MUSEUM OF NEW MEXICO
OFFICE OF ARCHAEOLOGICAL STUDIES

ARCHAEOLOGICAL TESTING AT FOUR SITES IN LOBO CANYON, CIBOLA COUNTY, NEW MEXICO

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ADMINISTRATIVE SUMMARY

In May 1989, the Office of Archaeological Studies (OAS, formerly the Research Section of the Laboratory of Anthropology), Museum of New Mexico, conducted archaeological testing at four lithic artifact sites near Grants, New Mexico. These sites were located along State Road 547 in Lobo Canyon. The testing program was conducted at the request of the New Mexico State Highway and Transportation Department (NMSHTD), which proposed to add 6 ft shoulders to both sides of the highway.

Three sites -- LA 68646, LA 68647, and LA 68648 -- are on Cibola National Forest land; LA 37884 is on private land. In each case, most of the site lies outside the existing right-of-way. Within the proposed project boundaries, the sites all appear to be superficial artifact scatters. Most of the items in the site assemblages are unmodified debitage of local lithic material. Diagnostic artifacts were found only at LA 37884 (in 1982, when the site was originally recorded) and LA 68648. No features were observed, and sterile soil lay just below the surface at all four sites. It is unlikely that the site portions within the project boundaries will yield important information on local prehistory, and we do not recommend any further cultural resource studies at these portions of the sites.

MNM Project No. 41.451.
NMSHTD Project No. SR 547.
State of New Mexico Archaeological Testing Permit No. SE-40.
Conducted under a Special Use Permit from Cibola National Forest.

Submitted in fulfillment of Joint Powers Agreement DO 3773 between NMSHTD and OAS.

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INTRODUCTION

Between May 15 and May 26, 1989, the Office of Archaeological Studies (formerly the Research Section of the Laboratory of Anthropology), Museum of New Mexico, conducted archaeological testing at four lithic artifact scatters in Lobo Canyon along SR 547, in Cibola County, north of Grants (Fig. 1). The work was performed at the request of Mr. William L. Taylor of the New Mexico State Highway and Transportation Department prior to proposed road construction on SR 547. Testing was directed by Daisy Levine, assisted by Kate Fuller and Adisa Willmer. Limited testing took place under a Cibola National Forest Special Use Permit, and State of New Mexico Archaeological Permit SE-43.

LA 68646, LA 68647, and LA 68648 are on land owned by Cibola National Forest. LA 37884 is on private land, although the right-of-way is owned by the state of New Mexico. Site location information is presented in Appendix 1, which has been deleted from copies of this report intended for unrestricted distribution.

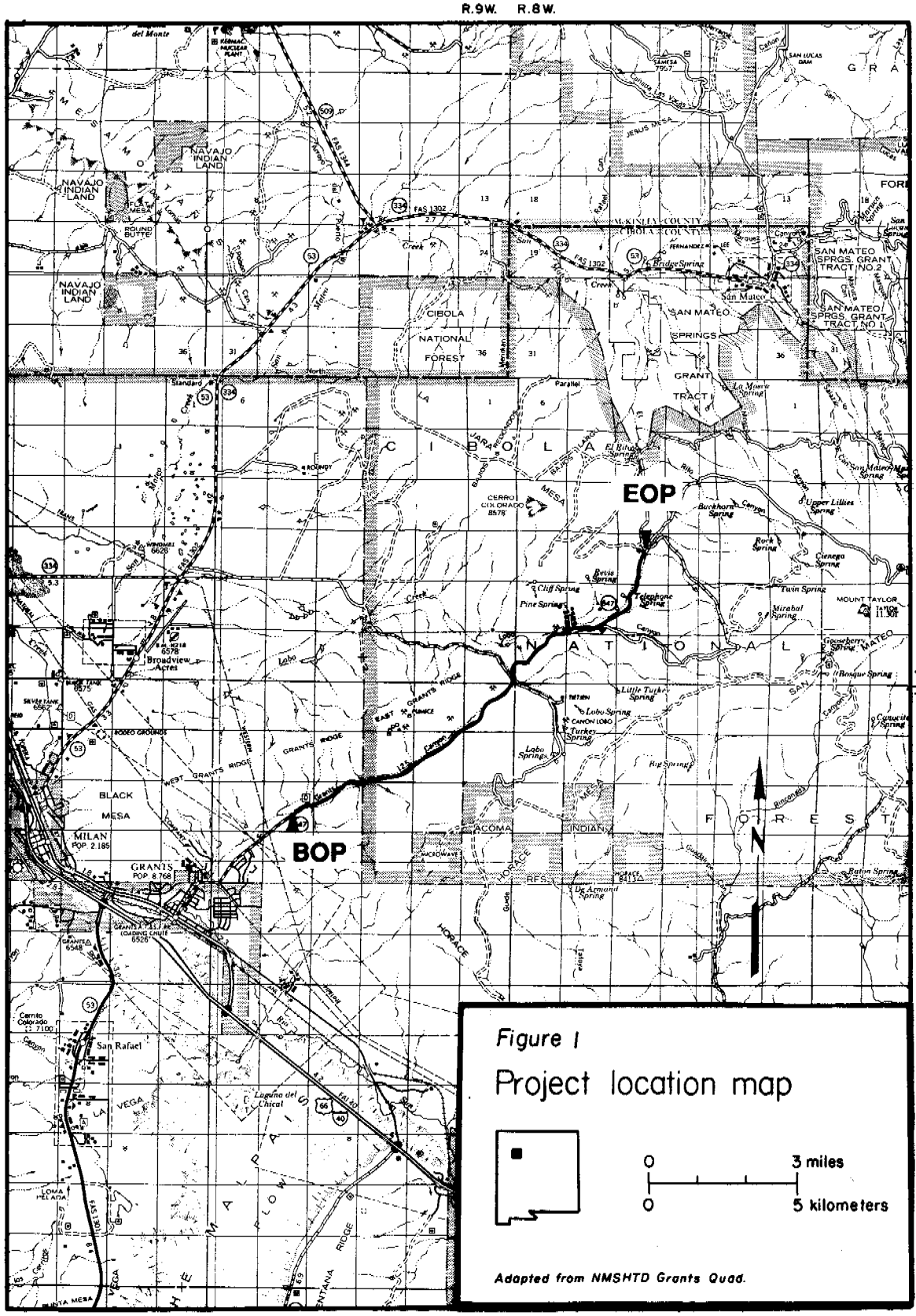

Figure 1

Project location map

Adapted from NMSHTD Grants Quad.

ENVIRONMENT

The project area is on the south slope of Mount Taylor. It runs northeast through Grants Canyon between ridges of sandstone and shale, and up Lobo Canyon to the top of La Jara Mesa, which is capped by a lava flow. The floor of Grants Canyon is fairly broad and flat, but Lobo Canyon is narrower and steeper. Elevation of the project area ranges from 2,049 m (6,720 ft) to 2,271 m (7,450 ft). There is no shortage of water in the canyons, as numerous mountain streams and springs flow in the area.

Climatic data is from the Grants Station, at an elevation of 1,988 m (6,520 ft). Mean annual precipitation is 410 mm (10.26 in), peaking in July and August. On the slopes of Mount Taylor, more precipitation would be expected. Mean annual temperature is -4.7 degrees C (49.1 degrees F). July is the warmest month, with an average temperature of 6.9 degrees C (70.9 degrees F). The coldest month is December, when the mean temperature is -15.8 degrees C (29.4 degrees F).

The soil association in the area is the Rock Land-Thunderbird, which includes the basalt-capped mesas, lava flows, and volcanic hills surrounding Mount Taylor. The topography within this association varies from gently to strongly sloping and undulating on ridge crests and mesa tops to steep and very steep on mesa sides, escarpments, and breaks. Soils are forming dominantly in materials weathered from basic volcanic rocks, mainly basalt. Ash, cinders, and eolian sediments of mixed origin have also contributed to parent materials in which these soils are developing. Soil thickness varies, but it is dominantly shallow to moderately deep. They are usually rocky, and basalt outcrops are common.

Vegetation varies with elevation. Towards the lower elevations of the project area, vegetation consists of extensive grasslands or open park-like areas mixed with areas of piñon and juniper. Ponderosa pine occurs at higher elevations, mixed with mountain mahogany and gambel oak. Common grasses are Arizona fescue, blue grama, western wheatgrass, mountain muhly, mountain brome, and little bluestem.

Fauna expected to be present in the project area include mule deer, mountain lion, jackrabbit, cottontail, coyote, and various small rodents and reptiles (Beal 1977:30).

Prehistoric Use of High Altitudes

There is a natural relationship between elevation and climate. As altitude increases, temperature and atmospheric pressure increase. Precipitation increases to a point and then decreases. Steepness and direction of slope, and local topographic variability, can modify these relationships. Climatic and geographic variables result in vertically zoned climatic characteristics, with corresponding vertical biotic zones (Harrill 1983:202). Biotic zones can be irregular due to intervening topographic variables such as cliffs, slopes, ridges, and valleys, which can alter climatic characteristics and produce microclimates.

Harrill (1983:202) has defined high altitude areas as extending upward from the lower boundary of the ponderosa pine zone, implying a range of 2,130 m (7,000 ft) and above (which would include three out of four of the sites in this project). High elevation environments in the Southwest limit the kinds of resource utilization that can be undertaken. In the mountains, there are marked seasonal changes, and high altitude zones are productive only during summer months. Because of seasonal variation, altitudes above 2,439 m (8,000 ft) are generally inaccessible for most subsistence purposes during the winter. Therefore, at elevations above the limits of agriculture, resources are obtained only on a seasonal basis (Harrill 1983:203).

A high elevation environment thus affects the types of sites that are found. Because of the inaccessibility of mountain areas during a four-to-five-month period, sites above 8,000 ft are expected to be seasonal. Agricultural sites are rare because there is a shorter length of frost-free days. However, at these elevations, populations have taken advantage of the increased rainfall and pushed the upper limits of the frost-free period (Harrill 1983:203).

Above the limits of feasibility for agriculture, high-altitude resource utilization patterns fall into three categories. These types of sites generally experience a seasonal and short-term occupation:

1. Subsistence-oriented resource utilization (seasonal hunting and gathering).

2. Non-subsistence oriented resource utilization (raw material and mineral procurement).

3. Religious or spiritual uses, such as shrines and sacred areas.

Harrill (1983:204) noted two basic trends with regard to high-altitude sites. First, with an increase in elevation, a site's artifact assemblage becomes more generalized, with few diagnostic artifacts. Second, as altitude increases, sites become smaller, with less labor investment in site features, and fewer artifacts are found due to seasonal and short-term use. This first characteristic was observed at all four sites of this project; the second was not as apparent.

Climate played a major role in the development and abandonment of the area. Increased population in a fragile environment put stress on the system, necessitating methods to compensate. Irrigation systems are one example, leading to increased agricultural production in a dry climate. Allan et al. (1976) developed a climatic reconstruction of the Mount Taylor region starting with A.D. 900:

A.D. 900-1100: Generally moist conditions prevailed, particularly from A.D. 1000 to 1050. It was drier towards the end of this period, ending with a severe drought.

A.D. 1100-1300: There was above-average moisture from A.D. 1200 to 1250, but the period culminated in the Great Drought.

A.D. 1300-1500: A shift towards summer-dominant rainfall characterizes this period, with intervals of above-average moisture from 1330 to 1430, and 1455 to 1490.

A.D. 1500-1700: A period of drought occurred from 1560 to 1590, followed by wetter years from 1610 to 1650. Colder temperatures probably shortened the growing season.

Ambler (1978) defined four environmental zones during a survey of San Mateo Mine, near La Jara Mesa (north of the project area), and related them to prehistoric settlement patterns:

Zone 1: Escarpment and talus below La Jara Mesa.

Zone 2: A series of north-to-south-trending ridges and valleys, generally steep and rocky territory.

Zone 3: Large, flat sandy areas.

Zone 4: Low sandy ridges and valleys at lower elevation.

He noted that larger pueblo sites (5-15 rooms) all occur in the lower elevations of Zone 4, while smaller pueblo sites occur in Zones 3 and 4. Temporary special use sites were found in Zone 2. Navajo sites were also found in Zone 2, close to Zone 4. He suggests that population pressure in Zone 4 may have pushed the population into Zone 3 and maybe even into Zone 2. Beal (1977) also developed a set of environmental characteristics to predict site distribution in the area:

Archaic	Stabilized dunes at divides or canyon heads; elevated areas above alluvial or eroded drainages; natural rock shelters; proximity to water; high mesa tops (isolated lithic scatters only); piñon-juniper, grassy dunes.
Pueblo	Slight elevations adjacent to alluvial floodplains and intermittent water sources; piñon-juniper/grassland ecotone; natural rock outcrops; special use sites on mesa tops in piñon-juniper or ponderosa.
Navajo	Sheltered, elevated alcoves; proximity to natural rock outcrops; escarpments or broken slopes; canyon heads; piñon-juniper; piñon-juniper/grass-land ecotone.
Spanish	North slopes overlooking open grasslands; margins of valleys; proximity to villages; piñon-juniper/grassland ecotone.

PREVIOUS ARCHAEOLOGICAL WORK IN THE AREA

Most of the recent work in the Lobo Canyon-La Jara Mesa area has been conducted by archaeologists from the Cibola National Forest. Ten lithic artifact scatters were recorded in 1984 during water development and revegetation projects. Seven of these sites are on La Jara Mesa, at the north end of the project area; three are in Lobo Canyon (Archeological Records Management System, State Historic Preservation Division).

In 1982, New Mexico State University conducted a survey for a proposed prison site in Lobo Canyon. Two sites were located, LA 37883 and LA 37884. LA 37883 is a Navajo ceremonial site; LA 37884 is a lithic artifact scatter, one of the four sites tested during this project.

Northern Arizona University conducted a field school in 1978 at two Pueblo II-III room blocks (LA 33315 and LA 33316) in Cibola Forest, 5 miles southwest of the village of San Mateo. Also in 1978, the Laboratory of Anthropology recorded LA 16283, a multicomponent site including an Archaic lithic artifact scatter, two small Anasazi (Pueblo II) pueblos, and a possible Navajo structure. Archaeologists from Cibola National Forest tested LA 16283 in 1988.

Outside the immediate Lobo Canyon area, Quivira Research Center tested two sites near Milan in 1987. Both were dense lithic artifact scatters. One dated to the Late Archaic period; the other was a multicomponent site from the Paleoindian period to the Anasazi period (Pueblo I-II).

CULTURAL OVERVIEW

Paleoindian Period (9500 B.C. to 5500 B.C.)

Paleoindian finds in the area consist of numerous projectile points and other tools found during a survey of Cebolleta Mesa (Broster 1983), 32 km (20 mi) south of Grants. This was a unique situation because of the number of Paleoindian points found at this high elevation, ranging from 2,267 to 2,408 m (7,440 to 7,900 ft). Previously, Paleoindian sites were believed to be found only at lower elevations, as the subsistence economy was based on hunting large Pleistocene herd animals. Points found dated from Clovis to Cody complex times. Most were found around a rincon, the main access to the mesa top, overlooking vast areas of rolling plains. The remainder were on top of the mesa in association with playas or overlooks.

Though rare, Paleoindian utilization of high altitudes has been documented in other areas of the Southwest. An isolated Clovis point was found in the Rio Valdez Divide in the Sangre de Cristo Mountains, at an elevation of 3,507 to 3,657 m (11,000 to 12,000 ft). Sites with Cody knives and Agate Basin, Allen, Eden, and Meserve points have been recorded at elevations from 3,354 to 3,505 m (11,000 to 11,500 ft) in the Colorado Front Range (Broster 1983).

Archaic Period (5,500 B.C. to A.D. 400)

Towards the end of the Paleoindian period, a warming trend resulted in the gradual extinction of the Pleistocene fauna. The hunting of megafauna was succeeded by the hunting of smaller game and the gathering of wild plant foods, which characterized the Archaic period (Irwin-Williams 1973). At sites dating to the early part of the Archaic, hearths, fire-cracked rock, lithic artifacts, and occasional grinding tools are found. During the late Archaic, population increased and was less mobile, and cultigens first appeared. Sites gradually became larger and structural components were more common. Five phases of the Archaic period have been established by Irwin-Williams (1973), based on work in the Arroyo Cuervo district of North Central New Mexico. A brief description of each follows.

Jay (5,500 to 4,800 B.C.) and Bajada (4,800 to 3,200 B.C.): Sites are small, limited-use base camps. Small, highly mobile groups characterize this time.

San Jose (3,200 to 1,800 B.C.): Remains of San Jose sites were first found in the Grants-Milan area by Bryan and Toulouse (1943). Population growth is indicated during this time by larger and more sites. Shallow basin metates and one-hand manos are common, suggesting a significant reliance on wild plant foods (Condie 1987:6).

Armijo (1,800 B.C. to 800 B.C.): A significant change occurred at the beginning of the Armijo phase with the introduction of corn. Horticulture gradually affected settlement patterns, eventually leading to a pattern of seasonal population aggregation and dispersion (Moore 1989:9).

En Medio (800 B.C. to 400 A.D.): The latter part of the En Medio phase corresponds to the Basketmaker II period and appears to be a transition from the nomadic hunter-gatherer subsistence to one combining hunting and gathering with some dependence on agriculture. Population again increased, represented by numerous seasonally occupied base camps, typically found at canyon heads and cliff bases (Irwin-William 1973). Storage pits, often slab-lined, occur at all Arroyo Cuervo En Medio sites. Tools include ground stone, stemmed corner-notched projectile points, bifacial knives and drills, scrapers, and choppers. Towards the end of the Archaic period, pottery and the bow and arrow were introduced, and there was a shift towards a more sedentary agricultural lifestyle. In contrast to the high population density in the Arroyo Cuervo district during this time, En Medio sites in the Grants-Milan area are extremely rare. However, these sites have been found on La Jara Mesa, 10 mi north of Grants (Condie 1987; Powell 1978).

Archaic occupation at higher elevations in the Cibola forest is extensive, while there is little evidence in the lower elevations of the San Mateo Valley (Allan et al. 1978; Schaafsma 1978; Powell 1978; Klager and Anschuetz 1979). The diversity of the topography in the forest offered more abundant resources than in the lowlands. However, with the shift to agriculture, the low flat areas were more desirable, though high mesas and mountainous regions were still exploited for hunting and gathering.

Anasazi Period (A.D. 400 to 1540)

The Cebolleta Mesa area, south of Grants, appeared to hang onto an Archaic adaptation longer than in the surrounding area, possibly until as late as A.D. 900 (Toulouse and Bryan 1943). During this time, early Anasazi settlement was occurring elsewhere. The population was becoming more settled, constructing pithouses, making pottery, and relying more heavily on agriculture. Above-ground masonry structures gradually replaced pithouses after A.D. 900. Local Anasazi population reached a peak between A.D. 1000 and 1050, when Chacoan outliers were constructed and occupied in the Grants and San Mateo area (Marshall et al. 1979). This period of growth lasted until A.D. 1140, when most of the outliers were abandoned.

The Pecos classification is the chronological framework that has been applied to most of the Anasazi area. Dittert (1959) developed a sequence of phases to apply specifically to the Acoma province, based on pottery types and other cultural changes (Table 1).

Basketmaker III

The Basketmaker III period has been described in three phases for the Arroyo Cuervo region (Irwin-Williams 1973:11-16) and in two for the Cebolleta region (Dittert 1959:518-526). This period is characterized by pithouses, plain gray pottery, and the advent of the bow and arrow. The economy was basically the same as in the preceding En Medio phase, with increased emphasis on plant food processing, indicated by the greater amount of ground stone found at sites.

Table 1. Cebolleta Mesa regional sequence (after Dittert 1959)

CULTURAL SEQUENCE	DATES A.D.	PECOS CLASSIFICATION
Acoma phase	1600-present	Pueblo V
Cubero phase	1400-1600	Late Pueblo IV
Kowina phase	1200-1400	Pueblo III to Pueblo IV
Pilares phase	1100-1200	Pueblo III
Cebolleta phase	950-1100	Pueblo II
Red Mesa phase	850-950	Early Pueblo II
Kiatuthlanna phase	800-870	Pueblo I
White Mound phase	700-800	Basketmaker III
Lobo Period	(?)-700	Basketmaker II to Basketmaker III

In the Arroyo Cuervo region, seasonal foraging sites are typically found on dune ridges along drainages, but main camp sites are still in rock shelters at cliff bases in the early part of this period. Later in the Basketmaker period, these areas were abandoned in favor of wider valley bottoms, as agriculture came to play a more important role in the subsistence economy (Irwin-Williams 1973:12-16).

In the Cebolleta Mesa region, a variety of topographic situations was utilized. Most late Basketmaker sites (White Mound phase) are on low benches bordering drainages below canyon heads, mesa slopes, or some of the higher sand hills. Contact with people from the Mogollon area to the south is indicated by the presence of brown ware pottery (Dittert 1959:523-524).

Pueblo I

During the Kiatuthlanna phase (A.D. 800-870), habitation sites were generally placed above constricted canyons and built against low cliff faces in side canyons. Jacal structures with stone foundations were the architectural style. These were arranged in a crescent shape beside a pithouse. Alluvial flats below were dry-farmed (Dittert 1959:526-527; Tainter and Gillio 1980:70).

Pueblo II

The Pueblo II period, represented by the Red Mesa (A.D. 870 to 950) and the Cebolleta (A.D. 950 to 1100) phases, was a time of widespread geographical development.

Generally, use of higher elevations decreased during this time, though scattered room blocks have been found in the uplands surrounding the San Mateo Valley (Tainter and Gillio 1980:73). In the Cibola forest adjacent to the San Mateo valley, fieldhouses and special-use sites have been documented (Koczan 1977; Koczan and Doleman 1976). Though the forest was generally not used for permanent occupation, agriculture and foraging occurred there on a seasonal basis.

Pueblo II architecture consisted of blocks of masonry rooms with a long axis running north-south and a plaza and kivas to the east. Fieldhouses were dispersed but abundant, as the population expanded to agricultural lands.

The population peaked during late Pueblo II, the Cebolleta phase (A.D. 950 to 1100). A proliferation of pottery types, both local and intrusive, indicated influence from other area. Allan (1976) believes this influx was mainly from the Chacoan area. During this time construction began on several Chacoan outliers in the area: El Rito, San Mateo, and Kin Nizhoni (Marshall et al. 1979). These were linked by roads to each other and to the Chacoan system.

Pueblo III

Substantial depopulation in the San Mateo Valley area occurred during the early Pueblo III period. Farther south, in the Cebolleta Mesa region, the period is characterized by large communities and intensive local specialization in artifact manufacture (McGregor 1965:63). The Pilares phase (A.D. 1100 to 1200) and the Kowina phase (A.D. 1200 to 1400) comprise this time frame. Site density in higher elevations decreased in favor of canyons. However, some later sites were still built on mesa tops, including Acoma Pueblo (Dittert 1959:548-554). Intensive farming took place, and most sites were located near good agricultural lands.

Pueblo IV

The Kowina phase (A.D. 1200 to 1400) and the Cubero phase (A.D. 1400 to 1600) comprise this period. It is characterized by a decrease in population and a general deterioration from the cultural peak of the Pueblo III period (Dart 1982:43). Small sites were built on overlooks near the Rio San Jose, and small shelters were built against low cliffs. Acoma Pueblo was the main large site during this time. Pottery types from Hopi, Zuni, and Rio Grande areas were introduced at Acoma (Dittert 1959:566).

Historic Period (1540 to Present)

Coronado's entrada into New Mexico in 1540 marks the beginning of the Spanish presence in the Southwest. Hostilities between the Spanish and the inhabitants of Acoma Pueblo were common. The pueblo was destroyed by the Spanish in 1599 and subsequently rebuilt with adobe bricks rather than rock masonry. Missionaries settled

at the pueblo, and a large adobe church was built. Sheep and various cultivable plants, were introduced (Beal 1977b:46).

Navajo occupation south of Mount Taylor began around A.D. 1700 (Hester 1962:82). They considered Mount Taylor the "sacred mountain of the south." The Spaniards attempted to establish missions at Cebolleta and Encinal, but these were overrun by raiding Navajos, who considered the missions to be a threat to their land and their way of life (Keur 1941:5). The first grant for present Cebolleta (on the site of the Navajo mission) was made in 1800 (Condie 1987:11). Spanish homesteads and ranches claimed vast areas of land, and as a consequence, water. Feuds over land use between the Navajos, Spaniards, and later, the Americans, continued into the Territorial period (1848-1912).

In the early part of the twentieth century, most of the major mines were near Gallup (Tainter and Gillio 1980), and mining in the Grants and Mount Taylor areas was limited. Some low-grade copper ore was discovered at Mount Taylor, but it was not profitable to mine (Post 1989). With the discovery of uranium in the Grants area in the 1950s, the population and economy boomed. Now, however, only one mine is still open, and the town of Grants serves mainly as a stopover for traffic on Interstate 40.

TESTING METHODS

At each site, artifacts were marked with pinflags to observe distribution and delineate the limits of the site. Only those site portions within the right-of-way were tested. Testing methods varied between sites and included augering, digging test pits or shovel tests, and artifact sampling and collection. Test pits were 1 by 1 m. They were excavated in 10 cm levels, and depths were measured in centimeters below each test pit datum (cmbd). After a culturally sterile level was completed, an auger test was placed in the base of each test pit to determine whether there was any more cultural fill below this level. All soil was screened through 1/4" mesh screens. The site was mapped using a transit, and locations of test pits, shovel tests, auger holes collection units, and artifact concentrations were plotted. Upon completion of testing, all holes and pits were backfilled. Artifacts that were recovered were brought back to the Museum of New Mexico for analysis and curation.

At LA 37884, artifacts within the right-of-way were piece-plotted and collected. Three 1 by 1 m test pits were dug, two on the west side of the highway and one on the east side. Auger tests were placed throughout the site to determine whether there were any buried features that were not found in the test pits.

It was not known at first that LA 68646 was on national forest land, so this site was not included in the testing permit. Forest Service guidelines for limited testing were followed instead. These guidelines stipulate the use of small collection units and shovel-tests (20 by 20 cm holes). Artifacts were collected from one 10 m diameter dogleash, and three shovel tests were dug. An auger transect, consisting of seven tests, was placed along the right-of-way.

At LA 68647 and LA 68648, 5 m diameter dogleash collection units were placed within the main artifact concentrations. The center of each dogleash became the northwest corner for a corresponding test pit. In addition, auger tests were placed throughout the sites.

SITE DESCRIPTIONS

LA 37884

Site Type: Lithic artifact scatter.

Cultural/Temporal Affiliation: Archaic/Anasazi Pueblo III.

Land Status: State of New Mexico.

Site Setting: The eastern portion of the site is in an area dominated by a basalt-capped hill, which slopes down to a grassy knoll truncated by the road cut for SR 547. West of the road, the site sits in a flatter, somewhat deflated area. Small basalt boulders are found throughout the site and appear to rest on a thin (10-15 cm) layer of fine sand. Immediately west of the site the land drops to the first terrace above an arroyo that runs through Grants Canyon. Grants Ridge, thought to be the source of the obsidian found at all of the sites investigated in this report, lies across the canyon. Site vegetation consists of spotty juniper, grasses, saltbush, cholla, and snakeweed. The site is at an elevation of 2,043 m (6,700 ft).

Site Description: LA 37884 extends 77 m east-west by 30 m north-south on both sides of SR 547 (Fig. 2). The site was previously recorded by Karl Laumbach in 1982. Two projectile points were collected at that time; one was an Archaic point, possibly from the Bajada phase (5000-3000 B.C.), and the other was from the Anasazi Pueblo III period (A.D. 1100-1300). No diagnostic artifacts were found during this testing project. The disperse nature and large size of the site, combined with the two projectile points from widely different time periods, suggest that the site material accumulated through multiple uses of the area over a broad time span. The scatter is comprised almost solely of Grants obsidian flakes (see "Lithic Artifact Analysis," below). The densest concentration (18 by 20 m) of these artifacts is on the west side of the road and extends outside of the right-of-way. Another dense area (20 by 12 m) is on the south half of the knoll on the east side of the road. The location of the concentrations on the lower slopes and terraces indicates that the artifacts are not washing down from the hill above. No features were found in association with the scatter.

Testing Results: Test Pit 1 was on the east side of SR 547. The top 5 cm of this pit was mostly gravel mixed with fine sand. Below this was a red to yellow clay. Level 2 was dug through a clay stratum, which was culturally sterile. Auger tests in and around the test pit and the road cut revealed the clay lens to be up to be up to 3 m thick.

Test Pit 2 was placed on the west side of the road in the midst of the densest concentration of artifacts. The fill of Level 1 was mostly a mottled sand, which changed to a homogenous dark sand with depth. Some small gravels and basalt fragments were present as well. At the beginning of Level 2, the fill rapidly turned into a compact dark brown clay with some small gravels. No artifacts were found, and an auger test was placed in the middle of the test pit to investigate any changes below Level 2. The clay

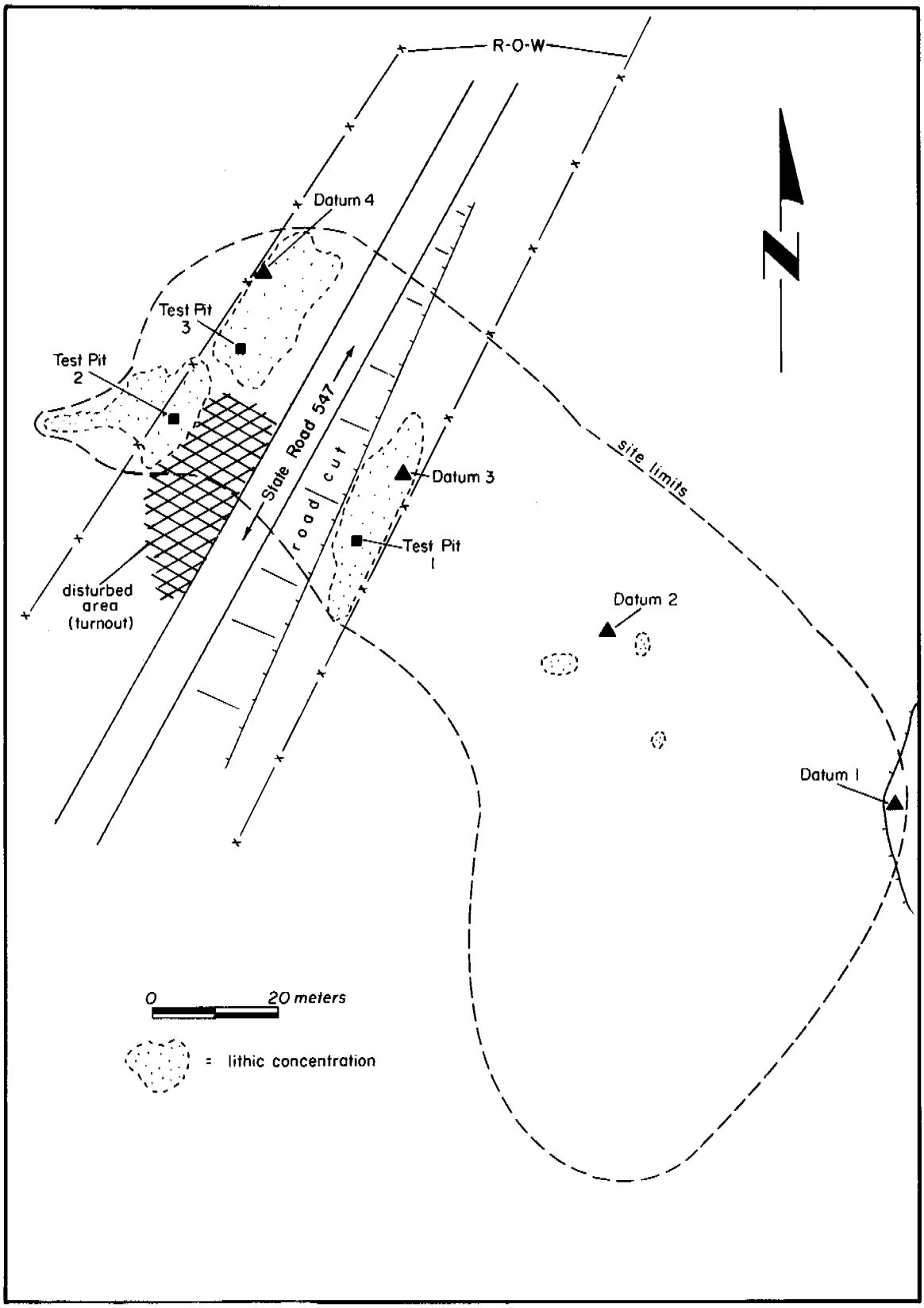

Figure 2. LA 37884 site map

continued for another 20 cm and then became mixed with sand. At 40 cm below the base of Level 2, the sand was mixed with caliche and was too fine to stay in the auger.

Test Pit 3 was also placed on the west side of the road, in an area near a two-track dirt road. Fill in Level 1 consisted of large gravels in a loose sandy matrix. Test Pit 3 produced the most artifacts, but most flakes were fragmentary and found within the top 5 cm of Level 1. Level 2 was sterile. As with the other test pits, a clay stratum was encountered. An auger test in the middle of the test pit revealed a fine light sand mixed with caliche beneath the clay. A rock at 20 cm below the base of Level 2 prevented further augering.

At the site, the stratigraphy consists of loose, gravelly, fine sand underlain by a lens of clay that is thicker on the east side of the road than on the west. The slope terminates at the roadcut and flattens out on the west side of the road to form a terrace above the arroyo in Grants Canyon. It is likely that alluvial action at this terrace is more recent than on the slopes to the east, and that the predominance of sand over clay is the result of this action.

Lithic Artifact Analysis: The results of the lithic artifact analysis are presented in Table 2. The high number of artifacts with no cortex, as well as the fact that no cores were found, indicate that secondary and tertiary reduction was occurring at the site. The dispersed nature of most of the site, the absence of many tools, the two projectile points from widely different time periods, and the lack of other features suggest that the site was used sporadically over a long period. A high ratio of distal flakes to proximal flake fragments and the low number of whole flakes indicate the highly fragmentary nature of the material and the possibility of trampling and/or mechanical disturbance either while the site was occupied, after it was left, or both. A turnout cuts into the part of the site where the densest concentration of artifacts lies, and a two-track road follows north from that turnout within the right of way. Mechanical disturbance is therefore likely.

Formal tools consist of a drill, three unifaces, and a biface fragment. All of the tools are made of Grants obsidian. The drill (17 by 8 by 5 mm) is retouched on the sides, and the tip has been utilized. Two of the unifaces exhibit retouch along one edge; the third uniface exhibits no use or alterations. The biface fragment measures 23 by 11 by 6 mm.

Informal tools consist of three flakes with unidirectional retouch -- two with unidirectional retouch and utilization, and one flake with a utilized edge. All of the informal tools are made of Grants obsidian.

LA 68646

Site Type: Lithic artifact scatter.

Cultural/temporal Affiliation: Unknown.

Land Status: Cibola National Forest.

Table 2. LA 37884 lithic artifact analysis

CATEGORY	ATTRIBUTE	NO.	PERCENT
MATERIAL TYPE	Grants obsidian	328	98.0
	Chert	6	1.8
	Clear obsidian	1	0.2
	TOTAL	335	100.0
ARTIFACT TYPE	Core flakes	290	86.6
	Angular debris	32	9.5
	Retouch flakes	2	0.6
	Tools	11	3.3
	TOTAL	335	100.0
INFORMAL TOOLS	Unidirectionally retouched	3	
	Unidirectionally retouched and utilized	1	
	Utilized	1	
FORMAL TOOLS	Uniface	1	
	Uniface with utilized edge	1	
	Drill with utilization	1	
	Uniface fragment with unidirectional retouch	1	
	Biface	1	
	Indeterminate tool fragment	1	
FLAKE PORTION	Whole	62	20.5
	Proximal	40	13.2
	Medial	85	28.1
	Distal	88	29.0
	Lateral	27	8.9
	Fragment	1	0.3
	TOTAL	303	100.0
CORTEX	0	250	74.6
	1-25 %	43	12.8
	26-50 %	16	4.8
	51 75 %	15	4.5
	76-100 %	11	3.3
	TOTAL	335	100.0

Site Setting: LA 68646 is 87 m east-west by 62 m north-south on the east side of SR 547 at an elevation of 2,195 m (7,200 ft) (Fig. 3). The site occupies a grassy clearing surrounded by piñon-juniper woodlands. A dirt road cuts through this clearing. Higher up, on the ridges above the canyon, are stands of ponderosa. Other vegetation consists of grasses, sagebrush, chamisa, snakeweed, saltbush, and cholla. A gypsum quarry lies west of the site on East Grants Ridge. The site is accessible via a dirt two-track that turns east from SR 547, cuts through the site, and ends at a dump above and east of the site.

Site Description: The site consists of a fairly dense lithic artifact scatter of obsidian and two possible rock alignments, only one of which is in the proposed project limits. As with LA 37884, soils in the area are a thin layer of fine, light tan sand underlain by thick beds of sterile clay.

Testing Results: Only limited testing was performed at this site. After flagging and mapping, artifacts were collected within one 10 m diameter dogleash. Three shovel tests were then placed within the right of way, including one within the vicinity of the rock alignment and two in high-density scatter areas. The small size of the shovel tests made subsurface observations difficult, but they did reveal that the sterile clay was not far under the surface. Shovel Test 1 (dug to 20 cm below surface) produced four lithic artifacts; Shovel Test 2 (23 cm below surface) produced seven, and Shovel Test 3 (17 cm below surface) produced two.

Seven auger tests were placed in a line along the right of way. No cultural strata were found in them, and most displayed the lens of fine sand over clay that is characteristic of the road cut, shovel tests, and LA 37884. Caliche mixed in the clay showed up between 40 and 50 cm below the surface in most cases, and augering was terminated at this point. Auger tests were also placed on both sides of the rock alignment to determine if differences existed from one side to the other. An auger test was then made at the end of the alignment to determine if the alignment continued below the surface. The results were negative in both cases, indicating that the alignment may not be cultural. If it is, it has limited information potential.

Lithic Artifact Analysis: The results of the lithic artifact analysis are presented in Table 3. As with LA 37884, the high number of lithic artifacts with no cortex combined with the lack of cores indicate that secondary and tertiary reduction sequence activities were probably occurring at the site. Again, the percentage of lithic fragments and particularly the high ratio of distal and medial flakes to proximal flakes suggests the fragmentary nature of the material and the possibility of mechanical disturbance or trampling by livestock. None of the artifacts collected was located in the two-track road or other areas of obvious modern disturbance. No diagnostic artifacts were associated with the site, and no other features except the possible rock alignments were found. Though denser than LA 37884, this site may also have experienced occasional use over long periods of time. The general scarcity of tools also suggests that, although they may have been manufactured at the site, the tools were taken and discarded elsewhere.

Tools found at LA 68646 include a drill (17 by 17 by 3 mm) with a broken tip and unidirectional retouch, and three utilized flakes.

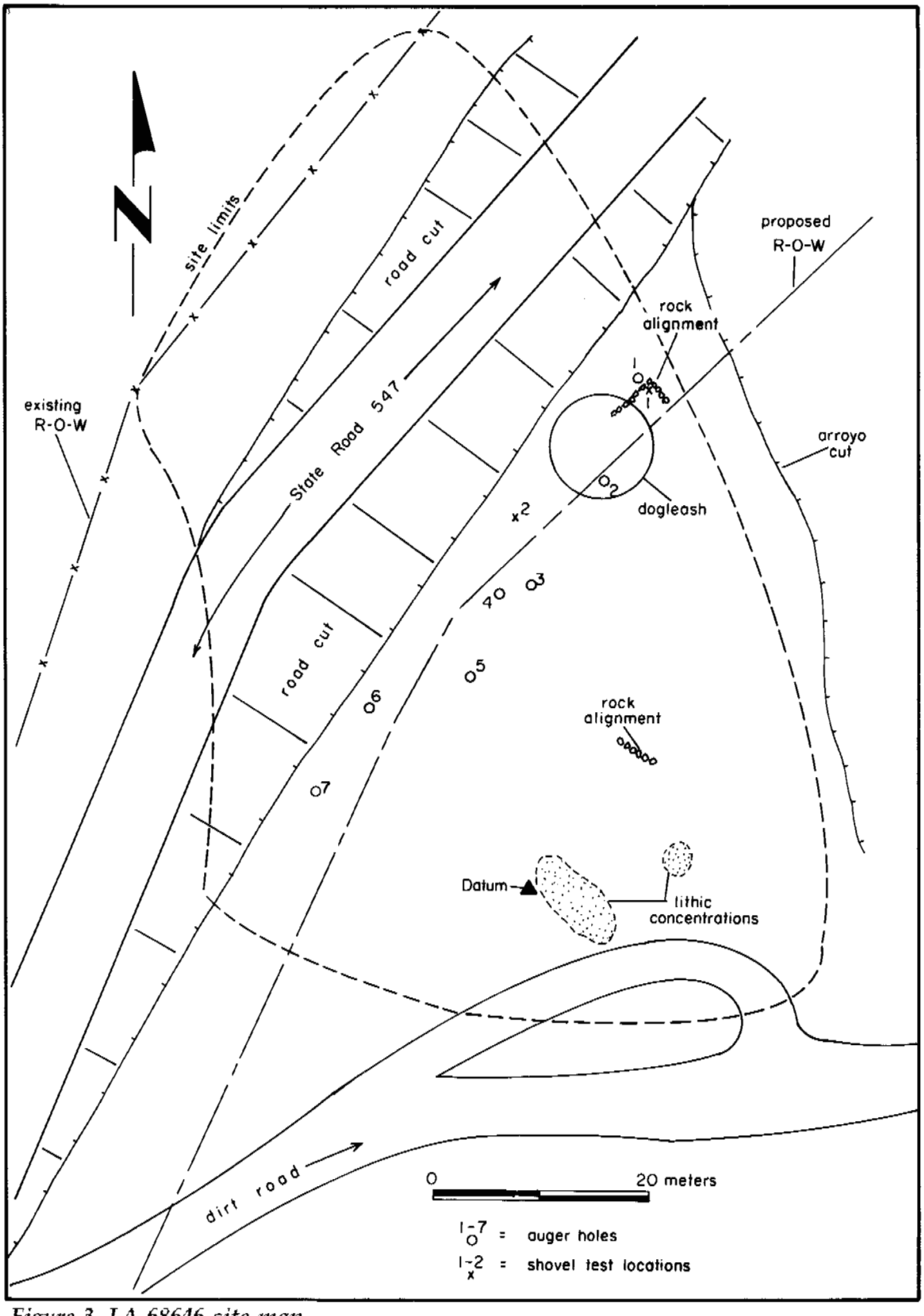

Figure 3. LA 68646 site map

Table 3. LA 68646 lithic artifact analysis

CATEGORY	ATTRIBUTE	NO.	PERCENT
MATERIAL TYPE	Grants obsidian	157	98.1
	Chert	2	1.3
	Black-brown obsidian	1	0.6
	TOTAL	160	100.0
ARTIFACT TYPE	Core flakes	130	81.3
	Angular debris	23	14.4
	Retouch flakes	3	1.8
	Tools	4	2.5
	TOTAL	160	100.0
INFORMAL TOOLS	Utilized edge	3	
	Unidirectional retouch (drill-like)	1	
FLAKE PORTION	Whole	21	15.3
	Proximal	20	14.6
	Medial	31	22.6
	Distal	49	35.8
	Lateral	16	11.7
	TOTAL	137	100.0
CORTEX	0	109	68.1
	1-25%	15	9.4
	26-50%	15	9.4
	51-75%	9	5.6
	76-100%	12	7.5
	TOTAL	160	100.0

LA 68647

Site Type: Lithic artifact scatter.

Cultural Affiliation: Unknown.

Land Status: Cibola National Forest.

Site Setting: LA 68647 is on the southeast side of SR 547. The site is on a gentle slope with a southern aspect and is cut by several north-south running drainages. It is bounded by the highway to the northwest, a drainage to the northeast, and it has a creek as its southern boundary. The elevation of the site is 2,220 m (7,325 ft). LA 68647 is located in a pine forest that consists of piñon, juniper, white pine, scrub oak, yucca, prickly pear, and mixed grasses. The soils consist of brown eolian sand (top soil) underlain by brown grey clay with caliche.

Site Description: LA 68647 is a moderate to dense lithic artifact scatter (over 5,000 artifacts). The site is 60 m long (east to west), 40 m wide (north to south), and it extends outside the proposed right-of-way (Fig. 4). Two main lithic artifact concentrations are located within the right-of-way. One is in the northeast part of the site and measures 5 by 5 m. The other (6 by 5 m) is 30 m northeast of the first concentration, at the center of the site. These two scatters were chosen for collecting and testing.

Testing Results: Testing at LA 68647 did not reveal any features or temporally diagnostic artifacts. The artifacts found were encountered in the first 10 to 15 cm of soil, a light brown eolian sand layer. Sterile soil was reached 16 to 30 cm below the present ground surface (20 to 46 cmbd).

Test Pit 1. This test pit was placed in the middle of Dogleash 1 to test if cultural material and subsurface deposition existed beneath the artifact concentration. Test Pit 1 was a 1 by 1 m excavation unit dug in two 10 cm arbitrary levels. The fill consisted of a top soil of light brown eolian sand, which was a cultural layer, underlain by a culturally sterile gray clay stratum with caliche specks. A total of three artifacts were collected from Test Pit 1 in Level 1. No artifacts were found in Level 2. No features or diagnostic artifacts were found in the test pit. The excavation was terminated when culturally sterile soil was reached. At the base of the excavation unit an auger hole was dug an additional 90 cm. The coring revealed brown sand that gradually became a clayey sand. No artifacts were found in the auger test.

Test Pit 2. Test Pit 2 was placed within Dogleash 2. The test pit was a 1 by 1 m unit excavated in two arbitrary 10 cm levels. The fill consisted of a culturally sterile gray sandy clay with caliche and pebbles overlain by light brown eolian top soil sand (the cultural layer). Eight lithic artifacts were found in the first level; Level 2 had no artifacts. No diagnostic artifacts or features were encountered in Test Pit 2. The excavation of the test unit was terminated at the base of Level 2 when the culturally sterile, sandy clay stratum was reached. At the base of Test Pit 2 an auger hole was dug an additional 70 cm, where rock was hit. The auger test did not reveal any cultural material.

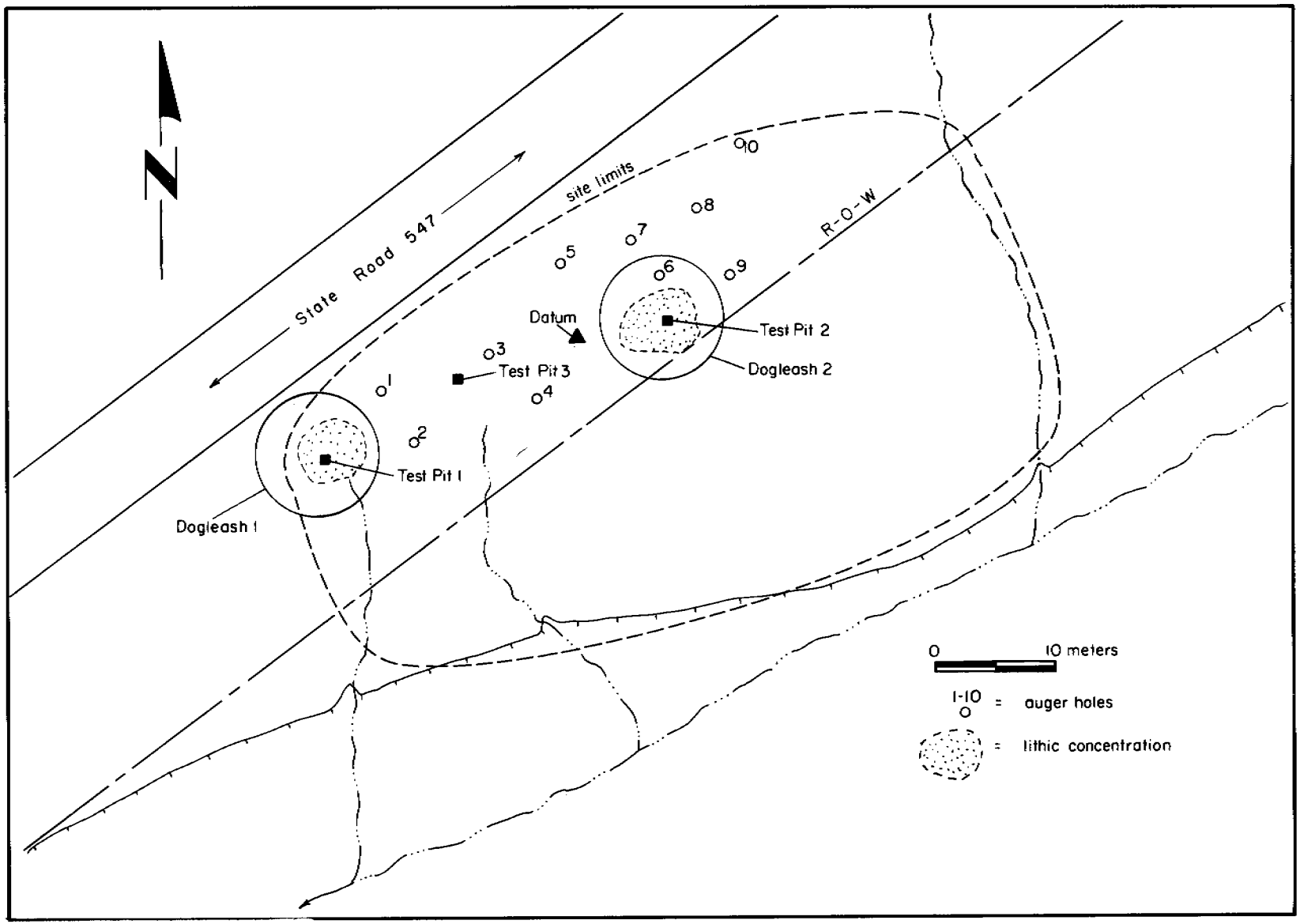

Figure 4. LA 68647 site map

Test Pit 3. Test Pit 3 was placed in the middle of Dogleash 3 to test for subsurface deposits that might have existed between the two lithic artifact concentrations. This test unit was a 1 by 1 m test pit that was excavated by 10 cm arbitrary levels. Two levels were dug. The fill consisted of two stratigraphic layers. Stratum 1 was a cultural layer that contained light brown eolian sand, and Stratum 2 consisted of a culturally sterile rocky clay soil. A total of 29 lithic artifacts was found in the first 5 cm of Level 1, and no artifacts were present in Level 2. No features or temporally diagnostic artifacts were encountered in Test Pit 3. An auger hole was dug at the base of Level 2 and extended down another 40 cm. The soil from the auger hole was culturally sterile and consisted of fine-grained brown sand with caliche.

Auger Tests: Ten auger holes were placed throughout the site to check for any cultural material that may have existed subsurface. No cultural materials were found in any of the auger holes. Following is a list of the auger holes, their depths, and the soil types encountered.

Auger 1: Base of auger hole was 55 cm below the present ground surface (cmbs).
Stratum 1: 0 to 10 cmbs. Consisted of top soil, light brown sand.
Stratum 2: 11 to 40 cmbs. Consisted of gray clay.
Stratum 3: 41 to 50 cmbs. Consisted of brown sand with gravels.
Stratum 4: 51 to 55 cmbs. Consisted of brown sand and caliche.

Auger 2: Base of auger hole was 45 cmbs.
Stratum 1: 0 to 20 cmbs. Consisted of top soil, light brown sand.
Stratum 2: 21 to 45 cmbs. Consisted of brown sand and caliche.

Auger 3: Base of auger hole was 68 cmbs.
Stratum 1: 0 to 30 cmbs. Consisted of top soil, light brown sand.
Stratum 2: 31 to 55 cmbs. Consisted of gray clay.
Stratum 3: 56 to 65 cmbs. Consisted of brown sand with gravels.
Stratum 4: 66 to 68 cmbs. Consisted of caliche.

Auger 4: Base of auger hole was 42 cmbs.
Stratum 1: 0 to 17 cmbs. Consisted of top soil, light brown sand.
Stratum 2: 18 to 35 cmbs. Consisted of gray clay.
Stratum 3: 36 to 42 cmbs. Consisted of caliche.

Auger 5: Base of auger hole was 60 cmbs.
Stratum 1: 0 to 20 cmbs. Consisted of top soil, light brown sand.
Stratum 2: 21 to 46 cmbs. Consisted of gray clay.
Stratum 3: 47 to 60 cmbs. Consisted of brown gray sandy clay with caliche.

Auger 6: Base of auger hole was 40 cmbs.
Stratum 1: 0 to 10 cmbs. Consisted of top soil, light brown sand.
Stratum 2: 11 to 30 cmbs. Consisted of gray clay.
Stratum 3: 31 to 40 cmbs. Consisted of caliche.

Auger 7: Base of auger hole was 54 cmbs.

Stratum 1: 0 to 20 cmbs. Consisted of top soil, light brown sand.
Stratum 2: 21 to 40 cmbs. Consisted of gray clay.
Stratum 3: 41 to 54 cmbs. Consisted of brown gray sandy clay.

Auger 8: Base of auger hole was 60 cmbs.
Stratum 1: 0 to 20 cmbs. Consisted of top soil, light brown sand.
Stratum 2: 21 to 44 cmbs. Consisted of gray clay.
Stratum 3: 45 to 60 cmbs. Consisted of caliche.

Auger 9: Base of auger hole was 46 cmbs.
Stratum 1: 0 to 20 cmbs. Consisted of top soil, light brown sand.
Stratum 2: 21 to 34 cmbs. Consisted of gray clay and caliche.
Stratum 3: 35 to 46 cmbs. Consisted of sand and caliche.

Auger 10: Base of auger hole was 54 cmbs.
Stratum 1: 0 to 20 cmbs. Consisted of top soil, light brown sand.
Stratum 2: 21 to 30 cmbs. Consisted of gray clay.
Stratum 3: 31 to 54 cmbs. Consisted of brown gray sandy clay and caliche.

Lithic Artifact Analysis: A total of 182 lithic artifacts was collected from the site during the testing program. Table 4 is a list of the lithic material analyzed. The artifact assemblage consisted primarily of Grants obsidian; small amounts of unidentified clear obsidian and chert were also present.

A low ratio of cores to flakes and a high number of lithic artifacts without any cortex indicates that later stages of core reduction (secondary and tertiary stages) probably occurred at LA 68647. Biface manufacturing is suggested by the presence of 10 biface (retouch) flakes.

There were seven informal tools from the site. These included utilized and/or retouched items. No formal tools were encountered at LA 68647.

LA 68648

Site Type: Lithic artifact scatter and recent trash component.

Cultural Affiliation: Basketmaker II to Basketmaker III, with a recent historic component.

Land Status: Cibola National Forest.

Site Setting: LA 69648 is on a southwest facing, gently sloping hill with small intermittent drainages. SR 547, running northeast to southwest, bisects the site. The elevation of the site is 2,258 m (7,450 ft). The site is situated in a pine forest that includes ponderosa pine, piñon, juniper, yucca, prickly pear, snakeweed, chamisa, and many grasses. The soils consist of a sandy top soil with lower layers that contain clay and caliche, terminating on a decomposing sandstone bedrock.

Table 4. LA 68647 lithic artifact analysis

CATEGORY	ATTRIBUTE	NO.	PERCENT
MATERIAL TYPE	Grants obsidian	178	97.8
	Chert	3	1.7
	Clear obsidian	1	0.5
	TOTAL	182	100.0
ARTIFACT TYPE	Core flakes	149	81.9
	Biface (retouch) flakes	10	5.5
	Angular debris	14	7.7
	Informal tools	9	4.9
	TOTAL	182	100.0
INFORMAL TOOLS	Utilized flake	8	4.4
	Unidirectionally retouched flake	1	0.5
FLAKE PORTION	Whole	19	11.9
	Proximal	30	18.8
	Medial	45	28.1
	Distal	60	37.4
	Lateral	6	3.8
	TOTAL	160	100.0
CORTEX	0	126	78.9
	1-25%	16	10.0
	26-50%	7	4.4
	51-75%	4	2.5
	76-100%	7	4.4
	TOTAL	160	100.0

Site Description: LA 68648 is a Basketmaker site that consists of a high density lithic scatter of over 5,000 artifacts. There also is a recent historic component in the northwest part of the site that includes a hearth and trash scatter of cans and glass (Fig. 5). This area had been disturbed by several two-track roads. Other physical disturbance of the artifact scatter has occurred on the south side of the site, where a Forest Service campground is located.

LA 68648 is 90 m long north to south and 85 m wide east to west. The prehistoric components of the site consist of six lithic artifact concentrations: five on the north side of the road and one on the south side. Four of the concentrations fell within the new proposed right-of-way and were designated as areas to be tested.

The recent component of the site is located in the northwest portion of the site, the area with recent disturbance. The trash scatter is comprised of tin cans and glass fragments dating from 1950 to the present. One small cache of glass was recorded that contained a piece of purple glass (1880-1920), a fragment of aqua glass (1880-1920), and a piece of green glass (1880-present). This small collection area, however, appears to have been brought in from elsewhere and is not related to the recently deposited historic trash scatter.

Dogleash/Test Pit Locations

Dogleash/Test Pit 1 and Dogleash/Test Pit 2 were placed in the same artifact concentration. This fairly dense artifact scatter (25 by 10 m) was located north of SR 547, near the center of the site, on a gentle slope. The artifacts were eroding north along a small drainage.

Dogleash/Test Pit 3 was placed in a dense lithic concentration that measured 11 m by 10 m. The concentration was situated on the north side of the road on the south aspect of a small knoll. Dogleash/Test Pit 3 was 25 m northeast of Dogleash/Test Pit 1.

Dogleash/Test Pit 4 was placed on the south side of the road, across from Dogleash/Test Pit 1 and Dogleash/Test Pit 2. This tested area was in a small lithic artifact concentration located just above the steep road cut and probably was cut by SR 547. The artifact scatter was 5 by 4 m.

Dogleash 5 (no test pit was excavated) was located in a small, dense artifact concentration (2.5 by 2.5 m) on the north side of the road in a fairly flat area. This dogleash was 10 m south of Dogleash/Test Pit 2.

After the dogleash units were collected and the test pits were dug, 13 auger tests were placed between these areas to check for any subsurface cultural deposition. All auger holes were dug until sterile soil was reached (15 to 60 cmbs).

Testing Results: The testing revealed one cultural level consisting of lithic artifacts within an eolian top soil stratigraphic layer. No features or diagnostic artifacts were

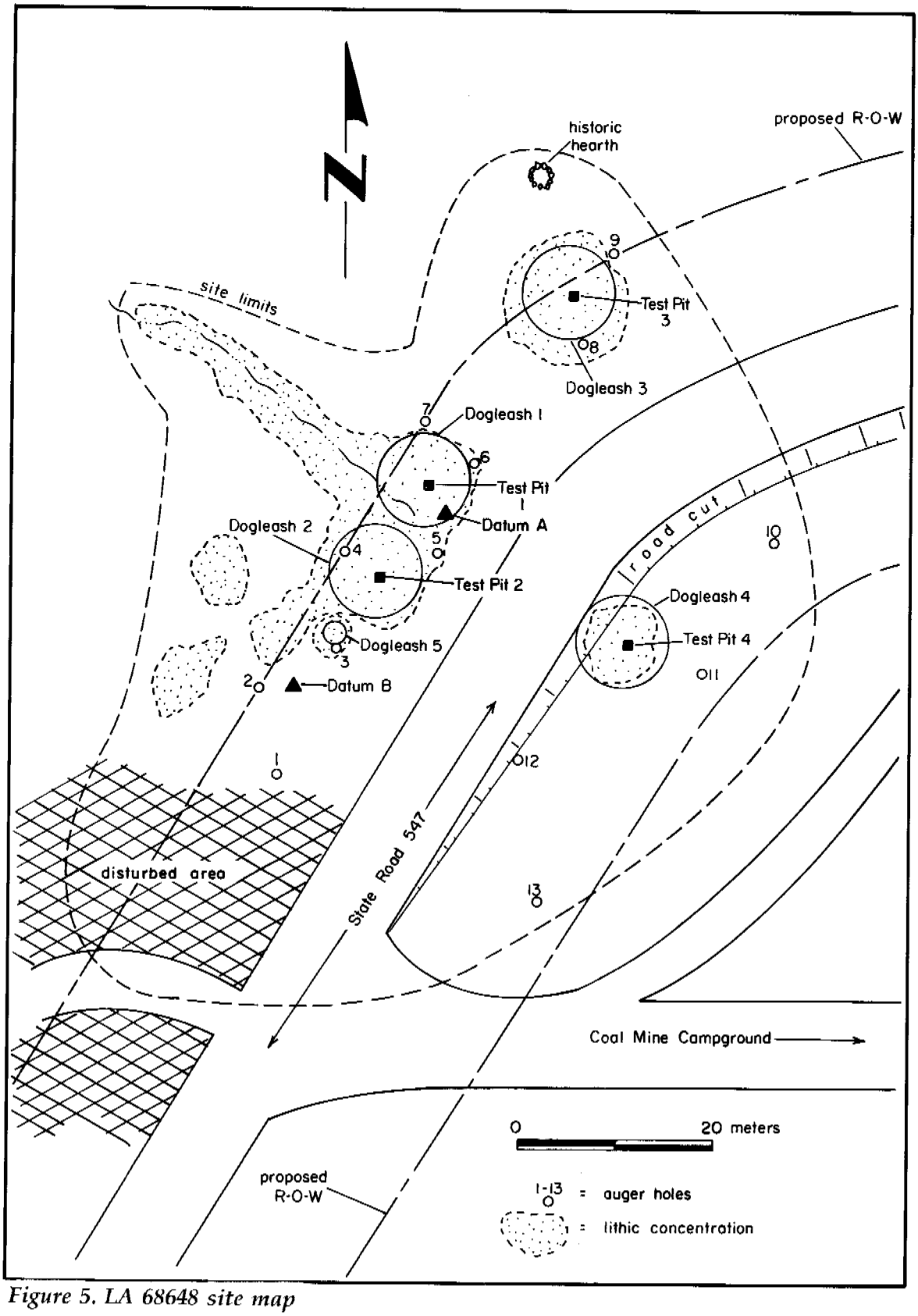

Figure 5. LA 68648 site map

encountered in the subsurface deposits of LA 68648. Most of the artifacts were found in the first 10 to 20 cm of soil. Layer two, a culturally sterile caliche sand, was 21 to 50 cmbd.

Test Pit 1. This test pit was placed within Dogleash 1 to test whether subsurface deposition existed below the artifact concentration. Test Pit 1 was a 1 by 1 m test pit excavated in two 10 cm arbitrary levels. The fill consisted of light brown sandy clay with some caliche overlain by a fine grained brown eolian sand (cultural layer). Seventy-one lithic artifacts were encountered in the first 11 cm; however, the rest of the test pit was culturally sterile. No features or temporally diagnostic artifacts were found within Test Pit 1. The excavation of the test pit ended when the sterile soil mixed with caliche was reached. An auger hole was dug down another 30 cm below the base of the Test Pit and yielded sterile brown sandy clay with caliche.

Test Pit 2. This test pit was located within Dogleash 2 and was placed to see whether any culturally related deposits were present under the lithic artifact scatter. It was dug in 3 arbitrary 10 cm levels. Level 1 was a cultural stratum that contained a fine-grained, brown, rocky eolian sand and a few specks of caliche. Forty-nine lithic artifacts were encountered in Level 1. Level 2 consisted of a light brown sand with fewer rocks and a high caliche content. Seventeen artifacts were found in this level. Level 3 was culturally sterile and was made up of decomposing sandstone with some caliche. Once sterile soil was reached in the test pit (at the base of Level 3), an auger hole was dug another 30 cm down to make sure no cultural material was present. Soil from the auger test was culturally sterile and consisted of decomposing sandstone.

Test Pit 3. This test pit was located in the center of Dogleash 3 to test for possibly related cultural deposits that might exist under the lithic artifact concentration. Test Pit 3 was excavated in two arbitrary 10 cm levels. Sterile soil was reached in Level 2. The fill consisted of two stratigraphic layers: Stratum 1, a cultural layer, made up of brown eolian sand with rocks, gravels, and some caliche specks; and Stratum 2, a sterile layer, comprised of decomposing sandstone, a high percentage of caliche, and some gravel. Twenty-one lithic artifacts were found in Level 1 and two lithic artifacts in the top 5 cm of Level 2. All the artifacts came from the top soil (the eolian sand). Test Pit 3 did not reveal any features or diagnostic artifacts. At the base of the test unit an auger hole was dug down another 30 cm into decomposing sandstone. No artifacts were present.

Test Pit 4. This test unit was placed in the center of Dogleash 4. The test pit was excavated to test for subsurface deposition that might be present beneath the lithic concentration. Test Pit 4 only consisted of one 10 cm level. Within this level two strata were present. Stratum 1 consisted of a shallow cultural layer of eolian brown sand for the first 5 cm of Level 1. Stratum 2 was a 5 cm thick layer of sterile decomposing sandstone, found elsewhere at the site. Four lithic artifacts were encountered in Stratum 1. However, no diagnostic artifacts or cultural features were present in Test Pit 4.

Auger Tests: Twelve additional auger holes were dug between the dogleash/test pits as well as throughout the site that fell within the confines of the proposed right-of-way. All auger tests came up sterile, and further testing at LA 68648 was not warranted. Following is a list of the auger tests, their depths, and the soils encountered.

Auger 1: Base of auger hole was 25 cmbs.
Stratum 1: 0 to 15 cmbs. Consisted of top soil, brown sand.
Stratum 2: 16 to 25 cmbs. Consisted of decomposing sandstone.

Auger 2: Base of auger hole was 30 cmbs.
Stratum 1: 0 to 10 cmbs. Consisted of top soil, brown sand.
Stratum 2: 11 to 20 cmbs. Consisted of light tan sand.
Stratum 3: 21 to 30 cmbs. Consisted of decomposing sandstone.

Auger 3: Base of auger hole was 50 cmbs.
Stratum 1: 0 to 10 cmbs. Consisted of top soil, brown sand.
Stratum 2: 11 to 20 cmbs. Consisted of gray sand.
Stratum 3: 21 to 30 cmbs. Consisted of light tan sand.
Stratum 4: 31 to 50 cmbs. Consisted of caliche.

Auger 4: Base of auger hole was 21 cmbs.
Stratum 1: 0 to 20 cmbs. Consisted of top soil, brown sand.
Stratum 2: 21 cmbs. Consisted of bedrock, sandstone.

Auger 5: Base of auger hole was 15 cmbs.
Stratum 1: 0 to 14 cmbs. Consisted of top soil, brown sand.
Stratum 2: 15 cmbs. Consisted of bedrock, sandstone.

Auger 6: Base of auger hole was 15 cmbs.
Stratum 1: 0 to 14 cmbs. Consisted of top soil, brown sand.
Stratum 2: 15 cmbs. Consisted of bedrock, sandstone.

Auger 7: Base of auger hole was 10 cmbs.
Stratum 1: 0 to 9 cmbs. Consisted of top soil, brown sand.
Stratum 2: 10 cmbs. Consisted of bedrock, sandstone.

Auger 8: Base of auger hole was 25 cmbs.
Stratum 1: 0 to 10 cmbs. Consisted of top soil, brown sand.
Stratum 2: 11 to 20 cmbs. Consisted of tan sand with caliche.
Stratum 3: 21 to 25 cmbs. Consisted of caliche.

Auger 9: Base of auger hole was 60 cmbs.
Stratum 1: 0 to 20 cmbs. Consisted of top soil, brown sand.

Lithic Artifact Analysis: A total of 1,013 lithic artifacts were analyzed from LA 68648. Table 5 is a list of lithic material and artifact types encountered. Most of the lithic material was Grants obsidian. Minor amounts of chert, chalcedony, basalt, siltstone, and unidentified clear obsidian were also present.

The lithic assemblage at this site represents the later stages of core reduction based on a high flake-to-core ratio. Only seven cores were present on the site. Also, only a small percentage of the assemblage had cortex present, which suggests that the lithic

material was transported to the site in a partially decortified state, and secondary and tertiary core reduction took place at the site. The presence of biface reduction at LA 68648 is minimal.

Thirteen formal tools were collected from the site. These include a Basketmaker II projectile point, Basketmaker III projectile point, two spokeshaves, seven unifacial scrapers, and two bifacial scrapers (one of which is a preform). Also included in the lithic assemblage were 24 informal tools (utilized and/or retouched items). Twenty of these expedient tools were core flakes, and four were angular debris.

Table 5. LA 68648 lithic artifact analysis

CATEGORY	ATTRIBUTE	NO.	PERCENT
MATERIAL TYPE	Grants obsidian	951	93.8
	Chert	26	2.6
	Chalcedony	14	1.4
	Basalt	7	0.7
	Silicified wood	6	0.6
	Clear obsidian	4	0.4
	Siltstone	4	0.4
	Quartzitic sandstone	1	0.1
	TOTAL	1013	100.0
ARTIFACT TYPE	Core flakes	830	81.9
	Biface (retouch) flakes	7	0.7
	Angular debris	132	13.0
	Cores	7	0.7
	Informal tools	24	2.4
	Formal tools	13	1.3
	TOTAL	1013	100.0
INFORMAL TOOLS	Unidirectionally retouched flake	3	12.5
	Utilized flake	7	29.1
	Unidirectionally retouched and utilized flake	10	41.7
	Unidirectionally retouched angular debris	1	4.2
	Utilized angular debris	1	4.2
	Unidirectionally retouched and utilized angular debris	2	8.3
	TOTAL	24	100.0
FORMAL TOOLS	Basketmaker II projectile point	1	7.7
	Basketmaker III projectile point	1	7.7
	Spokeshave	2	15.4
	Uniface	7	53.8

CATEGORY	ATTRIBUTE	NO.	PERCENT
	Biface	2	15.4
	TOTAL	13	100.0
FLAKE PORTION	Whole	307	35.8
	Proximal	121	14.1
	Medial	154	18.0
	Distal	223	26.0
	Lateral	52	6.1
	TOTAL	857	100.0
CORTEX	0	616	71.9
	1-25%	103	12.0
	26-50%	45	5.3
	51-75%	20	2.3
	76-100%	73	8.5
	TOTAL	857	100.0

CONCLUSIONS

Four sites along SR 547 were tested to determine the nature and extent of subsurface remains within an area proposed for shoulder improvements. Most of each of these sites lies outside of the proposed right-of-way. Testing revealed very few diagnostic artifacts, except at LA 68648. The only feature encountered was the rock alignment at LA 68646, which has limited information potential. Although artifact densities were high in some areas, remains appeared to be surficial, as sterile soil and bedrock lay close to the surface at all four sites. Therefore, it is unlikely that the site portions within the project boundaries will yield important information on local prehistory beyond what has already been recovered. We do not recommend any further cultural resource studies at these portions of LA 37884, LA 68646, LA 68647, and LA 68648.

REFERENCES CITED

Allan, W. C., R. P. Gauthier, F. J. Broilo, and R. W. Loose
1976 *An Archaeological Survey near San Mateo, New Mexico: The Keradamex Incorporated Lease.* Office of Contract Archeology, University of New Mexico, Albuquerque.

Ambler, J. R.
1978 *An Archaeological Survey of the San Mateo Mine Area, Cibola National Forest, New Mexico.* Miscellaneous Paper 13, Cultural Resource Report 23. USDA Forest Service, Southwestern Region, Albuquerque.

Beal, John D.
1977a *A Structured Reconnaissance Survey in San Lucas Canyon near San Mateo, New Mexico.* School of American Research, Santa Fe.

1977b *Cultural Resource Evaluation in the Malpais Recreation Area.* School of American Research, Santa Fe.

Broster, John B.
1983 Paleo-indian Adaptations to High Altitudes on Cebolleta Mesa. In *High Altitude Adaptations in the Southwest*, edited by Joseph C. Winter. Cultural Resources Management Report No. 2. USDA Forest Service, Southwestern Region, Albuquerque.

Bryan, Kirk, and Joseph H. Toulouse, Jr.
1943 The San Jose Non-ceramic Culture and Its Relation to Pueblo Culture in New Mexico. *American Antiquity* 8(3): 269-280.

Chapman, Richard C., and Jeanne A. Schutt
1977 Methodology of Lithic Analysis. In *Archaeological Investigations in Cochiti Reservoir, New Mexico*, vol. 2, edited by R. C. Chapman and J. V. Biella, pp. 83-96. Office of Contract Archaeology, University of New Mexico, Albuquerque.

Condie, Carol J.
1987 *Cebolleta Park (LA 46424) and Noke (LA46425), Two Sites on BLM Land Near Milan, Cibola County, New Mexico.* Quivira Research Center Publications 124. Albuquerque.

Dart, Al
1982 Archaeological Background. In *A Cultural Resource Management Plan for Timber Sale and Forest Development as on the Pueblo of Acoma*, pp. 33-44, edited by John B. Broster and Bruce G. Harrill. Forestry Archaeological Program, BIA, Albuquerque Area Office.

Davis, Emma Lou
1964 *Anasazi Mobility and Mesa Verde Migrations.* Ph.D. dissertation, University of California, Los Angeles.

Dittert, Alfred E., Jr.
1959 *Culture Change in the Cebolleta Mesa Region, Central Western New Mexico.* Ph.D. dissertation, University of Arizona, Tucson.

Harrill, Bruce G.
1983 High-Altitude Resource Utilization in the Southwest: Problems and Prospects. In *High Altitude Adaptations in the Southwest*, edited by Joseph C. Winter. Cultural Resources Management Report No. 2. USDA Forest Service, Southwestern Region.

Hester, James L.
1962 *Early Migration and Acculturation in the Southwest.* Museum of New Mexico Papers in Anthropology No. 6. Museum of New Mexico Press, Santa Fe.

Irwin-Williams, Cynthia
1973 *The Oshara Tradition: Origins of Anasazi Culture. Origins of Anasazi Culture.* Eastern New Mexico University Contributions in Anthropology 5(1). Portales.

Judge, James W.
1973 *Paleo-indian Occupation of the Central Rio Grande Valley in New Mexico.* University of New Mexico Press, Albuquerque.

Keur, Dorothy L.
1941 *Big Bead Mesa: An Archaeological Study of Navajo Acculturation, 1745-1812.* Memoirs of the Society for American Archaeology.

Klager, K. L., and K. F. Anschuetz
1979a *An Archaeological Survey of Two Proposed Exploration Areas near La Jara Mesa, South of the Floyd Lee Ranch, for Keradamex, Incorporated.* Office of Contract Archeology, University of New Mexico, Albuquerque.

1979b *An Archaeological Survey of Eighteen Proposed Drill Pad Locations in Lobo Canyon, New Mexico, for ARKLA Exploration Co.* Office of Contract Archeology, University of New Mexico, Albuquerque.

Koczan, Steve A.
1977 *A Cultural Resource Inventory of 2 1/2 Sections of Land Near Tse Bonita School, New Mexico, for Pittsburgh and Midway Mining Co.* Laboratory of Anthropology Notes 193. Museum of New Mexico, Santa Fe.

Koczan, Steve, and W. H. Doleman
1976 *An Archaeological Inventory of a Five-Section Tract North-west of San Mateo, New Mexico, for Kerr-McGee Corp.* Laboratory of Anthropology Notes 233. Museum of New Mexico, Santa Fe.

Marshall, Michael P., John R. Stein, and Richard W. Loose
1979 *Anasazi Communities of the San Juan Basin.* Public Service Company of New Mexico and New Mexico Historic Preservation Bureau, Albuquerque and Santa Fe.

McGregor, John C.
1965 *Southwestern Archaeology.* 2d ed. University of Illinois Press, Urbana.

Moore, James L.
1989 *Data Recovery Plan for Three Sites along State Road 502, Santa Fe County, New Mexico.* Laboratory of Anthropology Notes 495. Museum of New Mexico, Santa Fe.

Moore, Roger A.
1983 Patterns in Synchronic and Diachronic Variation in the Prehistoric Lithic Assemblages. In *Cultural Resource Investigations on Gallegos Mesa: Excavations in Blocks VIII and IX, and Testing Operations in Blocks X and XI, Navajo Indian Irrigation Project, San Juan County, New Mexico*, vol. 2. Navajo Nation Publications in Anthropology No. 24.

Post, Stephen S.
1989 *Archaeological Survey of the Rinconada Mine, Cibola County, New Mexico.* Laboratory of Anthropology Notes 483. Museum of New Mexico, Santa Fe.

Powell, Nina
1978 *An Archaeological Clearance Survey of 2 1/2 Sections of Land on La Jara Mesa, West of Mt. Taylor, West Central New Mexico.* Cultural Resources Management Division, New Mexico State University, Report 263. Las Cruces.

Schaafsma, Curt F.
1978 *An Archaeological Survey adjacent to San Mateo Mesa, Cibola National Forest, New Mexico.* Miscellaneous Paper 23, Cultural Resources Report 25. USDA Forest Service, Southwestern Region, Albuquerque.

Tainter, Joseph A., and David A. Gillio
1980 *Cultural Resources Overview, Mt. Taylor Area, New Mexico.* USDA Forest Service, Southwestern Region, Albuquerque, and Bureau of Land Management, New Mexico State Office, Santa Fe.

Vierra, Bradley J.
1985 *Testing Procedures and Research Design for the Coors Road Site, Bernalillo County, New Mexico.* Laboratory of Anthropology Notes 345. Museum of New Mexico, Santa Fe.

APPENDIX 2: LITHIC METHODOLOGY
(modified from Vierra 1985 and Moore 1983)

Lithic artifacts were classified as follows: lithic reduction debitage (flakes and angular debris); cores; formal, facially retouched tools (i.e. bifaces, projectile points and scrapers); and informal tools (flakes that are utilized and/or exhibit marginal (directional) retouch).

Angular debris

Pieces of material that are incidentally broken off during core reduction or tool manufacture are called angular debris. These pieces lack definable flake characteristics, such as a platform, bulb of percussion, and proximal/distal ends. Angular debris can take the form of large (>40 g) or small (<40 g) chunks (Chapman and Schutt 1977); no weights were differentiated for analysis in this case, though most if not all pieces probably fell under 40 g.

Flakes

Core flakes

Core flakes are pieces of material that have been detached from a core or a tool and which exhibit definable flake characteristics. These characteristics may include the presence of a striking platform, ventral and dorsal surfaces, a bulb of percussion, an eraillure, lines of force, and proximal and distal ends.

Biface flakes

Biface flakes are retouch flakes that have been detached from a bifacially retouched artifact. Attributes for biface flakes include a bidirectionally retouched platform; a lipped platform; dorsal scars that are parallel to each other and perpendicular to the platform; a thickness of 5 mm or less that is relatively even from proximal to distal ends; a weak bulb of percussion; a platform angle of 45 degrees or less; and a pronounced curvature (Harlan 1983).

Uniface Flakes

Uniface flakes are retouch flakes that may have been detached from a unifacially retouched artifact. They have the same characteristics as biface flakes, with the exception of a unidirectionally retouched platform and a platform angle greater than 45 degrees.

Retouch flakes

Tool retouch flakes that cannot be confidently defined as either biface or uniface flakes are called retouch flakes.

Core flakes

Core flakes are flakes that have been detached from a core. Attributes include single or multifaceted platforms, dorsal scars that may be parallel or perpendicular to the platform if they appear at all, a pronounced bulb of percussion, a thickness of 5 mm or more, and an eraillure.

Utilized Flakes

Flakes which exhibit some degree of use wear are called utilized flakes. Such flakes are also considered informal tools.

Flake Attributes Monitored

Material type

The lithic material type was recorded for all artifacts.

Material Color

The lithic material color was recorded for all artifacts.

Material texture

The lithic material texture (fine, medium, coarse, glassy) was monitored for all artifacts.

Measurements

The length, width, and thickness of artifacts were recorded in mm, using a sliding caliper. Length is defined as the distance along the proximal-distal axis of a flake and as the longest axis of the artifact for angular debris. The width measurement is taken perpendicular to the proximal-distal axis or the longest axis. Thickness is "the greatest measurement once the proximal-distal axis was rotated 90 degrees from the plane created by the length and width measurements" (Schutt and Vierra 1980:50).

Condition

The condition of the flake was recorded as either whole, or as proximal, distal, medial, or lateral fragments. These conditions were not applicable to angular debris.

Cortex

Cortex is the natural outer weathered surface of a lithic nodule. Cortex was noted for the dorsal surface and for the platform on flakes, and for the entire surface on angular debris. Given this, percentage of the amount of cortex was monitored in terms of 5 categories: 0, 1-25%, 26-50%, 51-75%, and 76-100%. Primary core reduction is indicated

by greater than 50% cortex; secondary reduction by less than 50% cortex, and tertiary by no cortex.

Platform type

The following types of platforms were recorded for flakes: cortical, collapsed, absent, single facet, single facet/abraded, multifacet, multifacet/abraded, retouched, retouched/abraded, crushed, obscured, and ridge. A cortical platform is unprepared and situated on cortex. A faceted platform has been prepared by removing a flake(s) to create a scar which is then used as a striking platform. An abraded platform is one that has undergone grinding so that the edges are rounded and worn. Grinding may be caused by either natural or human forces, or both. Retouched platforms are prepared platforms, which represent the edge margins of retouched artifacts. Unidirectionally and bidirectionally retouched platforms are generally representative of tool retouch flakes; however, cores might also have platforms which were prepared by retouch (i.e., to strengthen a platform and increase the control over flake removal). A collapsed platform occurs when the majority of the platform breaks away during removal of the flake. A battered platform exhibits impact scars or percussion rings which are the result of a cortical platform being struck, or the platform surface being hit by another object (e.g. a hammerstone). Crushed platforms are similar to battered platforms, only the platform or parts of it may be heavily damaged. Obscured platforms are platforms where the entire surface is damaged, so that the whole platform is hidden and deformed by scarring. The presence or absence of platform lipping was also recorded.

Alterations

Alterations include thermal, utilized edges (up to 5), uni- and bi-directional retouch, and uni- and bi-facial retouch.

Thermal

Thermal alterations are manifested by an unnatural luster, crazing, and/or potlids. Thermal alteration, or heating of the rock, can aid in controlling the way in which the rock will break by making it harder.

Retouch

Unidirectional retouch is retouch that extends less than one-third over the surface on one side of an artifact. Bidirectional retouch is retouch which extends less than one-third over the surface of two sides of an artifact (Chapman and Schutt 1977:36). Unidirectionally retouched artifacts may reflect expedient, informal tools used as scrapers. In contrast, bidirectionally retouched artifacts may represent expedient tools used for cutting activities.

Unifacial retouch is retouch that extends more than one-third over the surface on one side of an artifact. Bifacial retouch is retouch that extends more than one-third over the surface on two sides of an artifact. Both uni- and bifacial retouch are indicative of formalized tools.

Comments

Comments were made about various attributes that were not formally included within the debitage analysis format. These might include flawed characteristics, artifacts broken in manufacture, metal adhesions, soft hammer percussion, patination, and/or anything unusual.

Cores

Two different types of cores were recorded. These were test cores and single-faceted cores. Single-faceted cores are cores with all the flakes removed from one platform. A test core is a core with one flake removed. It may represent a cobble that has been tested for material quality and then discarded. Other types of cores include multifaceted, unidirectional, bidirectional, unifacial and bifacial, and pyramidal cores. None of these were found on any of the sites. Cores were monitored with the same attributes which were used for flakes.

Informal Tools

Informal tools are defined as "debitage or cores which are used for a task without having their shape and/or edge angle purposefully modified" (Moore:1983). Since it is unclear whether directional (i.e., marginal) retouch is purposeful, such retouch is included in this category. Informal tools are therefore artifacts which are utilized and/or uni- or bidirectionally retouched. The same attributes were monitored for informal tools as for debitage.

Formal Tools

Formal tools are "debitage purposefully modified to produce a shape and/or edge angle suitable for a specific purpose or set of tasks" (Moore:1983). Formal tools can also be utilized, but must be retouched either unifacially or bifacially. Formal tools include bifaces, unifaces, projectile points, spokeshaves, drills, and scrapers. Formal tools were monitored for the same attributes as debitage. Projectile points were additionally assigned a typology.