree of degradation seen in the pollen grains which do remain for analysis in a sample. It is known that the pollen grains from different taxa do not degrade at the same rate, rather that degradation is differential (Holloway 1981, and references cited therein). Some pollen taxa are relatively resistant to destruction, remaining part of the pollen record long after other types have disappeared altogether. Many pollen types readily degrade beyond recognition, while others are so distinct in shape that they remain recognizable even when degraded to optically clear "ghost grains" lacking sufficient structure to take up stain. Thus, differential degradation is compounded by differential recognition. Cushing (1967) devised a six-step scale for preservation/degradation observations; Hall (1981) refined this to a four-step scale. The utility of such scales is that they provide quantifiable evidence of degradation independent of the goals of 200-grain counts or 1000 grains per gram. The amounts and degrees of degradation have direct implications for the representativeness of the pollen counted by the analyst.

Since "perfect" pollen grains are rarely seen in archeological samples, degrees of degradation in this analysis have been largely ignored in favor of a single category, the Unidentifiables. These grains are included in the 200-grain count. If a pollen grain is well enough preserved to identify to genus or family, that identification is made without special notes being taken of its condition. If, however, a pollen grain is too degraded to assign positively even to family, it is classed as an Unidentifiable with notes as to its condition (degraded or crumpled). Grains which are too degraded to distinguish confidently as a pollen grain or as a spore are not counted at all.

In sum, three considerations must be weighed simultaneously for each pollen spectrum in the following report: statistical validity (200-grain count), relative abundance (1000 grains per gram, "rule of thumb"), and representativeness (degree of degradation). It is possible to have less than 1000 grains of pollen per gram of sample (as from an archeological context which biased the pollen rain, such as an enclosed room), which laboratory procedures could concentrate sufficiently to yield a 200-grain count. Use of such a count from a sample which <u>also</u> contained large numbers of degraded grains could lead to grossly erroneous conclusions on all fronts, since differential degradation of all taxa originally present in the sediment would result in altered proportions of those still present or in (differentially) recognizable condition. The absence of archeological evidence for structures around the pit features analyzed here, and the frequent presence of fungal hyphae in the samples, suggest that active physical degradation of the deposited pollen spectra is ongoing at La Vega.

## Implications of Sampling Loci

Practically speaking, greater or lesser numbers of pollen grains are recoverable from probably any archeological context. Given this, it follows that the archeological implications of the sampled context become paramount for the interpretation of the recovered pollen spectrum. Just as one example, a pollen sample from pit fill provides pollen information on the fill of the pit. If research questions are directed at events connected with the filling of the pit, the recovered pollen spectrum probably will be appropriate. If, however, research questions are directed at the original function(s) of the pit before it filled, then the recovered pollen spectrum from this sample will probably not be appropriate.

Another example is a pollen sample from a burned feature such as a hearth. Since pollen grains are destroyed by heat (Ruhl 1986) as well as by exposure to fire, it is likely that few, if any, of the pollen grains recovered from such a burned context relate to the use of the feature per se. Rather, it is highly likely that the recovered pollen grains post-date the active (burning) use of the feature, and indeed were preserved by the very absence of burning. However, since hearths are likely depositories for floor sweepings, questions aimed at identifying the plants which were present in the structure (or in the area if the hearth is not inside a structure) are reasonable and could justify the pollen analysis of hearthfill. Finely-tuned research questions are required. In all instances, pollen data should be integrated with flotation data, since each data set is usually preserved by different conditions.

Location-specific archeological considerations usually dictate where pollen samples will be taken. For example, the lack of preserved floor surfaces may require pollen samples to be taken from burned contexts or feature fill. Research questions formulated by the archeologist must be "field tested" to take into account the anticipated recovery of pollen grains from a sampling locus, and the implications of those recovered grains for site formation processes. In sampling situations where feature preservation is good, the decision as to where to sample is easier in one sense, but still requires forethought on the implications of the pollen grains expected to be recovered.

## RESULTS OF ANALYSIS

Table 3 presents the pollen spectrum from modern surface sample 705. Its estimated content of over 61,000 grains per gram of sample reflects the pollen contributions of the surrounding vegetation to the exposed sampling location, particularly the combined category of juniper/cottonwood. This category would probably have been much larger if the sample had been taken during peak pollination season for one or the other of the two taxa. Pollen of the combined Cheno/Am type, however, still clearly dominates the spectrum, followed by the contributions of wind-borne pine family (Pinaceae, pine, and spruce) and sunflower family pollen (Low-Spine Compositae and sagebrush). This general pattern of Cheno/Am dominance followed by Low-Spine Compositae is repeated throughout the archeological samples, with a few exceptions.

Table 3 also presents the pollen spectra of three samples from two archeological pit features. The fill sample from the base of Feature 18, a burned pit or possible fire pit, yielded a pollen spectrum essentially the same as the surface sample except for 6% wind-borne cattail (Typha) pollen. Cattails were not noted as present in the current environment of the site (Jeff Boyer, personal communication 1988), and the pollen type is absent from the surface sample. As commonly seen in this and other samples from La Vega, cattail pollen usually occurs as from two to four grains joined together and shed as a unit. Data on the maximum distance to which the compound grains can be carried are lacking, but Hyde and Adams (1958) illustrated cattail tetrads as forming part of the atmospheric pollen trapped at one or more of 15 collecting stations in England over a 13-year period. Wodehouse (1965: 127-128) similarly reported the presence of single-grained cattail pollen blown from the New Jersey meadows to his Yonkers, New York collecting station atop a building five stories high. Cattail pollen, then, can be expected to be carried some distance from the parent stands by wind currents.

The pollen spectrum from the corresponding sample near the base of Feature 31, an unburned pit, was too altered by degradation to warrant extensive counting (14 out of 31 grains were Unidentifiable, sample 236). Sample 146 from Level 2 of the Feature 31 fill, however, not only generally resembles the surface sample in content, but also contains nearly three

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TABLE 3: POLLEN CONTENT OF THE SURFACE SAMPLE, AND SAMPLES FROM FEATURES 18 AND 31, SITE LA 9075, LA VEGA, VALENCIA COUNTY, NEW MEXICO

expressed as percentages

* one or more clumps of 3 or more grains seen during count

( ) number of grains counted in pollen-deficient sample

| SAMPLE NO. | modern surface 705 | F-18, burned pit, fill at base 53 | F-31, unburned pit, Level 2 fill 146 | F-31, unburned pit, fill at base 236 |
|---|---|---|---|---|
| Pinaceae | 4 | - | 2 | - |
| *Picea* | 0.5 | - | 0.5 | - |
| *Pinus* | 6 | - | 2 | - |
| *Juniperus*/*Populus* | 15* | - | 5 | - |
| *Quercus* | 1 | - | - | - |
| *Ulmus* | - | - | - | - |
| *Alnus* | - | - | 0.5 | - |
| Cheno/Am | 65* | 78* | 81* | (13) |
| *Sarcobatus* | - | - | - | - |
| *Ephedra* | - | - | - | - |
| Gramineae | 1 | 3 | - | (1) |
| *Typha* | - | 6 | 2 | - |
| Low-Spine Compositae | 3 | 1 | 3 | (2) |
| *Artemisia* | 2 | 0.5 | - | - |
| High-Spine Compositae | 2 | - | 0.5 | - |
| Cichorieae | - | 1 | 0.5 | (1) |
| *Sphaeralcea* | 0.5 | - | - | - |
| *Eriogonum* | - | - | - | - |
| Onagraceae | - | - | - | - |
| Unknown | 1 | 0 | 0.5 | 0 |
| Unidentifiable | 1 | 10 | 3 | (14*) |
| Total Pollen Counted | 271 | 214 | 262 | 31 |
| No. Spike Counted | 6 | 17 | 2 | 36 |
| No. Grains/g (est.) | 61,246 | 17,070 | 177,636 | 1,168 |

times the estimated number of pollen grains. The dominant Cheno/Am pollen type was noted during the count as comprising mostly new-looking grains, and the other pollen grains were generally in very good condition. Only 3% of the total pollen grains were unidentifiable as the result of degradation. It is highly likely that the severely degraded pollen spectrum from the lower sample represents the remnants of the in-situ pollen rain, while the aberrant Level 2 spectrum results from modern pollen contamination, possibly as the result of road maintenance activities.

Locus 19 comprised numerous pit features, several of which appeared as clay-lined pits. Three of these (Features 19a1, 19a2, and 19a3) were bell-shaped storage bins associated with a possible mealing area (Feature 19a). Toll (1988) did not find any macrobotanical remains in the flotation samples from these features. Two samples each from one of the storage bins and the possible mealing area were analyzed for pollen content, and the results are presented in Table 4.

Neither sample 634 nor sample 633 from the F-19a possible mealing area yielded pollen from cultivated plants such as corn. Both samples did yield 2% grass pollen, conceivably the result of prehistoric processing of gathered grass seeds, but this low amount is little different from the 1% grass pollen present in the modern surface sample. Both samples evidence lowered percentages of Cheno/Am pollen types, the result of elevated Low-Spine Compositae percentages. However, the prolific production of wind-borne Low-Spine Compositae pollen types makes these frequencies of 7% and 9% too low to propose as representing exclusively human activities. The relatively high numbers of Unidentifiable grains (25% or 26%) suggests degraded in-situ pollen spectra relatively uncontaminated by modern pollen rain.

Two samples from the Feature 19a1 clay-lined storage bin were analyzed for pollen content. As shown in Table 4, sample 190 from the clay lining itself contained less than 700 pollen grains per gram, a situation repeated for other samples from clay linings in this study, and a situation not uncommon for clay samples in general. Sample 191 from the pit fill near the base contained some 1,700 grains per gram, 36% of which were too degraded to identify. The remaining pollen spectrum is dominated by an even lower percentage of Cheno/Am pollen types (26%) than the possible mealing area samples, and about twice the amount of Low-Spine Compositae (15%) as seen in those samples. As mentioned above, the prolific production of wind-borne Low-Spine Compositae pollen types prompts caution in the reading of this percentage in the storage bin sample as the result of human activities.

TABLE 4: POLLEN CONTENT OF SAMPLES FROM FEATURE-19A, SITE LA 9075, LA VEGA, VALENCIA COUNTY, NEW MEXICO

expressed as percentages
* one or more clumps of 3 or more grains seen during count
( ) number of grains counted in pollen-deficient sample

| SAMPLE NO. | F-19a, mealing area? fill near F-19a2<br>634 | F-19a, mealing area? fill near F-19a1<br>633 | F-19a1, storage bin, fill at base<br>191 | F-19a1, storage bin, clay liner<br>190 |
|---|---|---|---|---|
| Pinaceae | 6 | - | 4 | - |
| Picea | 0.5 | - | - | - |
| Pinus | 3 | 1 | 1 | - |
| Juniperus/Populus | 7 | 2 | 1 | (1) |
| Quercus | 1 | - | - | - |
| Ulmus | - | - | - | - |
| Alnus | - | 0.5 | - | - |
| Cheno/Am | 44* | 54* | 26* | (3) |
| Sarcobatus | - | 0.5 | - | - |
| Ephedra | - | 0.5 | - | - |
| Gramineae | 2 | 2 | 5 | - |
| Typha | - | - | - | - |
| Low-Spine Compositae | 7 | 9* | 15 | (2) |
| Artemisia | 0.5 | 2 | 1* | - |
| High-Spine Compositae | 2 | 3 | - | - |
| Cichorieae | 2 | 2 | 7 | - |
| Sphaeralcea | - | 0.5 | 0.5 | - |
| Eriogonum | - | - | - | - |
| Onagraceae | - | - | 0.5 | - |
| Unknown | 0 | 0 | 2 | 0 |
| Unidentifiable | 26 | 25* | 36 | (4) |
| Total Pollen Counted | 215 | 204 | 210 | 10 |
| No. Spike Counted | 67 | 104 | 167 | 20 |
| No. Grains/g (est.) | 4,351 | 2,660 | 1,705 | 678 |

The 7% Cichorieae pollen, on the other hand, requires some consideration. This is an insect-carried pollen type produced in low numbers by members of the chicory tribe of the sunflower family (Kapp 1969: 164). Although many of the genera in this tribe occur naturally in North America, many others are introduced from Europe and Eurasia (Correll and Johnston 1979: 1534-1535, 1722-1736). Notable among the introduced genera are dandelion (Taraxacum), chicory (Cichoria), and goatsbeard (Tragopogon), which the Cichorieae pollen grains from the La Vega samples most closely resemble (Wodehouse 1965: 462). The grains are generally well-preserved, contrasting with the high degree of pollen degradation in the sample (36% Unidentifiable). The flattened condition of the Cichorieae grains, however, prevents precise characterization of morphological details and a better identification. The pollen grains of dandelion in particular can be carried some distance by wind currents (Hyde and Adams 1958: 25). Were the Cichorieae pollen grains to originate from introduced taxa, their presence in the La Vega archeological samples would constitute evidence of at least minor modern contamination of the sediments rather than evidence of prehistoric use of native members of the chicory tribe.

Table 5 presents the pollen spectra of three more of the pit features which were found in Locus 19. The first of these, Feature 19b, is another clay-lined pit whose clay lining (sample 242) evidenced severe alteration of its original pollen spectrum (40% Unidentifiable). Pollen of cultivated plants was lacking, and the spectrum in general closely resembles that of sample 191 from the base of the fill of storage bin F-19a1 just discussed (sample 191, Table 4). The fill of Feature 19b (samples 225 and 231) generally resembles the surface sample except for the additional presence of cattail pollen. The unusually low degree of degradation in sample 231 from the fill of the feature (6%) may reflect the introduction of more recent pollen into the sediments as a result of the heavy rodent and insect disturbances noted during excavation (Richard Sullivan, field notes 19 March 1987). No macrobotanical remains were found by Toll (1988) in the flotation samples from Feature 19b.

Pit features 19d1 and 19d2 failed to produce pollen spectra well enough preserved to warrant counting. Their failure to yield macrobotanical remains (Toll 1988) effectively curtails exploration of their prehistoric use(s) from these angles.

Table 6 presents the results of the pollen analysis of samples from three remaining pit features from Locus 19. As shown there, none yielded pollen from cultivated plants, and all closely resemble the surface sample in the dominance of wind-borne Cheno/Am and Low-Spine Compositae pollen

TABLE 5: POLLEN CONTENT OF SAMPLES FROM FEATURES 19b, 19d1, AND 19d2, SITE LA 9075, LA VEGA, VALENCIA COUNTY, NEW MEXICO

expressed as percentages
* one or more clumps of 3 or more grains seen during count
( ) number of grains counted in pollen-deficient samples

| SAMPLE NO. | F-19b, storage bin fill 30cm BS 225 | F-19b, storage bin fill 67cm BS 231 | F-19b, storage bin, clay liner at base 242 | F-19d1, unid. pit, fill at base 651 | F-19d1, unid. pit, clay liner at base 650 | F-19d2, unid. pit, inferred base 700 |
|---|---|---|---|---|---|---|
| Pinaceae | - | 2 | 3 | - | (1) | (1) |
| *Picea* | - | - | - | - | - | - |
| *Pinus* | 0.5 | 1 | 0.5 | - | - | - |
| *Juniperus*/*Populus* | 0.5 | 2 | 0.5 | (1) | - | - |
| *Quercus* | - | - | - | - | - | - |
| *Ulmus* | - | - | - | - | - | - |
| *Alnus* | - | - | - | - | - | - |
| Cheno/Am | 64* | 73* | 29* | (1*) | - | (1) |
| *Sarcobatus* | - | - | - | - | - | - |
| *Ephedra* | - | - | - | - | - | - |
| Gramineae | 2 | 3 | 3 | - | - | - |
| *Typha* | 0.5 | 5 | 3 | - | - | - |
| Low-Spine Compositae | 6 | 3 | 14 | - | - | - |
| *Artemisia* | - | - | 0.5 | - | - | - |
| High-Spine Compositae | 4 | 0.5 | 2 | - | - | - |
| Cichorieae | 2 | - | 6 | - | - | - |
| *Sphaeralcea* | - | 5 | 1 | - | - | - |
| *Eriogonum* | 0.5 | - | - | - | - | - |
| Onagraceae | - | - | - | - | - | - |
| Unknown | 0 | 0 | 0 | 0 | 0 | 0 |
| Unidentifiable | 22 | 6 | 40 | (3) | 0 | (1) |
| Total Pollen Counted | 228 | 268 | 204 | 5 | 1 | 3 |
| No. Spike Counted | 60 | 18 | 101 | 16 | 22 | 20 |
| No. Grains/g (est.) | 5,153 | 20,189 | 2,739 | 424 | 62 | 203 |

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TABLE 6: POLLEN CONTENT OF SAMPLES FROM FEATURES 19f, 19g, AND 19h, SITE LA 9075, LA VEGA, VALENCIA COUNTY, NEW MEXICO

expressed as percentages

* one or more clumps of 3 or more grains seen during count

| SAMPLE NO. | F-19f, basin, W1/2, fill 681 | F-19f, basin, fill at base 678 | F-19g, burned pit, darkest fill 717 | F-19h, basin, darkest fill 755 | F-19h, basin, fill at base 725 |
|---|---|---|---|---|---|
| Pinaceae | 0.5 | - | 1 | 0.5 | 3 |
| *Picea* | - | - | - | - | 1 |
| *Pinus* | - | - | 1 | 1 | 5 |
| *Juniperus*/*Populus* | - | 0.5 | 1 | 0.5 | 5 |
| *Quercus* | - | - | - | - | 1 |
| *Ulmus* | - | - | 0.5 | - | 1 |
| *Alnus* | - | - | - | - | - |
| Cheno/Am | 68* | 72* | 76* | 79* | 49* |
| *Sarcobatus* | - | - | 1 | 1 | 0.5 |
| *Ephedra* | - | - | - | - | 0.5 |
| Gramineae | 1 | 0.5 | 0.5 | 2 | 4 |
| *Typha* | 5 | 2 | 2 | 1 | 0.5 |
| Low-Spine Compositae | 1 | 4 | 2 | 4 | 9* |
| *Artemisia* | 0.5 | - | 3 | 0.5 | - |
| High-Spine Compositae | 1 | 2 | 1 | 0.5 | 2 |
| Cichorieae | 1 | 3 | 1 | 0.5 | 0.5 |
| *Sphaeralcea* | - | - | - | 0.5 | - |
| *Eriogonum* | - | - | - | - | 0.5 |
| Onagraceae | - | - | - | - | - |
| Unknown | 0 | 0 | 0 | 0 | 0 |
| Unidentifiable | 21* | 17* | 12 | 9* | 19 |
| Total Pollen Counted | 227 | 207 | 238 | 214 | 236 |
| No. Spike Counted | 14 | 31 | 44 | 21 | 43 |
| No. Grains/g (est.) | 21,987 | 9,055 | 7,335 | 13,818 | 7,442 |

types. Wind-borne cattail pollen grains are also present in all of these samples, as are primarily insect-borne Cichorieae grains. Degradation is relatively low (9% to 21% Unidentifiables) which, when compared with the degradation seen in clay linings of storage pits, suggests that the fill of these features is either more recent or more disturbed by insect and rodent activity. No macrobotanical remains were found by Toll (1988) from any of these features, effectively curtailing exploration of their prehistoric use(s) from these angles.

## SUMMARY

The pollen analysis of these 18 archeological samples from various La Vega pit features failed to yield pollen evidence of cultivated plants, or to provide objective evidence for prehistoric use(s) of the features involving non-cultivated plants. Instead, most features of the archeological pollen spectra resemble those of the modern surface sample. Active biological degradation of pollen grains is responsible for the up to 40% Unidentifiables, and the lack of preserved pollen spectra mirrors the failure of the flotation samples to yield charred seeds other than those of Russian thistle (Salsola kali), a 19th Century introduction (Toll 1988).

## 17

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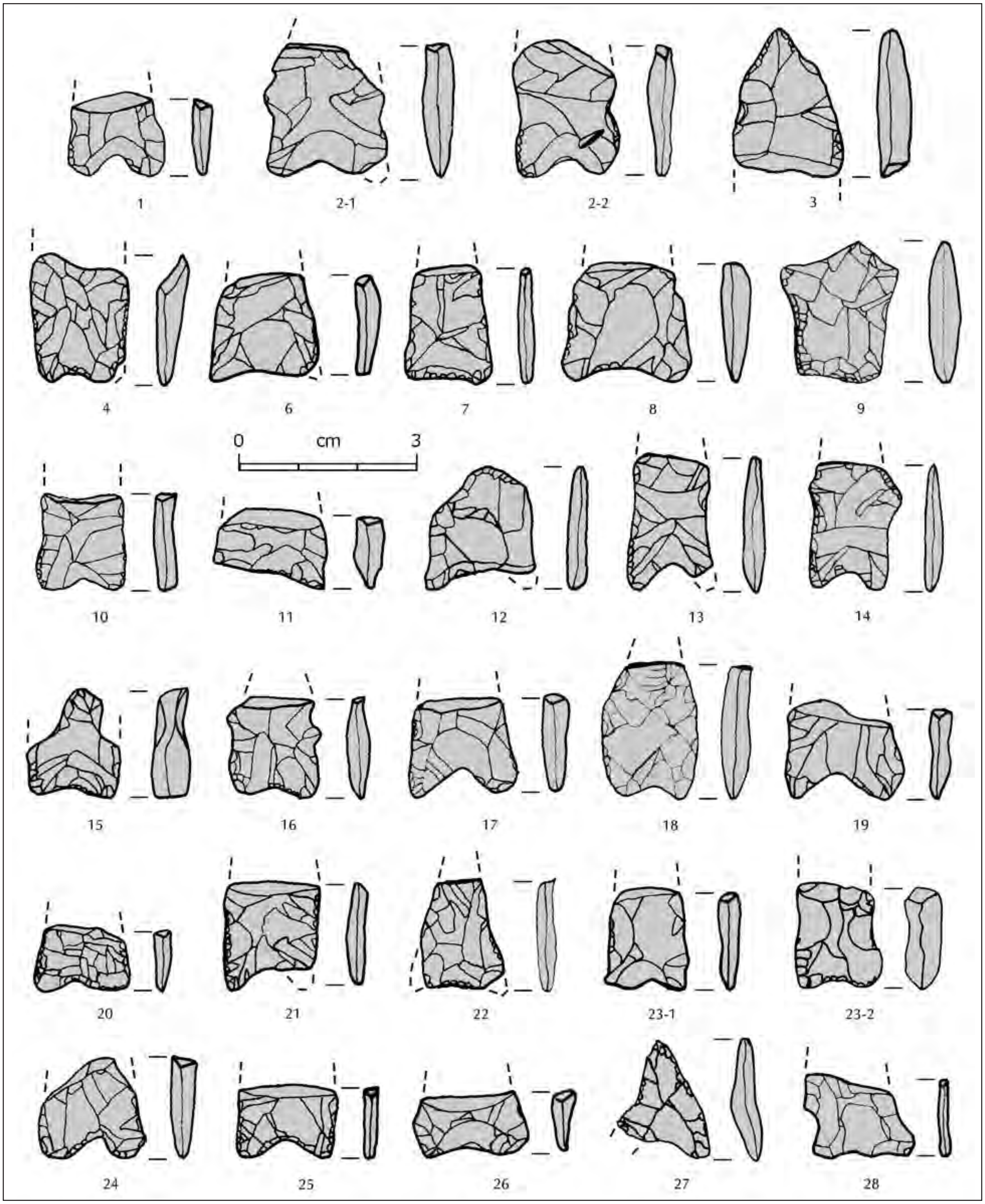
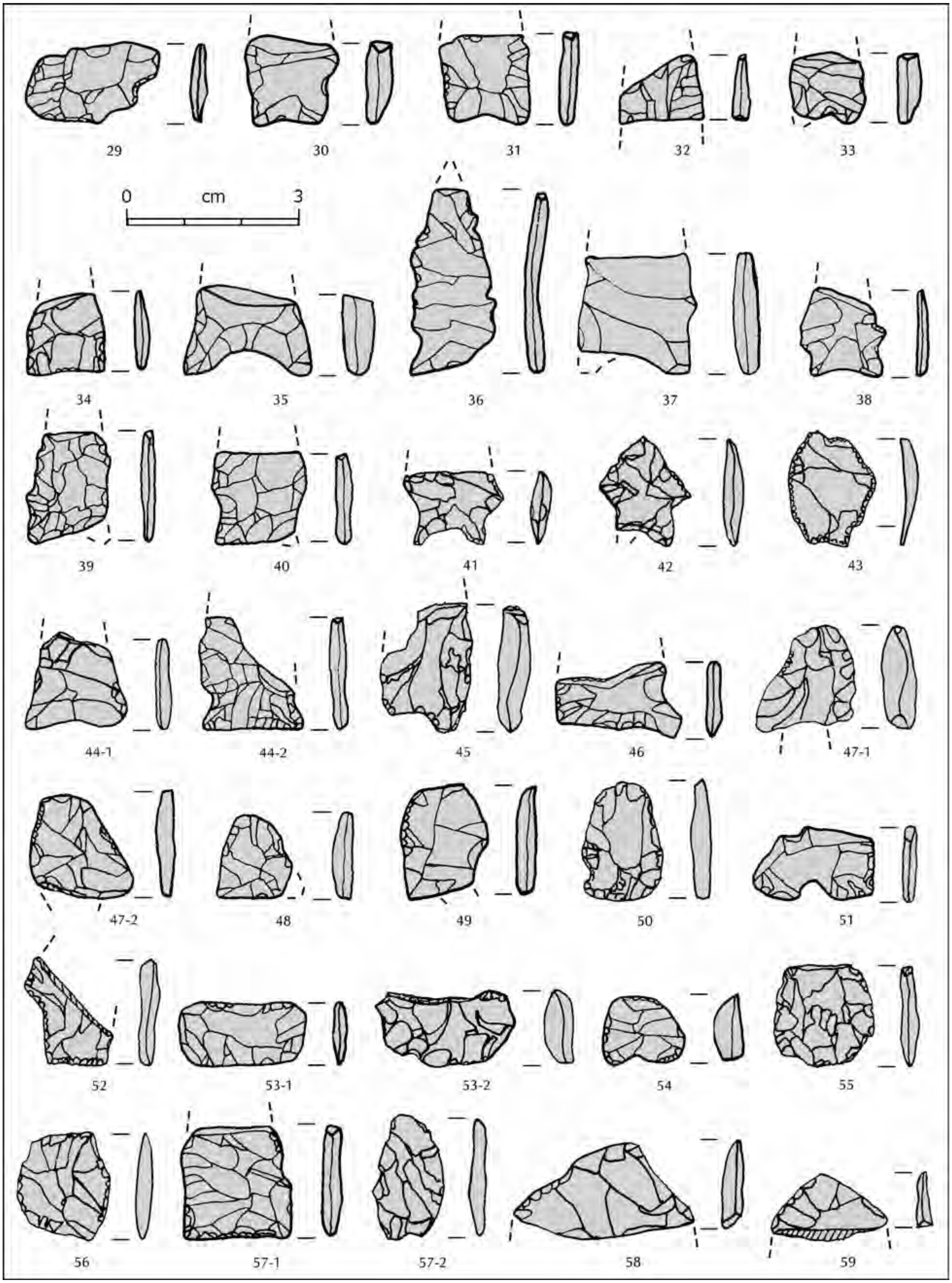
APPENDIX 4

# ARTIFACT ILLUSTRATIONS

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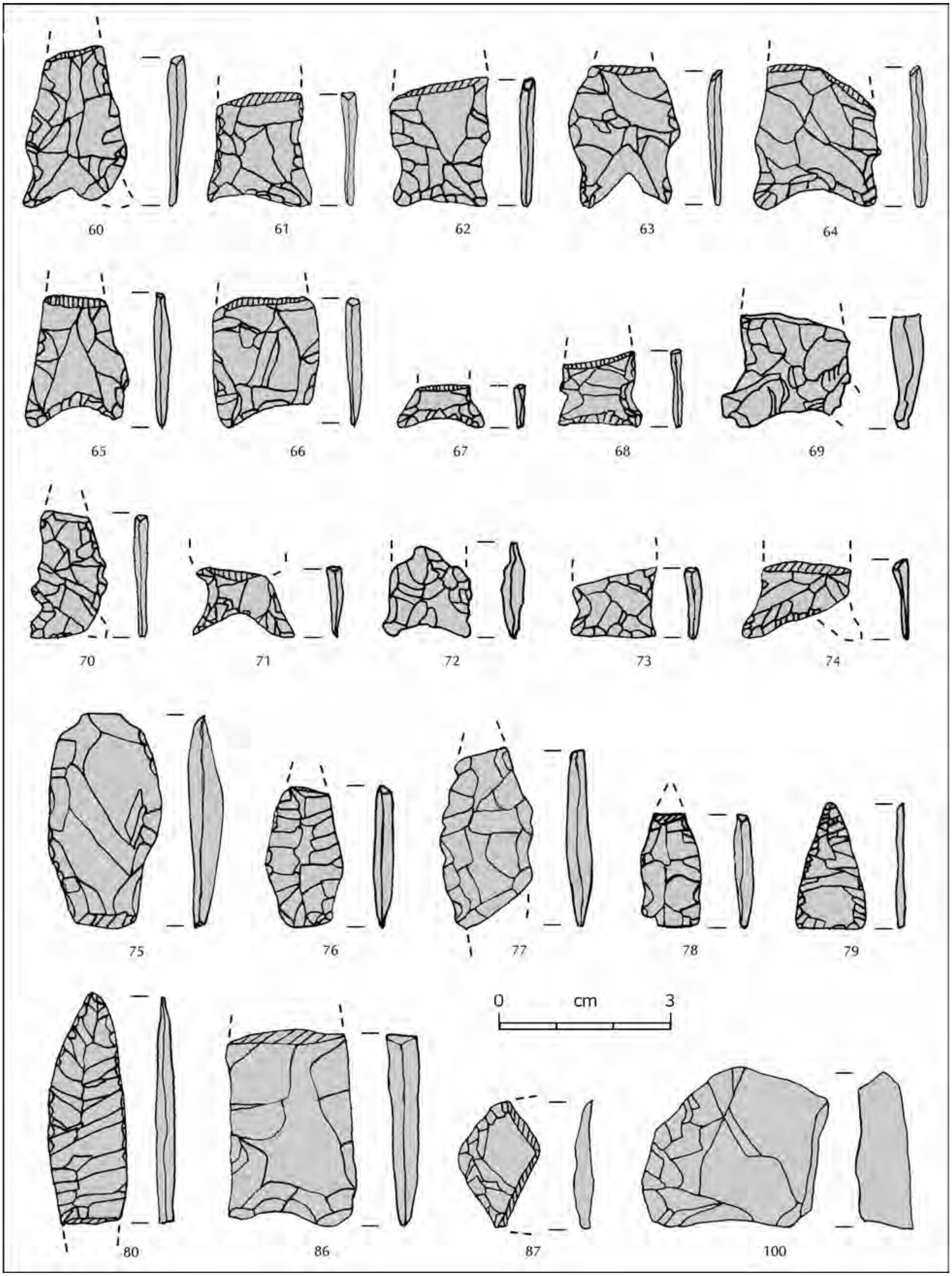
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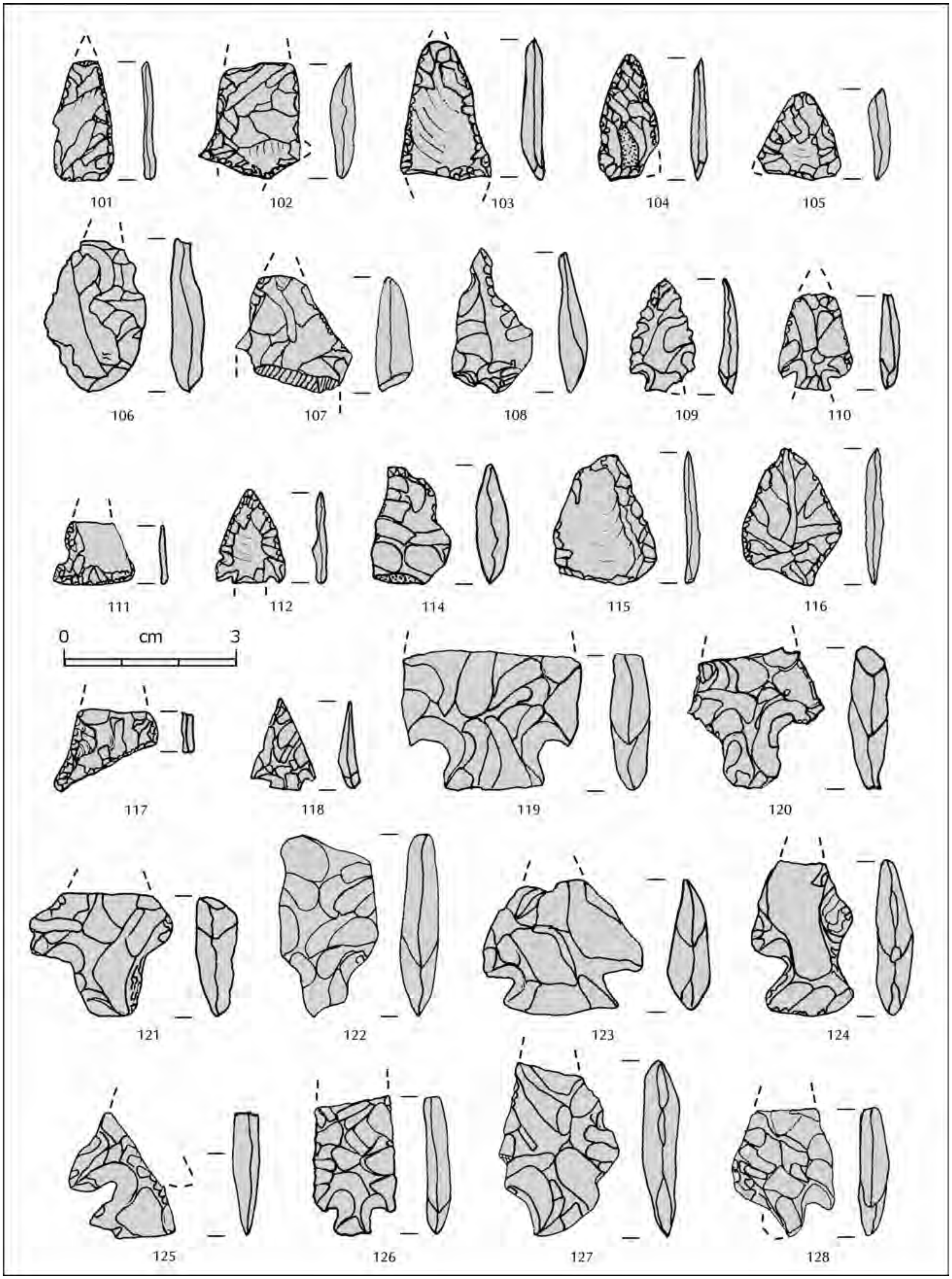
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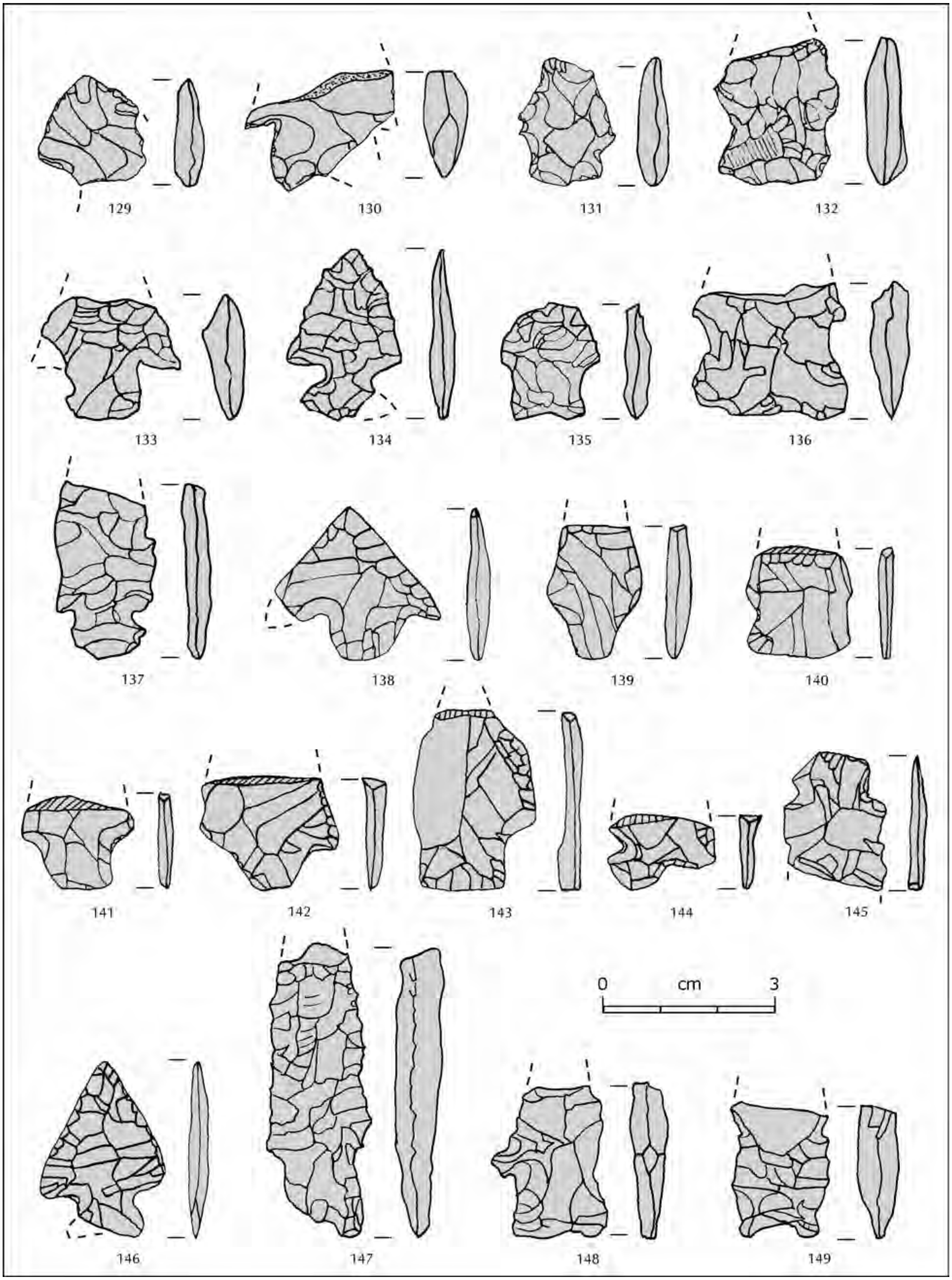

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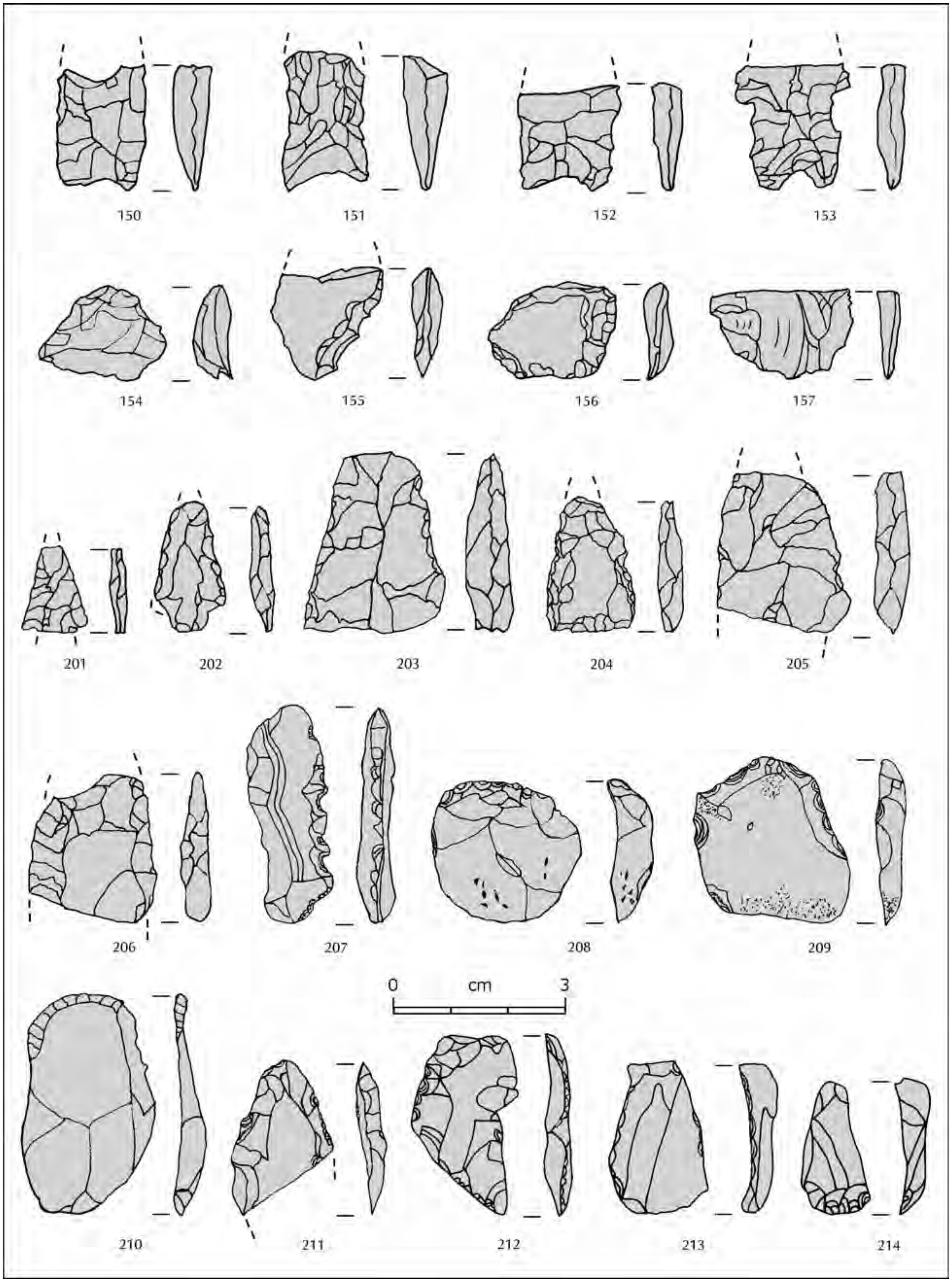
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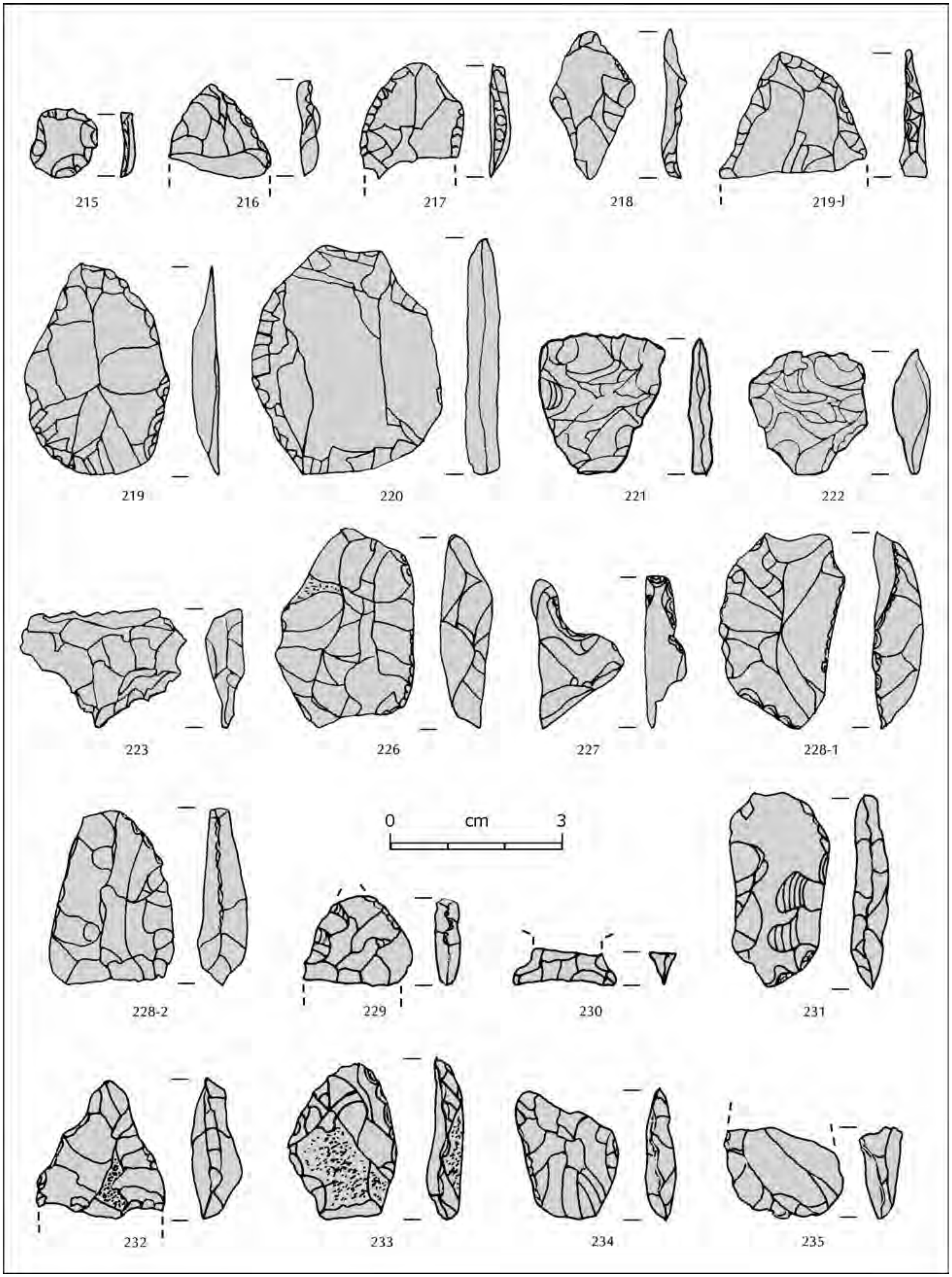
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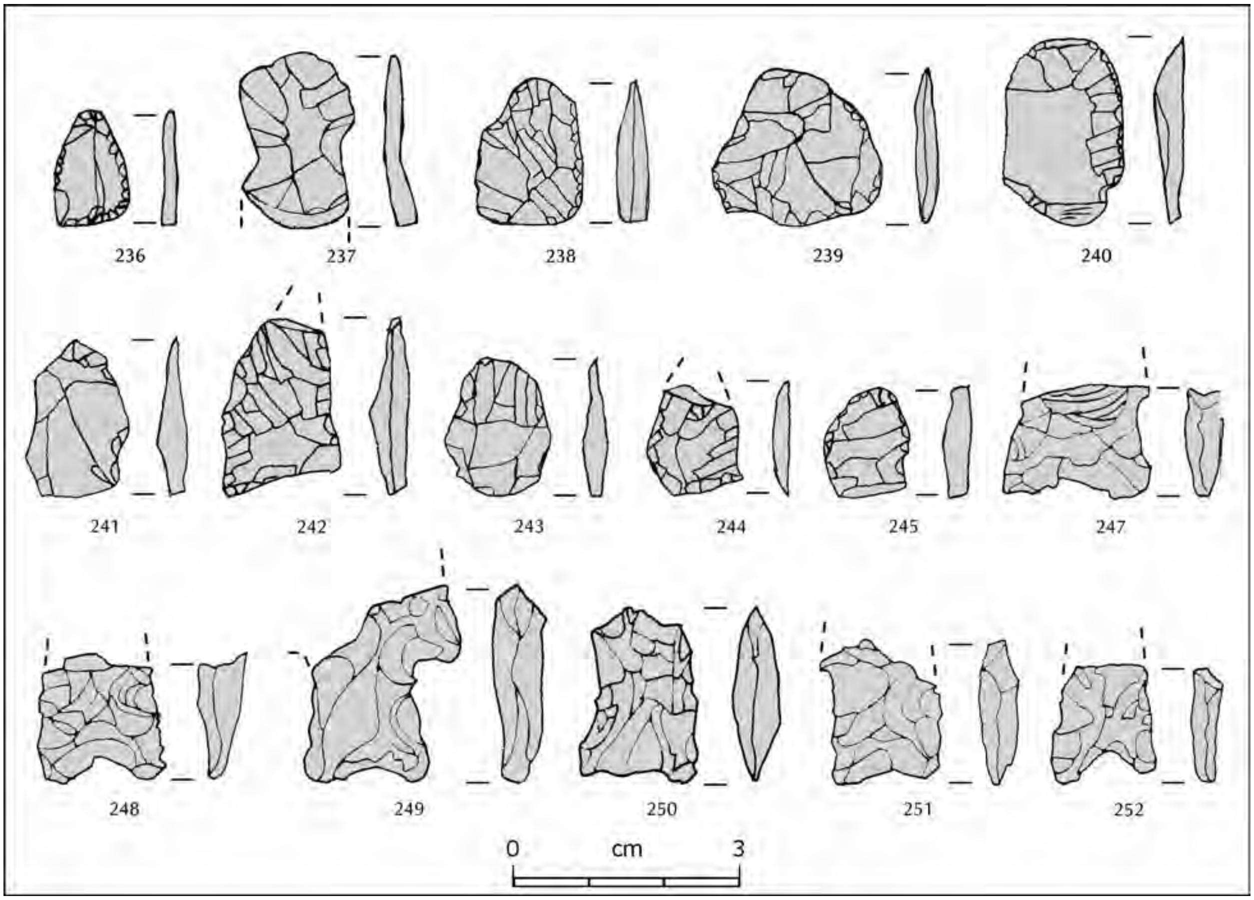
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# RADIOCARBON DATES

**The University of Arizona**
College of Arts & Sciences
Faculty of Science
Department of Physics
Building #81
Tucson, Arizona 85721
(602) 621-6820

April 6, 1989

Dr. Jeffrey L. Boyer,
Museum of New Mexico,
Laboratory of Anthropology,
P O Box 2087,
Santa Fe, NM 87504-2087

Dear Dr. Boyer,

Results on C-14 dating of your samples by accelerator mass spectrometry are given below:

| Date no. | Sample | Fraction of modern C-14 | C-14 age, BP | |
|---|---|---|---|---|
| AA-3631 | FS-13-14 | 0.9097±0.0058 | 760±50 | no |
| AA-3632 | FS-55 | 0.9105±0.0056 | 753±50 | |
| AA-3633 | FS-216 | 0.3332±0.0030 | 8,830±70 | 6880 BC |
| AA-3634 | FS-195 | 0.4390±0.0033 | 6,615±60 | 4665 BC |

The first two samples can be calibrated using the tree-ring calibration to give an absolute age. The values calculated are:

| | | |
|---|---|---|
| AA-3631 | FS13-14 | 1228-1277 AD (1σ) |
| | | 1170-1290 AD (2σ) |
| AA-3632 | FS55 | 1236-1278 AD (1σ) |
| | | 1189-1289 AD (2σ) |

The intervals quoted are 1σ (68%) and 2σ (95%) confidence intervals. I enclose an invoice for $1,600 for these measurements. If you have any questions, please call (602) 621-6816.

Yours sincerely,

Dr. A. J. T. Jull