MUSEUM OF NEW MEXICO

OFFICE OF ARCHAEOLOGICAL STUDIES

EXCAVATION OF A LITHIC ARTIFACT SCATTER (LA 66471) AND AN ARCHAIC PERIOD STRUCTURE (LA 66472) ALONG STATE ROAD 44, NEAR CUBA, SANDOVAL COUNTY, NEW MEXICO

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ADMINISTRATIVE SUMMARY

During October and November 1988, the Office of Archaeological Studies (formerly the Research Section) excavated two archaeological sites along State Road 44, Sandoval County. Data recovery efforts were conducted for the New Mexico State Highway and Transportation Department prior to road modifications.

LA 66471 is a dispersed chipped stone scatter with surface and subsurface deposits. Obsidian hydration dating suggests a possible 7,000-year period of intermittent occupation. Lithic artifact analysis indicates tool production was the primary site activity.

LA 66472 is a probable multicomponent middle to late Archaic lithic artifact scatter and burned structure with an interior hearth and artifacts. Obsidian hydration and carbon-14 dating suggest an early occupation sometime between 2000 and 600 B.C. An obsidian hydration date suggests a later occupation sometime between 47 B.C. and A.D. 447. Based on Archaic period models of settlement and subsistence for the San Juan Basin and its peripheries, the early occupation may be characterized as a fall and winter base camp. A possible later occupation is represented by tool manufacture debris.

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CONTENTS

ADMINISTRATIVE SUMMARY ii

INTRODUCTION 1

ENVIRONMENT 3

CULTURE HISTORY 5

EXCAVATION METHODS 13

EXCAVATION RESULTS 15
LA 66471 15
LA 66472 22

LITHIC ARTIFACT ANALYSIS 33
LA 66471 33
LA 66472 42

RESEARCH QUESTIONS 55
Site Chronology 55
Site Function 59
Patterns of Mobility 62
Material Selection 64

REFERENCES CITED 65

Appendix 1. Site legal descriptions 71
Appendix 2. Pollen Analysis by Richard Holloway 73
Appendix 3. Ethnobotanical Analysis by Mollie S. Toll 79
Appendix 4. Carbon-14 letter from Beta-Analytic 87
Appendix 5. Obsidian hydration report by John Montgomery, ENMU 89
Appendix 6. Obsidian source raw data by Bart Olinger, LANL 93

Figures

1. Project vicinity map 2
2. LA 66471 site map 16
3. LA 66471 Grid 99N/107-8E stratigraphic profile 20
4. Obsidian hydration and carbon-14 dates 20
5. LA 66472 site map 23
6. Plan and profile of Feature 1 and Feature 2, LA 66472 26
7. LA 66472, Feature 1 28
8. Whole flake lengths, outside Feature 1 area, LA 66472 47

9. Whole flake lengths, upper levels of Feature 1, LA 66472 47
10. Whole flake lengths, lower levels, Feature 1, LA 66472 49
11. Chiricahua-style projectile points, LA 66472 51
12. Manos from Feature 1, LA 66472 53

Tables

1. Oshara and Cochise tradition phase dates 6
2. Excavation unit data, LA 66471 17
3. Auger test data, LA 66471 18
4. Obsidian hydration date ranges and standard deviation, LA 66471 21
5. Excavation unit data, LA 66472 24
6. Auger test data, LA 66472 25
7. Obsidian hydration dates and standard deviation, LA 66472 30
8. Debitage type by material, LA 66471 34
9. Debitage type by surface and subsurface, LA 66471 36
10. All debitage types, length and width by level, LA 66471 36
11. Debitage type length and width by surface and subsurface, LA 66471 36
12. Mean length and width of whole flakes combined material types, LA 66471 38
13. Platform by material, all debitage, LA 66471 39
14. Cross-tabulation of debitage and material types, all proveniences, LA 66472 43
15. Cross-tabulation of debitage and material types,
outside of Feature 1 excavation area, LA 66472 44
16. Flake type by portion, outside of Feature 1 excavation area, LA 66472 45
17. Flake type by platform type, outside Feature 1 excavation area, LA 66472 46
18. Debitage by upper and lower level for Feature 1 excavation area, LA 66472 48
19. Upper and lower levels by material types, LA 66472 48
20. Dorsal cortex by material for upper and lower levels, LA 66472 48

INTRODUCTION

Between October 3 and November 7, 1988, the Office of Archaeological Studies (formerly the Research Section, Laboratory of Anthropology), Museum of New Mexico, excavated LA 66471 and LA 66472, two lithic artifact scatters along State Road 44, north of Cuba, in Sandoval County, New Mexico (Fig. 1). David A. Phillips, Jr. was the principal investigator. Stephen Post directed the excavations and the laboratory analysis. Rhonda Main, Scott Geister, and Guadalupe Martinez assisted in the field excavations. Guadalupe Martinez conducted the lithic artifact identification. The excavation required about 50 person-days.

LA 66471 is on state-owned highway right-of-way along the north side of State Road 44. The excavation was conducted under New Mexico State Archaeological Excavation Permit No. SE-39, expiration date 8-29-89.

LA 66472 is on Santa Fe National Forest Lands (south side) and Bureau of Land Management, Bankhead-Jones Land Use Lands, Rio Puerco Resource Area, Albuquerque District (north side). The excavation was conducted under the written authorization of the Santa Fe National Forest supervisor and Bureau of Land Management Cultural Resource Use Permit No. 21-8152-88-4, expiration date 12-19-88.

The data recovery efforts were completed prior to the start of highway reconstruction by the New Mexico State Highway and Transportation Department. The project included construction of new bridges, slope modification, and shoulder rehabilitation.

Site location data are contained in Appendix 1, which has been deleted from copies of the report intended for unrestricted distribution. This format is adopted to comply with Chapter 18-6-11.1, NMSA 1978.

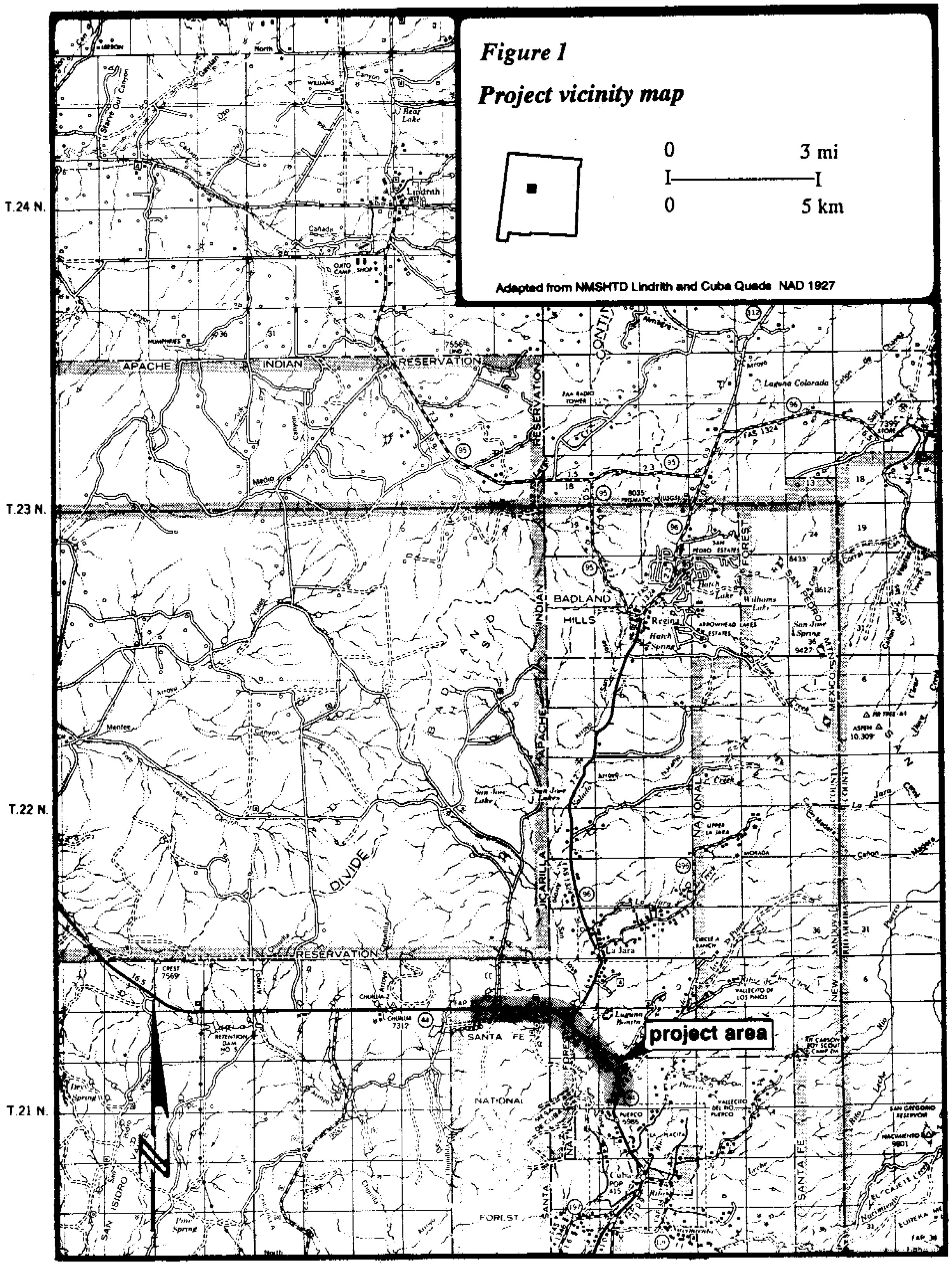

Figure 1

Project vicinity map

ENVIRONMENT

The Cuba area has broken topography of sandstone and shale mesas and outcrops, and ridges separated by narrow valleys in the uplands that broaden into south-flowing tributaries of the upper Rio Puerco of the East. Mesa de Cuba and Mesa Portales rise 150 m (500 ft) above the valley floors. Local elevations range from 2,134 m (7,000 ft) in the valleys to 2,286 m (7,500 ft) on the mesa tops. The Jemez Mountains form the east boundary, while the area to the north, west, and south has large tracts of rough and broken terrain interspersed with sagebrush range lands and valleys. Arroyo San Jose, Arroyo Chijuillita, and Rito de los Pinos are intermittent, primary drainages (Fig. 1).

Soils of the upland mesas and ridges are mainly Travesilla-Rockland association. Travesilla soils are "shallow, light colored, gently to strongly sloping soils, developing on sandstone mesas and breaks" (Maker et al. 1971:17). Rockland is a miscellaneous complex of shallow soils, outcrops of sandstone, and other types of sedimentary rocks (Maker et al. 1971:17). Miscellaneous minor soil and land forms are badlands, gullied land, alluvial soils, and soils of Penistaja, Las Lucas, and Litle series.

The Travesilla-Rockland association may be important in archaeological studies because of the variety of grass and shrubs that it supports. Indian ricegrass and sand dropseed occur and were part of Archaic period subsistence. Important shrubs and woody species include ponderosa pine, piñon, juniper, big sagebrush, bitterbrush, and serviceberry.

The alluvial fans and valleys are mainly Christianburg-Navajo association. The soils are nearly level to gently sloping, forming as fine-textured alluvium, principally from weathered shale. These soils erode easily, often forming deep gullies or arroyos. They do not support a wide variety of economic species of plants and shrubs. With a dense cover of vegetation these valleys may have supported seasonal deer and elk herds, making them desirable hunting locations.

The two major soil and land associations primarily support two plant communities: Great Basin montane scrubland and Rocky Mountain conifer forest (Brown 1982).

Great Basin montane scrubland is in the valleys and lower elevations of the ridges and mesas. This plant community has gambel oak, mountain mahogany, New Mexico locust, sagebrush, and rabbitbrush. The shrub overstory is interrupted by ponderosa pine, piñon, and juniper (Brown 1982:83-84).

Rocky Mountain conifer forest occurs on the mesa and ridge tops (Brown 1982:43-46). This community includes primarily ponderosa pine and occasional Douglas fir. Within the vegetational transition zone between the two main plant communities, as is found within the project area, piñon and juniper occur. The understory includes grama grass, mountain and screwleaf muhly, and a variety of tall and short grasses.

Faunal resources of the region include the previously mentioned large game and elk. Smaller game, including jack rabbit, are also present.

At Cuba, the mean annual precipitation, based on 20 years of records, is 348 mm (13.7 inches), increasing in amount and intensity at higher elevations. Precipitation primarily occurs in summer and winter dominant patterns, although local fluctuations are common. The mean annual temperature is 65.2 degrees F at Cuba, with monthly extremes of 60 to 120 degrees F recorded (Maker et al. 1971:6-7). The last frost usually occurs by June 3, with an average frost-free period of 111 days (Maker et al. 1971:7).

CULTURE HISTORY

This section briefly summarizes the Oshara and Cochise traditions of the Archaic period. Some problems with projectile point style, chronology, and cultural affiliation are presented. Finally, it summarizes more recent models for Archaic period settlement and subsistence. LA 66472 and LA 66471 either date to or have assemblage characteristics that are indicative of the late Archaic period.

The Archaic adaptation of the American Southwest has been described as part of a generalized and widespread tradition of hunting and gathering adapted to arid environments called the Desert tradition. Jennings (1953:204) defined the Desert Culture as a widespread pattern of hunting and gathering with movement based on plant availability and with the group membership based on kinship. Davis (1963) defined the Desert Culture as a mobile lifestyle exploiting plant foods found at different altitudes, with mobility allowing avoidance of extreme temperatures. Irwin-Williams (1967:455) defined it as a continuum of similar, closely related cultures, sharing many economic and organization elements with surrounding groups, but on the whole being distinguishable.

According to Irwin-Williams's (1967) definition, Desert Culture tradition is similar over a large area, but different regional expressions exist that were determined by resource availability, distribution, and frequency. These regional expressions should be highly similar in their core areas, and recognizable as distinct Archaic culture traditions. Based on studies in the Arroyo Cuervo region of the middle Rio Puerco of the East in New Mexico, Irwin-Williams defined the Oshara tradition. Combining artifact and settlement data, Irwin-Williams (1973) proposed a six-phase sequence for the Archaic period. These phases were marked by differences in tool kits and site structure and location. The observed changes in subsistence and regional settlement patterns were partly caused by changing climate that affected resource distribution and availability, and demographic composition of the overall population. This seminal work provided an important interpretive framework for later studies. The reader is referred to Irwin-Williams (1973) for more detail on the Oshara tradition. Table 1 outlines the phase names and dates.

Oshara tradition sites are identified by the widespread occurrence of projectile point types and chipped stone assemblages. Material evidence of the Oshara tradition is found throughout the northern half New Mexico, into western Arizona, southern Colorado, and southeastern Utah. Investigators in New Mexico and Utah note similarities between late Archaic projectile points of the Oshara tradition and those of the Great Basin (Moore 1980; Vierra 1980; Elyea and Hogan 1983). These similarities are attributed to diffusion, population movement, and communication networks of Archaic hunters and gatherers.

The Cochise tradition, another Archaic adaptation, has been defined for central and southern New Mexico and eastern and southeastern Arizona. It is based on excavations in the San Pedro Valley (Sayles and Antevs 1941) and Cienega Creek (Haury 1957) in southeast Arizona, and further supported by excavations at Ventana Cave (Haury 1950) and Bat Cave (Dick 1965). The Cochise tradition has been defined by Sayles (1945) as a desert grassland adaptation, with occupation of the mountainous regions not occurring until after 3500 B.C. Cochise Culture dates are in Table 1. Radiocarbon dates for Chiricahua Cochise Culture sites in the Mogollon Highlands

Table 1. Oshara and Cochise Tradition Phase Dates*

Oshara	Dates	Cochise	Dates
Jay	5500-4800 B.C.	Chiricahua, Desert	6000-1500 B.C.
Bajada	4800-3200 B.C.	Chiricahua, Mountain	3500-300 B.C. (?)
San Jose	3200-1800 B.C.		
Armijo	1800-800 B.C.	San Pedro	1500 B.C.-A.D. 0
En Medio	800 B.C.-A.D. 400		

*Oshara tradition dates from Irwin-Williams 1973; Cochise tradition dates from Sayles 1983; Wills 1988

and the Moquino site range between 3500 B.C. and 350 B.C. (Martin et al. 1949; Dick 1965; Beckett 1973).

Widespread evidence of the Cochise tradition begins with the Chiricahua stage. It reflects a mixed foraging economy with well-developed ground stone assemblages and lithic tool industries. Considerable variation in projectile point styles exists. Shapes range from the "classic" large side-notched triangular blade with a concave base to the diamond-shaped Pelona point, and the contracting stemmed Augustin point (Dick 1965). This regional variation was not questioned by most early investigators as the types had similar dates.

Doubts have been voiced about the projectile point dates and cultural affiliation for the Cochise tradition as they apply to the Mogollon Highlands (Chapman 1980; Hogan 1985a; Wills 1988). A key point of contention is the considerable time overlap for Chiricahua and San Pedro points in deposits from Bat and Ventana caves. They occur in most of the stratigraphic levels, but the overlap was attributed to post-occupation disturbance. Sayles (1983) suggested that the overlap showed cultural conservatism for the montane-based Chiricahua complex with both Chiricahua and San Pedro cultural traits co-occurring until the introduction of pottery. Hogan (1985a) suggests that the discrepancy may result from using chronological data from the montane and desert grassland ecosystems. He tentatively agrees that the Mountain Cochise occupation of southwestern New Mexico and eastern Arizona could have been delayed until 3500 B.C.

Wills (1988:29) calls the Chiricahua stage an "adequate representation of the Archaic in the Sonoran desert region." However, Cochise Culture classification schemes may be more variable for the Mogollon Highlands. Wills (1988:29) distinguishes between the Mogollon Highland and the Desert adaptation of southeastern Arizona, so that the cultural system through which early agriculture was adopted can be more clearly understood.

Wills (1988:17-26) questions the propriety of using projectile points, specifically "Classic" Chiricahua points, as cultural and temporal markers. Based on neck width and maximum width measurements for two Chiricahua Cochise collections and a White Mountain Apache collection, Wills found no clear difference in the White Mountain Apache points and the Chiricahua points from the Moquino site (Beckett 1973). Wills (1988:22) states:

> These data . . . reveal the complexity of equating point types with presumed prehistoric cultural entities or time periods. The scatterplot . . . does not mean that Moquino points are Apache points, or vice versa; it means that point form alone may not always be a reliable way to assess sources of variation in this particular tool class. More specifically, it can be argued that the Chiricahua point, as commonly recognized in the Rio Grande drainage, is not a good temporal indicator and therefore not a reliable cultural marker.

This statement could be applied to the Rio Grande drainage, the Jemez Mountains, the Gallina region, the San Juan Basin, and Southwestern Colorado. I also submit that if one were to reanalyze the Chiricahua points of Bat Cave, the Moquino site, and a collection made up of the isolated points from northern New Mexico and Southern Colorado and Utah, that the more northern Chiricahua points would show internal consistency, but would be different from the Bat Cave points.

The Oshara and Cochise traditions are assigned to broad cultural core areas that overlap somewhere between the Rio San Jose and the State Road 60 west of Socorro, New Mexico. This cultural boundary might need reconsideration given Wills's (1988) conclusion that the archaeological evidence of the Mogollon Highland Archaic and the Rio Grande Drainage Archaic may not warrant the Cochise Culture label.

The co-occurrence of Cochise and Oshara tradition projectile point styles has been observed by a number of investigators (Bryan and Toulouse 1943; Alexander and Reiter 1935; Agogino and Hester 1953; Hadlock 1962; Reinhart 1968; Hogan 1985a; Beckett 1973; Chapman 1977; Moore 1980; Baker 1981; Fuller 1988; Phagan in Blinman et al. 1988). Investigators working in southeastern Colorado who find "Chiricahua style" projectile points are less inclined to look to the Mogollon for similar examples and more inclined to suggest similarity with point styles from southeastern Utah (Fuller 1988; Phagan in Blinman et al. 1988).

The traditional boundary between the two areas is very roughly represented by the Moquino site (Beckett 1973). The Moquino site had mostly Cochise Chiricahua and San Pedro materials with a wide variety of projectile point styles. Carbon-14 dates associated with Cochise tradition projectile points ranged from 1950 to 265 B.C.

Hogan (1985a) found Cochise and Oshara materials in the Fence Lake area north of Quemado, New Mexico. The early Archaic occupation dates were from the Jay and Bajada phases of the Oshara tradition (Hogan 1985a:41). The middle Archaic period has mostly Chiricahua/ Cochise materials, and the late Archaic has each tradition equally present. Faced with the daunting task of explaining the overlap, Hogan (1985a:8) suggests that the area is "a broad frontier between regions habitually utilized by two Archaic populations." He also suggests that the limited remains result from sporadic use of the area by both groups (1985a:41).

While recent work suggests that projectile points are not always reliable cultural or temporal markers, large-scale survey and excavation projects have led to studies of Archaic site typology and distribution. These works have advanced the understanding of Oshara tradition settlement and subsistence. Surveys in the Mogollon Highlands have allowed some interpretation of Archaic land use away from the cave excavations used to define Archaic period culture history.

Archaeological surveys and excavations for the Coal Gasification Project (CGP) in the northern San Juan Basin provided a unique opportunity for the study of Archaic period settlement and subsistence. The studies tested models for site type and distribution in the many microenvironments of the project area. The models were based on assumptions about seasonal group movement in and around the San Juan Basin in response to plant maturation schedules. These assumptions were derived from ethnographic and ethnoarchaeological studies of living hunter-gatherer populations.

Reher and Witter (1977) used a "vegetative diversity model" to explain the local settlement pattern. This model had three main assumptions: (1) Archaic hunter-gatherers used a wide variety of plant and animal resources. Their sites should be in diverse environmental settings with ready access to a broad spectrum of resources; (2) That diverse resources may have supported a macroband base camp in the spring, summer, and fall; and (3) smaller camps represent periodic forays into other diverse resource zones (Reher and Witter 1977:115).

Reher and Witter (1977) defined Archaic site types based on the vegetative diversity model. These sites were habitation sites, limited activity sites, and base camps. Habitation sites would be in the most diverse environmental setting. Macrobands would use these sites. Limited activity sites would be for hunting and gathering forays, of limited duration and restricted activities. Base camps represent movement by microband-size groups into adjacent areas to exploit other resources. Occupation of these sites would be longer than the limited activity site, but substantially shorter than the habitation site. The Archaic sites at Pinabete Arroyo were suggested as macroband fall-winter habitation sites.

Moore (1980:363) offered an alternative model. Instead of vegetative diversity, he suggested that water availability determined the location of the habitational base camp. The habitational base camp is central to the foraging area, which is made up of extractive localities. Other important factors include setting and plant maturation rates that could sustain long-term foraging (Moore 1980:363).

Based on the plant maturation rates, Moore estimated a six-week summer occupation based on the best environmental conditions. This time span depended on the year-to-year resource abundance. Shorter occupation spans would be in keeping with the relatively arid and unproductive nature of the northern San Juan Basin.

Vierra (1980) refined Reher and Witter's (1977) Archaic site types using ethnographic studies of modern hunter-gatherer groups. He felt that Reher and Witter (1977) inadequately accounted for all of the archaeologically visible variability in site types. Adding to large habitation camp sites and dispersed special use sites, Vierra includes the task-specific site. It is defined as a nonhabitational or short-term specialized camp site (1980:355). Task-specific sites have limited size content, structure, and artifact distribution; less variability and noise in artifact assemblages; limited or no spatial organization; limited tool maintenance and activity-specific tool use; few or no hearths; and no storage or structural features (1980:355).

Macro- and microband habitations or base camps would have had longer occupations and diverse domestic activities. With longer occupations, the size, content, structure, and distribution of the artifact assemblages would increase (Vierra 1980:354). Artifact assemblages should have more functional variability and assemblage noise, and features and artifacts should show some spatial organization. Unlike the task-specific sites, most food processing occurred at the base camps. Base camps may have ground stone and fire-cracked rock, evidence of secondary stages of lithic tool reduction, formal tool production, varied tool use, more hearths and specialized features, and perhaps structures or storage features. Macroband and microband occupations would differ in artifact and feature frequency (Vierra 1980:355).

Moore (1980) and Vierra (1980) agreed that Archaic use of the UII area was by microband size groups when resources were abundant. The larger sites were reinterpreted as reoccupied microband base camps. This was based on the shallow deposits, the overlapping distribution of the artifacts, and nonpatterned feature placement.

The final phase of the CGP project provided the opportunity to re-evaluate the previous Archaic site types and settlement models.

Eschman (1983:375-384) evaluates the previous two projects' site types and settlement models with new excavation data. He agrees with Moore (1980) and Vierra (1980) that the Archaic sites reflect multiple uses by microband-size groups. Like Moore (1980), he feels water was important, but also cites Chapman's (1980) model of resource abundance as an additional determining factor.

Chapman (1980) argues that communication between groups reduced the need to inhabit areas with diverse resources. Knowledge of the maturation rates and weather conditions exchanged between Archaic groups would have allowed movement into areas of lower plant diversity, but of greater abundance. The New Mexico Navajo Mine Archaeological Project (NMAP) macrofossil data indicated specificity rather than diversity in the exploited plant resources (Eschman 1983:380).

Eschman (1983:381) argues that occupation could extend from late spring to the early fall. This agrees with Reher and Witter's previous assumptions. Rather than aridity causing low resource yields, a wetter, more favorable climate is suggested for prior to 800 B.C. More water would have allowed longer occupations at regular intervals. Early and mid-summer rainfalls would have triggered production by seed-bearing plants. Occupation span should have been increased through small-scale storage, prolonging food supplies. Storage would have taken the form of large baskets or cists. No archaeological evidence of this kind has been found in the CGP area.

Toll and Cully's (1983:385-391) study of plant remains from NMAP supports Moore's interpretation of the settlement pattern. While warning that the seed and plant remains represent fewer plants than were actually used, they found that goosefoot and ricegrass were included to the exclusion of other available economic species. Based on the presence of these two species and their maturation rates, Toll and Cully suggest a short-term, summer occupation geared towards the use of one or two resources (specificity). This is further supported by the use of saltbush as a primary wood component that would be available near the site, rather than other woody species that could only be acquired from more distant sources.

Toll and Cully (1983:386), like Chapman (1980), suggest that groups moved to take advantage of environmental change, which triggered seeding and flowering. This implies knowledge of the environmental conditions and of the location of patches that would yield abundant resources. This knowledge was acquired through direct experience and by communication with other groups.

Toll and Cully advance a model of mobility that predicts the establishment of seasonal base camps in the San Juan Basin and its peripheries as plants seed and flower. Spring and summer were spent in the San Juan Basin heartland, when mustard, ricegrass, and goosefoot were available. The plant resources of the San Juan River could have been used as needed. In the middle to late fall, groups would move upland to be near the woody and perennial succulents (mainly piñon). Upland movement would be aided by prior knowledge of piñon harvests and environmental conditions that promoted additional harvests along with the usual eight-year interval. Advantage could also be taken of the migratory habits of elk and deer herds, as they rut and move into lower elevations for winter grazing.

Elyea and Hogan (1983:393-402) offer a hunting and gathering strategy based on Binford's (1980) model for foragers and collectors. They apply it to the Archaic site types and locations in the NMAP and the San Juan Basin and its peripheries. Elyea and Hogan suggest that the Archaic residents of the San Juan Basin foraged in the San Juan Basin and collected in the upland environments (1983:399). Foraging is best in areas with a high available biomass, like the San Juan Basin in spring and summer. Base camps are moved into areas of abundant resources. Collecting entails trips from a fixed base camp to resource patches. The collectors return to the fixed base camp to process the wild foods.

Elyea and Hogan (1983) suggest a variation on Binford's model called the serial foraging strategy. Elyea and Hogan propose that while groups were split into small residential groups, they periodically moved near concentrated, seasonally abundant plant resources (Hogan 1987:57). On NMAP land this would have occurred from the early spring to the late fall. Residential camps would have been set up near water first, and abundant economic plant species second. These sites would have been used repeatedly through time.

Elyea and Hogan (1983:399) suggest that the occurrence of exotic lithic materials within the San Juan Basin indicates exchange and communication between Archaic groups. This partially accounts for nonlocal materials, but it does not explain the presence of nonlocal projectile points types made from local materials.

Archaic occupations of the upland environments are not well represented in the Cuba and Gallina area. The occurrence of undated lithic artifact scatters suggest Archaic use of the Cuba area. Temporal assignment for the lithic artifact scatters, however, is beset with the problem of separating Archaic period and later Pueblo and Athapaskan hunting and gathering activities.

Baker and Winter (1981) deal with high-altitude Archaic sites in the Jemez Mountains at Redondo Creek. Although this project resulted in a number of settlement and subsistence models for Redondo Creek sites, this summary will adhere to the model applied to the excavation data (Baker 1981:163-172). While the Redondo Creek project is at a higher elevation and in a different environmental zone than the Cuba project, it does serve as a contrast to the lower elevation studies of the northern San Juan Basin. Importantly, LA 66471 and LA 66472 may be transitional between the San Juan Basin and its surrounding upland environments, which include the Jemez Mountains.

Redondo Creek is one of several montane resource patches (therefore a slice of the total Archaic use of the west slope of the Jemez Mountains) that was used on a seasonal (probably early to late fall) basis. The settlement and subsistence patterns should show "evidence of a mixed foraging strategy based on rational economic decisions with little change in the relative emphasis of subsistence related activities" (Baker 1981:167). Evidence of this strategy should include numeric persistence of artifact type frequencies (like utilized flakes or bifacial tools), that reflect redundant and limited activities.

The chipped stone study revealed three types of subsistence activities: tool production, plant and animal processing, and plant processing (Baker 1981:169). Tool manufacture debris accounted for 90 percent of the artifact assemblages. A small sample of utilized flakes suggests that some processing occurred. The mean utilized edge angles were less than 40 degrees. This edge angle could have been used for plant or animal processing. Plant processing is also indicated by the occurrence of ground stone artifacts. Based on site type definitions from the San Juan Basin, plant processing is an activity that would be expected on base camps.

Redundancy is evident in material selection, retouched flakes, and utilized flake dimensions. Material selection was 90 percent obsidian and came from a single source. Utilized flakes were bidirectionally retouched in 50 percent of the cases. Utilized flake dimensions did not show a significant difference between sites (Baker 1981:170).

Persistent and redundant artifact patterns between site assemblages supported a model of stability for Archaic use of Redondo Creek. On the grand scale, this suggests that Archaic groups repeatedly returned to the mountains to use the same resources during the same time of the year (Baker 1981:171).

All of the settlement and subsistence models for the northern San Juan Basin predict that fall and winter habitation sites or macroband camps should occur in the high mesa country north of the San Juan River or in the Cuba area; however, well-dated sites with conclusive evidence of this pattern have not been found. Therefore, this pattern remains untested.

The Ridges Basin survey yielded 41 potential Archaic period sites, ten of which are large lithic artifact scatters (up to 50,000 sq m). Fuller (1989:340) interprets the large artifact scatters as possible winter base camps. Winter base camps should be near water, fuel, shelter, game, and aggregated pine nut resources (Steward 1938; Elyea and Hogan 1983; Vierra 1985a). These general criteria are fulfilled by the Ridges Basin area (Fuller 1989). Fuller (1989:13) lists a number of factors that support the winter base camp model. These include diverse artifact assemblages, site catchment characteristics, indications that multiple features are present, and the presence of ground stone tools. These large sites may have evidence of a mixture of activities resulting from a long span of seasonal use for hunting, gathering, and habitation. Although this interpretation is applied to the Ridges Basin sites, it may apply to other sites in the Cuba area and other upland areas around the San Juan Basin.

In assessing what model of hunter-gatherer subsistence strategy might best fit the Ridges Basin data, Fuller (1989:24) selected Vierra's (1988) composite collector/forager model. Vierra (1988:9-10) suggested that "The Archaic systems may have implemented a forager strategy from spring to fall and a collector strategy during the winter. That is, groups were residentially mobile from spring to fall, mapping onto exploitable resources; while during winter they utilized stored foods making logistical trips to food caches and for hunting." Fuller (1989:24) observes that the large lithic artifact scatters are juxtaposed with numerous critical resource zones. These large sites are ringed by small lithic scatters that may be satellite extractive localities. He feels that this site distribution could fit the winter phase of the composite collector/forager model.

These site type definitions and subsistence models provide a framework for interpreting LA 66471 and LA 66472. Comprehensive site data are not available for the Cuba area to evaluate these models. Instead, the models may shed light on site function on a small scale and add to our understanding of hunter-gatherers in the Cuba area at a more general level.

EXCAVATION METHODS

LA 66471 was gridded into 1-by-1-m squares. The grids extended from the right-of-way to the existing road cut for the full length of the artifact scatter. The crew walked 3-m-wide transects, pinflagging all artifacts. All artifacts within the grids were collected. Grid units were designated by the northwest corner as grid north/grid east.

After surface collecting, surface stripping was done for all of the 105N grid line from 106E to 140E, the 102N grid line from 107E to 135E, the 103N grid line 116E to 124E, and the 103N and 104N from 190E to 199E. All surface strip fill was screened through ¼-inch mesh screen. Excavation units, measuring 1-by-1 m, were placed within areas of highest artifact density, and at the edges of the artifact concentrations. A 1-by-1-m unit was located at 105N/102E, where an auger hole yielded charcoal flecks. At 99N/107-108E, a 1-by-2-m unit was placed where charcoal was recovered in an auger 1.2 m below the modern ground surface.

Excavation was in 10-cm levels. Artifact-bearing strata were homogeneous, therefore excavation in arbitrary levels was the most appropriate. All excavated fill was screened through ¼-inch mesh screen. Vertical control was maintained by measuring excavated depths below the northeast corner. Excavations continued until artifacts or charcoal were no longer encountered. A soil profile was drawn of one excavation unit wall.

Forty-one auger holes at 2-m intervals were placed across the artifact concentrations. The auger holes were located at or near the northwest grid corner. The boring continued until the soil lacked cultural material. At times the boring stopped when the dense and hard clayey substrata could not be penetrated. Where charcoal was found 1.2 m below the modern ground surface, more auger holes were used to determine the deposit's extent.

LA 66472 had a dispersed surface artifact scatter. The site area was examined, and the artifacts pinflagged. Surface artifacts were point provenienced with a transit, 30-m tape, and a stadia rod. Artifacts less than 50-cm apart were collected together. After collection, the pinflags were left in place.

Surface stripping was concentrated in areas of relative artifact density. After surface stripping, a 1-by-1 or 2-m unit was placed in each stripped area. The units were excavated in 10-cm levels until the soil lacked cultural material. Stratigraphic profiles were drawn of each unit and the soil strata described using the Munsell Color Chart and descriptive terms for texture, density, and organic content.

As excavation continued along the road cut, an additional 1-by-3-m unit was located perpendicular to the fence at 89-90N/60E, near an artifact concentration that was outside of the right-of-way fence. Excavation revealed two levels of darkly stained or mottled cultural fill. The profile of this trench was drawn and the strata described. In adjacent units, the top soil was removed to the top of the cultural fill, until the horizontal extent of the feature was defined. The cultural fill was removed in natural levels within 1-by-1-m units. The deepest and darkest stained and burned level was removed with a trowel. A formal floor was not encountered, so excavation stopped at the bottom of the burned and stained soil. Within the excavated area two features were defined. They were cross-sectioned, profiled, and then excavated in natural levels with flotation, pollen, and carbon-14 samples collected from within the features. The features were described on field journal and feature forms. Descriptions included soil color, soil texture and content, size, depth, artifact and organic material content, construction and condition. Excavation photographs of the features were taken.

Two additional excavation areas on either side of this feature were used to search for other features. They were excavated in 10-cm levels and no cultural levels were encountered.

To look for more buried features, auger holes were bored along the 96N grid line from 71E to 100E and along 90N line from 104E to 120E at 4-m intervals. The auger holes continued into noncultural soil levels. Soil strata depths were recorded and compared with the excavations around Feature 1 to determine whether other buried cultural features were present.

Mapping with a transit, 30-m tape, and a stadia rod followed excavation at both sites. All excavated areas were backfilled.

All artifacts and samples were taken to the Office of Archaeological Studies for processing. Ethnobotanical, radiocarbon, and obsidian sourcing and hydration samples were cleaned and/or sorted and sent to specialists for analysis. The lithic artifacts were washed and numbered for in-house analysis. Upon completion of the analysis the remaining materials were stored at the State Archeological Repository in Santa Fe. The excavation and analysis records were stored at the Archeological Records Management Section, State Historic Preservation Division, in Santa Fe.

EXCAVATION RESULTS

Excavation results are presented for each site. This includes a pre-excavation site description, strata descriptions, excavation unit and auger data, and a brief interpretation of the site based on the excavated data. Detailed interpretations, discussion of the lithic artifact data, and discussion of the research questions will be presented separately.

LA 66471

Preexcavation Site Description

LA 66471 is a prehistoric lithic artifact scatter on a ridge running northeast to southwest, at an elevation of 2,171 m (7,120 ft). It is in the Rocky Mountain conifer forest and Rocky Mountain scrubland transition zone, with snakeweed, prickly pear, narrowleaf yucca, tall bunch grasses, ponderosa pine, and piñon occurring on site. The ridge overlooks the Rito de los Pinos Valley to the east and Arroyo San Jose to the west.

Artifacts were found on both sides of State Road 44. The middle of the site was no longer present due to previous road construction. The northeast side of the right-of-way was leveled for materials stockpiling. A few lithic artifacts remained within the north right-of-way; most artifacts were in the south right-of-way. Estimated site dimensions were 30 m north to south by 140 m east to west. Lithic artifacts were estimated to number in the low hundreds, consisting mostly of secondary and tertiary stage lithic reduction flakes.

Excavation Unit and Auger Hole Data

The surface artifacts in the south right-of-way covered a 2,720-sq-m area (Fig. 2). Surface stripping in artifact concentrations covered 86 sq m (48 percent) within the concentrations and a 2 percent area of the right-of-way.

Eight nonrandomly placed units (seven 1-by-1-m units and one 1-by-2-m unit) were excavated in 10-cm levels within and at the edges of the artifact concentrations (Fig. 2). Excavation continued until culturally sterile soil levels were reached. The excavated depths for these units ranged from 20 to 50 cm below the modern ground surface. Grid locations, excavated depth and artifact frequency by level, and soil strata depths are presented in Table 2.

Grid 99N/107-188E, a 1-by-2-m unit was excavated in 10-cm levels. It was placed where charcoal flecks were found in the auger at 1.2 to 1.3 m below the modern ground surface. No artifacts were recovered from within this unit. The charcoal was mixed with very compacted clay, within a 10 to 15 cm thick level. A burned surface was defined at 1.25 m below the modern ground surface. No cultural materials were recovered from this level. The lack of cultural material from any level suggests that this is a natural burn. Because the burn is below the artifacts it must predate the prehistoric occupation of the site. The stratigraphic profile of this excavation

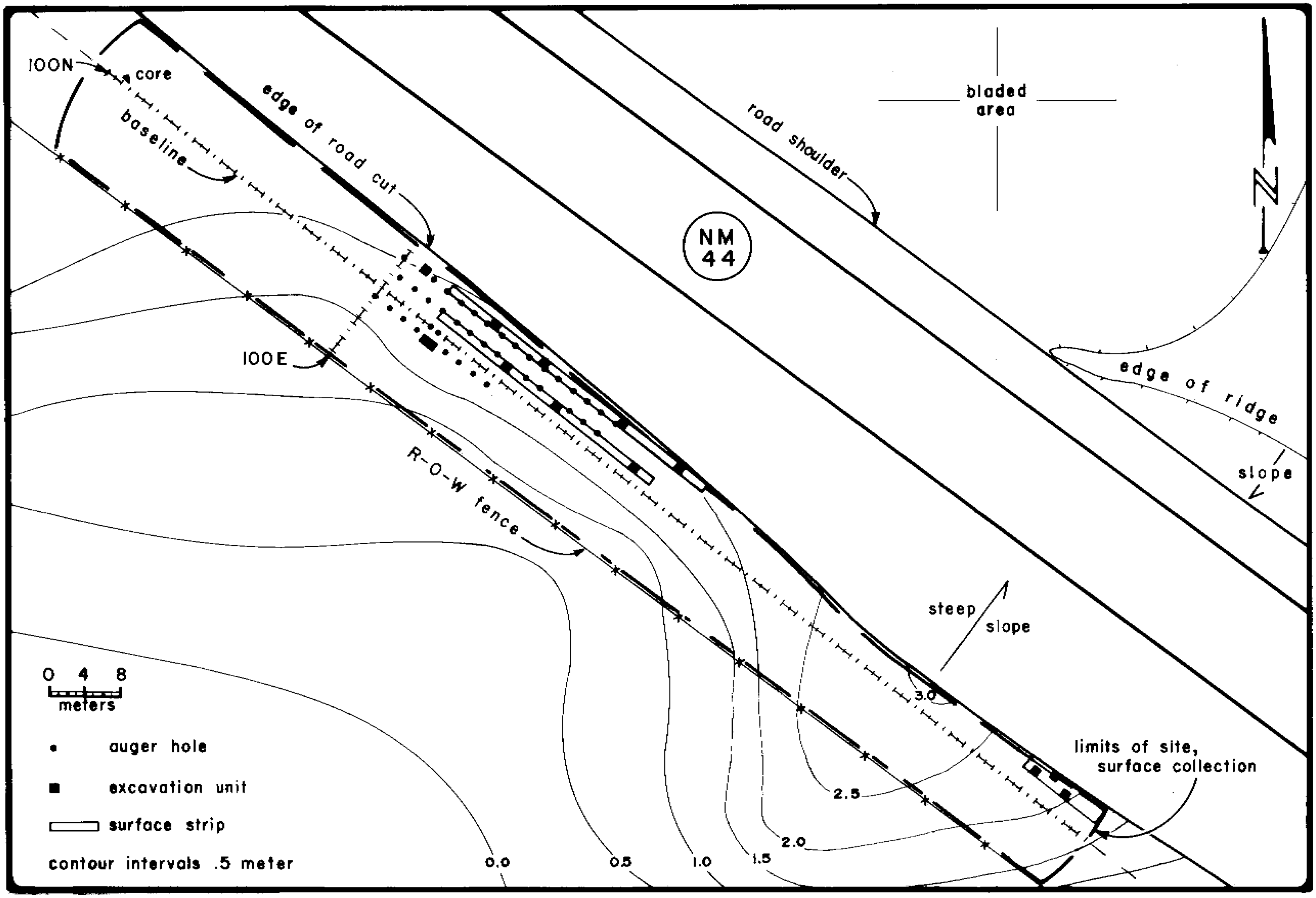

Figure 2. LA 66471 site map.

Table 2. Excavation Unit Data, LA 66471

Location	Size	Stratum 1	Stratum 2	Stratum 3	Comments
102N/105E	1-by-1		0-50		Excavated all to 40 cm and N½ to 50 cm; no artifacts or charcoal.
102N/123E	1-by-1	6	7-30		Levels 1 & 2 yielded artifacts; one flake from upper 5 cm of Level 3; no other cultural material.
102N/116E	1-by-1	6	7-30		Levels 1 & 2, and the top of Level 3 yielded artifacts; no other cultural material.
105N/137E	1-by-1	10	11-30		Artifacts to the top of level 3; no other cultural material.
105N/119E	1-by-1	16	17-20		No artifacts recovered.
105N/130E	1-by-1	15	16-30		Artifacts to the top of level 3.
99N/107-108E	1-by-2	12	13-96	96-156	Charcoal flecks and scattered burned soil at 125-128 cm; no other cultural material; appears to predate the site occupation represented by the surface lithic artifacts.
102N/134E	1-by-1	6	7-20		no artifacts recovered from below the bottom of Level 1.

unit is shown in Figure 3. Stratigraphic descriptions for this unit are presented in the following section.

Thirty-nine auger holes were placed across the site (Fig. 2). The auger holes were used to look for cultural material or features. The auger holes were located at the artifact concentrations. Auger hole depths ranged between .5 and 1.5 m below the modern ground surface. Auger hole depths and strata depths are presented in Table 3.

Stratigraphic Descriptions

The excavation units and auger holes defined three natural strata. The three strata occur across the site, although Stratum 3 was deeply penetrated only in Grid 99N/107-8E and by some of the auger holes. The strata depths are in Tables 2 and 3.

Stratum 1 was brown (10YR 5/3) silty sand that was deposited by wind and water. It was removed by surface strip, and contained the most artifacts, except for the surface. The shallow and loose nature of Stratum 1 suggests that it is impermanent, and that the artifacts recovered from surface and surface strip should be combined as a single analytical unit.

Table 3. Auger Data, LA 66471

Location	Stratum 1	Stratum 2	Stratum 3	Comments
SW 105N/100E		50		unable to continue beyond 50 cm, impenetrable soil was encountered
SW 105N/102E		52		unable to continue beyond 50 cm, impenetrable soil was encountered
SW 105N/104E		50		unable to continue beyond 50 cm, impenetrable soil was encountered
SW 105N/106E		46		unable to continue beyond 50 cm, impenetrable soil was encountered
SW 105N/108E		42		unable to continue beyond 50 cm, impenetrable soil was encountered
SW 105N/110E		40		unable to continue beyond 50 cm, impenetrable soil was encountered
SW 105N/112E		50		unable to continue beyond 50 cm, impenetrable soil was encountered
SW 105N/114E		40	41-50	unable to continue beyond 50 cm, impenetrable soil was encountered
SW 105N/116E		40	41-50	unable to continue beyond 50 cm, impenetrable soil was encountered
SW 105N/118E		50		unable to continue beyond 50 cm, impenetrable soil was encountered
SW 105N/120E		30	31-50	unable to continue beyond 50 cm, impenetrable soil was encountered
SW 105N/122E		40	41-50	unable to continue beyond 50 cm, impenetrable soil was encountered
SW 105N/124E		55	55-60	the auger was sterile
SW 105N/126E		60	61-85	the auger test was sterile
SW 105N/128E		62	63-92	the auger test was sterile
SW 105N/130E		70	71-90	the auger test was sterile
NW 102N/129E		75	75-90	the auger test was sterile
NW 102N/127E		60	61-90	the auger test was sterile
NW 102N/125E		50	51-65	the auger test was sterile
NW 102N/121E		35	36-57	unable to continue beyond 50 cm, impenetrable soil was encountered
NW 102N/119E		50	51-65	the auger test was sterile
NW 102N/115E		55	55-72	the auger test was sterile
NW 102N/113E		62	63-71	the auger test was sterile

Location	Stratum 1	Stratum 2	Stratum 3	Comments
NW 102N/111E		55	56-150	pea gravel at 55 cm, sterile
NW 102N/109E		72	73-80	the auger test was sterile
NW 102N/107E		50	51-144	the auger test was sterile
NW 102N/105E		50	51-75	the auger test was sterile
NW 102N/103E		61	61-70	the auger test was sterile
NW 102N/101E		40		unable to continue beyond 50 cm, impenetrable soil was encountered
NW 99N/100E		20		gravel, heavily compacted
NW 99N/102E		80	81-110	compact pea gravel @ 20; charcoal @ 80 cm
NW 99N/104E		0-60	61-90	pea gravel @ 20; charcoal @ 60 and 80 cm
NW 99N/106E		60	61-120	pea gravel @ 20; tree burn @ 25-45 cm
NW 99N/108E		50	51-140	charcoal @ 120-140 cm
NW 99N/110E		50	51-140	the auger test was sterile
NW 99N/112E		60	61-140	the auger test was sterile
NW 99N/114E		70	71-130	the auger test was sterile
NW 100N/107E		70	71-120	charcoal @ 95-115 cm
NW 100N/108E		70	71-140	charcoal @ 95-120 cm

Stratum 2 was compact, dark yellowish brown (10YR 4/4) silty clay. It had root intrusions and rodent burrows. Within the artifact concentrations, this level contains artifacts that decrease in number with depth. The bottom of this level often lacked cultural material.

Stratum 3 was a light yellowish brown to olive-brown (2.5YR 5/4-3) clay. It was very compact and dried into long vertical columns. There were occasional very small flecks of charcoal and calcium carbonate. Small burned clay lumps occurred near the bottom of the stratum (Fig. 3).

Site Dating

In a site as shallow as LA 66471, obsidian hydration dating is unreliable. However, no other datable materials were recovered, so obsidian hydration dating was applied as the best available technique. Obsidian hydration analysis was conducted on samples by the Agency for Conservation Archeology at Eastern New Mexico University, Portales. Dr. Bart Olinger of the Los Alamos National Laboratory did the source identification. The raw data from the source identification is provided in Appendix 6.

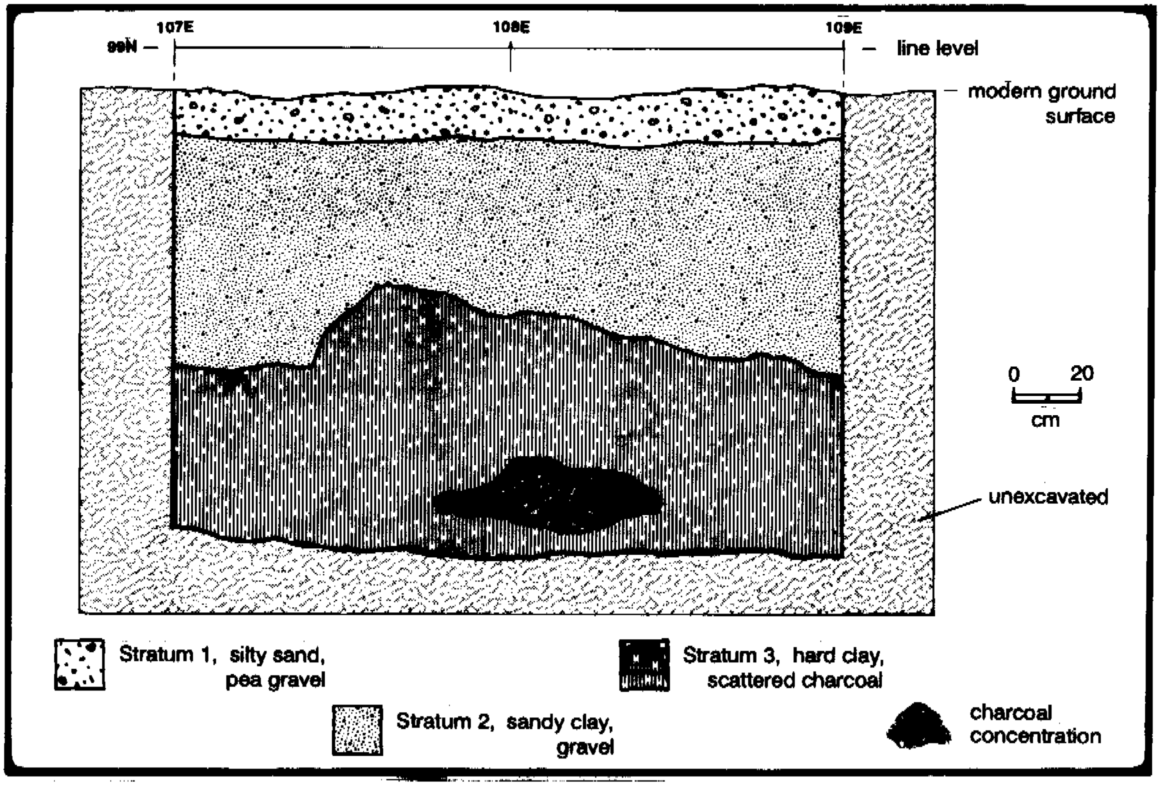

Figure 3. LA 66471, Grid 99N/107-8E stratigraphic profile.

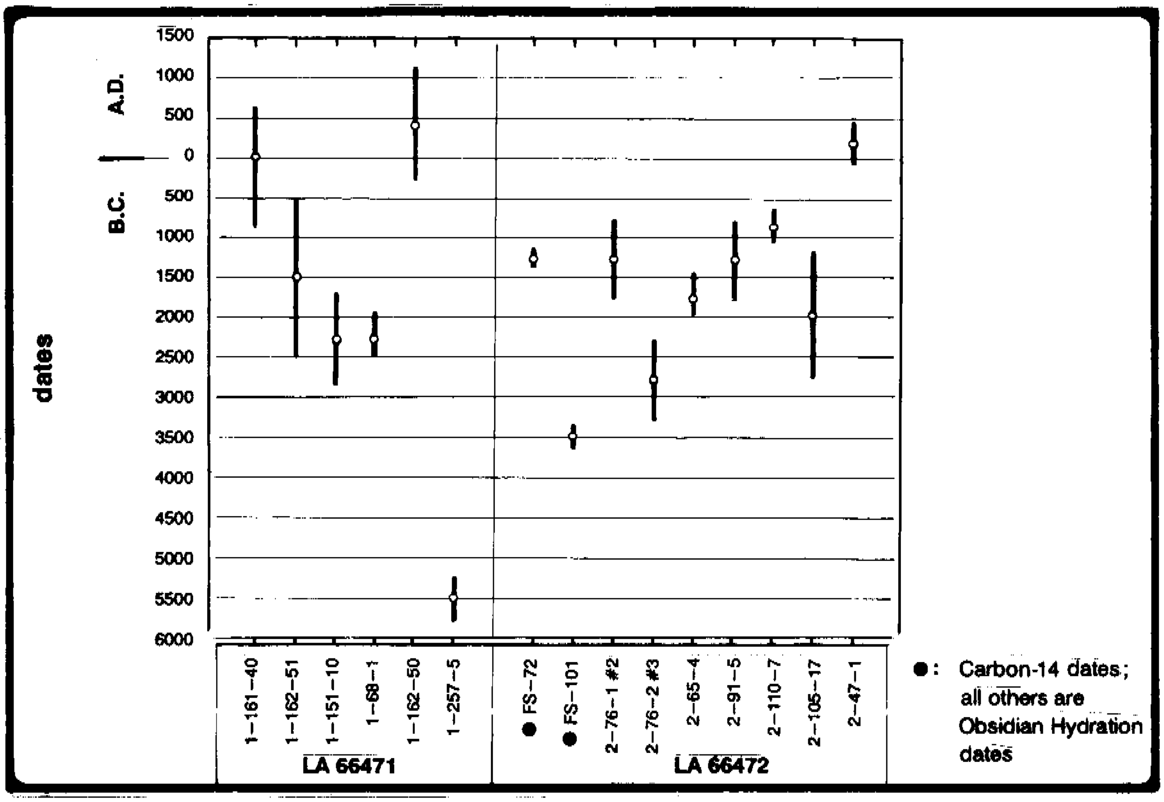

Figure 4. Obsidian hydration and carbon-14 dates.

Table 4. Obsidian hydration date ranges and standard deviation (sourced by B. Olinger, LANL, Appendix 7)

FS	Grid	Level	Source	Range	Mid-point	S.D. ±
161-40	102N/123E	1 (0-10)	Valle Grande	825 B.C.-A.D. 631	52 B.C.	773
162-51	102N/123E	2 (11-20)	Valle Grande	2473-497 B.C.	1485 B.C.	988
151-10	105N/120E	SS	Valle Grande	2740-1690 B.C.	2215 B.C.	525
68-1	106N/121E	Surface	Valle Grande	2473-1957 B.C.	2215 B.C.	258
162-50	102N/123E	2 (11-20)	Valle Grande	230 B.C.-A.D. 1130	A.D. 450	680
257-5	102N/134E	1 (0-10)	Valle Grande	5760-5210 B.C.	5485 B.C.	227

Samples were selected to be representative of various contexts within the site, to provide estimated dates for the arbitrary excavation levels, a basis for comparison between surface and subsurface contexts, and to compare samples from similar excavation levels. Cross-cutting proveniences can be used to test obsidian hydration date consistency. Inconsistency could be caused by shallow soil. In shallow soil, erosion or other disturbances may re-expose artifacts to sunlight and rainfall, which would alter the rind formation or remove a formed rind. Six samples were processed and only provide baseline data. No other datable materials were retrieved during the excavation.

Table 4 shows the provenience information with mid-dates and standard deviations. Figure 4 shows the date spread for each sample. All samples were from Valle Grande in the Jemez Mountains (Appendix 6).

As can be seen in Table 4, the results were highly inconsistent. There can be various reasons why a wide range of dates are obtained through obsidian hydration from reliable contexts (for example, site reuse and material reuse), but in a site this shallow the more obvious conclusion is that the attempt to date the site through obsidian hydration was unsuccessful.

In summary, the age of the site remains unknown. Given the shallowness of the site and the broad range of date obtained in the initial sample, additional obsidian hydration studies did not seem appropriate.

Summary of Results

The excavation at LA 66471 yielded 1,070 lithic artifacts from surface and shallow subsurface contexts. This number is much higher than the survey estimate. The assemblage is mostly the small flakes and angular debris that were the by-products of chipped stone tool manufacture and to a lesser extent tool maintenance. The primary materials used were obsidian from the Valle Grande source in the Jemez Mountains and a locally available mottled chert and chalcedony. The local material grades in color from white to mottled gray and is available in the lag gravel located immediately south of the site area. The small size and very high ratio of noncortical to cortical flakes for all material types suggests that the material was brought to the site in a reduced state.

Similar sizes in cortical and noncortical flakes and angular debris indicate that the unreduced raw material was probably small in size. The use of obsidian from a single Jemez mountain source may indicate an occupation by a single group that moved between the same location in the Jemez Mountains and LA 66471.

Subsurface artifacts 20 to 25 cm below surface may indicate repeated use of the site. Similarities in material type and debitage type percentages indicate that the site function did not change through time. The natural deposition rate of soil at the site during the prehistoric occupations is not known. The post-occupation deposition rate was fairly slow, however, given the high number of surface artifacts and the broad date range obtained from obsidian hydration.

The site is above two drainages and close to piñon-ponderosa parkland, which may have supported seasonal and resident herds of deer and elk. The emphasis on tool manufacture, and not tool use, suggests short-duration occupations for hunting. The absence of utilized flakes and small number of broken formal tools may indicate that other hunting activities occurred elsewhere. The small number of formal tools may also be a result of post-occupational scavenging or tool collection.

LA 66472

Preexcavation Site Description

LA 66472 was first recorded as a low density prehistoric lithic artifact scatter. It is on a north-south running ridge with a commanding view of the Rocky Mountain conifer forest and scrubland transition zone. The ridge is bordered on the east and west by small drainages that begin at the ridge and drain to the north and east. State Road 44 crosses the site with most of the lithic artifacts in the south right-of-way (Fig. 5). Data recovery efforts focused on the south right-of-way.

The site was recorded as a low density lithic artifact scatter with a small fire-cracked rock concentration. It is 120 m north to south by 50 m east to west. The lithic artifacts included chert and obsidian secondary and tertiary lithic reduction flakes. No primary core reduction flakes or raw material were observed. The fire-cracked rock concentration could not be relocated.

Excavation Unit and Auger Hole Data

Seven excavation units were placed in the artifact concentration (Fig. 5). The excavation units ranged from 1-by-2 m to 1-by-3 m in size, except around Feature 1, which was a 3-by-5-m excavation unit. The excavated depths ranged from 30 to 50 cm below the modern ground surface. Feature 1 units were excavated to the bottom of the occupation level. In all cases Stratum 2 was reached and partly excavated. Except for Feature 1, low numbers of lithic artifacts were recovered below the surface strip. Excavation data, except for the 3-by-5-m area around Feature 1, are presented in Table 5.

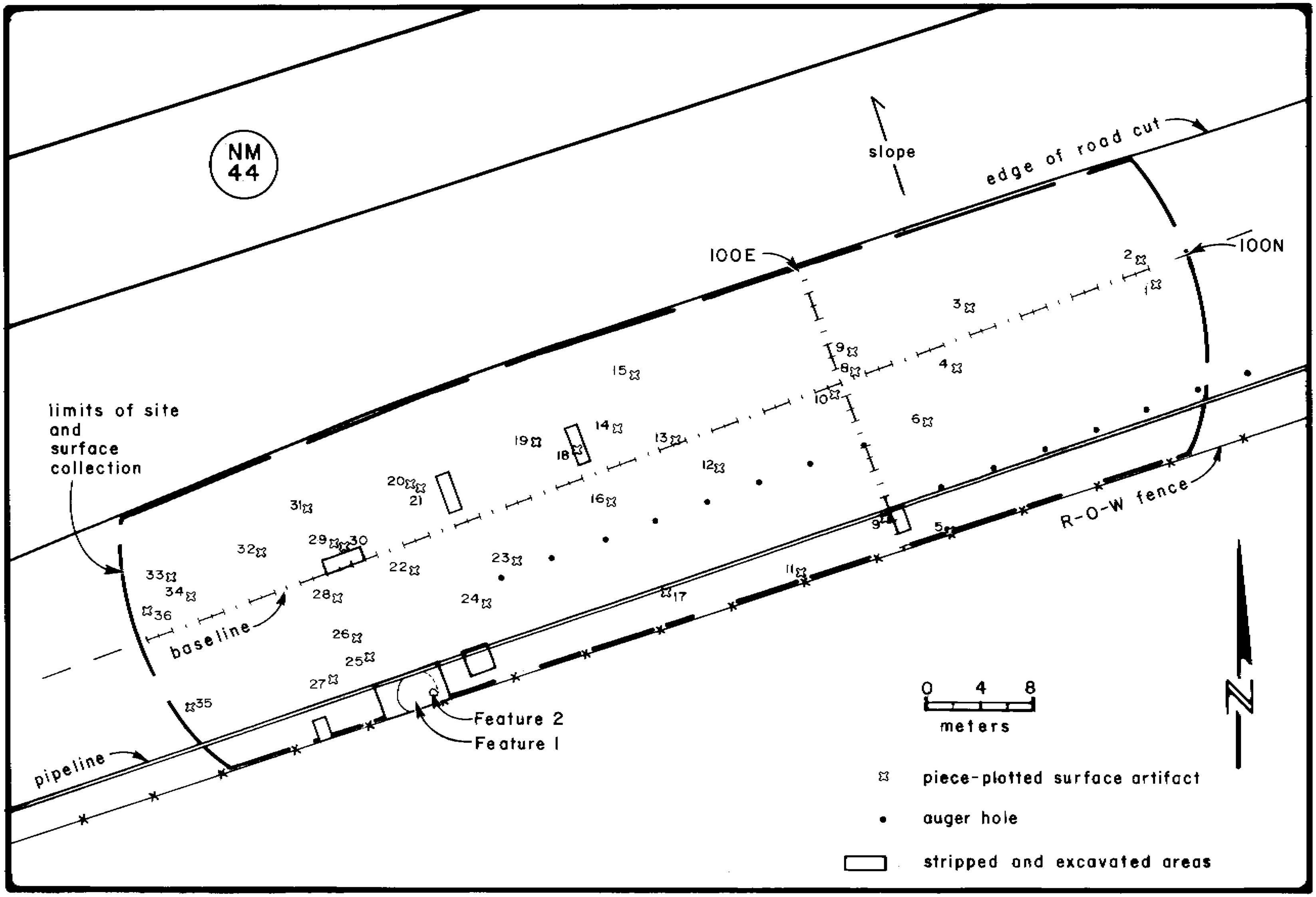

Figure 5. LA 66472 site map.

After the discovery of Feature 1, auger holes were bored to look for other deeply buried cultural deposits (Fig. 5). Table 6 presents the auger hole data. In all, 15 auger holes outside of excavation areas were bored into noncultural soil levels. Their depths ranged from 80 to 112 cm below the modern ground surface. The auger holes revealed that natural site stratigraphy was uneven; Stratum 2 and 3 occurred in different areas on the site. The intermittent strata distributions, however, were not caused by prehistoric occupation.

Site Stratigraphy

This description of site stratigraphy refers to the natural soil levels encountered in the auger holes and excavation units outside of the Feature 1 excavation area. Feature 1 stratigraphy was different and will be described separately.

Stratum 1 was light brown (10YR 5/4) eolian sand mixed with decomposed roots and plant matter. Low numbers of lithic artifacts were recovered from this stratum. This stratum grades into a more compact sand that was up to 25 cm deep. The deepest deposits were between the fence and the gas line trench. Stratum 1 was 8 to 10 cm deep near the edge of the road cut.

Stratum 2 was dark brown (10YR 4/2) sandy clay loam mixed with occasional pea gravel. It appeared to be formed by gradual movement of soils downslope. This stratum was below Stratum 1 and encountered to 112 cm below the modern ground surface. The bottom of this stratum was not reached since augering was halted when the soils were sterile. No artifacts were recovered from Stratum 2.

Stratum 3 was light brown (10YR 5/4-3) sandy loam mixed with occasional pea gravel. Lenses of pea gravel and gray clay were encountered in the auger holes suggesting that this is an alluvial deposit. Stratum 3 was encountered below Stratum 1 in the absence of Stratum 2. Augering indicated that Stratum 3 extended to a depth of at least 117 cm below the modern ground surface. No cultural material was encountered in Stratum 3.

Table 5. Excavation Unit Data, LA 66472

Location	Size	Stratum 1	Stratum 2	Stratum 3	Comments
80-90N/100E	1-by-2	10	11-40	41-100	Excavated 10 cm, augered 90 cm; no artifacts below strip
89-90N/55E	1-by-2	25	26-78	79-90	Excavated 90N/55E to 40 cm; augered 90 cm; no artifacts below 20 cm; debitage and small cores.
101-103N/80E	1-by-3	17	18-57	58-188	All excavated to 30 cm; 103N/80E to 40; augered to 188 cm; no artifacts.
101-103N/70E	1-by-3	10	11-35	35-150	102-103N/70E excavated to 20 cm; 101N/70E to 30 cm; augered to 150 cm; no artifacts below strip.

Location	Size	Stratum 1	Stratum 2	Stratum 3	Comments
90-91N/67-68E	2-by-2	22	23-40	41-50	91N/68E stripped only; 90N/68E to 10 cm; 91N/67E to 20 cm; 91N/67E to 50 cm; no artifacts below strip.
100N/60-62E	1-by-3	20	21		100N/60 & 62 to 10 cm; 100N/61E to 20 cm; no artifacts

Table 6. Auger Test Data, LA 66472

Location	Stratum 1	Stratum 2	Stratum 3	Comments
NW 95N/96E	12	112		sterile
NW 95N/92E	10	92		sterile
NW 95N/88E	8	40-110		sterile
NW 95N/84E	10	11-92		sterile
NW 95N/80E	8		9-117	sterile
NW 95N/76E	10		11-90	sterile
NW 95N/72E	8		9-105	sterile
NW 90N/100E	8		9-110	sterile
NW 90N/104E	8		9-107	sterile
NW 90N/108E	10	11-112		sterile
NW 90N/112E		11-110		sterile
NW 90N/116E	9	10-79	80-112	sterile
NW 90N/120E	10		11-108	sterile
NW 90N/124E	9		10-80	sterile
NW 90N/128E	9		10-96	sterile

Excavation Data from Feature 1

The Feature 1 excavation area started as a 1-by-3-m excavation unit (89-91N/61E) located near surface artifacts outside of the right-of-way. The excavation area was between the right-of-way fence and the gas line trench (Fig. 6). Feature 2 was located within Feature 1.

Initially, soil was removed in 10-cm levels to the top of the occupation surface. Increasing numbers of artifacts and darker soil staining were encountered with each successive level. At first the staining and artifacts were thought to be a hearth, but expansion of the excavation area to 3-by-3 m revealed that it was part of a more extensive burned stratum that was Feature 1.

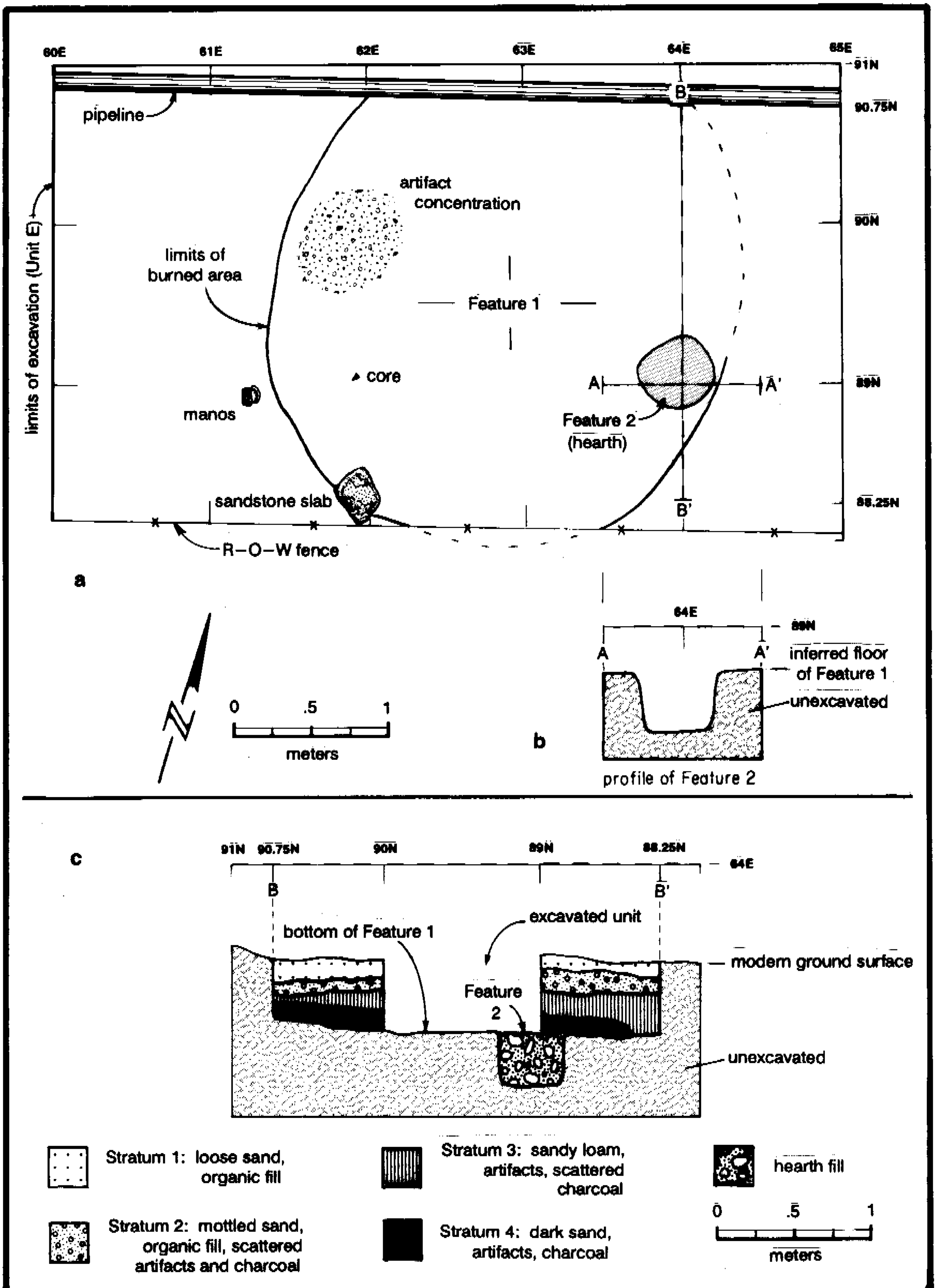

Figure 6. Plan and profile of Feature 1 and Feature 2, LA 66472: (a) plan of Feature 1 and Feature 2, excavated area; (b) stratigraphic profile of Feature 2; (c) stratigraphic profile of Feature 1.

Excavation to the south stopped at the right-of-way fence. Expansion to the north was deterred by the gas line that cut across the north edge of Feature 1 (Fig. 6). The cultural deposit was visible in the profile of the 62 East grid line, therefore excavation was extended an additional 2 m to the east, expanding the excavation area to 3-by-5 m (15 sq m). The upper unstained Stratum 1 was excavated and screened in one level, then the stained soil was removed as Stratum 2, to the top of the very darkly stained surface, Stratum 3, 2 to 4 cm above floor. Trowel excavation revealed that part of the east half of Feature 1 was oxidized. While determining the east extent of Feature 1, Feature 2, a hearth, was exposed. Extramural excavation 75 cm to the east and 125 cm to the west of Feature 1 yielded no additional cultural deposits.

After the floor of Feature 1 was excavated, a 25-cm-wide shovel trench was excavated from the east to the west edge across Feature 1. No further cultural deposits were encountered.

Stratigraphic Descriptions for Feature 1

Stratum 1 was loose brown (10YR 5/3) eolian sand mixed with decomposing roots, bark, and grass, similar to Stratum 1 outside of Feature 1 (Fig. 6). As mentioned previously, Stratum 1 depth is greatest between the gas line and the right-of-way fence and ranges between 12 and 15 cm deep. A total of 43 lithic artifacts was collected, representing core reduction and tool manufacture. Some of the artifacts from this level could be from cultural fill redeposited by gas line excavation and backfilling.

Stratum 2 was mottled, yellow-brown (10YR 6/4) eolian sand mixed with roots and decomposed plant matter, charcoal and a few artifacts (Fig. 6). The mottling was probably from rotted plant material. It was below Stratum 1 in the Feature 1 excavation area and ranged from 5 to 8 cm in depth.

Stratum 3 was a noncultural post-occupation deposit, but contained secondarily deposited artifacts. It was brown (10YR 5/4), loosely compacted sandy loam mixed with occasional artifacts and a few charcoal flecks (Fig. 6). It was between 10 and 40 cm deep. Stratum 3 was also assigned to soils below Stratum 4. Below Stratum 4, Stratum 3 lacked cultural material or charcoal flecks. Sterile soil occurred below Stratum 4.

Stratum 4 was very dark brown (10YR 5/3) eolian sand mixed with artifacts and charcoal and heavily stained by charcoal and oxidized soil particles (Fig. 6). This stratum includes the fill above the floor and the floor of Feature 1. It was 5 to 8 cm deep. The artifacts recovered from this level are probably a de facto assemblage, representing items left behind upon abandonment. It was very distinct and contrasted greatly with the noncultural fill outside of the feature.

Feature Descriptions

Feature 1 was the burned remains of a roughly circular-shaped structure that was shallowly excavated into Stratum 3 (Figs. 6-7). Its dimensions were 2.9 m east to west and 2.5 m north to south. The north edge of the structure was cut by a gas line trench and the very south edge appears to continue for a short distance beyond the right-of-way. The structure was basin shaped. The floor sloped from 63 to 69 cm below modern ground surface along the east edge to 73 and

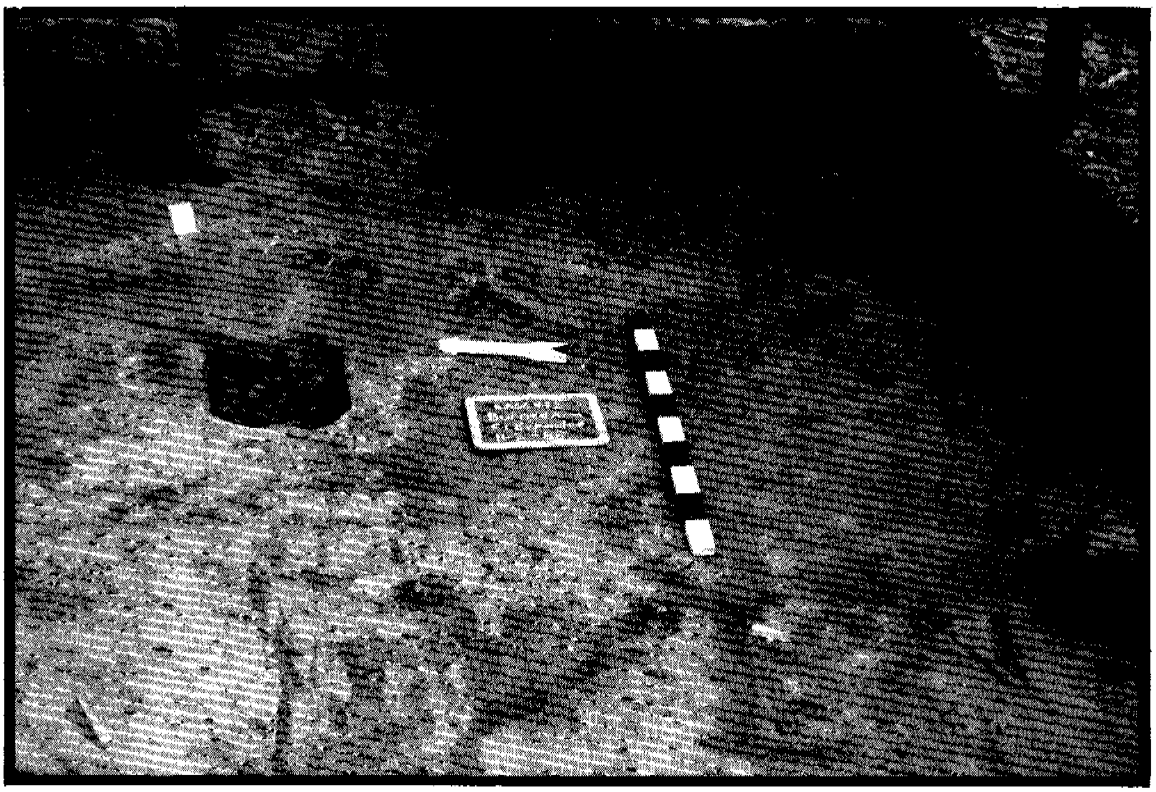

Figure 7. Feature 1, LA 66472.

81 cm below the modern ground surface along the west edge. The floor was uneven with no formal preparation evident. No postholes were found, suggesting a lean-to construction. The burned wood observed within the feature was mostly branches and brush. There were no large chunks of burned wood from which to infer a more substantial superstructure. Patches of oxidized soil in the east half of the structure indicated spots where the fire was very hot.

The east portion of Feature 1 may have been a work or equipment storage area. Artifacts recovered from within this area included burned or heat-treated flakes, a broken white chert side-notched projectile point, and a side-notched projectile point made from obsidian from the Valle Grande source in the Jemez Mountains (Appendix 6), a lithic artifact concentration, two one-hand manos, and two crumbly sandstone slabs. More detailed description and discussion of lithic artifact data are presented in the Lithic Artifact Analysis. A carbon-14 sample collected from this area yielded a calibrated date of 3,010 B.P. ± 80 years or 1060 B.C. with a one-sigma range from 1140 B.C. to 980 B.C.

Feature 2 was a circular, steep-sided hearth or small roasting pit (Fig. 6) at the east edge of Feature 1. The fill was very dark gray sand (2.5YR 3/2) mixed with charcoal and a few small tool production flakes. It was 50 cm in diameter and 36 to 38 cm deep. The top of the feature corresponds to the inferred floor of Feature 1. The sides and bottom were slightly hardened from burning, with the bottom color light yellowish brown (10YR 6/4). No diagnostic artifacts were found within or near Feature 2. Flotation, pollen, and carbon-14 samples were collected from the hearth interior. The carbon-14 sample yielded a adjusted and calibrated date of 4710 B.P. one sigma ± 160 or a 2810 B.C. with a one-sigma range between 2970 and 2650 B.C.

Site Dating

The vertical distribution of the artifacts and features suggests at least two occupations. Surface artifacts outside of the Feature 1 excavation area may be from a later occupation, although the samples are scant evidence to support such an argument. The associated artifacts and features may be from an earlier occupation. The recovery of two Cochise/Chiricahua or Sudden Shelter side-notched projectile points from Feature 1 indicate an Archaic period occupation. Carbon-14 samples were collected from two contexts within Feature 1. Obsidian samples from surface and Feature 1 contexts were sent for hydration dating. These three sources provide date ranges for site occupation.

In the San Juan Basin, the Chiricahua/Cochise or Sudden side-notched projectile points were found in association with Oshara tradition materials (San Jose 3200-1800 B.C. and Armijo 1800-800 B.C.). As mentioned earlier in this report, projectile points from Chiricahua and San Pedro stages of the Cochise tradition have often been found together at sites in the Mogollon Highlands. Chiricahua stage materials are traditionally dated between 6000 and 1800 B.C., but have been associated with carbon-14 dates as late as 265 B.C., which is a considerable overlap with the San Pedro phase. Upland and more northern Chiricahua materials post-date 3500 B.C. and correspond with the San Jose phase of the Oshara tradition. So Chiricahua stage projectile points may date between 3500 and 265 B.C., a 3,200-year span.

The carbon-14 samples were collected from hearths in Feature 1. Specimen 72 is from Feature 1, 30-45 cm below the modern ground surface. Specimen 101 is from Feature 2, 62-84 cm below the modern ground surface. Both samples were smaller than 1.0 g and were subjected to extended counting time to reduce the statistical error. The samples were processed by Beta-Analytic Inc., of Coral Gables, Florida. The samples were ponderosa pine branches and may represent wood that was older than 20 years. It is also possible that the samples are from old wood, which could yield dates older than the occupation.

The one-sigma carbon-14 date ranges and mid-dates are presented in Table 7 and Figure 4 with the obsidian hydration dates. FS 72 yielded a mid-date of 1266 B.C. with an 80-year single standard deviation. Even with a potential 300- to 400-year overestimation resulting from the use of old wood for fuel and construction, the mid-date falls within an acceptable range for the Chiricahua style projectile points as they occur in the San Juan Basin and its peripheries.

Four obsidian hydration dates correspond well with the FS 72 carbon-14 date, as seen in Table 7 and displayed in Figure 4. These samples are from three different fill levels within Feature 1 and from the blade of FS 76, a Chiricahua/Sudden side-notched-style projectile point recovered from the east portion of Feature 1. The four dates range from 1965 to 613 B.C., a range that accommodates the carbon-14 mid-date and the potential 300-400 year date overestimation. A fifth obsidian hydration date falls at the end of the spectrum. This date has a 775-year sigma that is problematic. At the risk of relying too heavily on weak evidence, I suggest that one of the site occupations did occur between 2000 and 600 B.C. or the late San Jose to late Armijo time periods.

Another earlier occupation may be suggested by another cut on the blade of FS 76, where the blade edge and tip appear to be reworked, and the carbon-14 date obtained from Feature 2 (FS 101). The hydration mid-date is 2739 B.C. with a range between 3296 and 2276 B.C. The

Table 7. Obsidian Hydration Dates and Standard Deviations (sourced by B. Olinger, LANL Appendix 7)

FS	Grid	Level	Date Range and Material Source	<Midpoint	S.D. ±
76-1 (cut 2)	F.1, 90N/61E	55 cm BD	1720-794 B.C. Valle Grande, Jemez Mts.	1257 B.C.	463
76-1 (cut 3)	F.1, 90N/61E	55cm BD	3296-2276 B.C. Valle Grande, Jemez Mts.	2739 B.C.	557
65-4	89N/61E	1 (0-10)	1965-1475 B.C. Valle Grande, Jemez Mts.	1720 B.C.	245
91-5	91N/61E	2 (21-30)	1720-794 B.C. Valle Grande, Jemez Mts.	1257 B.C.	463
110-7	89N/61E	3 (31-50)	1037-613 B.C. Valle Grande, Jemez Mts.	825 B.C.	212
105-17	90N/63E	4 (62-84)	2740-1190 B.C. Valle Grande, Jemez Mts.	1965 B.C.	775
47-1	102N/62E	1 (0-10)	47 B.C.-A.D. 447 Valle Grande, Jemez Mts.	A.D. 200	247

carbon-14 sample from Feature 2 provided a calibrated mid-date of 3579 B.C. with a range between 3527 and 3615 B.C. This range is about 300 years earlier than the earliest obsidian hydration range, although FS 105-17 spans the gap between the two possible date ranges. Whether these two dates and the FS 105-17 date represent an earlier occupation or dating aberrations cannot be addressed without a larger sample of dates.

Confusion arises from the date obtained from the second cut on FS 76. The cut was made across a flake scar that succeeded the biface thinning. This implies that the second cut post-dates the first cut, which is at an old flake scar on the blade face and margin. The dates show the opposite.

Besides the ambiguous dates from the FS 76 cuts, the two dates from Features 1 and 2 suggest other problems. Based on field observation the features were assumed to be contemporaneous. However, the nearly 2,300-year difference between the carbon-14 mid-dates contradicts the assumption. According to the carbon-14 dates, Feature 2 is older. If it is older than Feature 1, then the structure was superimposed on top of Feature 2, after it had been filled by eolian sand. However, the floor of Feature 1 corresponds to the top of Feature 2 suggesting strongly that they were used at the same time. Thus, the excavation data contradict the archaeometric data.

Finally, a single obsidian hydration date of A.D. 200 with a range of 53 B.C. to A.D. 447 from a surface sample may indicate a later occupation. I noted previously that the light surface scatter appeared to be later and not associated with the Feature 1 occupation.

To summarize, three possible occupations are tentatively indicated by the obsidian hydration and carbon-14 dates. The latest occupation dates between 53 B.C. and A.D. 447. The middle occupation is the most confidently dated and ranges between 2000 and 600 B.C. The earliest occupation may date between 3615 and 2276 B.C., although these dates are contradicted by contextual evidence.

The two projectile points could be associated with the early or middle occupation, depending on the traditional chronological sequence that one employs. More recent evidence from the San Juan Basin and its peripheries suggests that the middle occupation dates may be the most appropriate.

Summary of Results

LA 66472 was first identified as a low density lithic artifact scatter. Excavation revealed it as a probable multicomponent lithic artifact scatter with a structure. The earliest component dates to sometime during the middle Archaic period (San Jose phase), as evidenced by a carbon-14 date and a single obsidian hydration date. As noted this evidence is ambiguous at best. A second occupation occurred between 2000 and 600 B.C. Evidence of this occupation includes a structure with an interior hearth, two projectile points and two one-hand manos. The intramural hearth is used to infer a late fall or winter camp. From the manos wild seed and nut processing may be inferred; the two "Chiricahua style" projectile points suggest that hunting forays may have been staged from the site, and the lithic reduction debris suggests that both tool manufacture and maintenance and core reduction occurred. The pollen and flotation studies provided no information on seasonality or subsistence. The analysis results are presented in Appendixes 2 and 3.

A later occupation is indicated by the surface artifacts and a single obsidian hydration date. The surface artifact scatter that appeared to be separate from Feature 1 may have resulted from later tool manufacture and core reduction. Perhaps these activities were associated with hunting forays.

Lithic materials suggest movement within and west of the Jemez Mountains around Cuba. Obsidian from Polvadera and Valle Grande (Appendix 6) sources were used for tool manufacture and core reduction. Locally available cherts comprised the major material recovered from the site. This pattern is similar to LA 66471.

The ridge top setting may have been an ideal location for a late fall or winter residence or base camp. It is within walking distance of surface water. The ridge top is in a resource-abundant transition zone that may have supported abundant migratory and residential game animals. The small size of the structure argues for occupation by a microband or family unit.

This excavation shows that lithic artifact scatters in the Cuba area may be residential sites or base camps for Archaic hunter-gatherers. Numbers and density of surface artifacts that are used to estimate intensity and length of occupation have been shown here to be poor indicators of subsurface remains. Until more data have been collected from excavated lithic scatters in the Cuba area, all local lithic artifact scatters should be treated as having the potential for extensive subsurface remains.

LITHIC ARTIFACT ANALYSIS

The lithic artifact analysis for LA 66471 and LA 66472 focused on the four research questions outlined in the data recovery plan (Post 1988). The research questions were oriented towards site dating and regional cultural-history, site function, hunter-gatherer mobility, and looking at material selection and tool use. The analysis monitored variables that would be functionally and temporally informative.

Definitions of analysis categories and attributes are found in Vierra (1985b). This section will present the lithic analysis data for each site in descriptive and tabular form. The research questions will be interwoven into the discussion of the results, with specific research questions addressed in a later section.

LA 66471

Original estimates of surface lithic artifacts were in the low hundreds. The excavation recovered 1,070 artifacts from surface and subsurface contexts. The relatively shallow subsurface cultural deposit suggests that the artifacts were deposited during repeated occupations over a relatively short period. This is contradicted by the obsidian hydration dates, however.

The lithic assemblage is mostly core reduction and tool manufacture debitage. Biface manufacture flakes are the most common, followed by core reduction flakes (Table 8). The high frequency of biface manufacture flakes is interesting because they are rarely the most common debitage type in lithic artifact assemblages, regardless of the period. Core reduction flakes are usually more common than biface flakes. Angular debris, which is often present in percentages ranging from 10 to 30 percent, is only 5.1 percent. This may reflect the tool and core reduction technology or the elasticity of chert that tends to yield less angular debris in core and biface reduction. The five rejuvenation flakes occur in low numbers but support an interpretation of tool maintenance.

Of the 14 different material types identified, chert (39.7 percent), mottled chert (32.6 percent) and chalcedony (12.5 percent) occurred in quantities greater than 10 percent (Table 8). The obsidian, which is probably all from the Valle Grande source, combined for 10.2 percent. The remaining materials occur as less than 2 percent. Pedernal chert was the only low frequency nonlocal contributor. The cherts were probably obtained from the local lag gravel. They are mostly white, pink, and cream colored with mottling resulting in a wide range of multicolored specimens. They range from opaque to translucent and chalcedonic. A small nodule of mottled chalcedonic chert was collected from the slope gravel in the erosion channels immediately south of the site. The nodule is small, but the material is very similar to the cherts found in this assemblage.

Material textures were mostly fine grained (86.2 percent). The high percentage of fine-grained texture reflects the high percentage of chert, chalcedony, and obsidian present in the assemblage. Poor quality material may have been culled out at the source.

Table 8. Debitage Type by Material, LA 66471.

Material Type Count Row Pct Col Pct	DEBITAGE TYPE					
	Core Flake	Biface Flake	Angular Debris	Undeter. Flake	Rejuv. Flake	Row Total
Pedernal Chert	17 81.0 5.3	2 9.5 .4	2 9.5 3.6			21 2.0
Speckled Chert		2 100.0 .4				2 .2
Undiff. Chert	136 32.0 42.4	168 39.5 33.9	23 5.4 41.8	97 22.8 50.3	1 .2 20.0	425 39.7
Brushy Basin Chert	1 100.0 .3					1 .1
Fossiliferous Chert	2 100.0 .6					2 .2
Clastic Chert	2 66.7 .6	1 33.3 .2				3 .3
Mottled Chert	95 27.2 29.6	167 47.9 33.7	19 5.4 34.5	66 18.9 34.2	2 .6 40.0	349 32.6
Banded Chert		1 100.0 .2				1 .1
Silicified Wood	1 20.0 .3	2 40.0 .4	1 20.0 1.8	1 20.0 .5		5 .5
Chalcedony	25 18.7 7.8	85 63.4 17.1	7 5.2 12.7	17 12.7 8.8		134 12.5
Mossy Chalcedony	9 56.3 2.8	6 37.5 1.2	1 6.3 1.8			16 1.5
Quartzite			1 100.0 1.8			1 .1
Quartizitic Sandstone	1 100.0 .3					1 .1

Material Type Count Row Pct Col Pct	DEBITAGE TYPE					
	Core Flake	Biface Flake	Angular Debris	Undeter. Flake	Rejuv. Flake	Row Total
All Obsidian	32 29.4 10.0	62 56.9 12.5	1 .9 1.8	12 11.0 5.7	2 1.8 40.0	109 10.2
Column Total	321 30.0	496 46.4	55 5.1	193 18.0	5 .5	1070 100.0

Material type and texture are indicators of procurement behavior and group mobility. In this assemblage, the most common materials, fine-textured chert and chalcedony, are and probably were available in the local gravel. Because debitage frequencies are similar to obsidian, these materials must have been considered equally suitable as obsidian for the tools that were produced. Obsidian may have been preferred while it was available, but the local material sufficed when it was not.

Local or limited mobility is indicated by the low frequency of materials from distant sources. Low frequencies of nonlocal material reflect the use of suitable local material, making transport of nonlocal material less important. Some movement between higher elevations and LA 66471 is indicated by the 10.2 percent occurrence of obsidian. The obsidian is from the Valle Grande source in the Jemez Mountains. The obsidian was identified by Dr. Bart Olinger, Los Alamos National Laboratory (Appendix 6). This source is 40 km (25 mi) southwest of the site. Whether the Valle Grande obsidian occurs in the drainages of the western Jemez Mountains is unknown. A closer source may exist within the drainages. Cortical obsidian flakes are so rare that inferences about potential sources cannot be made. The occurrence of obsidian in all levels suggests a persistent use that may have occurred over a short time span, by a group or groups with similar mobility patterns.

Fine-textured and glassy material types dominated surface and subsurface proveniences. From this I suggest that the assemblage is an accumulation of core reduction and tool manufacture debris. Because few medium- or coarse-textured materials occur, a limited set of tool types may have been produced over a relatively short time span. If manufacture did not change through time, then the assemblage should have similar percentages of core, biface flakes, and angular debris in surface and subsurface proveniences. To test this assumption, the assemblage was split into surface and subsurface groups. Surface strip and surface artifacts formed one group, and the artifacts from below surface strip formed the other group.

Table 9 shows that there are differences in the debitage percentages for surface and subsurface proveniences with a 12 percent increase in the biface flakes from surface to subsurface. A chi-square test shows that there is a statistically significant difference at the .002 probability level, that level and debitage type are not independent. This association is not statistically strong (Cramer's V). This difference could be due to archaeological methods (recovery bias), past human behaviors (changes in activity through time), or site formation processes that affected the relationship between surface contexts and small flakes.

Table 9. Debitage Type by Surface and Subsurface, LA 66471.

	DEBITAGE TYPE					
Count Row pct Col pct	Core Flake	Biface Flake	Angular Debris	Undeter. Flake	Rejuv. Flake	Row Total
Surface	270 31.8 84.1	374 44.1 75.4	50 5.9 90.9	151 17.8 78.2	3 .4 60.0	848 79.3
Subsurface	51 23.0 15.9	122 55.0 24.6	5 2.3 9.1	42 18.9 21.8	2 .9 40.0	222 20.7
Column Total	321 30.0	496 46.4	55 5.1	193 18.0	5 .5	1070 100.0

Table 10. All Debitage Types, Length and Width by Level, LA 66471.

Level	Length (mm)		Width (mm)	
Statistics	Mean	Standard Deviation	Mean	Standard Deviation
Surface and Surface Strip	12.8	5.0	11.7	4.6
Levels 1-3	12.7	4.6	11.8	4.0

Table 11. Debitage Type Length and Width by Surface and Subsurface, LA 66471.

Debitage type by level	Length (mm)		Width (mm)	
Surface	Mean	St. Dev.	Mean	St. Dev.
Core flake	13.4	5.2	13.2	4.8
Biface flake	12.0	4.0	11.3	4.0
Angular debris	18.4	8.0	13.1	6.8
Undeter. flake	11.8	4.6	9.9	3.8
Subsurface				
Core flake	13.4	5.5	13.6	4.7
Biface flake	12.2	4.2	11.5	3.5
Angular debris	19.4	5.3	12.0	4.5
Undeter. flake	12.1	4.2	10.3	3.4

Small artifact size may result in fewer numbers of small flakes recovered by surface collection. Screening may recover greater numbers of small flakes. Since surface and surface strip artifacts were combined this bias should be reduced. Mean length and width for all debitage types by surface and surface strip demonstrates that mean artifact lengths and widths are equivalent (Table 10). Therefore, combining the two groups reduces potential recovery bias and does not appear to obscure differences that may be due to past human behavior.

Are there differences in debitage sizes from the surface/surface strip and Level 1 to Level 3 proveniences? We have shown different distributions of debitage type and material type by vertical provenience. We do not know if natural processes or archaeological recovery methods created the different distributions. The mean length for each debitage type shows that in general, debitage appears to be slightly larger in the subsurface than in the surface/surface strip proveniences (Table 11). Some larger debitage types do exist in both groups, but they occur in very small numbers and should not affect the means. Standard deviations for each debitage type tend to be fairly close. Because the same screen size was used for all excavations, very small flakes (less than ¼-inch diameter) had an equal chance of being missed for both groups. Since smaller flakes may migrate vertically more than larger flakes, and the debitage sizes are very similar for each group, erosion probably did not cause the differences between debitage percentages for the two groups.

It appears that assemblage differences in biface flake to core flake percentages in the two provenience groups are due to past human activity rather than natural processes or recovery methods. The next step is to examine these differences in terms of the reduction strategies. Different subsistence practices and mobility patterns may require different core reduction or tool production and use (Binford 1983). Archaic groups may produce larger biface flakes from prepared cores or large bifaces. These flakes were used as expedient blades or scrapers. These larger biface flakes, except for size, look similar to smaller biface flakes (Kelly 1988). Puebloan hunters who may be closer to a residential site may produce more activity-specific tools creating a unimodal size distribution occurring.

For LA 66471, we intuitively suggest that the biface and core reduction flakes will probably display little size variability. The primary purpose for core reduction would have been to produce finished bifaces, not expedient tools. This assumption is partly supported by the low frequency of cortical flakes, which indicates that material was brought to the site in a reduced state. This assumption will be tested by examining the distribution of whole flake lengths and widths and the occurrence of unutilized flakes.

To see if material type conditioned flake lengths, the material types were combined into six categories: chert, silicified wood, chalcedony, quartzite, and obsidian. Obsidian, chert, and silicified wood have sufficient numbers of whole flakes from both core and biface flake debitage categories to make comparisons. Comparison of flake lengths by debitage type, material type, and vertical provenience shows that flake lengths in all cases are generally under 2.0 cm (Table 12). The larger flakes 2.0 cm and above do not favor one material type, debitage type or provenience. Reduction of large cores or bifaces was never a common activity at the site.

Another debitage attribute that relates to stage of reduction is platform type. Logically, procurement of raw material and early core reduction should result in a high percentage of cortical and single faceted platforms. Multifaceted platforms should be very rare. In contrast, a

Table 12. Mean Length and Width of Whole Flakes by Combined Material Types

LENGTH (MM)	Mean	S.D.	Total
ALL CHERT	15.0755	6.1283	106
Surface and surface strip	14.6951	6.3083	82
Below surface strip	16.3750	5.3877	24
CHALCEDONY	13.0952	4.0854	21
Surface and surface strip	13.5556	4.1618	18
Below surface strip	10.3333	2.5166	3
ALL OBSIDIAN	12.4091	3.0341	22
Surface and surface strip	12.9286	3.4744	14
Below surface strip	11.5000	1.9272	8
WIDTH (MM)			
ALL CHERT	12.9340	4.6524	106
Surface and surface strip	12.8780	4.7464	82
Below surface strip	13.1250	4.4066	24
CHALCEDONY	11.2381	4.1220	21
Surface and surface strip	11.4444	4.3821	18
Below surface strip	10.0000	2.0000	3
ALL OBSIDIAN	10.3182	3.8096	22
Surface and surface strip	11.2857	4.1774	14
Below surface strip	8.6250	2.4458	8

heavy emphasis on biface production and late stage core reduction should result in higher percentages of multifaceted platforms and platform preparation (Schutt 1980). Retouched platforms occur with tool maintenance or modification. Table 13 shows that the most common type of platform is the missing platform. This corresponds with the large number of partial flakes that were identified. Without the missing category, multifaceted platforms and platform preparation are more common, suggesting an emphasis on biface reduction. This pattern holds true for both surface and subsurface proveniences.

The tight distribution of small flakes for all material types, the low percentages of cortical flakes, and the higher frequencies of platform types that are indicative of biface reduction combine to suggest that cores were brought to the site in reduced form regardless of material type. Biface reduction was probably directed more towards small biface production rather than the removal and use of large biface flakes. This pattern would be consistent with hunting forays

Table 13. Platform by Material, All Debitage, LA 66471

Count Row pct Col pct Platform	Material Type				
	All Chert	Chalcedony	Quartzite	All Obsidian	Row Total
Surface					
Absent	203 67.2 58.0	60 19.9 50.8		39 12.9 50.6	302 55.3
Cortical	5 50.0 1.4	3 30.0 2.5		2 20.0 2.6	10 1.8
Retouched/ Abraded		1 100.0 .8			1 .2
Multifaceted/ collapsed	5 62.5 1.4	1 12.5 /8		2 25.0 2.6	8 1.5
Abraded/ collapsed	1 33.3 .3	2 66.7 1.7			3 .5
Collapsed	10 66.7 2.9	2 13.3 1.7		3 20.0 3.9	46 8.4
Single faceted	36 78.3 10.3	7 15.2 5.9		3 6.5 3.9	46 8.4
Multifaceted	8 53.3	3 20.0 2.5	1 6.7 100.0	3 20.0 3.9	15 2.7
Battered/ crushed	1 33.3 .3	1 33.3 .8		1 22.2 1.3	3 .5
Retouched	3 60.0 .9	1 20.0 .8		1 20.0 1.3	5 .9
Single faceted/ abraded	32 59.3 9.1	12 22.2 10.2		10 18.5 13.0	54 9.9
Multifaceted/ abraded	46 54.8 13.1	25 29.8 21.2		13 15.5 16.9	84 15.4
Column Total	350 64.1	118 21.6	1 .2	77 14.1	546 100.0

Count Row pct Col pct Platform	Material Type				
	All Chert	Chalcedony	Quartzite	All Obsidian	Row Total
Levels 1-3					
Absent	46 59.7 60.5	16 20.8 66.7		15 19.5 48.4	77 58.8
Cortical	3 100.0 3.9				3 2.3
Multifaceted/ collapsed				1 100.0 3.2	1 .8
Abraded/ collapsed	1 100.0 1.3				1 .8
Collapsed	4 100.0 5.3				4 3.1
Single faceted	2 66.7 2.6			1 33.3 3.2	3 2.3
Multifaceted	1 33.3 1.3	2 66.7 8.3			3 2.3
Multifaceted/ abraded	11 44.0 14.5	4 16.0 16.7		10 40.0 32.3	25 19.1
Single faceted/ abraded	8 57.1 10.5	2 14.3 8.3		4 28.6 12.9	14 10.7
Column Total	76 58.0	24 18.3		31 23.7	131 100.0

staged from camp sites with butchering and processing, as well as other subsistence activities occurring at the kill site and the base camp or residence. This assemblage is not clearly from a particular time and but represents persistent and restricted activities that could have occurred during any prehistoric period.

I am unable to explain the higher ratio of biface to core flakes in the subsurface group. It is most likely that this difference did not result from a difference in activities. Portions of debitage types may indicate whether different reductive methods occurred in the two provenience groups. Flake portions reflect success of flake removal, material suitability, or stage of reduction. Use of similar material and technology for a similar purpose should result in similar waste. While the subsurface group has more biface flakes, the percentages of whole and partial flakes are very similar across proveniences.

To summarize, the debitage assemblage consists of waste flakes from biface production and reduction of small, partially reduced cores. Tool production and core reduction occurred repeatedly during a period of site use. Locally available materials were most common. Valle Grande obsidian was common, if not abundant, in all levels. This suggests movement of the material at least 40 km if the material was procured directly rather than through exchange. Persistence in material types, breakage patterns, and debitage types suggest that biface manufacture and small core reduction were the main archaeologically visible activities. Whether the patterns reflected by this assemblage are Archaic or Puebloan could not be determined.

Nondebitage Lithic Artifacts

Core. FS 275-2 is a mottled gray-white chalcedonic chert core recovered from the surface. It is 7.8 cm long by 6.5 cm wide by 3.9 cm thick, and it weighs 261.1 g. It is 20 percent covered by a water-worn cortex. It has two platforms that exhibit multidirectional flake scars. This material is very similar to the chert nodules observed in the gravel immediately south of the site. The core appearance suggests that flakes were removed to be used as expedient tools or for small biface manufacture.

Biface Fragments. FS 226-1 was recovered from the surface. It is the proximal end of a large mottled gray chalcedonic chert flake that has been bifacially retouched. The snap fracture suggests that it was broken during manufacture. Its measures 3.3 cm long by 3.0 cm wide by .8 cm thick and it weighs 2.7 g. It was meant to be a tool rather than a bifacial core used to produce tool flakes.

FS 285-2 is from surface strip and is the indeterminate portion of a pink-white mottled chalcedonic chert biface. It is marginally and facially retouched. Lateral and horizontal snap fractures indicate that it was broken during manufacture. None of the dimensions is complete. These are 1.6 cm long by 1.4 cm wide by .5 cm thick and 1.3 g in weight.

FS 66-1 was from the surface and is a convex basal fragment of a bifacially retouched white chalcedonic chert flake. All measurements are partial and it is .9 cm long by 2.5 cm wide by 1.1 thick, and it weighs 2.1 g. Perhaps this is a part of an unfinished projectile point.

FS 26-1 is a lateral and proximal fragment of a red-white mottled chalcedonic chert biface. One side shows complete bifacial retouch. The other side was begun and never finished, indicating breakage during manufacture. The size of the fragment indicates that it was intended to be a knife or scraper rather than a projectile point. Its partial measurements are 25 cm long by 16 cm wide by .6 cm thick and it weighs 3.3 g. This biface is evidence of more than projectile point manufacture.

FS 161-33 was from Level 1. It is the medial and lateral fragment of a red-white mottled chalcedonic chert biface. It is likely that the biface was broken in manufacture. Its partial measurements are 1.0 cm long by 1.9 cm wide by .5 cm thick, and it weighs 1.4 g.

FS 278-2 was collected from the surface strip. It is the only obsidian biface fragment recovered. It is the broken tip of a unifacially flaked biface that exhibits unimarginal retouch on the ventral side. It appears to have been broken during manufacture. Its partial dimensions are 1.3 cm long by 1.3 cm wide by .3 cm thick, and it weighs .5 g.

Ground Stone Artifact

A single ground stone fragment of fine-grained sandstone was recovered from the surface. The ground surface is flat, with no visible striations. The fragment is so small that measurements would be meaningless. The presence of the ground stone fragment suggests that activities other than just core reduction and biface manufacture were conducted, although the ground stone fragment may have been used to abrade platforms and biface edges prior to flake removal.

LA 66472

LA 66472 was first recorded as a dispersed, low frequency lithic artifact scatter. Excavation revealed the initial assessment to be accurate, but also that the site was a base camp for a middle or late Archaic group. Unlike LA 66471, the LA 66472 lithic artifact assemblage is more diverse, including debitage, projectile points, biface fragments, utilized flakes, and ground stone artifacts.

The debitage analysis yielded 366 artifacts from 6 debitage types (Table 14). Debitage was recovered from surface and subsurface proveniences. The assemblage will be separated into debitage recovered from in and around the Feature 1 excavation area and the rest of the site. Most of the artifacts that were recovered from the surface are in the latter category, while the former contains most of the subsurface artifacts.

Proveniences Outside of the Feature 1 Excavation Area

This subassemblage includes piece-plotted surface artifacts and those from surface strip zones and excavation units for proveniences outside of Grids 89 to 91 North and 60 to 64 East. A total of 101 lithic artifacts were collected. Table 15 shows the four debitage types are fairly evenly distributed; biface flakes were the most numerous. The debitage types are distributed amongst 12 material types, of which locally available cherts and chalcedony are the most common. No cortex was recorded on 86.1 percent of the debitage types, with all cortical debitage exhibiting coverage of less than 50 percent.

Angular debris accounts for 21.8 percent of the debitage, the remainder are various core flakes, biface flakes, and undetermined flakes. Of the flakes, 40 percent of the biface flakes and 56.5 percent of the core flakes are whole (Table 16). Platforms are missing from 50.6 percent of the flakes, while platform preparation and other attributes of late stage core reduction or biface manufacture are present on 38.1 percent of the flakes (Table 17).

Table 14. Cross-Tabulation of Debitage and Material Types, All Proveniences, LA 66472

Material Type	Debitage Type						
	Core Flake	Biface Flake	Angular Debris	Undeter. Flake	Rejuv. Flake	Hammer Spall	Total
Pedernal chert		1 .9 50.0	1 1.6 50.0				2 .5
Undiff. chert	34 31.8 26.8	29 25.7 22.8	31 48.4 24.4	33 41.8 26.0			127 34.7
Washington Pass chert		1 .9 100.0					1 .3
Clastic chert		1 .9 100.0					1 .3
Mottled chert	47 43.9 38.8	33 29.2 27.3	18 28.1 14.9	22 27.8 18.2	1 100.0 .8		121 33.1
Silicified wood	3 2.8 14.3	5 4.4 23.8	6 9.4 14.3	8 10.1 38.1			21 5.7
Chalcedony	9 8.4 21.4	20 17.7 47.6		7 8.9 16.7			42 11.5
Mossy chalcedony	4 3.7 66.7			2 2.5 33.3			6 1.6
Quartzite	1 .9 25.0	1 .9 25.0				2 100.0 50.0	4 1.1
Obsidian	9 8.4 22.0	22 19.5 53.7	3 4.7 7.3	7 8.8 17.1			41 11.2
Total	107 29.2	113 30.9	64	79 21.6	1 .3	2 .5	366 100.0

Table 15. Cross-Tabulation of Debitage and Material Types, Outside of the Feature 1 Excavation Area, LA 66472

Material Type	Debitage Type				
	Core Flake	Biface Flake	Angular Debris	Undeter. Flake	Total
Pedernal chert			1 4.5 100.0		1 1.0
Undiff. chert	8 34.8 21.6	6 20.0 16.2	12 54.5 32.4	11 42.3 29.7	37 36.6
Clastic chert		1 .9 100.0			1 1.0
Mottled chert	8 34.8 36.4	7 23.3 31.8	3 13.6 13.6	4 15.4 18.2	22 21.8
Silicified wood		2 6.7 40.0	2 9.1 40.0	1 3.8 20.0	5 5.0
Chalcedony	3 13.0 21.4	9 30.0 42.9	4 18.2 19.0	5 19.2 23.8	21 20.8
Mossy chalcedony	1 4.3 100.0				1 1.0
Quartzite	1 .3 100.0				1 1.0
Obsidian	3 13.0 25.0	4 13.3 33.3		5 19.2 41.7	12 11.9
Total	23 22.8	30 29.7	22 21.8	26 25.7	101 100.0

Table 16. Flake Type by Portion, Outside Feature 1 Excavation Area, LA 66472

	Flake Type			
Portion	Core	Biface	Undeter.	Total
Undetermined			24 100.0 96.0	24 30.1
Whole	13 52.0 56.5	12 48.0 40.0		25 32.1
Proximal	5 33.3 21.7	10 66.7 33.3		15 19.0
Distal	2 28.6 8.7	5 71.4 16.7		7 9.0
Medial	3 42.9 13.0	3 42.9 10.0	1 14.3 4.0	7 8.9
Column total	23 29.5	30 38.5	25 32.1	78 100.0

No utilized flakes were identified in this assemblage. All of the lithic artifacts were from core reduction or biface manufacture. No whole or broken tools were recovered, but the small size of the debitage suggests that small bifaces were made. The small size of the flakes and the low abundance of cortical flakes suggest that all materials were brought to the site in a semireduced form (Fig. 8). Although the chalcedonic chert of local origin is the most common material recovered, no raw material was found on or near the site. Obsidian, which comprises 11.9 percent of the assemblage, occurs in frequencies similar to those of LA 66471. Two samples of obsidian were from the Polvadera source, which is different than the Valle Grande source used exclusively at LA 66471.

The lithic debitage from the Feature 1 excavation area totaled 265 artifacts; all artifacts were collected from subsurface contexts. The important cultural strata were 3 and 4. Stratum 1 and 2 may be mixed with fill from gas line excavations. I think it is likely that the artifacts in Stratum 2 are associated with the Feature 1 occupation, but first I will compare upper and lower strata.

Separating the assemblage into the two strata yielded only minor differences in the distribution of attributes across debitage types. More artifacts were recovered from the lower levels, Stratum 3 and 4 (168) than the upper levels, Stratum 1 and 2. Percentages of debitage types for the two levels are similar, although core and biface flakes are more numerous in the lower levels, and undetermined flakes are more numerous in the upper levels (Table 18). Material types occur in similar frequencies with the local chalcedonic chert the most common. Obsidian occurs in similar percentages for both levels (Table 19).

Table 17. Flake Type by Platform Type, Outside Feature 1 Excavation Area, LA 66472

Platform	Flake Type			
	Core	Biface	Undeter.	Total
Absent	5 12.5 21.7	9 22.5 30.0	26 65.0 100.0	40 50.6
Cortical	3 100.0 13.0			3 3.8
Collapsed		1 100.0 3.3		1 1.3
Single Faceted	4 80.0 17.4	1 20.0 3.3		5 6.3
Multifaceted		4 100.0 13.3		4 5.1
Single faceted/ Abraded	7 53.8 30.4	6 46.2 20.0		13 16.5
Multifaceted/ Abraded	4 30.8 17.4	9 69.2 30.0		13 16.5
Total	23 30.1	30 38.0	26 32.9	79 100.0

From the upper levels, only 6 of 25 flakes are greater than 2.0 cm in length. Only three flakes were greater than 3.0 cm, and they are core flakes (Fig. 9). In the lower levels 16 of 46 flakes are greater than 2.0 cm long, but only 6 are greater than 3.0 cm long, of which 5 are chert, and 1 is obsidian (Fig. 10). Three of the long flakes are biface flakes. These data tend to support an interpretation of reduction of small cores and small biface manufacture as the primary lithic artifact manufacturing activities. Three long biface flakes from the lower levels are limited evidence of a reduction strategy focused on the production of large biface flakes for use as unmodified tools. This kind of reduction might be expected at a residence or base camp, where a wider range of activities were performed. This contrasts with LA 66471, which shows no evidence of an expedient reduction strategy.

While a large number of small flakes suggest a focus on biface manufacture and reduction of previously reduced cores, presence of dorsal cortex may also indicate stage of reduction. In the upper levels 83 pieces of debitage (85.6 percent) do not exhibit cortex (Table 20). Cortex is most common on the local chalcedonic chert. In the lower levels, 134 (79.8 percent) pieces of debitage are noncortical. Obsidian has more cortical debitage in the lower levels suggesting that it was transported as cores. There is a slight increase in cortex over the upper levels, which also supports the base camp interpretation.

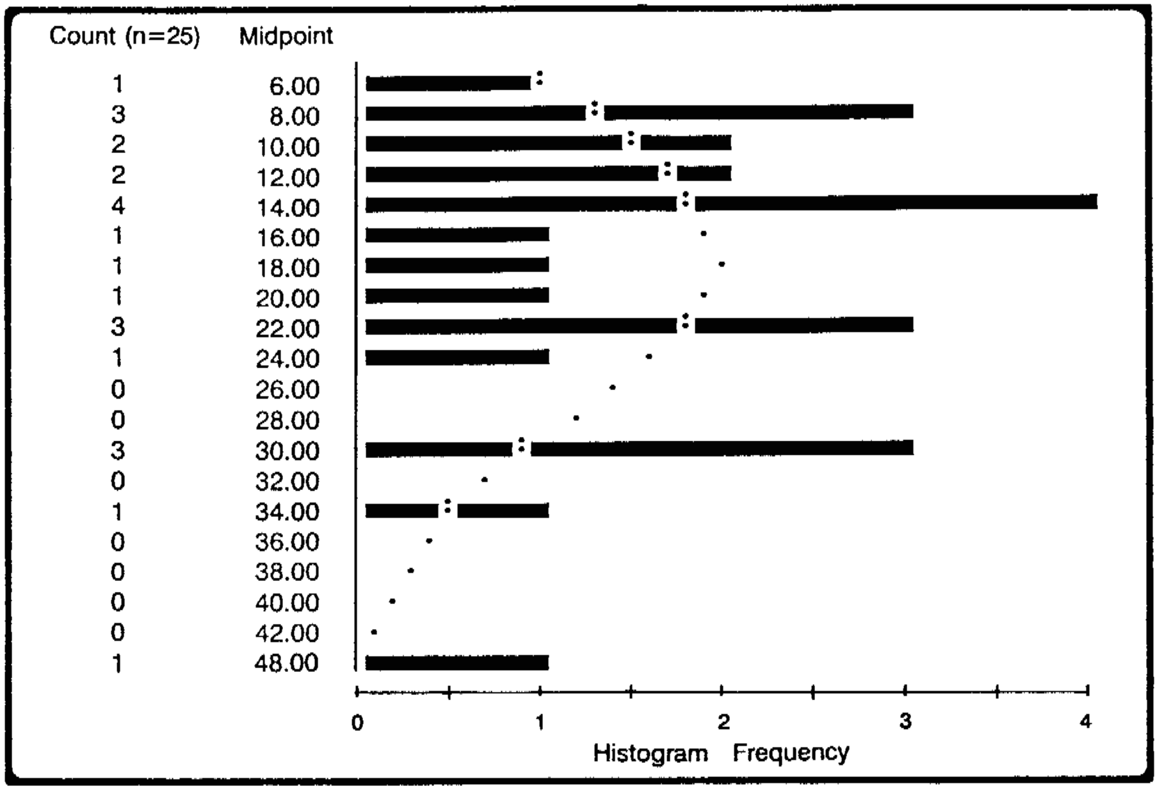

Figure 8. Histogram of whole flake lengths outside of Feature 1, LA 66472.

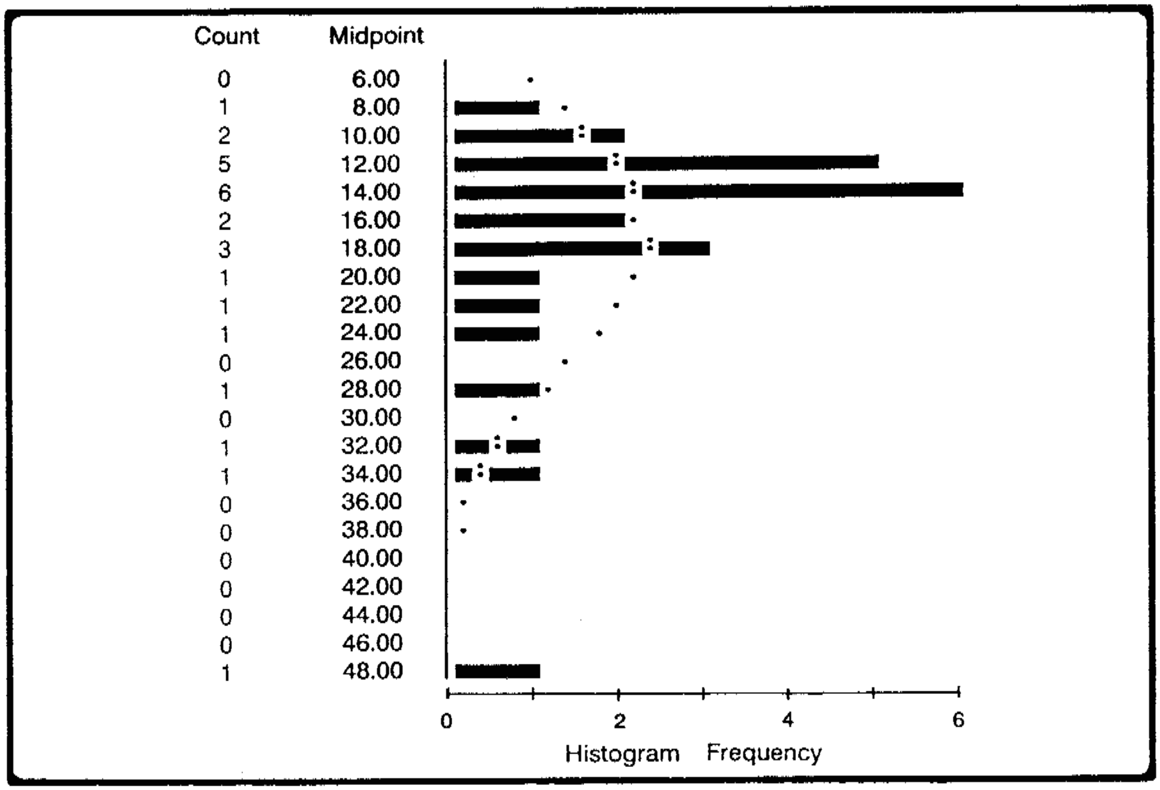

Figure 9. Histogram of whole flake lengths from upper levels, Feature 1, LA 66472.

Table 18. Debitage by Upper and Lower Level for Excavation Area 1, LA 66472

Debitage Type	Core Flake	Biface Flake	Angular Debris	Undeter. Flake	Rejuv. Flake	Hammer. Spall	Total
Upper Levels	22 22.7 26.2	29 29.9 34.9	17 17.5 40.5	28 28.9 52.8	1 1.0 100.0		97 36.6
Lower Levels	62 36.9 73.8	54 32.1 65.1	25 14.9 59.5	25 14.9 47.2		2 1.2 100.0	168 63.4
Total	84 31.7	83 31.3	42 15.8	53 20.0	1 .4	2 .8	265 100.0

Table 19. Upper and Lower Levels by Material Types, LA 66472

	All Chert	Sili. Wood	Chalcedony	Quartzite	All Obsidian	Total
Upper Levels	70 72.2 36.6	7 7.2 43.8	9 9.3 34.6		11 11.3 37.9	97 36.6
Lower Levels	121 72.0 63.4	9 5.4 56.3	17 10.1 65.4	3 1.8 100.0	18 10.7 62.1	168 63.4
Total	191 72.1	16 6.0	26 9.8	3 1.1	29 10.9	265 100.0

Table 20. Dorsal Cortex by Material for Upper and Lower Levels, LA 66472

	Percent of Dorsal Cortex			Row Total Col Percent
	0	< 50	> 50	
Upper Levels				
Chert	59 84.3 71.1	11 15.7 78.6		70 72.2
Silicified wood	6 85.7 7.2	1 14.3 7.1		7 7.2
Chalcedony	8 88.9 9.6	1 10.1 7.1		7 7.2
Obsidian	10 90.9 10.3	1 9.1 7.1		11 11.3
Total Col. Percent	83 85.6	14 14.4		97

	Percent of Dorsal Cortex			Row Total Col Percent
	0	< 50	> 50	
Lower Levels				
Chert	97 80.2 32.8	24 19.8 72.7		121 72.0
Silicified wood	8 88.9 6.0		1 10.1 100	9 5.4
Chalcedony	14 82.4 10.4	3 17.6 9.1		17 10.1
Quartzite	2 66.7 1.5	1 33.3 3.0		3 1.8
Obsidian	13 72.2 9.7	5 17.8 15.2		18 10.7
Total Col. Percent	134 79.8	33 19.6	1 .6	168 100.

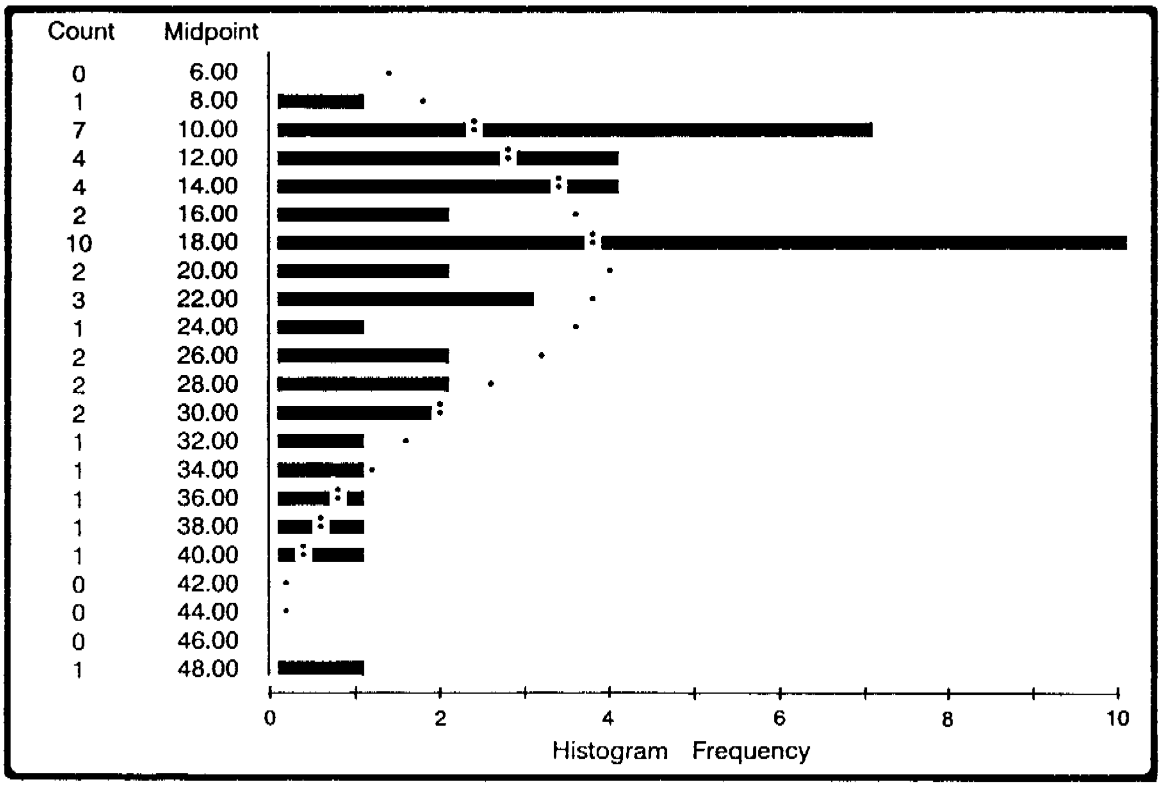

Figure 10. Histogram of whole flake lengths from lower levels, Feature 1, LA 66472.

If there was more core reduction in either level, then there should be an increase in angular debris, which is produced in higher frequency during early stages of reduction. Upper levels have 17.5 percent angular debris and lower levels have 14.9 percent. This contradicts the other evidence for increased core reduction in the lower levels. Core reduction flakes occur in the lower levels, but biface manufacture may have been the main reductive activity.

Material selection from Feature 1 excavation area suggests a continuation of the patterns found at LA 66471, except that the obsidian comes from more than just the Valle Grande source. One piece of Polvadera obsidian came from the upper levels of the Feature 1 excavation area. The remainder of the samples were from the Valle Grande source. One sample from within Feature 2, a hearth, is strong evidence that Valle Grande obsidian was used by Feature 1 occupants.

The chipped stone debris from the Feature 1 excavation area is from more kinds of lithic reduction than is evidenced by the area outside Feature 1. Lithic reduction focused on making small bifaces, although larger core or biface reduction flakes are associated with the lower levels. The raw materials are mostly local with obsidian brought from two sources in the Jemez Mountains. The debitage is not abundant suggesting a short occupation for Feature 1.

Nondebitage Lithic Artifacts

Projectile Points. Two projectile points recovered from Feature 2, a hearth within Feature 1, are similar to Chiricahua points found in northern New Mexico. Chiricahua points are usually associated with the Cochise tradition. The two points are also similar to the Sudden side-Notched point that is common to the southeastern Great Basin in Utah. As mentioned earlier, this projectile point style seems to be more common in northern New Mexico and may be more closely aligned with population movement or information exchange between groups in the San Juan Basin and the Great Basin to the northwest than with the Cochise/Chiricahua groups of southwestern New Mexico and southeastern Arizona.

FS 71-11 was recovered from within Feature 1. It was broken during excavation, and part of the base is missing. It is made from gray-banded silicified wood, which occurs as debitage in this assemblage. Its measurements are: blade length 2.0 cm; blade width 2.1 cm; base length 1.7 cm: base width greater than stem width; stem width 1.1 cm; thickness 0.9 cm; weight 4.3 g. The blade is straight sided, with a rounded tip that has been reworked. The overall length is 3.7 cm but it is only a reflection of the reworked length not the original length. The basal sides are straight with a concave base. It is deeply side-notched (Fig. 11a).

FS 76-1 was recovered from within Feature 1. It was made of obsidian from the Valle Grande, Jemez Mountains. The tip and blade margins have been reworked reducing the size of the blade. Its measurements are blade length 2.0 cm; blade width 1.9 cm (with one tang missing); base height 1.4 cm; base width 2.4 cm; neck width 1.4 cm; thickness 0.5 cm; weight 3.0 g. One margin is straight and the other is sinuous from reworking. The base is slightly concave, with no grinding apparent. The flake is deeply side notched. This point style fits well the Chiricahua/Sudden Shelter projectile points illustrated for the San Juan Basin, the Piedra Lumbre (near Abiquiu), and southeastern Colorado (Fig. 11b).

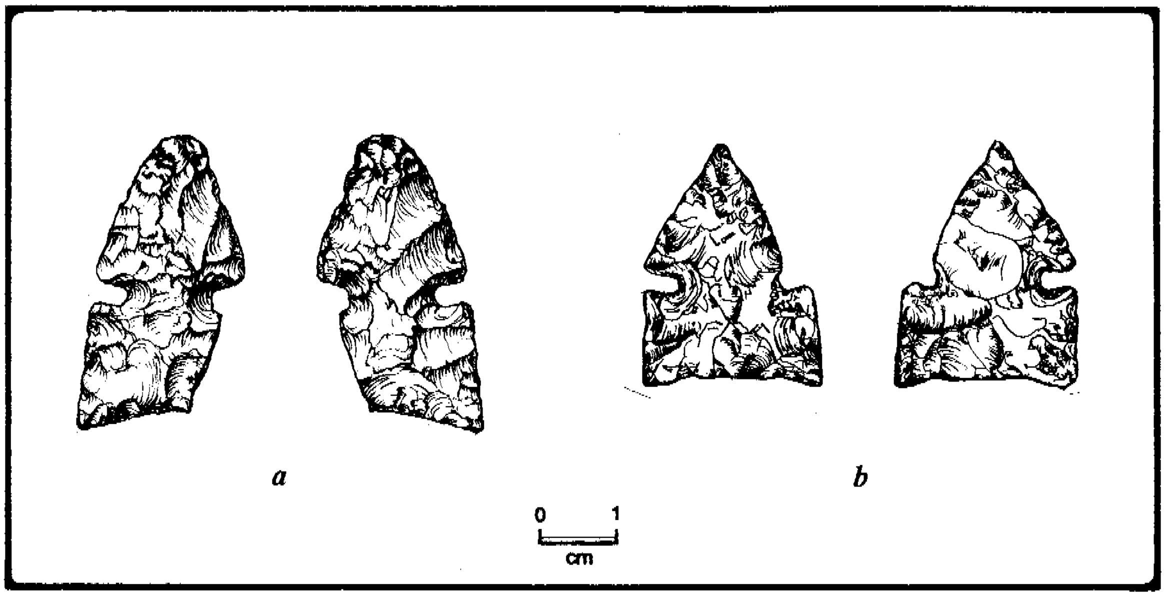

Figure 11. Cochise Chiricahua projectile points, Feature 1, LA 66472; (a) FS 71-11, (b) FS 76-1.

Core/Hammerstones. Two core/hammerstones were recovered from inside Feature 1, near floor level. FS 111-1 is a small silicified wood nodule. It measures 6.9 cm long by 4.9 cm wide by 3.1 cm thick, and weighs 115 g. It has one flake scar. The small nodule size may have halted further flake removal. Pronounced ring fractures along the longest continuous ridge and at both long ends are evidence of its repeated use for hammering or shaping. FS 108-1 is a partly reduced nodule of medium-grained mottled chert. It measures 7.9 cm long by 5.6 cm wide by 3.5 cm thick and weighs 200 g. The chert's blocky fracture may have halted its reduction. One rounded end exhibits ring fractures from repeated battering of hard materials.

Facially Retouched Artifacts. Six facially retouched artifacts (other than projectile points) were identified. All but one came from within the Feature 1 excavation area; four came from near the floor level. A description of each follows.

FS 70-9 is a bifacially retouched fragment of pink-white mottled local chert. Breakage occurred at a crystalline inclusion. The artifact may be heat-treated or it was burned with the structure. Its dimensions are 2.9 cm long by 2.8 cm wide by .7 cm thick and it weighs 3.5 g. Its two edge angles are 58 and 64 degrees.

FS 37-1 is a white chalcedonic chert biface fragment recovered from the surface. It was probably broken in manufacture. Abraded edges suggest platform preparation. It is a distal and lateral fragment that started out as a chunky biface, based on its present thickness. Its dimensions are 2.0 cm long by 1.3 cm wide by 1.0 cm thick, and it weighs 2.8 g. None of these measurements are complete.

FS 50-3, from surface strip in Grid 100N/62E, is an indeterminate portion of a white chalcedonic chert bifacially retouched flake. The material is fine grained with no apparent inclusions. A snap fracture is evidence of breakage during manufacture. All measurements are partial. It is 1.9 cm long by 1.3 cm wide, by .5 cm thick, and it weighs 1.0 g. It exhibits no edge damage, further supporting that it was broken in manufacture.

FS 90-20 was from the Feature 1 excavation area in Stratum 2. It is a unifacially flaked and unimarginally retouched scraper made from mottled white chert. It is marginally retouched along the distal and lateral edges. The snap fracture may have occurred during use. Both edge angles measure between 45 and 50 degrees. The edges exhibit unidirectional scarring and rounding along a convex and concave edge. Its dimensions are 2.4 cm long by 2.2 cm wide by .4 cm thick, and it weighs 1.8 g.

FS 60-9 is the medial portion of bifacially retouched gray-white mottled chert flake. It has numerous inclusions, two of which are located at the fractures indicating breakage during manufacture. All measurements are partial and are .12 cm long by 2.4 cm wide by .6 cm thick, and 1.6 g in weight.

FS 79-21, 22, 23 are three fragments of a bifacially retouched artifact that was heat-treated and broken in manufacture. The material is white mossy chert with numerous inclusions. The size of the fragments suggest that it was either a bifacial tool or bifacial core. The largest fragment measures 3.4 cm long by 4.7 cm wide by 1.7 cm thick, and it weighs 23.8 g.

Ground Stone Artifacts. Three ground stone artifacts were recovered from Feature 1 excavation area. Two manos were from the floor at the western edge of Feature 1. The mano fragment came from the upper fill.

FS 62-1 is a fragment of a mano from indurated sandstone cobble of white quartz inclusions. It measures 6.9 cm long by 3.5 cm wide by 3.8 cm thick, and it weighs 115.5 g. The mano fragment has a biconvex cross section with longitudinal and transverse striations.

FS 96-1 is a whole one-hand mano formed from a coarse-grained friable sandstone cobble. It measures 9.7 cm long by 8.1 cm wide by 4.1 cm thick, and it weighs 492 g. It has a biconvex cross section, with battering (probably from shaping) on all four edges. Both sides are pecked and exhibit transverse striations. The specimen burned with the structure (Fig. 12).

FS 61-1 is a whole one-hand mano formed from a medium-grained indurated sandstone cobble. It measures 10 cm long by 8.6 cm wide by 4.6 cm thick, and it weighs 648 g. It has a biconvex cross section with both faces pecked. It has transverse striations and it is burned on one side (Fig. 12).

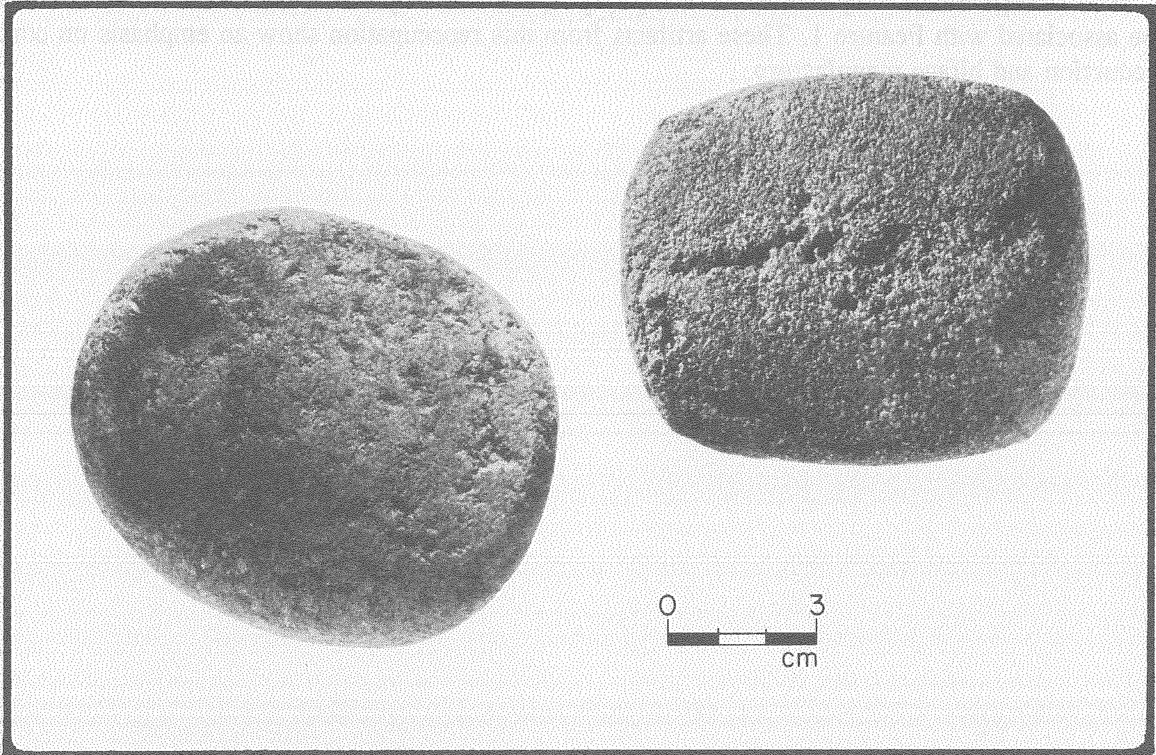

Figure 14. Manos from Feature 1, LA 66472.

Summary of Results, LA 66472

The lithic artifact analysis yielded evidence of core reduction and biface manufacture at the site during two possible occupations.

Feature 1 and its associated features and tool kit suggest that a wide range of activities were conducted at the site. The manos are evidence of plant processing. Each mano has a different grain size and texture that could have been used for different stages of nut or seed processing. Hunting is indicated by the two whole projectile points. Hide or vegetal processing are indicated by at least one scraping tool. Local materials are the most common. This suggests knowledge of their source locations and of there flintknapping properties. Small numbers of medium-grained cherts and quartzite occurred, but were not selected for most tool manufacture. The less desirable materials were used as hammerstones. Breakage in manufacture of bifaces due to excessive force and material impurities also indicates that while high quality materials were brought to the site, selection was not always foolproof. The low frequency of cortex on the debitage and the lack of exhausted cores suggests that raw materials were brought to the site in a very reduced form. Use of Polvadera and Valle Grande obsidian are evidence of movement into the Jemez Mountains or exchange with groups that were based in or near the sources or drainages that contain redeposited nodules. The small numbers of artifacts that either were used in or result from site activities indicate that the occupation of Feature 1 was short-lived (perhaps a single occupation), and by a very small group, perhaps an individual or nuclear family.

A re-occupation of very limited duration may be indicated by the surface artifacts that cannot be associated with Feature 1. These artifacts from this reoccupation show an emphasis on core reduction and biface manufacture.

RESEARCH QUESTIONS

Initial evaluation of the LA 66471 and LA 66472 data potential suggested that they would yield comparable information. Data from each site was to be used to address questions of site and regional chronology and site function and regional settlement patterns and land use. As the preceding sections have shown, LA 66471 and LA 66472 yielded very different results. Because there are two different data sets I will address each question separately for each site.

Site Chronology

The first question asks when the site was occupied. If the site can be dated, how does it fit into the Archaic period Oshara tradition or the Gallina phase of the Pueblo period? Chronological data were derived from archaeometric sources, projectile point types, and the study of reduction strategies that may reflect Archaic or Puebloan subsistence and settlement behaviors. The latter two sources are based on comparisons with studies in the Arroyo Cuervo region of the Rio Puerco of the East and the San Juan Basin and its peripheries.

LA 66471

Lithic artifact analyses and obsidian hydration study yielded data that can be used to address chronology. The obsidian hydration study has been discussed in the Site Dating section. The potential for dating the site by comparing lithic reduction technologies with other studies has not been explored.

The dates obtained from obsidian hydration were inconclusive. Samples from similar contexts yielded a broad date range. The six obsidian hydration dates have a 7,000-year span from the Archaic period to the Gallina phase. A number of possible explanations for such a broad range include post-depositional mixing of Archaic and Pueblo components, the reuse of Archaic materials by subsequent Pueblo populations, either at the source or at LA 66471, or the dates may be erroneous.

Another way to refine site chronology is by comparing the lithic artifact assemblage with known Archaic and Anasazi assemblages. These assemblages have a variety of attributes that may reflect different technologies used to exploit similar resources. The frequencies of these attributes may be compared with LA 66471. Investigators do caution that the uncritical acceptance of attributes may lead to erroneous results.

Schutt (1980) suggests that to meaningfully compare Archaic and Anasazi assemblages for differences that result from different technologies, assemblages must be from sites in similar environments where extractive activities would be similar. For instance, in the San Juan Basin similar environmental situations for Archaic and Anasazi sites allowed for assemblage comparisons. All sites that were compared were assumed to be temporary base camps and plant gathering and processing loci (Vogler et al. 1982; Schutt 1980; Hogan et al. 1983; Gomolak and

Heinsch 1982). We need to ask, should LA 66471 really be compared with San Juan Basin sites?

Stiger (1986:8) presents a table that compares criteria for identifying Archaic and Pueblo lithic technologies used by previous investigators in the San Juan Basin and the Jemez Mountains. Interestingly, while there is agreement between analysts on what attributes are most indicative of culturally diagnostic technological behaviors, there is also quite a bit of confusion. Attributes included raw material selection, formal flaked tool abundance, cortex frequency, flake size, debitage abundance relative to cores and tools, core abundance, utilized flake frequency, and reduction trajectory. The only instance where there is complete agreement is in core abundance, where two investigators suggest that cores are less abundant on Archaic sites in comparison to Anasazi sites. But only two out of six analysts even discuss this variable. For utilized flake abundance or variability, two say there are fewer on Archaic sites, two say there are more, and one suggests that there is greater variability in Archaic period utilized flake assemblages.

Perhaps the most important lithic artifact class for archaeologists, including formal tools and ground stone, is debitage. Bifaces that were broken in manufacture may have been reworked and used for a different purpose or carried off by the maker or subsequent site occupants. Lithic debitage is the glue that binds all San Juan Basin assemblages. While tool fragments, cores, and ground stone may be missing, occur in small numbers, or moved, reworked, or otherwise transformed, debitage always remains. Waste products had the least utility and were usually left behind.

Hicks's (1986) summary of lithic analyses clearly demonstrates that through time archaeological studies have focused more on debitage attributes rather than overall characteristics of Archaic versus Anasazi assemblages. Through replication studies of biface and core reduction techniques polythetic attribute sets have been developed with which analysts can isolate the by-products of different reduction strategies (Hicks 1986; Acklen et al. 1990; Schutt 1980). Agreement on polythetic sets by researchers is rare, although Hicks's research shows that some comparability is present. Hicks (1986) demonstrates that while researchers are interested in basically the same problem, they continuously reinvent the wheel resulting in noncomparable analysis criteria. The constant reinvention may be a refinement process that brings us closer to a better understanding of prehistoric behaviors or it may be viewed as an impediment to better understanding, as divergent analysis criteria yield similar, but not truly comparable data.

Hicks (1986:6-6 to 6-13) observes that earlier studies were also plagued by lumping sites for all Archaic and Anasazi into single groups. Characteristics of Basketmaker III and Pueblo III core reduction and flake and tool production, for example, were treated as similar, as though subsistence strategies and associated technology had remained stagnant through time. Hicks' maintained and demonstrated to a degree that rigorous attribute analysis could yield greater temporal refinement.

This brings us to a problem that applies to LA 66471. Lithic reduction at LA 66471 appears to be from tool manufacture and late stage core reduction. From this emphasis on tool production we can infer that this was a hunting site. Ethnographic studies and historical accounts of North American Indian hunting practices show that major hunting occurred in the fall and early winter, when herds were in good condition prior to winter and aggregated for mating. Presumably, all hunters hunted when the game was abundant and in good condition, regardless of the period. Because Anasazi and Archaic populations probably hunted deer and elk that would have migrated and grazed along the Rito de los Pinos, hunting sites from both time periods should be present. If they hunted similar game, their tool needs and material selection would have been similar. Given similar site location, similar tool needs, and similar material availability, Anasazi and Archaic lithic assemblages from this area should also be similar.

Although we have comparative assemblages from the San Juan Basin, we lack comparative data for tool manufacture from hunting sites on the west slope of the Jemez Mountains or the mesa country around Cuba. Acklen et al. (1990) identified Archaic and Anasazi period sites in a project area at the north end of the Jemez Mountains. Four Anasazi period lithic artifact scatters were interpreted as hunting camps. Archaic hunting camps were also identified as a common site type. After examining the survey-recorded sample assemblages, Acklen et al. (1990:138) concluded that "The lithic analysis from the monitored OLE data set suggests a great deal of homogeneity between lithic assemblages. These assemblages, whether Archaic of Anasazi, tend to follow similar reduction trajectories." They further observe that this contradicts the conventional archaeological wisdom that Archaic people were better flintknappers, and that they tended to use better materials than Pueblo populations.

Another implication of this study is that when locally available raw materials are abundant and suitable for biface manufacture, and both groups were far from the habitation or seasonal base camp, Anasazi and Archaic reduction trajectories will be virtually identical. Given Acklen et al.'s (1990) observation, and the strong evidence for LA 66471 being a hunting camp, it would be foolish to try to assign even a general time period for occupation. If the more locally available chalcedonic chert had exhibited different core flake to biface flake to angular debris ratios than the more distantly available obsidian, then perhaps we might talk about a more locally based adaptation versus a more mobile hunting adaptation. Instead, the materials were used in a very similar manner.

It would be foolhardy to define an occupation period based on material type. An example of this scenario would be that the more sedentary higher altitude-based Gallina populations hunted the mesa country and used the locally available sources with which they were more familiar. More mobile and therefore less well informed Archaic populations would bring obsidian to the mesa country to produce hunting gear. As convenient as this might seem, I think it is unlikely that Archaic populations lacked knowledge about resources upon which they depended for survival.

In conclusion, a general temporal assignment based on the lithic artifact assemblage would be foolhardy. There are not enough recorded hunting or tool production sites that are distinctly Anasazi or Archaic from which temporally sensitive assemblage profiles may be drawn. Even if they existed, it is likely that the similarities would confound classification.

LA 66472

Site dating at LA 66472 is less problematic than LA 66471, although a narrow date range was not obtained. Independent date ranges come from two diagnostic projectile points, two carbon-14 samples, and seven obsidian hydration samples. As discussed in the LA 66472 Site Dating section, there may be two possible occupation periods. The best dated occupation range is 2000 to 600 B.C. This falls within the late San Jose to late Armijo phases of the Oshara tradition, and the late Chiricahua to early San Pedro stages of the Cochise tradition. This date range allows some discussion of regional Archaic settlement patterns and how this site might fit the proposed models.

The date range spans the late San Jose phase to late Armijo phase, a period of significant change for the Archaic people of the Oshara tradition in the Arroyo Cuervo region (Irwin-Williams 1973). During the San Jose phase there is a marked increase in population in the region, as evidenced by more base camps at canyon heads and greater numbers of hunting and plant gathering sites. Irwin-Williams (1973:8) suggests that population growth was a result of increased moisture that made critical resources more reliable and abundant. In the Armijo phase, evidence of corn growing is first apparent. Irwin-Williams (1973:9-10) states that, "Maize probably represented only a small increment to the diet. However, it presented a relatively concentrated, relatively reliable and seasonally abundant resource, which could for the first time provide a source of localized temporary seasonal surplus. Accordingly, its significance cannot be overestimated." The advent of corn horticulture led to changes in population growth and to a less mobile settlement pattern.

Many of the large areal studies conducted in the San Juan Basin (Reher 1977; Kirkpatrick 1980; Del Bene and Ford 1982; Vogler et al. 1982; Hogan and Winter 1983; Moore and Winter 1980) indicate there is an increased number of San Jose and Armijo phase sites over earlier Jay and Bajada phase sites. This in part may be due to environmental amelioration proposed by Irwin-Williams (1973). A more favorable climate would have supported more abundant and reliable plant and animal resources. The central San Juan Basin, which was previously only marginally habitable, became more attractive. Elyea and Hogan (1983) suggest that environmental conditions in the CGP lease were so good that Archaic populations stayed from late spring to early fall. This contradicts assumptions made about the environment by Moore (1980) and Toll and Cully (1983) who suggested a six-week maximum occupation span. Regardless of which environmental model is actually the most accurate, more people in the central San Juan Basin translates into more Archaic sites at higher elevations on the periphery of the San Juan Basin. Under the model of seasonal mobility (Toll and Cully 1983; Elyea and Hogan 1983; Fuller 1989) these sites served as late fall and winter base camps.

It is against the backdrop of increased population and site density that LA 66472 may be discussed. The Archeological Records Management Section (ARMS) files list a single Archaic period site near LA 66472, LA 47775, which dates to 1800 B.C. Other Archaic sites lack phase diagnostic materials (how do we know they are Archaic?) but they are small in number. Temporally nonlithic scatters range from 24 to 10,000 sq m. Some of these sites or portions of these sites may be Archaic. The site files show that the biggest sites (5,000-10,000 sq m) are often dispersed lithic artifact scatters. This suggests that occupation was short with only minimal repeated use of these larger sites. Therefore, the increased site density during late Archaic times that is noted for the Arroyo Cuervo region and the San Juan Basin has not been verified in the Cuba area.

Limited survey coverage of the Cuba area hampers the interpretation of Archaic period settlement patterns. As suggested by models for San Juan Basin Archaic period sites, the mesa country and higher elevations may support late fall and winter microband base camps. LA 66472 would seem to fit this mode. The structural remains and hearth with projectile points and ground stone are good evidence to support the interpretation of a microband base camp. It could have been used for hunting and gathering as well as food processing and shelter during cold weather.

Site Function

Inferences about site function are based on the artifacts, features, and environmental context of the site. Excavation yielded artifacts from LA 66471 and artifacts and features from LA 66472. The lithic artifact assemblages and features will be summarized with an emphasis on inferred site activities. General environmental information will supplement interpretations based on artifacts and features. The pollen and ethnobotanical studies did not provide additional subsistence or paleoenvironmental data.

LA 66471

Site function can be discussed based on the lithic artifact assemblage and the local environment. The lithic artifact data are mostly debitage from core reduction and tool manufacture. The environmental data are more general because detailed studies of local flora and fauna availability are lacking.

The lithic artifact assemblage has 1,070 pieces of debitage, 1 core, 6 biface fragments, and an indeterminate fragment of ground stone. The debitage analysis revealed core reduction and tool manufacture and maintenance were the main site activities. Surface and subsurface assemblages had similar artifact types and frequencies. This suggests little change in site activities through time, as represented by artifact accumulation. Flake dimensions by material type and frequencies of material types remained stable through time. Most of the debitage was small in size and of locally available material. Lithic raw material was partly reduced off-site, as indicated by the infrequent occurrence of dorsal and platform cortex. Local chert and obsidian were used to make bifaces.

Tools were made on-site but not used. There were no utilized flakes and the six biface fragments probably broke in manufacture. The unfinished appearance of the fragments, combined with snap fractures, supports the conclusion of breakage in manufacture, rather than from use. The few maintenance flakes may come from refurbishing old tools prior to hunting.

A single indeterminate ground stone fragment is the only evidence of nonproduction activities. Typically, ground stone implies food processing, which is more commonly associated with a base camp. The single ground stone fragment is slim evidence for identifying LA 66471 as a base camp.

LA 66471 overlooks the east branch of the Arroyo San Jose. Arroyo San Jose and Rito de los Pinos combine to form a major upland tributary of the Rio Puerco of the East. Arroyo San Jose is joined by La Jara Creek, 1.6 km (1 mi) north of LA 66471 in a wide, open, grassy valley. Rito de los Pinos and La Jara Creek carry water most of the year. Both drainages have headwaters in the upper elevations of the Jemez Mountains, and could have served as spring and fall migration routes for elk herds.

LA 66471 is at the northeast tip of Mesa de Cuba, with an elevation between 7,200 and 7,300 ft. Piñon-ponderosa parkland cover the mesa tops and slopes providing an ideal environment for deer. Deer in contrast to elk prefer more protected parkland environments where tree cover combines with intermittent meadows.

In the immediate area, Rocky Mountain montane conifer forests and Great Basin conifer woodland predominate. These plant communities support a large number of economic species that could have been used by local populations for fuel, food, and medicine. While the potential for prehistoric use of these plants is recognized, LA 66471 data provided little insight into how or when they were used.

Based on the excavation data and the site setting, it is reasonable to conclude that LA 66471 was used primarily as a core reduction and tool manufacture and maintenance site in preparation for hunting. While the local environment undoubtedly supports a wide range of food plants, this site was used more for hunting. Its situation on the edge of Mesa de Cuba and near major waterways suggests placement with the purpose of providing the greatest number of opportunities for a successful hunt. The lack of utilized flakes and finished formal tools supports an interpretation of LA 66471 being used to gear up for the hunt with other locations used for butchering, processing, and consumption.

LA 66472

The excavation of LA 66472 yielded more artifact and feature variability than LA 66471. The artifact assemblage has debitage, cores, hammerstones, utilized flakes, biface fragments, two projectile points, and two one-hand manos. The burned remains of a brush structure included an interior hearth and the majority of the debitage and functionally distinct artifacts.

LA 66472 is on a ridge at the north end of Mesa de Cuba. The confluence of the Arroyo San Jose and La Jara Creek is 2.4 km (1.5 mi) to the north. A spring is shown on the USGS 7.5' Cuba Quadrangle 2.4 km (1.5 mi) due east of LA 66472. The headwaters of Arroyo Chijuillita are 1.6 km (1 mi) to the west and northwest. Mesa de Cuba and the low ridges that extend off the north end of the mesa are well wooded with piñon, juniper, and ponderosa pine. The same environmental advantages described for LA 66471 also hold true for LA 66472.

The artifact assemblage, features, and environmental context can be combined to make a strong case for LA 66472 being a late Archaic microband late fall or winter base camp. Most of the artifacts and the three features can be assigned to a single component. Late fall and winter base camps have been proposed for all recent models of hunter-gatherer seasonal mobility (Elyea and Hogan 1983; Toll and Cully 1983; Moore 1980; Vierra 1980; Hogan 1985b; Fuller 1988, 1989). A large number of cold weather sites have yet to be excavated, however, so their existence is still part of an untested model. The seasonal mobility models favored by previous investigators propose late spring to early fall occupation of the San Juan Basin, with occasional use of well-watered peripheries, and late fall to early spring occupation of the upland environments on the periphery of the San Juan Basin.

Fuller (1989) outlines the criteria that determine where a cold weather base camp may be located. The main resource requirements include proximity to water, fuel, shelter, game and aggregated pine nut resources. The LA 66472 location fulfills these basic criteria with most of the resources present in abundance.

Water is the most distant but one of the most frequently required resources. While it is possible that the site occupants might travel over 1.6 km (1 mi) for water, it is at the top end of the distance threshold demonstrated for some populations (Chisolm 1968). This may not have been a great hardship on Archaic people or an undocumented water source may be closer.

While shelter may be critical where wood is not abundant, it is likely that in the well-wooded environs of Mesa de Cuba, wood for a shelter and fuel was not a problem. In other words, shelter could be constructed almost anywhere on the mesa.

Another resource that is not listed as critical, but is still important to consider, is lithic raw material. While obsidian sources are present in the Jemez Mountains, regular trips to the 40-km distant sources may not have been within the realm of winter travel. A caching strategy may have reduced the number of trips into the Jemez Mountains. Even if obsidian was available from caches, the locally available good quality chalcedonic chert would have been important for winter settlement.

LA 66472 does seem to fit the criteria of a winter base camp with added advantages. The question still remains whether the artifact and sample data support the interpretation. Implied in the base camp label is a greater range of activities than would be evident at logistical sites, like a hunting camp or tool production site (for example, LA 66471).

The stone tool data for the Feature 1 excavation area of LA 66472 can be compared with LA 66471, which fits the profile of a limited activity or camp site. Variables that can be compared are ratio of core flakes to manufacturing flakes, flakes to angular debris, artifact types to artifact numbers, and broken to whole tools. If the assemblages result from a different set of activities then these measures should be different.

LA 66472 and LA 66471 have different core flake to manufacturing flake ratios. LA 66472 is 84:83 (1.01:1) and LA 66471 is 321:496 (.65:1). At LA 66472, the ratio is almost even. At LA 66471, there are 35 percent fewer core flakes. This suggests less emphasis on biface manufacture at LA 66472.

The flake (core and manufacturing flake) to angular debris ratio for the two sites is also different. At LA 66471 the ratio is 15:1. At LA 66472 the ratio is 4:1. There are four times as many flakes to angular debris at LA 66471 compared to LA 66472. Higher frequency of angular debris is expected if early stages of core reduction occur and fewer flakes would result from an expedient tool production versus biface production. Expedient tool production would have been necessary to provide implements for a wider range of activities on site and at resource extraction sites.

A different measure compares the number of artifact types to the total stone assemblage. The expectation is that as the number of artifacts increases so should the number of tools. If this is not the case, then tools were used more frequently than expected or that tools were made on site but used elsewhere. Of the 1078 artifacts recovered from LA 66471 there were only 8 artifact types. Chipped stone debris is the most common; the bifaces are all fragments; and the ground stone is a fragment. This suggests very limited activity, with the focus on tool production rather than tool use. LA 66472 had 10 artifact types for only 277 artifacts. This is about four times fewer artifacts than LA 66471, but two more artifact types. This would suggest a greater range of activities occurred at LA 66472, with more tools discarded or left from on-site use.

On-site versus off-site tool use can also be used to compare sites. LA 66471 had 7 tools identified and all of them were broken. From LA 66472, 7 of the 12 tools were whole or nearly whole. These tools may have been discarded after on-site use. The obsidian projectile point shows extensive reworking, and may have had a number of uses besides a dart point. Three manos are whole and are of different grain size and texture. They may make up a grinding tool kit that could have been used for different seeds or nuts or for making different textured meals. The differences are not great, but they do indicate a different range of activities at the sites and perhaps different uses of tools, like on-site versus off-site.

These four comparative measures indicate there are differences in the stone tool assemblages of LA 66471 and LA 66472. The differences relate to tool manufacture, use and discard. LA 66471 has higher ratios of biface to core flakes and flakes to angular debris than LA 66472. LA 66472 scores higher in the measures for tool types and condition. The LA 66471 assemblage reflects very limited activities, which would be expected of a camp site; LA 66472 exhibits stone artifact variability that would be expected at a base camp.

Based on variables of assemblage content, site structure and content, and the surrounding environment, LA 66472 fits the characterizations of a fall-winter base camp. The low number of artifacts and the burned condition of the structure indicate that it was a fall-winter base camp for one year. There is no significant accumulation of artifacts, reconstruction of hearths, or overlapping of features to suggest repeated occupations. LA 66472 would appear to fit the model of Archaic mobility for the San Juan Basin quite well.

Patterns of Mobility

The patterns of mobility for the LA 66471 and LA 66472 occupants were to be addressed by looking at ethnobotanical data and lithic artifact materials. The ethnobotanical studies yielded no remains that can be used to interpret group mobility or range. Of interest for LA 66472 is the absence of corn pollen or parts suggesting the site was used for hunting and gathering, excluding the use of cultigens. Cultigens may have been used in parts of the San Juan Basin during the 1,400-year span in which the occupation of LA 66472 could be placed (Simmons 1982:968). The lithic artifact raw materials yield a little more information, but it, too, is scant.

LA 66471

Exotic raw materials that can be traced to a specific source are Pedernal chert and obsidian from the Jemez Mountains. They are at opposite ends of the Jemez Mountains and provide some indication of the range that the LA 66471 occupants might have had.

The Pedernal chert sources are common at the north end and the east slope of the Jemez Mountains. Pedernal chert is found at its source, Pedernal, which is near Youngsville, New Mexico (Warren 1974). It is also common in the terrace gravel of the eastern foothills of the Jemez Mountains and the Pajarito Plateau. The most likely source for use by Cuba area groups would be the north end of the Jemez Mountains. This source, by a non-montane route, is 80 km (50 miles) distant. This distance is at the upper range of annual movement for arid-zone hunter-gatherers (Vierra n.d.:8), but well within the overall or lifetime range for the same groups. Vierra (1987) has suggested that there is an eastern San Juan Basin Archaic group that used the Jemez Mountains for fall and winter base camps. Perhaps the range of this posited group includes the north end of the Jemez Mountains and the Nacimiento range east and northeast of Cuba.

Besides Archaic period use, Gallina phase use cannot be ruled out. Pedernal is located at the southeastern periphery of the Gallina Culture area across the Chama River from settlements on mesas Golondrina and Vieja. Gallina phase sites also occur on the west slope of the Nacimiento Mountains and on Cuba Mesa. Pedernal could have been within the occasional range of hunting forays. Pedernal chert is a common occurrence on Gallina phase sites in the Regina and Llaves areas (O'Leary 1983). The low occurrence of Pedernal chert at LA 66471 suggests that travel to the source area was rare.

The Jemez Mountain obsidian sources are most abundant 40 km to the southwest. At LA 66471, all of the obsidian identified by Dr. Bart Olinger, Los Alamos National Laboratory, had the Valle Grande signature. Baugh and Nelson (1987:318) identify a number of localities within the Valle Grande complex. They suggest that the Cerro del Medio is the most important because of the quality and size of the raw material. We do not know which of the Valle Grande localities was the actual source for the LA 66471 obsidian. It could have been procured near the primary source during high mountain hunting forays. Other secondary sources may exist in the terrace gravel of the Rio Puerco and Jemez River. These would have been more accessible, but with a reduced selection of size and quality. The composition and location of secondary sources on the west slope of the Jemez Mountains is poorly understood and their importance to hunting efforts only speculative.

The most common lithic raw material is chalcedonic/chert, which occurred on-site and probably locally wherever lag gravel was exposed. Because there was no difference in how nonlocal and local materials were used at LA 66471, local hunting was mostly supplied by local material. The exotic materials may represent the extreme north and south extent of the hunting range of local groups. An overall range of at least 120 km north to south can be suggested for all groups who used the site.

LA 66472

The only identifiable nonlocal material in the LA 66472 assemblage is obsidian. Two sources were identified by XRF (Appendix 6): Polvadera and Valle Grande. These are two separate sources. Polvadera obsidian occurs commonly on the east slope of the Jemez Mountains and on the Southern Plains (Baugh and Nelson 1987:318). Three samples of Polvadera obsidian were identified. Two are from the surface and one is from 20 cm below the surface in the Feature 1 excavation area. The remainder of the samples are from the Feature 1 excavation area and were from the Valle Grande source. The occurrence of more Polvadera obsidian from the surface very weakly supports the notion that the surface artifacts result from a second occupation.

The lithic artifact and feature evidence suggest that LA 66472 could have been a fall-winter Archaic residence. If this is the case, the presence of Valle Grande obsidian suggests that the fall-winter range was fairly extensive. Obsidian may have been obtained from Jemez Mountain sources during fall hunting forays. Unfortunately, there was no faunal material recovered that would indicate hunting mountain game. If the Feature 1 occupation was only for a single year, the Jemez Mountains could be suggested as an important seasonal destination for hunting or gathering forays.

To conclude, neither site had enough faunal or floral remains and artifact diversity from which to infer seasonal mobility. The lithic materials suggest a range that included extensive parts of the west slope of the Jemez and Nacimiento Mountains. Lithic raw material is the only resource that can be traced to these areas. A 40-km radius is suggested for LA 66472 residents. A 120-km diameter can be suggested for occupants of LA 66471. These distances may not represent resource procurement areas as much as trip distances for specific resources including lithic tool raw material. The more extensively used resource area is probably local, as suggested by the predominance of local lithic materials from both sites.

Material Selection

The studies showed that for LA 66471 and LA 66472 there was an unexpected similarity between the use of local and nonlocal raw material in the lithic reduction debris, tools and tool fragments, and inferred tool use. Chert bifaces and biface flakes were recovered from LA 66471. Obsidian and chert bifaces and biface manufacture flakes were recovered from LA 66472. O'Leary, during a seismic survey near our project area, found mainly chert, chalcedony, and quartzite (1983). O'Leary notes that quartzite was ubiquitous in the terrace gravel above drainages (O'Leary 1983:18). Chert and chalcedony also may have occurred in the gravel. The survey data suggest that local materials were preferred for local extractive efforts. Obsidian appears to be restricted to sites with either residential occupation or repeated use over time. From this perspective, there does appear to be local differences in how local and nonlocal materials were used.

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APPENDIX 2

POLLEN ANALYSIS OF LA 66472

Report Submitted to:

Steve Post
Museum of New Mexico
Research Division
Sante Fe New Mexico

Report Submitted by:

Richard G. Holloway Ph.D.
Biology Department
University of New Mexico
Albuquerque New Mexico 87131

Castetter Laboratory for Ethnobotanical Studies Technical Series
Report No. 271

JUNE 1990

INTRODUCTION

Three pollen samples were recovered during excavation of LA 66472, Cuba North Site by personnel of the Museum of New Mexico. These pollen samples were sent for preliminary analysis to the Castetter Laboratory for Ethnobotanical Studies at the University of New Mexico. Initially, scans of the pollen residues were requested in order to evaluate the potential for pollen recovery from this site.

METHODS AND MATERIALS

Initially, 30 mililitres (ml) of soil were sub-sampled and prior to chemical extraction, three tablets of concentrated *Lycopodium* spores were added to each sub-sample. This was done to permit the later calculation of pollen concentration values and secondly, to serve as a marker against accidental destruction of the pollen assemblage by laboratory methods. The samples were initially treated with 35% HCl to remove carbonates. The residues were then treated with cold 70% HF overnight, and then treated with a heavy density separation using Zinc Chloride (S.G. 1.99-2.00) in order to remove other inorganic particles. The lighter, organic portion was removed by pipet, concentrated, and subjected to a short acetolysis (Erdtman, 1960) of 10 minutes to remove extraneous organic matter. The residue was dehydrated and stained with safranin and transferred to a mounting media of 1000 centistoke silicon oil using methanol.

A drop of the polliniferous residue was mounted on a microscope slide for examination. The slide was examined using 250X magnification. A minimum count of 200 grains/sample, as suggested by Barkley (1934), was not attempted for these samples as only limited microscopy was initially requested. This procedure involved counting a minimum of 50 marker grains and tablulating the pollen concentration values on this basis. Pollen concentration values were computed for each sample using the following formula:

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

Where:
- PC = Pollen Concentration
- K = *Lycopodium* spores added
- Σ_p = Fossil pollen counted
- Σ_L = *Lycopodium* spores counted
- S = Sediment volume

Statistically, the concentration values provide a more reliable estimate since a minimum number of marker grains were counted rather than relying upon the fossil grains.

RESULTS AND DISCUSSION

Table 1 below contains the results of the pollen analysis. Very little pollen was present in any of these samples. Primarily, the pollen present were those of taxa normally resistent to deterioration. The concentration values are all well below 1000 grains per ml which is generally considered to be the cutoff for conducting the analysis

Table 1: Results of Pollen Analysis from LA 66472, Cuba North

	FS 114 E 1/2 113 bd 90129	FS 85 80N/61E beneath burned sandstone 90130	FS 84 90N/61E 53-57 cm 90131
Pinus	1	2	5
Juniperus			1
Picea	1		
Poaceae	1		2
Chenoam	3	6	2
Asteraceae hs	1	2	4
Artemisia			1
Unknown	1		
Indeterminate	3	10	1
pollen sum	11	20	16
Marker	66	51	60
Concentration	242	568	386

The assemblages are all severely altered and even were a 200 grain pollen count to be attempted, the data recoverey would be minimal. FS 85 in spite of containing the highest pollen concentration values was the least well preserved. What pollen was present was all severely deteriorated, as indicated by the high numbers of indeterminate type pollen. At this point, no interpretation is possible, nor would it be meaningful. For all intents and purposes, no pollen is present in these samples.

CONCLUSIONS

The pollen assemblages of the three samples are so severely deteriorated that no interpretation of the pollen results is possible. The prognosis for obtaining meaningful results from these sediments is not hopeful.. My recommendation is that no further analyses from these samples be conducted.

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APPENDIX 3

FLOTATION FROM A BURNED, LATE ARCHAIC STRUCTURE (LA 66472),

NORTH OF CUBA, NEW MEXICO

MNM #41.434

Final Report

Submitted to:

Steven Post
Museum of New Mexico
Office of Archeological Services
Box 2087
Santa Fe, New Mexico 87504

Submitted by:

Mollie S. Toll
Castetter Laboratory for Ethnobotanical Studies
Department of Biology
University of New Mexico
Albuquerque, New Mexico 87131

December 6, 1990

CASTETTER LABORATORY FOR ETHNOBOTANICAL STUDIES, TECHNICAL SERIES #287

Soil samples from a brush structure lying about half a meter below present ground surface were examined for evidence of subsistence and fuel use practices of the late Archaic inhabitants. LA 66472 is situated approximately 6 miles (9.7 km) north of Cuba, NM, on a pinyon and ponderosa-covered ridge top, overlooking sage-grassland valleys.

The 3 soil samples collected during excavation were processed at the Office of Archeological Studies, Museum of New Mexico, by the simplified "bucket" version of flotation (see Bohrer and Adams 1977). Each sample was first measured as to volume (ranging from 3.2 to 17.1 liters), and then immersed in a bucket of water. A 30-40 second interval was allowed for settling out of heavy particles, and then the solution was 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.

Three flotation samples taken from hearths and burned material on the floor were scanned to get an overview of what sort of botanical remains were present. All materials caught in the larger screens (4.0 and 2.0 mesh) were sorted completely, and brief samples of materials from the 1.0 and 0.5 mm screens were examined. Material passing through all screens (usually containing very few fragmentary remains of seed taxa occurring in the larger screens) was not examined at all. Examples of each taxon encountered were collected, but no effort was made to retain every seed present, and seeds were not counted. Scanning provides a reliable record of presence and absence of seed taxa in flotation samples. Where cultural plant materials are present in low frequency (as is often the case with Archaic deposits relatively close to the modern ground surface), scanning is a cost-efficient method of providing an overview of botanical conditions, without spending a great deal of laboratory time counting and labeling modern, intrusive seeds. Scanning revealed indicators of modern biological disturbance such as roots, rodent or insect scats, and insect parts in all three samples. Charred goosefoot seeds in samples 119 and 120 signalled the presence of prehistoric botanical activity; these samples were subsequently fully sorted. All materials in sample 120 were examined, but the large size of sample 119 required subsampling of materials from screens with openings 1 mm and less. An estimated number of seeds present in the total sample was calculated using the fraction (by volume) of each screen size examined. Results in Table 1 present the actual number of seeds recovered, and an adjusted number of seeds per liter of original soil sample (taking into account both subsampling, in the case of 119, and soil volume).

Feature 1, labelled a "possible hearth", contained roots, insect parts, and scats, but no identifiable botanical remains (Table 1). Feature 2, a hearth, contained many modern materials along with charcoal and carbonized goosefoot seeds (four whole seeds and four seed halves, for a minimum count of seven seeds). Recent vegetation included stems, bracts, glumes and seeds from grasses and composites, a pinyon needle bundle, and seeds of clover and lupine. Burned material from the floor surface again contained carbonized goosefoot seeds, along with grasses, roots, and insect parts to indicate recent disturbance.

From flotation sample 119, a sample of 20 pieces of charcoal was identified (10 from the 4 mm screen, and 10 from the 2 mm screen). Each piece was snapped to expose a fresh transverse section, and identified at 45x. Charcoal from Feature 2 was all coniferous, and evenly divided between juniper (larger pieces) and pine (Table 2). Wood types reflect the varied arboreal species present close by, in this area of considerable topographic variation. LA 66472 is located on a ridge top, in a zone mapped as "Juniper-Big Sagebrush Association" (Donart, Sylvester, and Hickey 1978). The juniper-sage association and "Western wheatgrass-Big sagebrush Association" better characterize two adjoining valleys, while the higher elevation of the site environs shows characteristics (presence of pinyon and some ponderosa) of the "Pinyon-Juniper Series", mapped as a few kilometers southeast of LA 66472.

At LA 66742, charred goosefoot seeds, from a hearth and burned material on the floor, are the sole potential indicator of prehistoric food use of a wild plant. This taxon is found more frequently than any other seed type in archeological sites of northwestern New Mexico, from the Archaic period through Pueblo III, and in habitats from valley bottom shrub-grasslands to arboreal uplands (Toll 1983). The charcoal found in Feature 2 reflects the coniferous species of the immediate site environs, with no indication of the abundant (but poorer in heat value) sage of nearby valley bottoms.

Table 1. Flotation Results, LA 66472.

Taxa	[SCAN] FS 83 Fea. 1 Hearth	[FULL-SORT] FS 119 Fea. 2 Hearth	[FULL-SORT] FS 120 90N/64E Floor
ANNUALS:			
Chenopodium goosefoot		7/3.1*	2/0.6*
Compositae sunflower family		3/0.2	
Thelesperma greenthread		1/0.1	
cf. *Lupinus* lupine		1/0.1	
cf. *Melilotus* clover		3/0.7	
Unknown			1/0.3
GRASSES:			
Sporobolus dropseed			1/0.3
Gramineae cf. *Tridens*		14/0.8	
Gramineae grass family			1/0.3
TOTAL SEEDS	0	32	5
ADJUSTED TOTAL [seeds per liter]	0	5.2	1.5
TOTAL TAXA	0	7	4
TOTAL BURNED TAXA	0	1	1
Original Soil Volume	2.9 liters	17.1 liters	3.2 liters

*some or all specimens carbonized
a/b number before slash indicates actual number of seeds recovered/ number after slash indicates an adjusted estimate of seeds per liter of original soil sample (taking into account both subsampling, and soil sample size)

Table 2. Species Composition of Charcoal from Flotation Sample 119, LA 66472.

Taxa	Pieces #	Pieces %	Weight g	Weight %
Juniperus juniper	10	50	0.4	67
Pinus sp. pine	10	50	0.2	33
TOTAL	20	100	0.6	100

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BETA ANALYTIC INC.

UNIVERSITY BRANCH
P.O. BOX 248113
CORAL GABLES, FLA. 33124

APPENDIX 4

REPORT OF RADIOCARBON DATING ANALYSES

FOR: David A. Phillips & Stephen Post
Museum of New Mexico

DATE RECEIVED: March 26, 1990

DATE REPORTED: April 21, 1990

SUBMITTER'S PURCHASE ORDER #

OUR LAB NUMBER	YOUR SAMPLE NUMBER	C-14 AGE YEARS B.P. ± 1σ	C13/C12 per mil	C-13 adjusted C-14 age	Gm C
	Project 41.434, site LA 66472				
Beta-36644	FS 72	2,950 +/- 80	- 21.4	3,010 +/- 80	0.8*
Beta-36645	FS 101	4,710 +/- 160	- 21.9	4,760 +/- 160	0.3*

* Small carbon sample given quadruple-normal counting time to reduce attendant statistical errors.

These dates are reported as RCYBP (radiocarbon years before 1950 A.D.). By international convention, the half-life of radiocarbon is taken as 5568 years and 95% of the activity of the National Bureau of Standards Oxalic Acid (original batch) used as the modern standard. The quoted errors are from the counting of the modern standard, background, and sample being analyzed. They represent one standard deviation statistics (68% probability), based on the random nature of the radioactive disintegration process. Also by international convention, no corrections are made for DeVries effect, reservoir effect, or isotope fractionation in nature, unless specifically noted above. Stable carbon ratios are measured on request and are calculated relative to the PDB-1 international standard; the adjusted ages are normalized to -25 per mil carbon 13.

BETA ANALYTIC INC.
RADIOCARBON DATING LAB
CALIBRATED C-14 DATING RESULTS

Calibrations of radiocarbon age determinations are applied to convert results to calender years. the short term difference between the two is caused by fluctuations in the heliomagnetic modulation of the galactic cosmic radiation and, recently, the advent of large scale burning of fossil fuels and nuclear devices testing. Geomagnetic variations are the probable cause of medium term differences and long term (greater then 8000 BP) are still unknown.

Radiocarbon dating laboratories have analyzed hundreds of samples obtained from known-age tree rings of oak, sequoia, and Douglas fir. Curves generated from the results depicting the atmospheric carbon content at specific time periods have been incorporated in computer programs. The result of the calibration analysis applicable to your research follows.

(Caveat: these calibrations assume that the material dated was short lived, i.e., living for 20 years like branches, some shells, small plants, a collection of individual tree rings, etc.. For other materials, the "Old Wood Effect" would produce uncertainties; both the maximum and minimum ranges of age possibilities could be overstated by that error source. Also, but less likely, in extreme cases they might even turn out to be understated.)

Calibration file: ATM20.14C

```
Beta-36644
 Radiocarbon Age BP  3010  ± 80
  Calibrated age(s) cal BC  1266
                    cal BP  3215
  cal AD/BC (cal BP) age ranges obtained from intercepts (Method A):
   one Sigma**   cal BC 1401-1153(3350-3102) 1147-1130(3096-3079)
   two Sigma**   cal BC 1440-1010(3389-2959)

   Summary of above ---
   minimum of cal age ranges (cal ages) maximum of cal age ranges:
      one sigma    cal BC 1401 ( 1266) 1130
                   cal BP 3350 ( 3215) 3079
      two sigma    cal BC 1440 ( 1266) 1010
                   cal BP 3389 ( 3215) 2959


Beta-36645
 Radiocarbon Age BP  4760  ±  160
  Calibrated age(s) cal BC  3615, 3579, 3527
                    cal BP  5564, 5528, 5476
  cal AD/BC (cal BP) age ranges obtained from intercepts (Method A):
   one Sigma**   cal BC 3772-3763(5721-5712) 3700-3360(5649-5309)
   two Sigma**   cal BC 3950-3840(5899-5789) 3820-3090(5769-5039)
                 3061-3044(5010-4993)

   Summary of above ---
   minimum of cal age ranges (cal ages) maximum of cal age ranges:
      one sigma    cal BC 3772 ( 3615, 3579, 3527) 3360
                   cal BP 5721 ( 5564, 5528, 5476) 5309
      two sigma    cal BC 3950 ( 3615, 3579, 3527) 3044
                   cal BP 5899 ( 5564, 5528, 5476) 4993
```

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** 1 sigma = square root of (sample std. dev.^{2}+ curve std. dev.^{2})
2 sigma = 2 x square root of (sample std. dev.^{2}+ curve std. dev.^{2})

APPENDIX 5

EASTERN NEW MEXICO UNIVERSITY Portales 88130

Agency for Conservation Archaeology

June 12, 1990

Mr. Stephen Post
Laboratory of Anthropology/Research Section
P.O. Box 2087
Santa Fe, NM 87504-2087

Dear Mr. Post:

This letter details the results of the obsidian hydration analysis done on 12 obsidian artifacts from two sites (LA 66471 and LA 66472) near Cuba, New Mexico.

Obsidian Hydration Analysis

Methods

The 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 was 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 Canada

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

The hydration rim was 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. The optics of the microscope were calibrated against a standard to compensate for any changes in barometric pressure and temperature. Measurements were taken by one observer. Exterior sides of the samples were scanned to find the widest and narrowest portions of the hydration rim. Five measurements were then made at five different locations. These measurements were then averaged and the depth of the hydration rim (in microns) and the standard deviation were calculated.

Results

Obsidian hydration dates were determined using hydration rate constants derived by Michels (1984, 1987) for the Cerro del Medio and Polvadera Peak sources. The necessary temperature data was obtained from recorded data at the Cuba weather station. The rim measurements, standard deviations, and determined dates are summarized in Table 1. Artifact 2-76-1 was cut in three different places as requested. Measurements were obtained only from cut 2 and cut 3. Cut 1 was prepared twice and it was still not possible to get a measurable rim on it.

Please be aware that there are a number of factors that could affect the accuracy of the hydration dates. These include the condition of the artifacts (surface vs. subsurface), accuracy of the hydration rate constant, accuracy of the source determinations, and accuracy of the temperature data. It would be best to use these results in conjunction with other chronometric data from the site, rather than by themselves.

If you have any questions, please do not hesitate to contact me at (505) 562-2254.

Sincerely,

John L. Montgomery, Ph.D.
Co-Director, Obsidian Hydration Laboratory

Table 1. Results of Obsidian Hydration Analysis on Artifacts from LA 66471 and LA 66472.

Artifact No.	Source	Rim Depth	Standard Deviation	Hydration Date
1-161-40	Valle Grande	2.3	0.4	2042 ± 773 B.P. (52 B.C.)
1-162-51	Valle Grande	3.0	0.4	3475 ± 988 B.P. (1485 B.C.)
1-151-10	Valle Grande	3.3	0.2	4205 ± 525 B.P. (2215 B.C.)
1-68-1	Valle Grande	3.3	0.1	4205 ± 258 B.P. (2215 B.C.)
1-162-50	Valle Grande	2.0	0.4	1544 ± 680 B.P. (A.D. 450)
1-257-5	Valle Grande	5.3	0.4	7475 ± 275 B.P. (5485 B.C.)
2-76-1 (cut 2)	Valle Grande	2.9	0.2	3247 ± 463 B.P. (1257 B.C.)
2-76-1 (cut 3)	Valle Grande	3.5	0.2	4729 ± 557 B.P. (2739 B.C.)
2-91-5	Valle Grande	2.9	0.2	3247 ± 463 B.P. (1257 B.C.)
2-110-7	Valle Grande	2.7	0.1	2815 ± 212 B.P. (825 B.C.)
2-105-17	Valle Grande	3.2	0.3	3955 ± 775 B.P. (1965 B.C.)
2-65-4	Valle Grande	3.1	0.2	3710 ± 245 B.P. (1720 B.C.)
2-47-1	Polvadera Peak	3.0	0.2	1789 ± 247 B.P. (A.D. 200)

APPENDIX 6

Obsidian Source Data by Bart Olinger, Los Alamos National Laboratory (LANL)

OBSIDIAN FROM LA66471, CUBA NORTH

	Fe	Rb	Sr	Y	Zr	Nb	cnts	source
471-008-01	15.4	17.4	01.5	10.3	36.8	18.7	6265	#78 VALLE GRANDE
471-151-10	14.0	19.3	01.3	11.3	37.4	16.8	7578	#78 VALLE GRANDE
471-257-05	17.8	14.1	01.0	11.9	38.1	17.2	5845	#78 VALLE GRANDE
471-276-09	16.8	15.8	00.4	13.4	37.1	16.6	6730	#78 VALLE GRANDE
471-051-01	16.1	18.0	00.9	12.0	37.6	15.5	6830	#78 VALLE GRANDE
471-058-01	16.8	16.2	02.3	12.3	34.4	18.0	5825	#78 VALLE GRANDE
471-162-11	18.0	17.0	03.0	11.0	36.0	15.1	5545	#78 VALLE GRANDE
471-162-14	21.5	16.4	01.2	09.5	35.0	16.4	4545	#78 VALLE GRANDE
471-162-15	18.7	17.7	01.7	09.2	37.1	15.7	5428	#78 VALLE GRANDE
471-162-19	20.7	16.1	01.7	12.2	34.3	14.9	5140	#78 VALLE GRANDE
471-162-41	18.5	17.1	01.1	09.8	37.1	16.4	4985	#78 VALLE GRANDE
471-208-02	19.1	12.5	00.8	14.0	40.4	13.3	2768	#78 VALLE GRANDE
471-162-19	14.2	16.9	00.8	13.3	37.8	17.0	6483	#78 VALLE GRANDE
471-162-50	14.7	17.4	00.7	11.6	37.4	18.2	8010	#78 VALLE GRANDE
471-161-39	13.8	17.5	01.2	12.5	35.9	19.1	8293	#78 VALLE GRANDE
471-161-40	15.2	17.1	02.1	34.7	18.9	18.9	7310	#78 VALLE GRANDE

S.A UNKNOWN means that the obsidian came from a particular source A that has not been identified. The number IDs are those of Fred Nelson; they and the sources are described in
NEW MEXICO OBSIDIAN SOURCES AND EXCHANGE ON THE SOUTHERN PLAINS
TIMOTHY G. BAUGH & FRED W. NELSON, JR.,
J. FIELD ARCH. V.14, PP313-329, 1987

OBSIDIAN FROM LA66472, CUBA NORTH

	Fe	Rb	Sr	Y	Zr	Nb	cnts	source
472-039-01 -Surf	08.0	23.4	04.0	11.4	27.0	26.1	4215	#85 POLVADERA
472-091-01	12.5	18.6	01.1	12.0	38.4	17.3	8427	#78 VALLE GRANDE
472-122-01	12.3	17.1	00.9	11.4	39.9	18.4	8613	#78 VALLE GRANDE
472-088-02	14.8	17.7	05.0	13.8	32.1	16.6	6128	#78 VALLE GRANDE
472-088-03	16.0	19.3	03.9	11.5	32.4	16.9	7075	#78 VALLE GRANDE
472-111-03	17.5	19.3	02.7	10.0	35.0	15.5	6153	#78 VALLE GRANDE
472-111-04	15.2	16.8	02.5	10.8	39.3	15.4	6070	#78 VALLE GRANDE
472-107-01	13.0	16.4	02.8	13.0	36.9	17.9	7770	#78 VALLE GRANDE
472-047-01 -Surf	12.1	28.3	04.2	13.4	23.0	18.9	5125	#85 POLVADERA
472-065-04	13.1	18.6	00.5	11.7	39.2	16.9	8840	#78 VALLE GRANDE
472-076-01	14.4	17.0	01.4	12.0	38.5	16.6	7855	#78 VALLE GRANDE
472-110-07	13.2	16.4	01.3	12.1	39.5	17.5	8248	#78 VALLE GRANDE
472-079-19	13.3	16.4	01.8	11.6	37.2	19.8	9030	#78 VALLE GRANDE
472-079-20	15.3	16.5	01.6	12.4	38.5	15.6	7303	#78 VALLE GRANDE
472-105-17	12.2	16.9	01.2	12.4	37.9	19.3	8683	#78 VALLE GRANDE
472-066-19	10.4	23.8	02.8	12.4	26.7	23.9	5355	#85 POLVADERA
472-111-01	17.1	14.2	02.0	14.0	33.0	19.7	6483	#78 VALLE GRANDE

S.A UNKNOWN means that the obsidian came from a particular source A that has not been identified. The number IDs are those of Fred Nelson; they and the sources are described in
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