MUSEUM OF NEW MEXICO

OFFICE OF ARCHAEOLOGICAL STUDIES

LOCO HILLS TESTING: ARCHAEOLOGICAL TEST EXCAVATIONS AT TWO SITES ALONG U.S. 82, EDDY COUNTY, NEW MEXICO

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ADMINISTRATIVE SUMMARY

Between December 8 and 11, 1992, and January 4 and 8, 1993, the Office of Archaeological Studies (OAS), Museum of New Mexico, conducted archaeological test excavations at LA 43315 and LA 89658 along U.S. 82, northeastern Eddy County, New Mexico. Excavations were conducted at the request of William L. Taylor, New Mexico State Highway and Transportation Department (NMSHTD). The sites are located on land administered by the USDI Bureau of Land Management (BLM), Carlsbad Resource Area.

LA 43315 is a large site consisting of 13 irregularly shaped blowouts separated by low shinnery oak- and mesquite-covered coppice sand dunes. Artifacts, including chipped stone flakes, brown ware sherds, and fire-cracked rocks, are present on the surface of all but one blowout. One blowout has stains of dark, ashy sand, perhaps representing burned features buried beneath adjacent dunes. A strip 12 m wide along the north side of the site is within NMSHTD right-of-way, comprising about 13 percent of the site area. Archaeological testing was limited to that area. Test excavations at LA 43315 focused on determining whether significant cultural deposits or features were present within NMSHTD project limits and the depositional context of artifacts or features. A single ashy stain apparently represents a simple hearth dug into the floor of a large blowout. A calibrated radiocarbon date of A.D. 980 (range: 887-1023) was obtained from mesquite charcoal in the hearth. Macrobotanical analysis reveals no evidence of food processing or preparation. Hand and mechanical excavation did not reveal any other features or cultural deposits within NMSHTD project limits.

LA 89658 is a small site consisting of a concentration of fire-cracked limestone rocks, four scattered pieces of fire-cracked limestone, and a possible ground stone fragment. Other than the possible ground stone fragment, no artifacts were found on the surface of the site. Test excavations at LA 89658 focused on determining whether a subsurface hearth feature was present beneath the concentration of fire-cracked limestone and whether buried features or cultural deposits were present within NMSHTD project limits. No chronometric or relative date can be given for the site. Excavations revealed that the shape and dimensions of the hearth cannot be defined, although a lens of possible burned sand suggests a depth of about 20 cm. This information indicates that the hearth was not used for a long time. The site was probably a short-term campsite.

The simple hearth at LA 43315 cannot be expected to yield data beyond what has been gained through analyses of the collected flotation and radiocarbon samples. No chronometric or relative date can be given for the hearth at LA 89658, and its shape cannot be defined. Hand and mechanical excavations at LA 89658 revealed that it is very unlikely that other features or cultural deposits are buried in the shallow soil at the site. Given the extent and results of archaeological test excavations at LA 43315 and LA 89658, we feel that the goals of testing have been met. Extensive testing has failed to reveal the presence of significant cultural deposits or features at either site, and no further studies are recommended in conjunction with this project.

Submitted in fulfillment of Joint Powers Agreement DO5486 between the New Mexico State Highway and Transportation Department and the Office of Archaeological Studies, Museum of New Mexico, Office of Cultural Affairs.

NMSHTD Project No. F-028-2(5).
MNM Project No. 41.552 (Loco Hills Testing).
Test excavations conducted under authorization of USDI BLM Cultural Resource Use Permit No. 21-8152-92-8.

CONTENTS

Figures

Tables

INTRODUCTION

An archaeological survey along U.S. 82 east of Artesia, Eddy County, New Mexico, recorded two archaeological sites and relocated two others (Marshall and Evans 1992). The survey was conducted by the New Mexico State Highway and Transportation Department (NMSHTD) in advance of planned reconstruction of a portion of U.S. 82. Of the four sites, all located on land administered by the USDI Bureau of Land Management (BLM), Carlsbad Resource Area, two are beyond project limits and will be avoided by NMSHTD planned activities. The other two, LA 43315 and LA 89658, extend into the project limits and cannot be avoided. A program of archaeological testing was recommended to determine the extent and data potential of the portions of these sites within project limits.

Between December 8 and 11, 1992, and January 4 and 8, 1993, the Office of Archaeological Studies (OAS), Museum of New Mexico, conducted archaeological test excavations at LA 43315 and LA 89658. Excavations were conducted at the request of William L. Taylor, NMSHTD, and were authorized by BLM permit number 21-8152-92-8. Yvonne R. Oakes, OAS assistant director, acted as principal investigator, while Jeffrey L. Boyer acted as project director. The field crew consisted of Boyer, Vernon Lujan, Christine Sterling, Deborah Johnson, and Marcy Snow. Eligio Aragon of Alley Cat Excavating operated the backhoe for mechanical excavations. In the laboratory, Regge Wiseman helped Deborah Johnson analyze the ceramic artifacts. Johnson analyzed the lithic artifacts, and Mollie Toll identified the radiocarbon samples and analyzed the macrobotanical samples.

The Loco Hills project area is in northeastern Eddy County, approximately 44.2 km (27.5 miles) east of Artesia (Fig. 1). LA 43315 is about 2.4 km (1.5 miles) east of the village of Loco Hills, and LA 89658 is about 5.6 km (3.5 miles) east of Loco Hills. See Appendix 1 for site location information (this appendix has been removed from copies intended for public distribution).

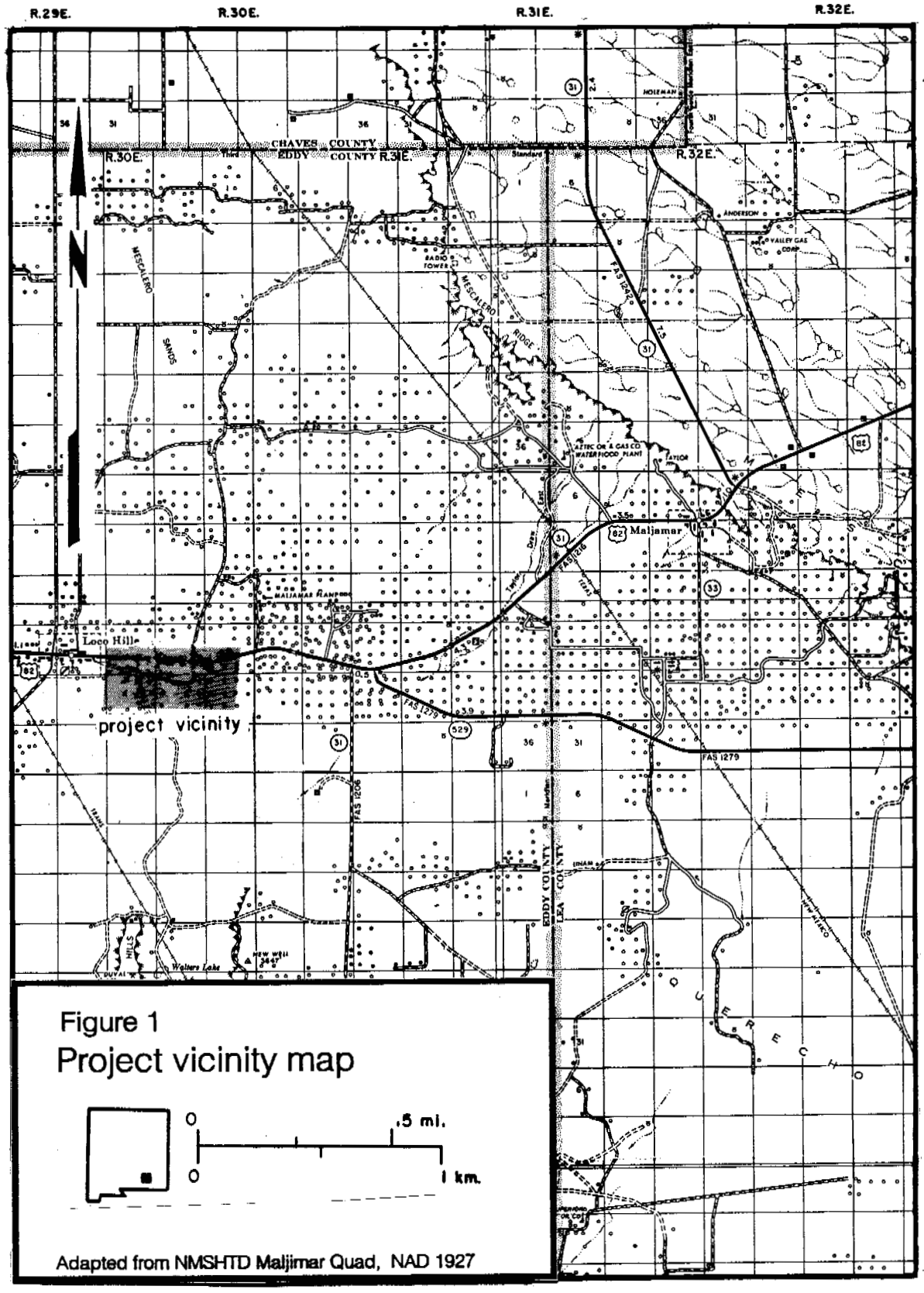

Figure 1
Project vicinity map

0 .5 mi.
0 1 km.

Adapted from NMSHTD Maljimar Quad, NAD 1927

NATURAL ENVIRONMENT

Regional Physiography and Geomorphology

The Loco Hills project area is in the middle Pecos Valley of southeastern New Mexico. Sebastian (1989a:4) defines the middle Pecos Valley as reaching from Alamogordo Reservoir north of Fort Sumner to the New Mexico-Texas state line. It stretches between the Capitan, Sacramento, and Guadalupe Mountains on the west and the Llano Estacado on the east. The project area is in the southern portion of the middle Pecos Valley, near Artesia. Principal tributary drainages of the Pecos in this portion stretch up to 160 km (100 mi) from the western mountains. Smaller, intermittent arroyos drain west from the Llano Estacado escarpment.

The project area is about 22 km (13.5 mi) west of the Llano Estacado escarpment near the eastern edge of the Pecos Valley (Fig. 2). The Llano Estacado is the remnant of an alluvial plain that once reached from the eastern side of the Rocky Mountains to the Great Plains. The uppermost formation of this plain is a sandy alluvium known as the Ogallala formation. It overlies thick, sedimentary shale and limestone deposits. Within the Ogallala formation, carbonate deposits form a thick caliche layer known throughout the region as "the caprock" (Sebastian 1989a:4-7).

On its west side, the Llano Estacado is separated from the mountains of central New Mexico by the Pecos Valley, which is bisected by the Pecos River. The Pecos River originally drained the Sacramento Mountains but eventually joined the "Upper Pecos-Brazos system," which drained the southwestern side of the Sangre de Cristo Mountains (Sebastian 1989a:7). In so doing, it began to run from north to south on the plains east of the mountains. Eventually, cutting and erosion created the broad Pecos Valley and separated the Llano Estacado from the mountains. Five erosional surfaces are defined within the Pecos Valley (Fig. 3). The uppermost is the Sacramento Plain, stretching east from the mountain foothills. Joyce and Landis (1986:7), Landis and Bamat (1986:9), and Sebastian (1989a:7) correlate this surface with the Ogallala formation of the Llano Estacado on the opposite side of the valley. However, their geologic cross-section maps, which are taken from the work of Nials (1980), show that the Sacramento Plain is the exposed surface of a sedimentary formation that also underlies the Ogallala formation. The Sacramento Plain may have been the contact zone between the Llano Estacado and the mountain foothills.

Below the Sacramento Plain is a second erosional surface that seems to expose the same sedimentary formation exposed in the Sacramento Plain. It is known as the Diamond A Plain or Pediment (Joyce and Landis 1986; Landis and Bamat 1986; Sebastian 1989a) and has been correlated with the Mescalero Plain or Pediment on the east side of the valley. The latter is a sedimentary formation underlying the Ogallala formation but overlying the earlier sediments exposed on the Diamond A and Sacramento Plains. Therefore, it seems likely that the Diamond A Plain represents a contact zone between the Mescalero Plain sediments and the mountain foothills.

The Pecos River has cut a wide floodplain into the floor of the valley. The three latest erosional surfaces are found within that area. They are the Blackdom, Orchard Park, and Lakewood terraces and are not relevant to this project.

The Loco Hills project area is located on the Mescalero Plain or Pediment east of the Pecos River

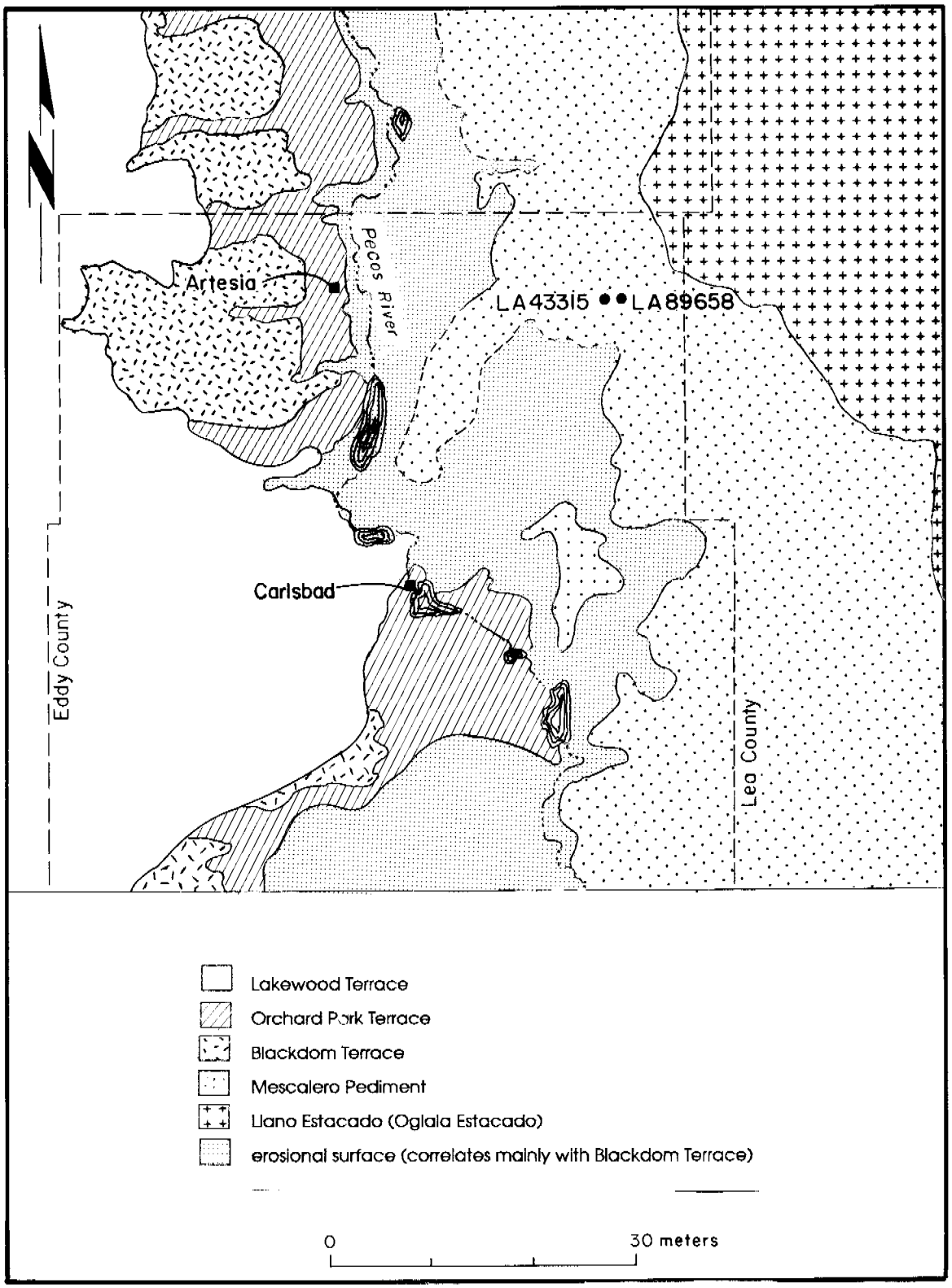

Figure 2. Geomorphic surfaces in the middle Pecos Valley (after Nials 1980).

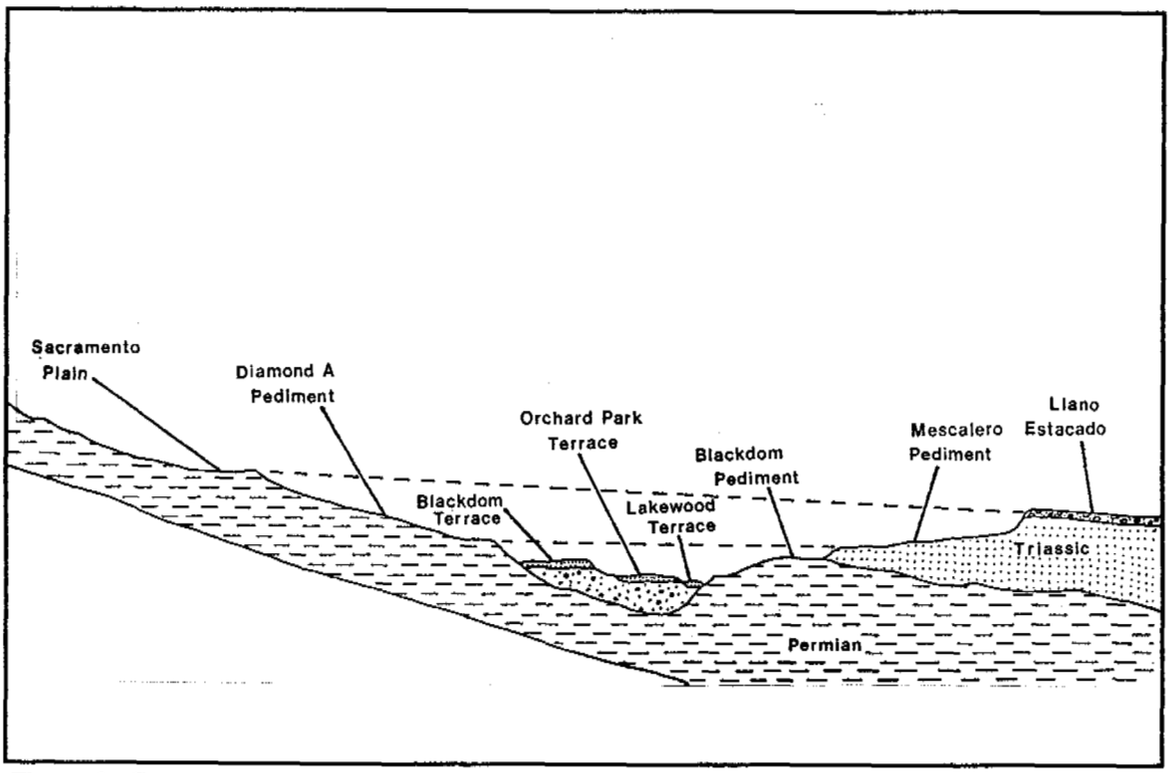

Figure 3. Cross section of the Pecos Valley showing relationships between geomorphic surfaces.

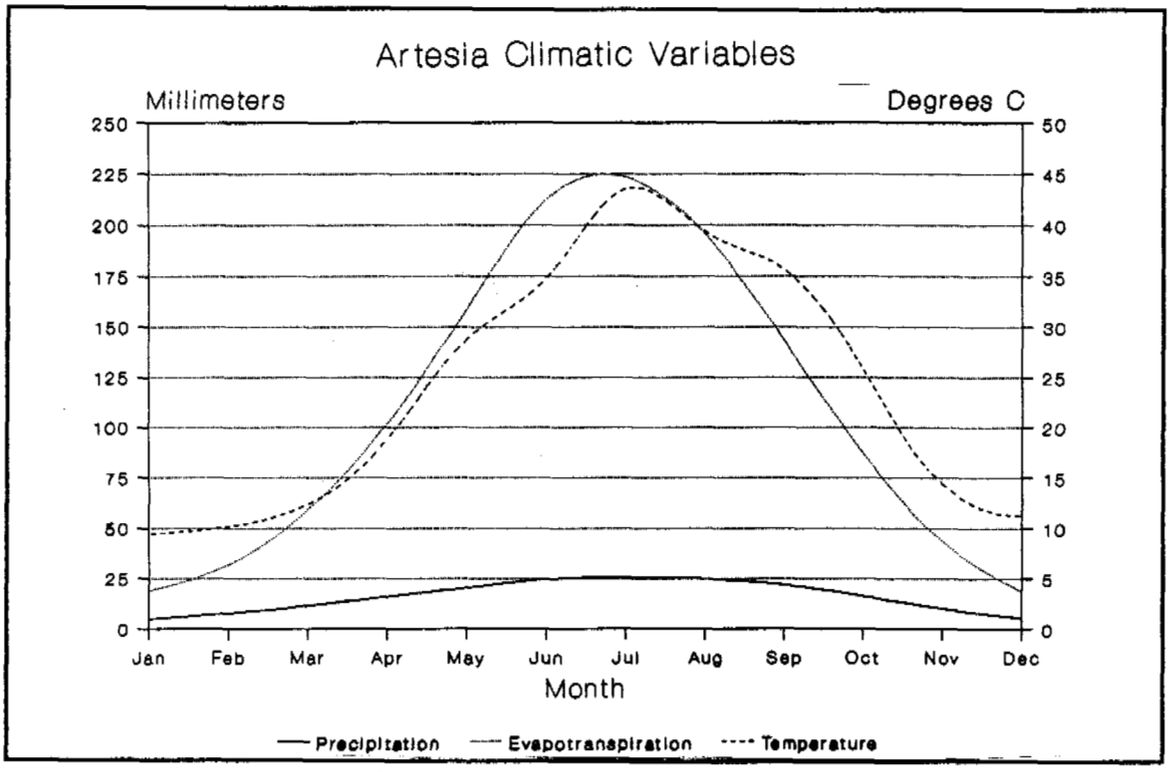

Figure 4. Artesia climatic variables.

(see Fig. 2). This erosional surface is exposed in a belt along the west side of the Llano Estacado. It ranges in width from about 10 km (6 mi) north of Kenna to 70 km (43.5 mi) near the New Mexico-Texas state line. The plain slopes gradually to the west. Most of the Mescalero Plain is covered by eolian dune sands known as the Mescalero Sands. They are derived from Pecos Valley soils carried west by prevailing winds and trapped atop the Mescalero Plain against the escarpment of the Llano Estacado. Apparently, the Mescalero Sands are the product of several cycles of eolian deposition and erosion that produced three to nine series of dune formations. In the simpler sequence with three series, the earliest is older than 15,000 years, the latest is younger than 5,000 years, and the intermediate series formed some time between these dates. A more complex sequence of nine dunes from the Monahans area of western Texas has been tentatively correlated with deposits in Lea County (Joyce and Landis 1986:12; Landis and Bamat 1986:10). Beneath the dunes is a 5 to 6 m (16 to 20 ft) thick caliche formation, thought to correlate with formation of the Blackdom Terrace.

Soils

The following description of soils and soil formation is quoted from Joyce and Landis (1986:12-13), Landis and Bamat (1986:13-15), and Bowman et al. (1990:11-12). It is derived from Nials's (1980) extensive work in the region.

> Unconformably overlying indurated caliche in much of this part of southeastern New Mexico is a strongly weathered red soil. There are relatively minor amounts of pedogenic clay in this soil, which also is slightly argillaceous and relatively more resistant to eolian erosion than are overlying sandy sediments and soils. Water erosion, however, has affected this soil, and in many places it has been eroded totally away, exposing the underlying caliche. At the other extreme, the soil's maximum thickness is estimated to be in excess of 6.6 ft (2 m) in some areas. Due to its composition and stratigraphic position, it is interpreted to have been formed in the very late Pleistocene, 10,000 to 15,000 years ago. The soil is easily recognized by its bright red color and is a convenient marker horizon for archaeologists. Erosion of overlying sediments and soils often lags cultural materials to the lower surface.
>
> Subsequent localized erosional and depositional processes resulted in the accumulation of at least 10 ft (3 m) of dune sand over varying thicknesses of the Pleistocene soil described above. Weak soil formation occurred in these sands and is estimated to date to 3,000-4,000 years ago (Archaic period in age). These "Altithermal" soils are characterized by cambic B or color B horizons, but are represented only poorly in localized areas of southeastern New Mexico. The only identifying feature of this soil is . . . a slight reddening below unaltered sediments of the overlying horizon. Intense eolian erosion and deposition after this weak soil formation may well have obscured its identification in most areas.
>
> Organic materials later began to accumulate during the initial stages of soil development, forming a weak A horizon during a period of relative stability. It is common to find this horizon associated with ceramic artifacts in southeastern New Mexico. Informally called a "Puebloan" soil, this relatively dark, humic-stained soil in some areas overlies a very slight reddening indicative of incipient B horizon development. During this soil formation, local eolian erosion continued to a minor degree and redeposited some organically stained sediments. In some localities, evidence of this appears as multiple or unusually thick organic-rich horizons.

Modern deposits of unconsolidated, unmodified eolian sand overlie buried remnants of the soils described above in many of the dunes of southeastern New Mexico. These deposits have no signs of pedogenic alteration and usually are cross bedded and/or laminated. On occasion, darker, humic-stained horizons of sand are present, but they represent redeposition of materials derived from nearby exposures of earlier soils. These modern sands vary in thickness from little more than a trace up to 16 ft (5 m). Where these sands are thick, they serve to protect archaeological materials on some cultural resource sites. However, most sites in southeastern New Mexico have been eroded to some extent by deflation in modern times, and it often is difficult to find sites in primary context.

The "strongly weathered red soils" overlying the caliche bed appear to be Typic Haplargids, which make up about half of the Haplargids-Torripsamments association within which the sites are located. These thick, reddish-brown, sandy clay loam subsoils are generally found in "the gently undulating areas between the dunes and rolling ridges occupied by deep sands" (Maker et al. 1974:36). That is, they are most commonly seen in blowout floors. As discussed above, this is because their clay content and compact nature make them less susceptible to eolian erosion.

The other half of the association consists of Typic Torripsamments, which occur on coppice dunes. They are loose, easily eroded, brown to reddish-brown, fine sands overlying thick deposits of fine sand (Maker et al. 1974:37). The upper, loose sands appear to correspond to the "modern deposits of unconsolidated, unmodified eolian sand" described above. The lower part of these sands may correspond to the "Altithermal" soils described above, dating between 4,000 and 3,000 B.P.

Water

The Pecos River and its major tributaries are the only perennial sources of flowing water in southeastern New Mexico. The river is about 35 km (22 mi) west of this project area and was probably not a significant water source at either site. Cedar Lake Draw is a wide, shallow drainage basin about 3.2 km (2 mi) southeast of LA 43315 and 1.7 km (1.1 mi) south of LA 89658. Drainage feeds into an intermittent basin called Cedar Lake. Permanent water is not available at the "lake" or in the draw; whether either was a permanent water source in the past is not known.

There are no sources of water on either site. However, at LA 43315, we noticed that an area near the west side of the site was characterized by tall, long-stemmed, broad-leafed grasses growing within the on-site shrub-grassland community. Whether this reflects the presence of high surface water and what the source of such water might be is not known but was frequently the subject of speculation during fieldwork.

Climate

Modern Climate

Maker et al. (1974:26-27) describe the climate of southeastern New Mexico as

the arid continental type, characterized by low rainfall, warm summers, and mild winters. Somewhat more than half of the annual precipitation falls in summer. The moisture distribution pattern in the Pecos Valley part, as in the remainder of eastern New Mexico, is a minimum in winter rising to a summer maximum. . . . Most of the summer precipitation falls as brief but occasionally heavy thunderstorms. Prolonged rains are practically unknown. Snow falls a few times each winter but usually disappears within a day. Winds are light to moderate throughout most of the year but may be strong during the spring. Humidities are low.

Mean temperatures at Artesia range from 5.0 degrees C (41.0 degrees F) in January to 26.1 degrees C (78.9 degrees F) in July (Gabin and Lesperance 1977:117). "Maximum day and minimum night temperatures commonly differ 30 degrees [F; 16.7 degrees C] or more. Artesia had a record maximum temperature of 116 degrees [F; 46.7 degrees C] and a minimum of 35 degrees below zero [F; -37.2 degrees C]" (Maker et al. 1974:27). Artesia has an average frost-free season of 198 days between April and October.

Mean monthly precipitation in Artesia ranges from 9.4 mm (0.4 inch) in January to 47.7 mm (1.9 inches) in July, with an annual mean of 284.5 mm (11.2 inches). Mean monthly potential evapotranspiration (PE) ranges from 18.8 mm (0.7 inch) in January to 229.4 mm (9 inches) in July, with an annual mean of 1,296.9 mm (51.1 inches). There is a significant precipitation deficit ranging from 7.5 mm (0.3 inch) in December to 189.3 mm (7.5 inches) in June, with an annual precipitation deficit of 1,012.2 mm (39.9 inches) (Gabin and Lesperance 1977:117). Figure 4 shows the differences between precipitation and PE. It also shows that the annual increases and decreases in precipitation deficit correspond closely to temperature, although the annual decline in PE occurs slightly ahead of the temperature decline. The months of maximum precipitation are May through October (Gabin and Lesperance 1977). Artesia receives an average of 213.1 mm (8.4 inches) of precipitation during this period. Using Allessi and Power's (1965:612) figure of 152 mm of water as a minimum requirement for corn germination, growth, and fruit production, there is enough moisture available from precipitation during this six-month growing season. However, this is also the hottest period of the year, and, consequently, evapotranspiration is very high, averaging 1,038.4 mm (40.9 inches). This creates a moisture deficit of 825.3 mm (32.5 inches) during the growing season that would need to be made up by ground moisture stored from precipitation during the winter and spring. Those months, however, contribute only 25.1 percent of the average annual precipitation, and Figure 4 shows that there is a precipitation deficit during those months as well. These data are supported by climatic data from the nearby communities of Maljamar, Hobbs, and Lovington in Lea County (Gabin and Lesperance 1977:175, 177, 178). They demonstrate that under modern desertic conditions, agriculture is at best a precarious economic pursuit without substantial supplemental water.

Paleoclimate

The current climatic conditions may have characterized the region since about 500 B.C. Elias and Van Devender (1992) studied numerous radiocarbon-dated packrat middens from the northern Chihuahuan Desert of southwest Texas and southeast New Mexico. Their results show that during the last glaciation of the Pleistocene, faunal and floral species throughout the region were those of temperate environments. Coniferous woodlands were widespread. Beginning about 20,000 B.C., the floral record suggests a shift to open woodlands with a "well-developed grassy understory" (Elias and Van Devender 1992:13). "The transition from the temperate fauna of the Wisconsin interval to the more xeric fauna of the post-glacial interval started at about 12,500 YBP [10,500 B.C.] with the

arrival of the first xeric-adapted species" (Elias and Van Devender 1992:113). The "principal botanical change" marking this transition was the disappearance of piñon pine, which occurred between about 9000 and 8250 B.C. Still, a number of temperate species persisted in the region, living primarily near the northern edge of the Chihuahuan Desert in ecotonal situations created by shifts in the desert boundary. By 5500 B.C., halfway through this transition period, there is good evidence for the establishment of desert grasslands. Finally, by 500 B.C., "the last of the temperate species are replaced by species associated with desertscrub communities" (Elias and Van Devender 1992:114). After that time, only desert species are identified in the packrat middens. While the Loco Hills project area is in the desert grassland zone somewhat north of the Chihuahuan Desert, Elias and Van Devender's data suggest that regional climatic conditions have not changed substantially since about 500 B.C.

Gunn (1987) provides a different perspective. Using a "precession-volcanism" curve that plots global climatic change based on intensity of volcanism, he sees several trends that he feels may be important for understanding human use of southeastern New Mexico. The curve plots temperature changes relative to a line at 15 degrees C, below which the climate is temperate to mesic and above which it is xeric. Prior to about 9000 B.C., the global climate was relatively temperate but shifting toward drier conditions. The curve crosses the 15 degree line to xeric conditions about 8000 B.C., about the time Elias and Van Devender feel that piñon woodland communities disappeared due to a shift to drier conditions. Following a moderately temperate shift between 6700 and 6000 B.C., the curve stays between 15 and 16.5 degrees for four millennia. This is the longest and most xeric period in Gunn's sequence. Around 1900 B.C., the curve drops below the 15 degree line. From 1000 B.C. to about A.D. 1650, the curve stays on the temperate side of the line, with short mesic peaks around A.D. 200, 800, and 1500. Around A.D. 1650, the curve again crosses the line to drier conditions. As it nears the present, it nears 16 degrees C. While Gunn's curve is similar to Elias and Van Devender's data prior to 2000 B.C., there are significant differences after that time. Elias and Van Devender find evidence for increasingly drier conditions through time, reaching the modern climate by 500 B.C. Gunn sees a long temperate period with mesic peaks lasting until about A.D. 1650, followed by a shift to modern desertic conditions. Gunn argues, then, that the shift to the modern climate occurred about 2,100 years after the date determined by Elias and Van Devender. This is potentially very important since it has implications for understanding human adaptations to local and regional environmental conditions. Gunn (1987:76-77) correlates transitions between phases in the Terminal Archaic and Late Prehistoric (Ceramic) periods with episodes of high volcanism and cooler, more temperate climatic conditions. He suggests that the movement of puebloan "village life" into the region was associated with temperate conditions that encouraged expansion of puebloan society and economy. However, he does not speculate why mesic conditions around A.D. 900 should encourage puebloan expansion while similar conditions around A.D. 1300 would force reduction of the puebloan range back to the north and east.

The disagreements between Gunn and Elias and Van Devender are symptomatic of controversies over paleoclimatic reconstructions for the region. Sebastian (1989a) notes that the period of most disagreement seems to be between about 5000 and 3000 B.C. These years correspond to Antev's altithermal period, characterized as dry and warm. Gunn's volcanism sequence shows a similar period between 7000 and 2000 B.C. But Elias and Van Devender's data do not support this interpretation; rather, they see a gradual drying beginning about 10,500 B.C.

Although Sebastian (1989a:17) sees consistency in paleoclimatic reconstructions after 3000 B.C., her review is at odds with both Gunn and Elias and Van Devender. She feels that pollen data show

increasing moisture after 3000 B.C., with a marked increase beginning about 500 B.C. These conditions lasted until about A.D. 1000, after which moisture conditions similar to those of modern times have prevailed. Sebastian offers a third opinion on when modern desertic conditions began in the region, between Elias and Van Devender's date of 500 B.C. and Gunn's date of A.D. 1650, but closer to the latter. This points out the need to resolve this issue, since it is likely to be critical for understanding human use of the region. As discussed in the next chapter, controversy over regional culture history, particularly in the Ceramic period, centers on the role of agriculture in regional adaptation. We noted above that modern climatic conditions make agriculture a tenuous economic strategy without a great deal of supplemental water. Consequently, dating the transition to climatic conditions approximating those of today is vital for understanding prehistoric economic strategies.

Vegetation

The Loco Hills project area is in the semidesert grassland of southeastern New Mexico. This area is transitional between the plains grassland of the Great Plains to the north and east and the Chihuahuan Desert to the south. Characteristic grasses are short-stemmed and include black, slender, and chino grama, bush muhly, threeawn, buffalograss, Indian ricegrass, and alkali sacaton. These grasses co-occur with a desert shrub community that includes mesquite, shinnery oak, sand sage, chamisa, snakeweed, catclaw acacia, hackberry, and creosotebush. Succulents include sotol, various agaves and yuccas, cholla, prickly pear, and other cacti (Brown 1982). Vegetation in the project area is dominated by shinnery oak and lesser amounts of mesquite in association with various grasses.

Oakes (1982:12) notes that the dunal area of Eddy County is included in the Shinnery Belt, a somewhat linear vegetation zone whose shrub community is dominated by shinnery oak and, to a lesser extent, by mesquite. Largely although not exclusively bounded on the east by the Llano Estacado, the Shinnery Belt seems to follow the Mescalero Plain and Sands, with the exception of a large oak area in southern Roosevelt County. Oakes (1982) examined historic maps showing the extent of the belt and its vegetative zones. Figure 5, taken from her report, shows shinnery oak and mesquite localities in the region in 1880. The location of this project area north of the nearest overlapping oak and mesquite localities suggests expansion of the specific localities during the last century.

In another report, Oakes (1985) discusses differing opinions regarding the use of mesquite and oak by the region's prehistoric and early historic aboriginal inhabitants. While mesquite pollen is present in prehistoric pollen records, and its use has been documented at prehistoric sites (O'Laughlin 1981; Carmichael 1981; Oakes 1981), Phillips (cited in Oakes 1985:6) has suggested that nonriverine mesquite was relatively restricted in distribution until recent overgrazing and fire suppression allowed its range to expand. Thus, he feels it was not a dependable food resource during prehistoric or early historic periods. Likewise, Phillips (cited in Oakes 1985:7) contends that shinnery oak was not extensively used as a food resource. Although the bitter acorn of the shinnery oak was a documented food of the Mescalero Apaches (Basehart 1974), Phillips notes that tannin leaching was not common among other Southwestern Indians and, therefore, feels that the acorns were not commonly used prehistorically. Based on site locations, on-site features, and local resource availability, Oakes (1982, 1985) argues that her Hackberry Lake sites were the scenes of acorn and mesquite collection and processing. Obviously, the issues of prehistoric availability and use of these two shrubs, which are now so common in the region, are tied both to the accuracy of paleoclimatic reconstructions and to historic and modern land use. The latter may be approached by analysis of historic documents, much

as Oakes has done for the Shinnery Belt. However, the shift to essentially modern desertic conditions and the prehistoric distribution of these plants must be better defined before the issues of availability can be resolved. Similarly, data recovery investigations at sites in the region must focus on collecting economic data, both direct and indirect, to resolve the issues of use.

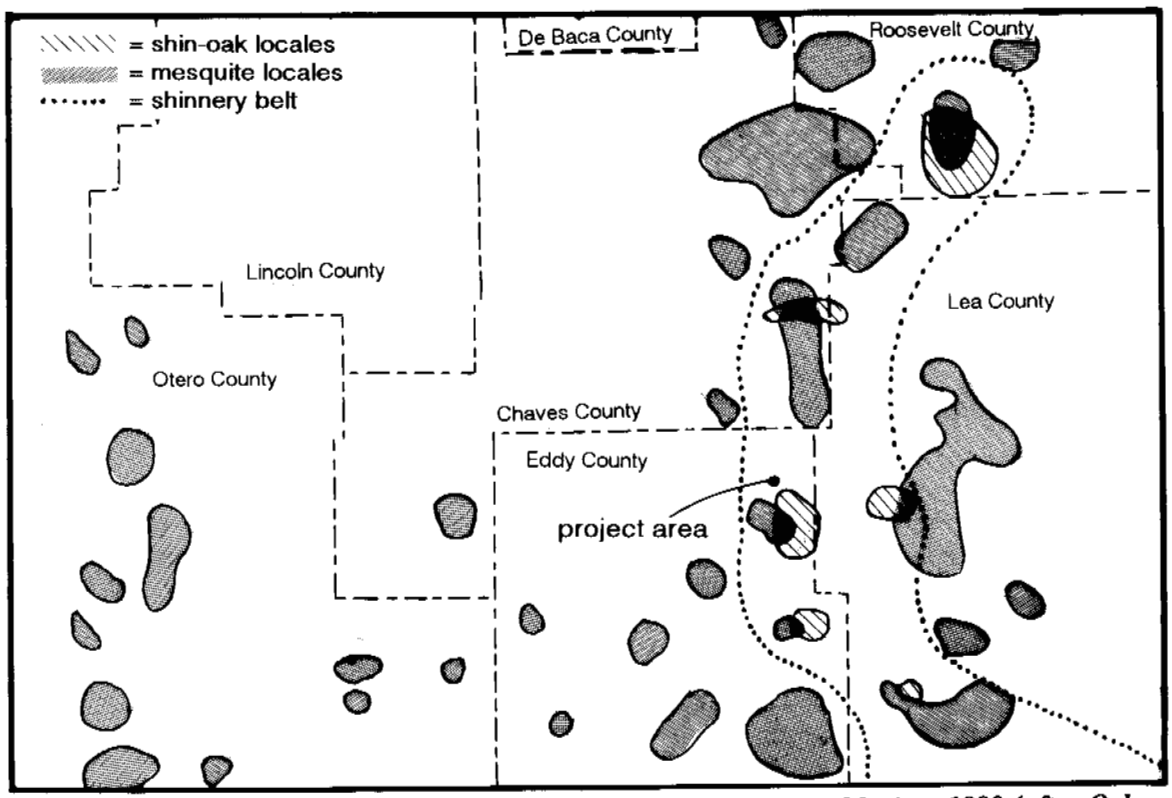

Figure 5. Shinnery oak and mesquite localities in southeastern New Mexico, 1880 (after Oakes 1982).

Fauna

The mammalian fauna of the semidesert grassland are primarily rodents. They include ground squirrel; plains pocket gopher; blacktailed jackrabbit; hispid pocket mouse; kangaroo, cotton, and wood rats; and prairie dog. Large mammals include mule deer and antelope. Bison were present until the late nineteenth century. A variety of snakes and other reptiles are present. Common birds include Swainson's hawk, quail, turkey, and mourning dove (Brown 1982).

Although no mammals were seen on either site during fieldwork, numerous deer tracks were seen at LA 43315 almost every morning. In addition, we were visited on one afternoon by a very large Swainson's hawk. Either sick or hurt, the bird did not appear to be afraid of humans and only moved away from the site when the backhoe was started.

CULTURAL ENVIRONMENT

This chapter is intended to provide a summary overview of the culture history of the region within which the Loco Hills project area is located. The reader is referred to Sebastian and Larralde (1989) for a detailed synthesis of the prehistoric and historic periods of human occupation of southeastern New Mexico. This discussion focuses on the prehistoric periods, as appropriate to the project.

Paleoindian Period (pre-7000 B.C.)

Sebastian (1989b:19) notes that "the Paleoindian period is one of special significance in the history of eastern New Mexico" because the region has figured prominently as the location of Paleoindian sites such as Folsom and Blackwater Draw. She observes that "the identified Paleoindian sites in the (BLM) Roswell District are located either on the Llano Estacado in the eastern third of the district or in the Guadalupe Mountains at its southwestern extreme." While her discussion does not include any sites near the Loco Hills project area, her map of Paleoindian components (Sebastian 1989b:21) shows several sites in the general vicinity with one or two components. They include three south of Artesia in the Pecos Valley, several on the Mescalero Plains, and several more along the Llano Estacado escarpment. The sites with multiple components are along the escarpment. One site, southwest of Hobbs, has five Paleoindian components. However, she notes that components are usually assigned from the presence of Paleoindian projectile points and that they often cannot be verified due to depositional factors such as erosion as well as the possibilities of artifact curation and site reoccupations (Sebastian 1989b:22-23).

Sebastian (1989b:30-33) provides brief descriptions of excavations at several sites in the region. The reader is referred to her report for references. Clovis sites (weighted average radiocarbon date 9044 $\pm$ 63 B.C.) in southeastern New Mexico include Blackwater Draw and Burnet Cave, the former on the Llano Estacado and the latter in the foothills of the Guadalupe Mountains. Representative Folsom sites (weighted average radiocarbon date 8301 $\pm$ 204 B.C.) include Blackwater Draw, Elida, and Frank's Folsom Campsite, all on the Llano Estacado. Plainview Complex materials (weighted average radiocarbon date 7854 $\pm$ 103 B.C.) have been found at the Milnesand site on the Llano Estacado, at sites in the Rio Bonito drainage of the Sacramento Mountains, and at the north end of the Guadalupe Mountains. Frederick and Agate Basin/Hell Gap artifacts have not been securely identified in the region. Firstview Complex artifacts (weighted average radiocarbon date 8005 $\pm$ 267 B.C.) have come from Blackwater Draw and the San Jon site, both on the Llano Estacado. Finally, Cody Complex materials (weighted average radiocarbon date 6715 $\pm$ 74) may have been identified at Blackwater Draw and San Jon. They have been found in the Abo project area north of Roswell and near Big Salt Lake in the Pecos Valley, a possibly significant departure from the normal distribution pattern of Paleoindian sites in the region.

Sebastian (1989b:34-36) discusses the different perspectives on Paleoindian subsistence, summarizing the argument that big-game hunting and/or scavenging was only one part of a generalized hunting-gathering economy and that big game hunting was the mainstay of the Paleoindian economy. Observing that identifiable Paleoindian artifacts are those associated with hunting and processing big-game animals, she notes that an accurate assessment of Paleoindian dependence on hunting requires "a means of identifying the non-hunting-related components of the settlement system--

a process that will require investment in the development of models of hunting-and-gathering settlement organization and assemblage content against which the archeological record can be examined" (Sebastian 1989b:35).

Archaic Period (ca. 7000-6000 B.C.-A.D. 900-1000)

Sebastian (1989c:41; italics hers) characterizes Archaic period research in southeastern New Mexico with the following observations:

> The Archaic period has a long history of archeological neglect in the Southwest in general and in southeastern New Mexico in particular.
>
> If there is one statement that would receive universal agreement among those reviewing the archeology of southeastern New Mexico, it is that we know *very* little about the Archaic of this region. This is especially unfortunate since . . . more than half of the recorded sites in this part of the state are aceramic lithic scatters (and thus possibly representing Archaic sites), a far higher proportion than those noted for other parts of the state. As a result of the comparative lack of research interest in Archaic sites, we have neither basic space/time systematics for this period (that is, suggested patterns of variability through time or across space) nor means of even identifying which of this multitude of aceramic scatters are in fact Archaic sites.

Unlike Paleoindian remains, Archaic sites and components are more widely distributed within the region. However, comparison of Sebastian's maps (1989b:21; 1989c:49) shows that while known Paleoindian materials are concentrated near the mountains and on the Llano Estacado, most of the known Archaic sites and components are in the middle Pecos Valley south of Roswell. The reality and possible significance of this difference has yet to be studied. Although Jelinek (1967) notes the presence of Jay and San Jose projectile points on sites in the middle Pecos Valley, Sebastian's (1989c:43-46) review of Archaic-period radiocarbon dates shows that most range from A.D. 30 to 980. This may suggest relatively little use or occupation of the region during the early Archaic period, a research question of some importance considering the significance of the region to research in the earlier Paleoindian period. In particular, this issue is tied to the magnitude of change involved in the extinction of large Pleistocene animals and assumed human subsistence changes from focal to more generalized hunting-gathering strategies in the supposed "transition" between the Paleoindian and Archaic periods.

Sebastian (1989c:54-56) proposes a model of "serial foraging" for the Archaic period in southeastern New Mexico. In this model, Archaic hunter-gatherers used a strategy of "sequential procurement of seasonally available resources in conjunction with some use of cached resources during the harshest portion of the winter season" (Sebastian 1989c:55). This strategy, Sebastian feels, accounts for several characteristics of the Archaic record in southeastern New Mexico. They include (1) the near absence of bison remains in Archaic sites coupled with "eclectic" faunal assemblages, suggesting that "the Archaic strategy was one of eating whatever was available at the moment"; (2) the lack of evidence for intensive mescal, sotol, or shinnery oak use in earlier Archaic sites and for horticultural development, together suggesting a "non-intensive subsistence strategy" that did not require "complex processing or storage"; (3) extreme redundancy of site types in the settlement record, pointing to "an endless series of small, residential camps"; and (4) the preponderance of late

Archaic radiocarbon dated sites, suggesting population growth through time.

It should be pointed out that, if the term "Archaic" is used to refer less to a specific period of time than to generalized hunting-gathering economies and attendant settlement systems, then the Archaic period may be said to have lasted until the late A.D. 1800s in southwestern New Mexico. While archaeologists often espouse the latter definition, the temporal parameters are somewhat ingrained, and the Archaic period is still usually thought of as ending with the introduction of pottery, the bow and arrow, and agriculture into a region. Unless we believe that with the introduction of these items and presumably associated changes in lifestyles, all hunter-gatherers in a region were converted to sedentism and farming, we must ignore the parts of the archaeological and historical records that assure us that hunter-gatherers were present throughout the Southwest, including southeastern New Mexico, until the modern era. In a region such as southeastern New Mexico, where hunting and gathering were apparently the most important economic/subsistence activities for most of the length of human occupation, the role of economic change and the introduction of economic alternatives such as agriculture can only be assessed within the framework of a fuller understanding of human utilization of naturally occurring resources. It is, therefore, unfortunate that so little attention has been paid to Archaic adaptations that Bowman et al. (1990:18) can lament, "Despite the long time span, very few interpretations have been made concerning the Archaic period."

Ceramic Period (ca. A.D. 900-1000 to 1450)

As Sebastian (1989d:73) points out, the Ceramic period in southeastern New Mexico is defined not by assumed adaptational changes but by technological change, specifically, the introduction of pottery into the region. Nonetheless, pottery is sufficiently correlated in most archaeologists' minds with adaptational changes that Bowman et al. (1990:18) can say that this was a period during which "limited sedentism and horticulture are assumed to have developed in the region." Sebastian (1989d:73, 82-83) suggests that the correlation is not well demonstrated in the archaeological record.

In 1965, Corley presented a phase sequence for the southern portion of middle Pecos Valley (south of Roswell) that was based on the assumption that the region was an eastern extension of the Jornada Mogollon as defined by Lehmer (1948). Corley's (1965) sequence has been revised by Leslie (1979), whose sequence is most commonly used. It consists of four phases. Early Querecho-phase sites (ca. A.D. 950-1100) appear to be nonstructural, although possible room floors have been observed, and small, rectangular pithouses are present on some sites dating late in the phase. Ceramic types are local variants of Jornada Brown found with Mimbres and Cebolleta Black-on-white. Corner-notched projectile points, basin metates, and convex manos complete the diagnostic assemblage.

The Maljamar phase (A.D. 1100-1250) is defined by pithouse villages comprised of up to 20 or 30 structures. Leslie (1979) suggests that this trend is associated with increased sedentism, although Oakes (1985:14) argues that this is not well demonstrated. Nonstructural sites from this phase are common, presenting a dichotomy discussed in more detail below. Jornada Brown variants are joined by corrugated plain wares late in the phase. The decorated ceramic assemblage is much more diverse than that of the preceding phase. It includes Chupadero Black-on-white, Three Rivers Red-on-terracotta, El Paso Polychrome, and Playas Red and Incised. Corner-notched projectile points are replaced by side-notched points, and mortars and pestles and one-hand manos appear in this phase.

Between the Maljamar and the succeeding Ochoa phases, there is a transitional phase commonly referred to by the ponderous name of the Post-Maljamar/Pre-Ochoa phase. Leslie (1979) suggests that it began about A.D. 1300, while Stuart and Gauthier (1981) date its beginning between A.D. 1150 and 1200. Oakes (1985) and Bowman et al. (1990) date the phase between A.D. 1250 and 1350. The nature of this phase is as problematic as its dating. Leslie (1979) sees it as a sort of hiatus, during which the region was either temporarily abandoned or saw an influx of (new?) Jornada Mogollon people who displaced the local inhabitants--what Sebastian (1989d:77) calls "some dislocation of population." Stuart and Gauthier (1981) suggest that a climatic shift adversely affected the region's agricultural potential, prompting an economic change focusing on bison hunting. This follows Jelinek (1967), who explains high frequencies of large animal remains at late sites as a response of the people to renewed resource availability, which encouraged them to leave their horticultural practices in favor of hunting bison in the Pecos Valley and deer and antelope in the highlands. Sebastian (1989d:80-82) summarizes the arguments for increased versus selective large animal exploitation at late prehistoric sites.

Interestingly, sites from this "hiatal" phase are characterized by significantly increased diversity in ceramic assemblages, suggesting "an increase in cultural influences from outside the area" (Bowman et al. 1990:19). Types present include Glaze A Red and Yellow, Gila, Ramos, and El Paso Polychrome, Lincoln Black-on-red, and "northern" variants of plain and corrugated brown wares. The faunal and ceramic information suggest that the transitional phase was one of considerable upheaval in the culture history of the region because subsistence patterns and interregional relationships were altered in the course of 100 years or less.

The final phase of the Ceramic period is the Ochoa phase, dated between A.D. 1350 and 1450. Sites consist of surface structures occurring singly and in roomblocks. Ochoa Indented takes the position of the most common local brown ware type and is a marker for this phase. Apparently, the diversity of imported decorated types remains high, but the frequency within assemblages drops considerably from the preceding transitional phase. Projectile point style also changes to small, triangular points with indented or notched bases. This is thought to indicate increased interaction with people from the Great Plains.

Oakes (1985:14) and Sebastian (1989d:79) point out that Leslie's phase sequence is based on ceramic cross-dating and projectile point typologies, while the number of absolute dates is small. Chronometric dates, when obtained, have often been examined in light of their correspondence to established phase dates based on assemblage characteristics rather than with an eye to refining phase dates. Further, there are issues raised by changing architectural and artifactual patterns that provoke controversy regarding the phase sequence.

Concerning a correlation between pottery, sedentism, and agriculture that underlies the normative regional culture sequence, Sebastian (1989d:73) observes that there is an "unusually high proportion of nonstructural Ceramic period sites" in the region relative to other parts of the state. Her analysis of file data from New Mexico Cultural Records Information System (NMCRIS), Archeological Records Management Section, Historic Preservation Division, shows that less than 10 percent of recorded Ceramic period components show evidence of structural remains. While the actual percentage may be somewhat higher, this figure appears to be at least characteristic. The most common explanation for this situation is that Jornada Mogollon people moved into the area, maintained traditional, horticultural pithouse and pueblo villages, and also exploited seasonally available plant and animal resources by adopting seasonally mobile settlement as needed. The Jornada

Eastern Extension people, then, are thought to have been much more mobile than their contemporaries in much of the rest of the Southwest. Sebastian (1989c:82) finds two problems with this scenario:

> It is difficult, however, to envision a pattern of mobility under which the occupants of the small number of known and suspected structural sites could have created the large number of known non-structural Ceramic period sites, especially since the structural sites occur in very localized areas and the scatters occur over vast areas far from known structural sites.

It is also difficult to suggest a seasonal round for such an adaptation that would solve the scheduling conflicts between wild resource availability and agricultural labor requirements and the logistical problems of highly mobile groups using stored agricultural products.

Sebastian (1989d:83) offers an "alternative model" in which the region was occupied by both agriculturalists and hunter-gatherers, both groups using and perhaps making ceramic vessels. In this case, the mere presence of sherds at a site is not sufficient to define it as Jornada Mogollon. In fact, she argues, "The presence of ceramics on sites created by groups of both types . . . has caused the remains of two very different settlement and subsistence systems to be lumped together into an apparently anomalous pattern." Sebastian contends that her model of different but contemporaneous regional inhabitants accounts for the variation seen in the settlement record and for apparent assemblage discrepancies such the presence of bifacial lithic reduction debris associated with ceramics and projectile points considered diagnostic of the Jornada Eastern Extension phases.

The implications of the contrast between Sebastian's model and the traditional approach are several and significant (see Sebastian 1989d:92). If all ceramic sites in the region represent the presence of semisedentary horticultural people who also exploited wild resources, then archaeologists must address issues of seasonal scheduling and differing wild and domestic resource locations, including storage. We must also resolve the issue of the fate of the Archaic hunter-gatherers who inhabited the region before the introduction of pottery. If, on the other hand, two different adaptations are evidenced, how are we to define the differences archaeologically so that sites can be assigned to groups of people and, in turn, we can accurately study their different economic and settlement strategies? Sebastian (1989d:92) offers several research questions to address in data recovery situations that may help to resolve these issues.

Oakes (1985:14) takes a slightly different perspective, but one that also questions the traditional approach:

> The general lack of evidence for structures during the Ceramic period seems unusual. As Laumbach and Beckett observe, most riverine environments in New Mexico attracted prehistoric populations who built various types of permanent settlements. Then why were no settlements built along the Pecos River? The lack of habitation units is not so unusual if Ceramic period occupations are viewed as an extension of earlier Archaic adaptations. The addition of ceramics and the use of smaller points to hunt smaller game are the only adaptive changes found between the periods in southeastern New Mexico. It is probably justifiable, therefore, for researchers to rework Corley's and Leslie's classification scheme for the Ceramic period in terms of mobility strategies and subsistence modes rather than principally on ceramic attributes.

Oakes' perspective may be a bit limited, since there is evidence of structural remains at Ceramic period sites in the middle Pecos Valley. Still, she raises the same issue raised by Sebastian: is there

sufficient indication of sedentary horticulture to justify a phase sequence that mirrors those of other regions where sedentism and horticulture are indisputable parts of the culture history? Sebastian argues in favor of a horticultural population, but contends that it was not the only, or perhaps, even the predominant group in the region. She also argues for the presence of hunter-gatherers who adopted ceramics and adapted to the presence of the farmers but maintained what was otherwise an Archaic lifestyle. Oakes, whose perspective is drawn from the large, nonstructural Ceramic-period sites on the Mescalero Plain, focuses on the considerable evidence for a hunting-gathering economy during the Ceramic period. As such, she is seeing one part of Sebastian's bipartite occupant model, and her data support Sebastian's view. These interpretations strongly suggest that the actual utility of the phase sequence has to be called into question until the issues raised by Oakes, Sebastian, and others are resolved.

TESTING AND LABORATORY PROCEDURES

Archaeological testing was designed to provide information on the nature and data potential of those portions of the sites found within NMSHTD project limits. Specifically, testing was intended to determine the actual size of each site and to reveal whether subsurface features or deposits of cultural material are present. A testing design was submitted to NMSHTD and BLM (Appendix 2). It outlined general and specific testing procedures for the project.These procedures were followed in the field, with modifications based on their results (see "Results of Test Excavations").

Artifacts collected during testing were returned to OAS for analysis. Lithic artifacts were analyzed using standardized analytical formats (OAS n.d.a, n.d.b). Ceramic artifacts were examined for information on ceramic types, vessel forms, surface treatment or decoration, and temper materials. Radiocarbon samples were returned to OAS, analyzed for species identification, and submitted for analysis. Flotation samples were returned to and analyzed at OAS. Procedures are detailed by Toll (1993).

RESULTS OF TEST EXCAVATIONS

LA 43315

LA 43315 is a large site measuring 90 m east-west by 100 m north-south. It consists of 13 irregularly shaped blowouts separated by low shinnery oak- and mesquite-covered coppice sand dunes (Figs. 6 and 7). Artifacts, including chipped stone flakes, brown ware sherds, and fire-cracked rocks, are present on the surface of all but one blowout. One blowout, outside NMSHTD project limits, has stains of dark, ashy sand, perhaps representing burned features buried beneath adjacent dunes. The site is at the southeast end of a wide, low hill. It is bounded on the north by the U.S. 82 roadcut, on the south by the hill slope, and on the east by a large deflation basin. A strip 12 m wide along the north side of the site is within NMSHTD right-of-way, comprising about 13 percent of the site area. Archaeological testing was limited to that area. Test excavations at LA 43315 focused on two goals: determining whether significant cultural deposits or features were present within NMSHTD project limits and determining the depositional context(s) of artifacts or features found.

Site-Specific Testing Procedures

The locations of all surface artifacts were identified using pinflags. This activity showed that artifacts were only present in blowout areas between low oak- and mesquite-covered dunes and that very few artifacts were actually present within project limits.

A primary site datum, Datum A, was placed outside project limits. Designated 200N/200E, this datum was used to establish a grid network across the site. The site was mapped using transit and stadia rod. Three subdatums were located within project limits. Their elevations relative to the main datum provided vertical elevation control during test excavations.

Based on the locations of artifacts within project limits, three areas were selected for test excavation. Test Area 1 was at the edge of a blowout in the northwest part of the site. Test Areas 2 and 3 were in the large blowout in the center of the site. Excavations were based on 1 m by 1 m units within the grid network and were conducted in 10 cm arbitrary levels. In Test Area 1, one 1 m by 1 m unit was excavated to a depth of 40 cm below surface (Level 4). Four other units were excavated to the bottom of Level 2 (20 cm), while one was excavated to the bottom of Level 1. In Test Area 2, two units were excavated, one to the bottom of Level 1 and one to the bottom of Level 2. In Test Area 3, three units were excavated to the bottom of Level 1. An auger was used to examine the soil beneath one excavation unit in each test area.

Because the portion of the site within project limits was bisected from north to south by a buried gas pipeline and from east to west by a fence and a buried telephone cable, backhoe trenches radiating from the blowout were not possible. A backhoe was used to excavate three long trenches through dunes within project limits (Fig. 8). These trenches approximately paralleled the length of the project limits. Trenches 1 and 2 in the northwest and north-central parts of the site were excavated to the caliche layer, approximately 1.6 m below surface. Caliche was not encountered in Trench 3 in the northeast part of the site. Excavation stopped at 1.75 to 2.3 m below surface. A full profile was drawn of Trench 2. Profiles were also drawn of representative 1 m wide sections of Trenches 1 and 3. Based

on the results of mechanical and hand excavation, shovel tests and "off-site" trenches were not necessary.

While moving the backhoe between Trenches 1 and 2, a dark, ashy stain was exposed in the sand between Test Areas 2 and 3. Loose sand around the stain was stripped to define its plan shape. The stain was recorded, and a .5 m by 1 m unit was excavated to the bottom of level 3 to cross-section the stain. A profile of the stain in the west wall of the excavation unit and plan views of the stain in each level were drawn. A flotation sample of the ashy sand was collected, as was charcoal for radiocarbon dating. Following this, an area of approximately 56 sq m was surface-stripped of loose sand to look for other similar features. Because this activity took place on the last day of the field session, and since no artifacts were found associated with the stain or on the surface of the stripped area, the entire area was stripped as a single unit.

In addition, one projectile point and six sherds were collected outside project limits. This procedure was specified in the testing design to provide additional chronological data for the site. The locations of collected artifacts are recorded on the site map.

Testing Results

Excavations failed to reveal the presence of significant cultural features or deposits within project limits. No features or deposits were found in the three backhoe trenches. Hand excavations in Test Areas 1, 2, and 3 demonstrated that artifacts were only present in the upper 10 cm of loose blowout sand. Confirming the results of many other investigations of dune sites, the presence and number of surface artifacts was not necessarily indicative of the presence and number of subsurface artifacts. Only one of the eleven 1 by 1 m excavation units in the three test areas had any surface artifacts, and it had only one. However, eight units yielded artifacts from Level 1 (0-10 cm), and one yielded artifacts from Level 2 (10-20 cm). Still, the number of artifacts from all excavation units totals less than 12.

Only one possible feature was discovered during testing. As mentioned above, it is a dark, ashy stain in the sand that may represent a hearth. After stripping the loose sand above it, the feature was recorded as a large, irregularly shaped, dark stain within the two-track road that follows a buried telephone cable through the site (Fig. 9). A visit from a spotter for the telephone company confirmed that the length of the stain is caused by the buried cable trench, which runs along the north side of the stain. Excavations in the 0.5 by 1 m unit on the east side of the stain revealed that the cable trench can easily be distinguished from the actual stain, which is limited to the south half of the unit. The profile cross section shows that the ash stain appears as a shallow, dish-shaped stratum in the sand (Stratum 1). It is 34 cm wide at the surface and 6 to 7 cm deep. Beneath it to the south is another stained area that extends from 7 to 32 cm below surface (Stratum 3). The two stains are separated by a lens of yellowish red sand. While this lens is the same color as the natural sand around the stains, it is of slightly different texture and may represent a rodent hole. If so, then the two stains may be part of the same feature. Below the lower stain (Stratum 3) is an area of very lightly stained sand (Stratum 4) that likely represents percolation of ash and charcoal into the sand beneath the actual stain. A flotation sample was collected from the upper stain (Stratum 1). Charcoal was also collected from Levels 1, 2, and 3 of the excavation unit. No artifacts were found associated with the stain. Radiocarbon dating, discussed below, indicates that the feature is prehistoric. It was probably a small, informal hearth.

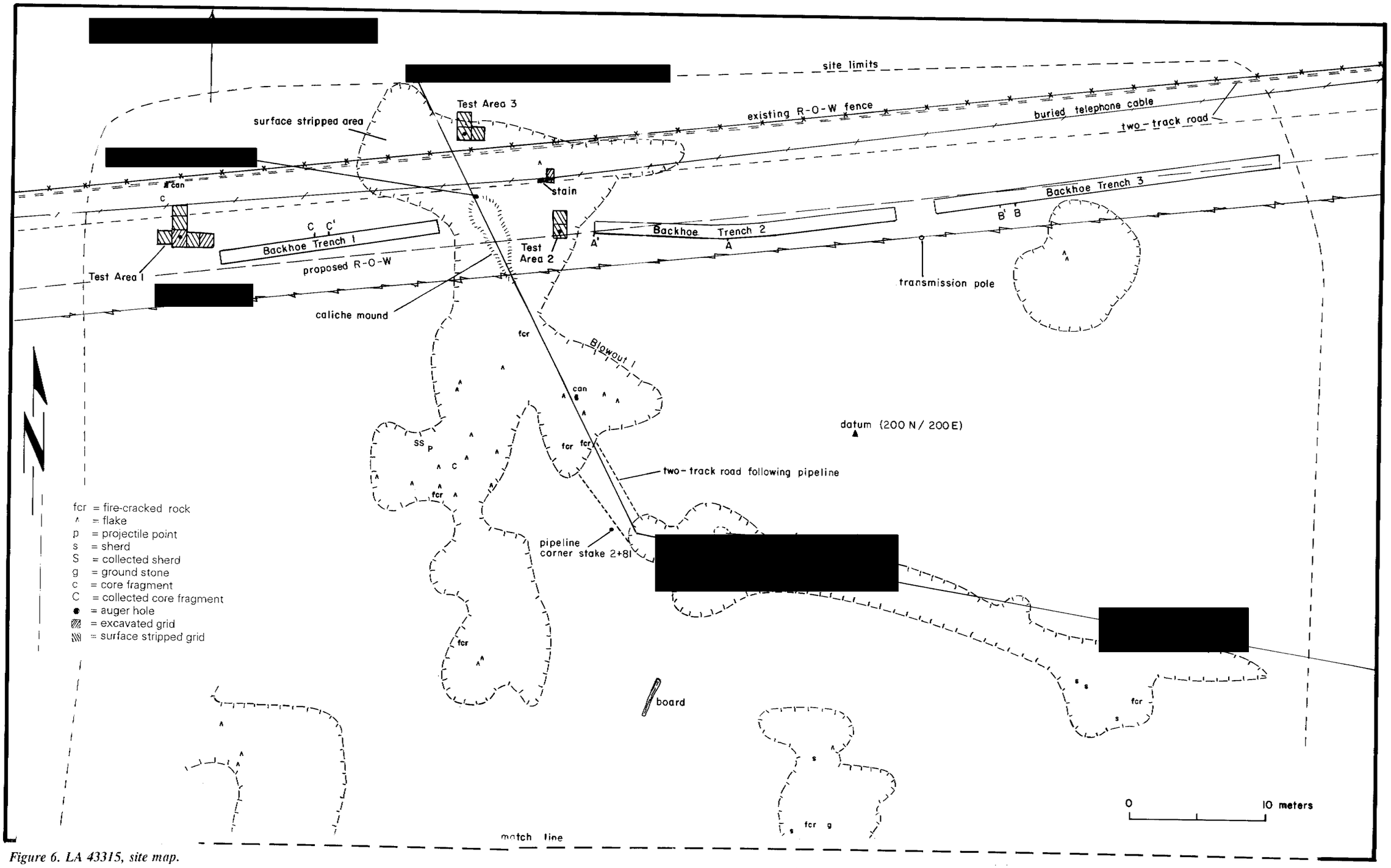

Figure 6. LA 43315, site map.

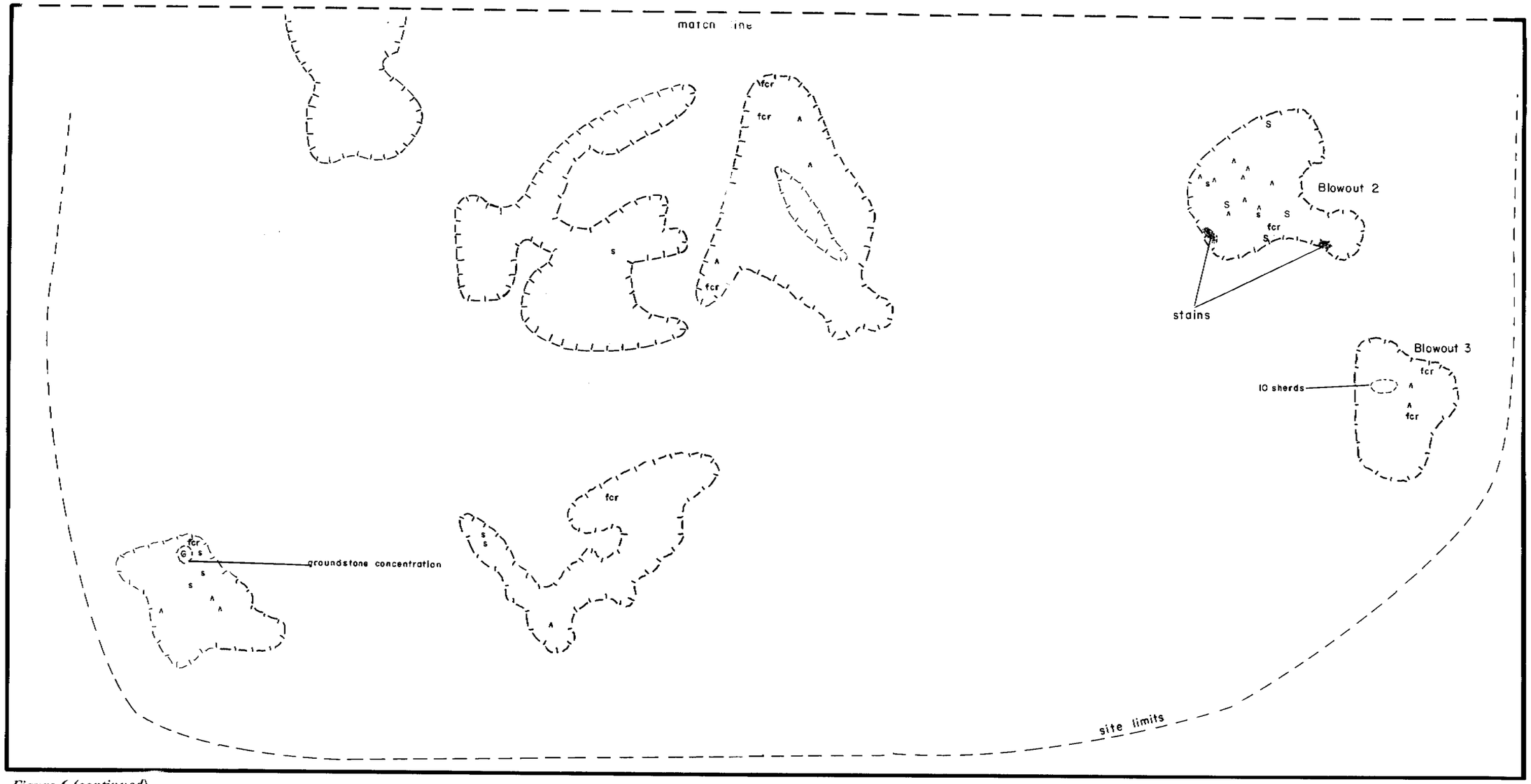

Figure 6 (continued).

Figure 7. Large, central blowout and adjacent oak-covered coppice dunes, LA 43315.

Figure 8. Excavating Backhoe Trench 1, LA 43315.

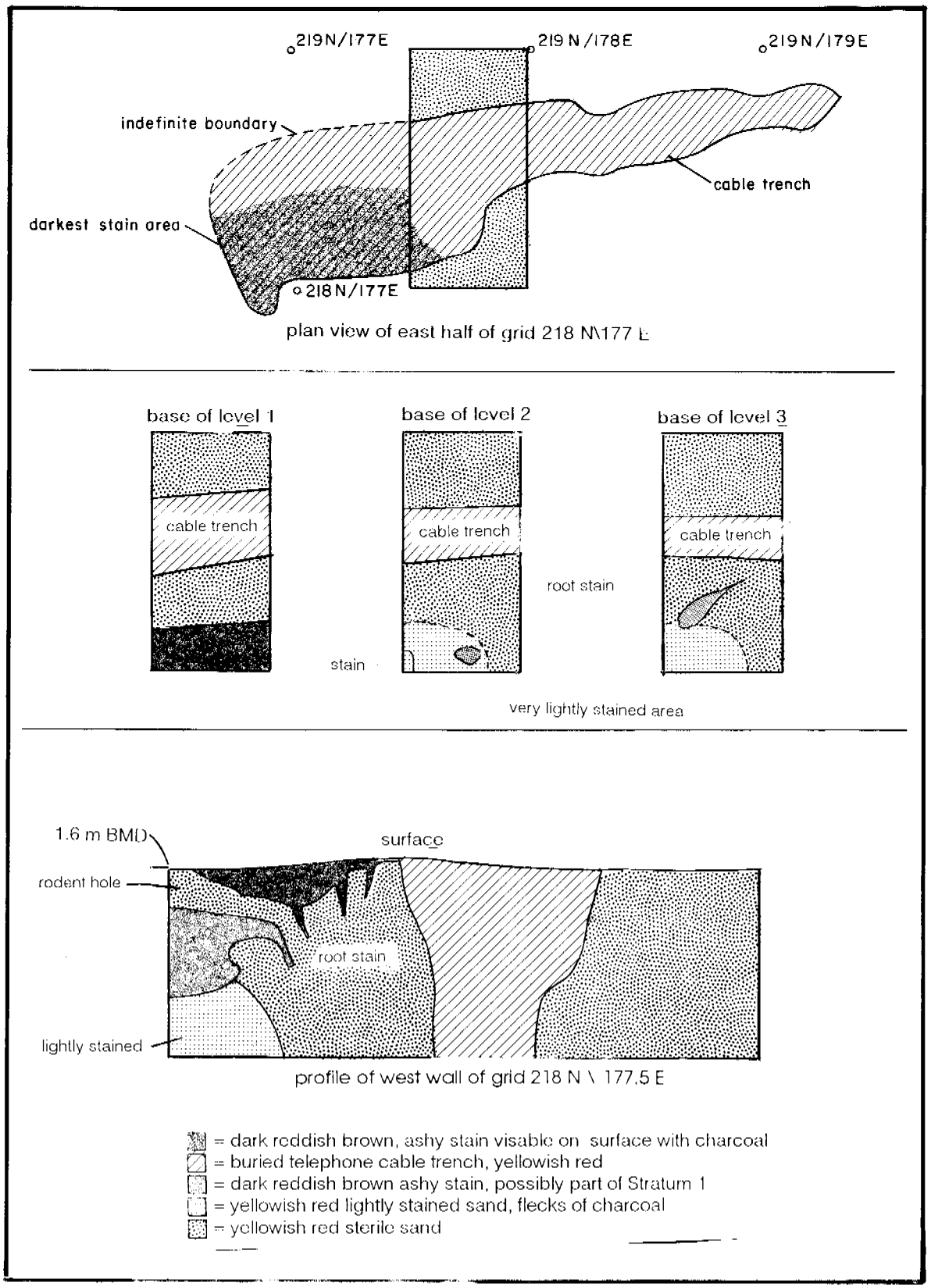

Figure 9. Stain 1, LA 43315, plan and profiles.

Hand and mechanical excavation revealed that the context of artifact deposition and the location of the possible hearth feature is a series of natural sand strata overlying a caliche layer. These strata were first defined in unit 211N/151E in Test Area 1, where excavations to 40 cm below surface revealed that the upper 30 cm consisted of reddish-yellow (Munsell color 5YR6/8), clayey sand. Beginning about 20 to 25 cm below surface, the sand became more compact, and the sand between 30 and 40 cm was very compact and hard. An auger hole reached the pink (5YR8/4) caliche layer at 52 cm below surface (2.57 m below main datum). This stratigraphy was confirmed in Test Area 2, where caliche was encountered in an auger hole at 2.37 m below main datum. Figure 10 shows the stratigraphy of the dune on the east side of the large central blowout (Blowout 1 in Fig. 6). Stratum 1 is a layer of loose, yellowish red sand, corresponding to the unconsolidated sand described in the soil section of "Natural Environment." Stratum 2 is also a layer of loose sand, but it is grayer (reddish brown) from organic matter. This stratum contains most of the root material from plants growing on the dune surface. It may correspond to the weak A horizon commonly referred to as the "puebloan" soil. Stratum 3, which underlies Stratum 2 at the east and west ends of the trench, is similar but with less organic matter, and so it has a lighter gray color. The presence of roots and decayed organic material in Stratum 2 and its consequent grayer color is the only apparent difference between Strata 2 and 3. Stratum 3 may correspond to the "Altithermal" soils formed between 4,000 and 3,000 years ago, or it may be a weak B horizon beneath Stratum 2. Beneath Strata 2 and 3 is Stratum 4, which is redder than the upper strata and much more compact. This is the same sand encountered at 20 to 25 cm below surface in Test Area 1 and probably corresponds to the red, Pleistocene, clayey sand. Because Figure 10 is the profile of a dune rather than the side of a blowout, Stratum 4 is 60 cm to 1.3 m below surface in that area. Note that while Stratum 4 generally slopes down to the east, as does the whole dune, it is closer to level than the loose sands above it (Strata 1-3). Thus, most of the dune's morphology in terms of height, shape, and slope is conditioned by the sands in Strata 1, 2, and 3.

It seems clear that the floor of the large, central blowout is the eroded surface of Stratum 4. It is, therefore, probably significant that Levels 1 and 2 in Test Area 1 yielded over a dozen artifacts. These levels are the equivalent of Strata 1 and 2, which is some 15 to 25 cm above Stratum 4 in this area. Conversely, Levels 1 and 2 in Test Area 2, which were near the transition between Strata 3 and 4 at the foot of the adjacent dune, yielded only one artifact. This suggests that most artifacts at the site are deposited in the loose sand of Strata 1 and 2 and are left in the blowouts by wind erosion. It may also explain the field crew's observation that, across the site, blowout floors with more surface artifacts and small gravels appeared to be deeper relative to adjacent dunes and to have less loose sand than those with fewer artifacts and gravels. There was no indication of actual cultural deposits or features in the profiles exposed by the backhoe trenches. The only indication from hand or mechanical excavations of a living surface was the location of the hearth, which appeared to have been excavated into the sand on the floor of the blowout. However, stripping the loose sand from a large area around and to the west of the stain failed to reveal any other possible features or any indication of an actual surface.

Figure 10 suggests that the caliche layer drops to the east, a conclusion supported by Trench 3, in which caliche was never found. This explains why the deflation basin east of the site is much deeper than the on-site blowouts. The low, wide hill on which the site is located is probably composed of a caliche rise covered by sand dunes. As the caliche layer drops, so does the local landscape.

Analysis of Cultural Materials

Ceramic Artifacts (by Regge N. Wiseman). Eight brown ware sherds were recovered during the testing at LA 43315. One sherd from the surface of Blowout 2 fits the description of El Paso Brown in that it has large and small, subrounded temper grains of white feldspar, slightly frosted quartz, and occasional mafics. Temper particles show through on the surface, and the dark gray to black paste appears to be sandwiched between the reddish-brown surface colors.

Another sherd from the same provenience generally fits the description of Jornada Brown. The temper of mostly white feldspar is finely ground (particles are angular), the paste is a medium gray-brown, and both surfaces are highly polished. Two problems arise in assigning this sherd to the Jornada Brown type. Firstly, one edge has several large temper grains, suggesting that the fine temper exposed in the fresh break (for purposes of analysis) is not characteristic of the sherd, and secondly, the overall characteristics of the sherd are not much different from most of those described below as South Pecos Brown. Also, we cannot be certain that the surface sheen is due totally to polishing by the potter. To some degree, the sheen was probably induced by environmental conditions (extremes of temperature, sand-blasting, etc.) that resulted in rounding and polishing of the edges of the sherd as well as its surfaces.

A third sherd, from Blowout 1, clearly fits the criteria for South Pecos Brown. It has rather large temper particles of gray feldspar (plus a few accessory minerals), occasional temper particles that protrude to the surface and have fine cracks radiating away from them, a light to medium gray or gray brown paste, and a well-smoothed to polished surface finish.

The remaining five sherds generally fit the description of South Pecos Brown except that they have predominantly white feldspar for temper, with little or no gray feldspar. The proveniences of these sherds are the surface of Blowouts 1 (n=1) and 2 (n=2) and Levels 1 (n=1) and 2 (n=2) of Grid 211N/151E in Test Area 1. Two of the sherds have eroded surfaces, and two others have the same rounded-edge, sand-blasted polish described above for the probable Jornada Brown sherd.

Except for the El Paso Brown sherd, all of the sherds are similar in many respects and could conceivably belong to the same general "type." If so, they most closely conform to South Pecos Brown, a type originally defined by Jelinek (1967) in his work along what he calls the Middle Pecos River, northwest of the project area. South Pecos Brown, as the name implies, is expectable in the project area. All of the sherds are small pieces from the bodies of large vessels. Although it is probably a relatively safe bet that all are from jars, no sherd has any characteristic undeniably associated with either jars or bowls.

The dates of manufacture for the three pottery types identified from this site--El Paso Brown, Jornada Brown, and South Pecos Brown--are broadly but poorly defined. El Paso Brown (Lehmer 1948), the primary early pottery type for the El Paso region, dates between A.D. 200 and 1100 (Whalen 1981). Jornada Brown (Jennings 1940; Mera 1943), the primary utility pottery for the Glencoe phase of the Sierra Blanca region west of Artesia (Kelley 1984), has been radiocarbon dated as early as ca. A.D. 200 in the Texas Panhandle (Hughes and Willey 1978) and certainly lasted until A.D. 1300 or 1350 in the Sierra Blanca country. South Pecos Brown, at the latest, was made between A.D. 900 and 1100 (Jelinek 1967) and probably earlier. These dates suggest an occupation during the Querecho phase.

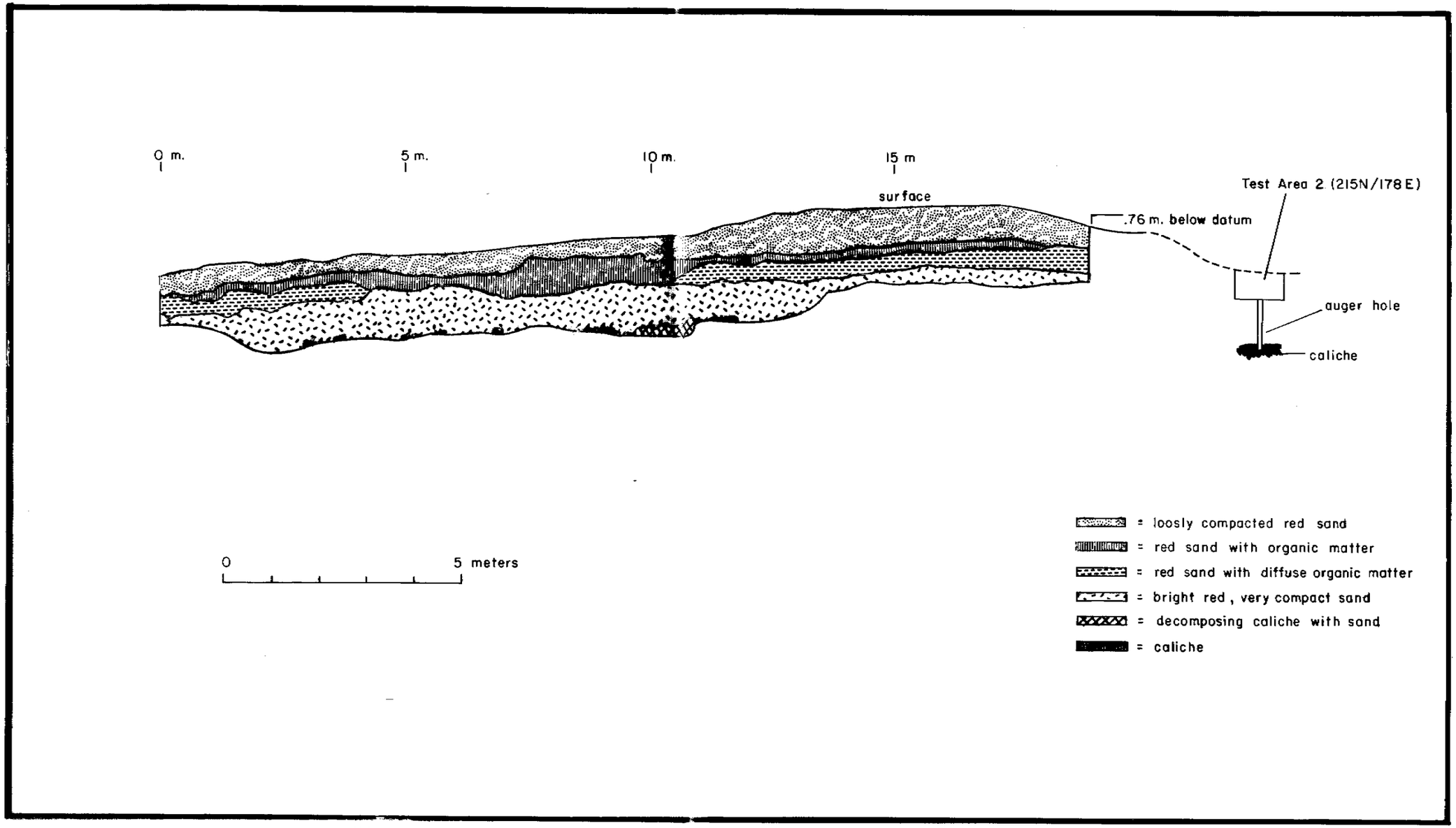

Figure 10. Profile of Backhoe Trench 2, LA 43315.

Chronometric Dates. Charcoal samples were collected from Levels 1, 2, and 3 in the excavation unit on the east side of the hearth. In the laboratory, they were combined into a single sample to provide a sufficient amount for radiocarbon dating. The sample was submitted for radiocarbon dating (Beta-60606). It yielded a 1-sigma adjusted date of A.D. 870 $\pm$ 80 (A.D. 790-950) and a 1-sigma calibrated date of A.D. 980 (calibrated range, A.D. 887-1023). These dates fall early in the Querecho phase.

When the sample was examined to identify plant species, it was found to consist entirely of mesquite (Toll 1993:2). This is potentially significant since mesquite is not the dominant shrub plant on the site today. Whether the predominance of mesquite in the hearth reflects vegetational change or choice by site occupants is not known. However, it does show that mesquite was present and possibly the dominant shrub plant on the site during the early Querecho phase, disputing Phillips's argument (Oakes 1985:6) that mesquite was largely restricted to riverine areas until recent overgrazing encouraged its expansion.

Chipped Stone Artifacts. Eight chipped stone artifacts were recovered from the test excavations at LA 43315. In addition, a crude side-notched projectile point was collected from the surface of the site outside project limits. Side-notched points are considered diagnostic of the Maljamar phase of the Ceramic period, ca. A.D. 1100-1250. Table 1 lists the nine chipped stone artifacts by artifact morphology and material type. The most common artifacts are core flakes, followed by angular debris. These artifacts point to expedient core reduction. The only tools are a small cobble tool that showed no sign of use-wear and the projectile point. The point (Fig. 11) is a small, side-notched point made from a brown chert flake. In the OAS standardized format, it is classed as an early-stage biface, defined as a tool exhibiting "primary thinning" as seen in bifacially worked edges with irregular outlines and variably spaced flake scars (OAS n.d.a). Most of the artifacts are of undifferentiated chert. Three other materials, silicified wood, quartzite, and limestone, are each represented by one artifact. The latter two materials are available on-site as alluvial gravels found in the sands, although whether they were procured on-site is not known.

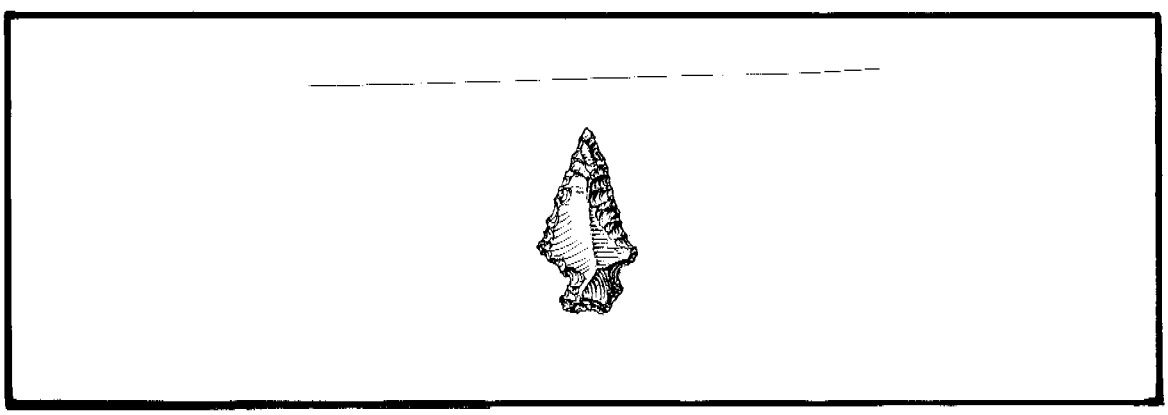

Figure 11. Projectile point, LA 43315.

Table 2 lists chipped stone material type by material quality. It shows that most material is either fine or medium grained. Only the quartzite cobble tool is coarse grained. Table 3 shows cortex percent and type for each material. None of the chert flakes have any cortex, indicating that previously reduced chert cores were brought to the site. Of the three artifacts with cortex, one, the quartzite cobble, is waterworn, and two are not. Since the quartzite cobble could have come from on-site deposits, the waterworn cortex does not necessarily indicate that it was procured from a river or drainage setting. The alluvial gravels found on-site have waterworn cortex. The silicified wood artifact has nonwaterworn cortex, suggesting procurement at an unknown quarry location.

The following interpretations are offered with the caveat that nine artifacts are probably not a representative sample of the chipped stone assemblage at LA 43315. Nonetheless, several patterns are suggested. Dominance of core flakes and the lack of biface flakes suggest that the site occupants were from a relatively sedentary "puebloan" population. These characteristics of the chipped stone assemblage are associated with expedient core reduction technology, which is seen at sites occupied by sedentary villagers. However, this generalization is derived from analyses of assemblages in the Anasazi and Mogollon areas, where distinctions between villagers and mobile hunter-gatherers are more easily made. Its applicability to the Jornada Eastern Extension has not been demonstrated.

Table 1. LA 43315, chipped stone artifact morphology by material type

Artifact Morphology	Material Type				Total
	Chert, undifferentiated	Silicified wood, undifferentiated	Quartzite, undifferentiated	Limestone	
Angular debris	1	1	-	1	3
Core flake	4	-	-	-	4
Cobble tool, undifferentiated	-	-	1	-	1
Projectile point	1	-	-	-	1
Total	6	1	1	1	9

Table 2. LA 43315, chipped stone material type by material quality

Material Type	Material Quality					Total
	Fine grain	Fine grain with flaws	Medium grain	Medium grain with flaws	Coarse grain	
Chert, undifferentiated	2	1	2	1	-	6
Silicified wood, undifferentiated	1	-	-	-	-	1
Quartzite, undifferentiated	-	-	-	-	1	1
Limestone	-	-	1	-	-	1
Total	3	1	3	1	1	9

Table 3. LA 43315, chipped stone material type by cortex percent and type

Material Type	Cortex (%)					Cortex (type)		
	0	10	40	50	Total	Waterworn	Nonwaterworn	Total
Chert, undifferentiated	6	-	-	-	6	-	-	-
Silicified wood, undifferentiated	-	-	-	1	1	-	1	1
Quartzite, undifferentiated	-	1	-	-	1	1	-	1
Limestone	-	-	1	-	1	-	1	1
Total	6	1	1	1	9	1	2	3

Material selection emphasizes fine- and medium-grain chertic materials (chert and silicified wood). In turn, these materials were clearly not procured on-site. The chert flakes have no cortex, indicating that considerable core reduction took place elsewhere and that reduced cores were brought to the site. The silicified wood artifact came from a quarry location. The other two artifacts could have come from on-site materials. This information points to some mobility on the part of the site occupants. It does not provide information on the extent of that mobility. It also shows preferences in lithic materials and planning for on-site tool needs, which were met with expedient core flake tools.

Macrobotanical Remains. A sample of the soil in Level 1 of the hearth was collected for macrobotanical analysis. Table 4 shows that the macrobotanical remains consisted of only six seeds. Two are from indigobush, and four are unidentifiable. Toll (1993:2) states, "Seeds encountered in the flotation samples included only recent intrusives, variously shiny and new looking." Thus, the macrobotanical remains provide no evidence of food processing or preparation associated with the hearth. This suggests that the hearth was used for heating rather than cooking.

Table 4. Loco Hills testing sites, macrobotanical remains (actual seed count/count adjusted per liter of soil, for samples of other than the 1 liter standard size)

Seed Taxa	Site and Feature	
	LA 43315, Hearth (650 ml)	LA 89658, Hearth (800 ml)
Indigobush (*Dalea* spp.)	2/2.5	-
Unknown, cf. *Labiatae* (mint family)	-	1/1.5
Unidentifiable	4/5.0	-
Total	6/7.5	1/1.5

Conclusions

Dates from ceramic analysis and radiocarbon dating show that LA 43315 was occupied in the early Querecho phase. The projectile point suggests a Maljamar-phase occupation. Given the large size of the site and the fact that the point was collected outside the project limits, these data probably show only that the site was occupied during multiple phases, one of which is represented by the hearth and at least some of the sherds. The significance of this is diminished, however, by the problems discussed earlier regarding the controversy over the number of social groups inhabiting and using the region and the nature of their adaptations. Thus, the fact that the ceramic artifacts and the hearth approximately correspond in date does not necessarily indicate that the site represents the presence of a Jornada Mogollon puebloan population. In the first place, no ceramic artifacts were found in association with the hearth. This may indicate that the correspondence in dates is fortuitous. While a 160 year range is small for radiocarbon dates, it is far too large to prove any association with site occupation by

ceramic vessel users. Further, and more importantly, the issues raised by Sebastian (1989d) and Oakes (1982, 1985) have not been resolved. Until they are, we cannot determine the significance of the fact that the hearth and sherds at LA 43315 date within the time range of a phase in the regional sequence.

Concerning site structure, we can say that the floor of the large, central blowout at LA 43315 was exposed during the tenth century, allowing site occupants to place a shallow, informal hearth in the top of the red, Pleistocene layer. The condition of the hearth suggests that it was covered and only recently exposed, perhaps by soil disturbance associated with the buried telephone cable.

LA 89658

LA 89658 measures 6 by 4 m. It consists of a concentration of fire-cracked limestone rocks, four scattered pieces of fire-cracked limestone, and a possible ground stone fragment (Fig. 12). The concentration is located along the west side of a very small drainage running north and northeast from the highway. Other than the possible ground stone fragment, no artifacts were found on the surface of the site. Test excavations at LA 89658 also had two goals: determining whether a subsurface hearth feature was present beneath the concentration of fire-cracked limestone and whether buried features or cultural deposits were present within NMSHTD project limits.

Site-Specific Testing Procedures

A primary site datum, Datum A, was placed outside project limits. Designated 100N/100E, this datum was used to establish a grid network across the site. On the last day of fieldwork at the site, it was mapped using transit and stadia rod. At that time, we determined that the fire-cracked rock concentration is actually just outside NMSHTD project limits.

The concentration was photographed and mapped (Fig. 13). A 1 by 1 m grid unit encompassing the south half of the concentration was excavated, allowing the field crew to cross-section the feature. It was excavated in 10 cm arbitrary levels to the bottom of Level 3 (30 cm below surface). A flotation sample was collected from Level 3. A possible radiocarbon sample was also collected, but laboratory analysis revealed that, rather than charcoal, the sample consisted of gray, compact soil and insect body parts. It was not submitted for dating. An auger hole was used to examine the soil beneath Level 3. A profile was drawn of the north wall of the excavation unit.

A backhoe was used to excavate a single long trench paralleling the length of the project limits between the fire-cracked rock concentration and the existing fence. It was excavated to the caliche layer 10 to 60 cm below surface, and a full profile was drawn. Based on the results, shovel tests and "off-site" trenches were not necessary.

Testing Results

Excavations in the south half of the concentration revealed that fire-cracked rock was also present below the surface. Thirteen fire-cracked rocks were collected from the surface and Level 1 (0-10 cm below surface), and ten others were collected from Level 2 (10-20 cm). Excavation in Level 3 revealed a thin lens of compact sand protruding from the north wall of the excavation unit at 22 cm

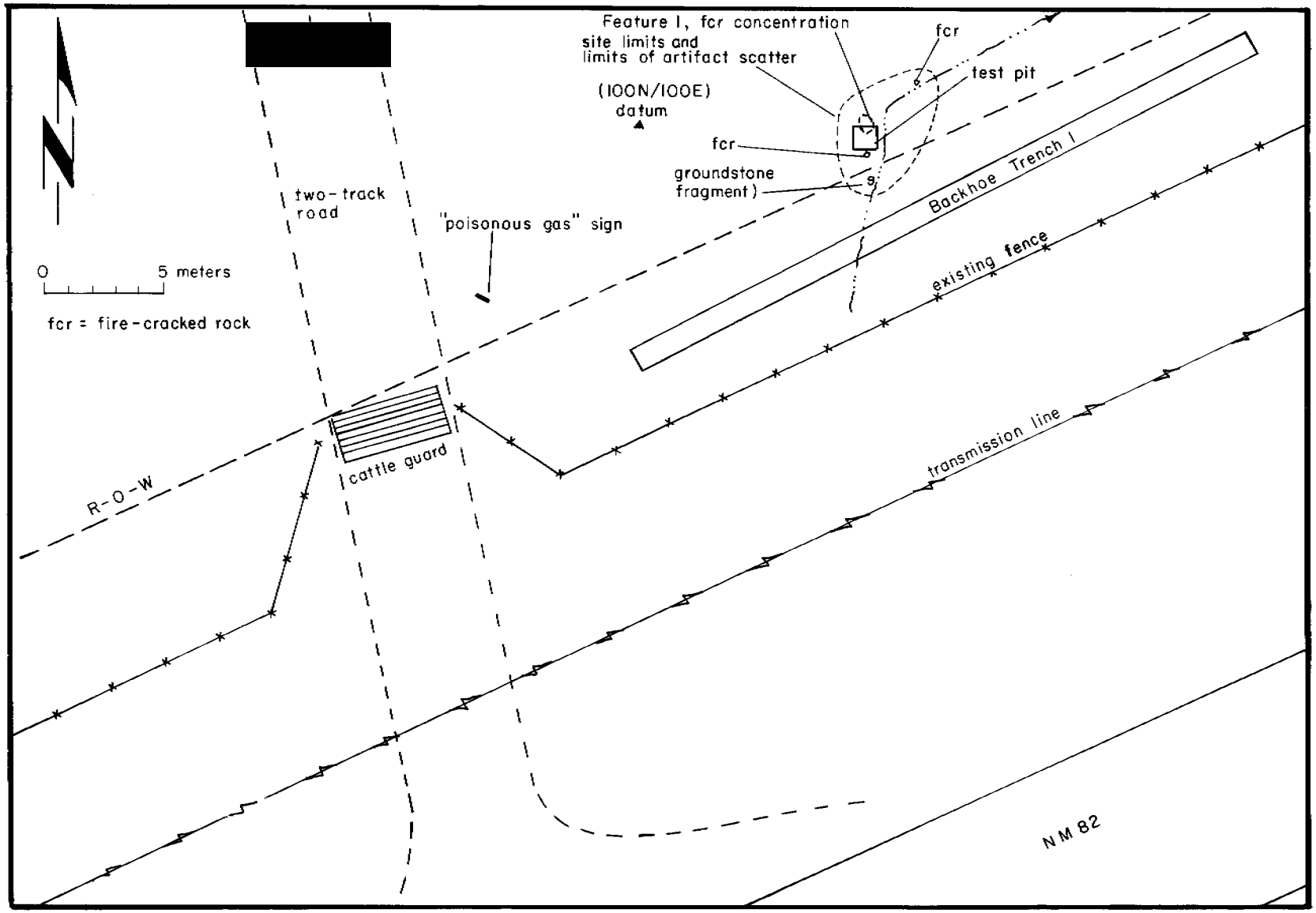

Figure 12. LA 89658, site map.

below surface (Figs. 14 and 15). The lens was 3 by 6 cm by about 1 cm thick. In Figure 15, it is seen as a small bump on top of the rectangular pedestal. It appeared to have been burned, although clearly not baked, and may have been the floor of a shallow hearth pit now represented only by the fire-cracked rock. It was located directly beneath the center of the surface concentration. No other discoloration, changes in soil texture, or burned soil was observed, and there was no other evidence for the size or shape of the hearth. Caliche was encountered in Level 2 and filled most of the southern two-thirds of the unit in Level 3.

Figure 13. Feature 1 (fire-cracked rock concentration), LA 89658.

Concerning the second testing goal, the profile of the backhoe trench (Fig. 16) confirms the stratigraphy revealed by hand excavation. On-site stratigraphy consists of a thin layer of loose sand (Stratum 1) underlain by a layer of sand with organic material, mostly roots (Stratum 2), followed by a thicker layer of sand containing small gravels (Stratum 3). Correlation with the regional soil sequence is not clear, although the organic layer may correspond to the weak A horizon. Caliche was encountered 20 to 50 cm below surface. In the center of the profile, a shallow depression shows the location of the small drainage that runs past the fire-cracked rock concentration. Caliche and decomposing caliche is present 5 to 15 cm below surface, mirroring the shallow depth at which caliche was found in the excavation unit. When work began at the site, it seemed clear that the presence of a feature on the surface indicated that subsurface deposits or features were not likely to be present. Shallow natural deposits above the caliche layer support this conclusion.

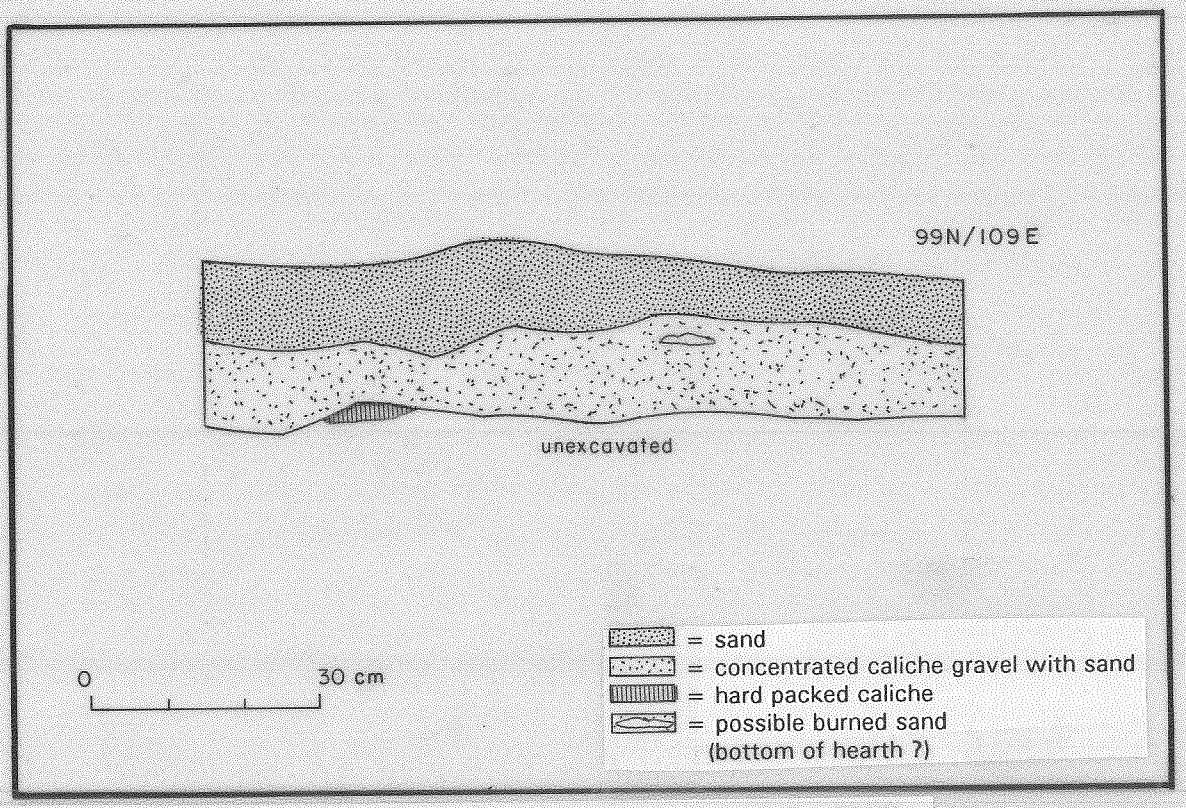

Figure 14. Feature 1, profile of grid unit 99N/109E, north wall, LA 89658.

Figure 15. Feature 1 (possible burned sand), LA 89658.

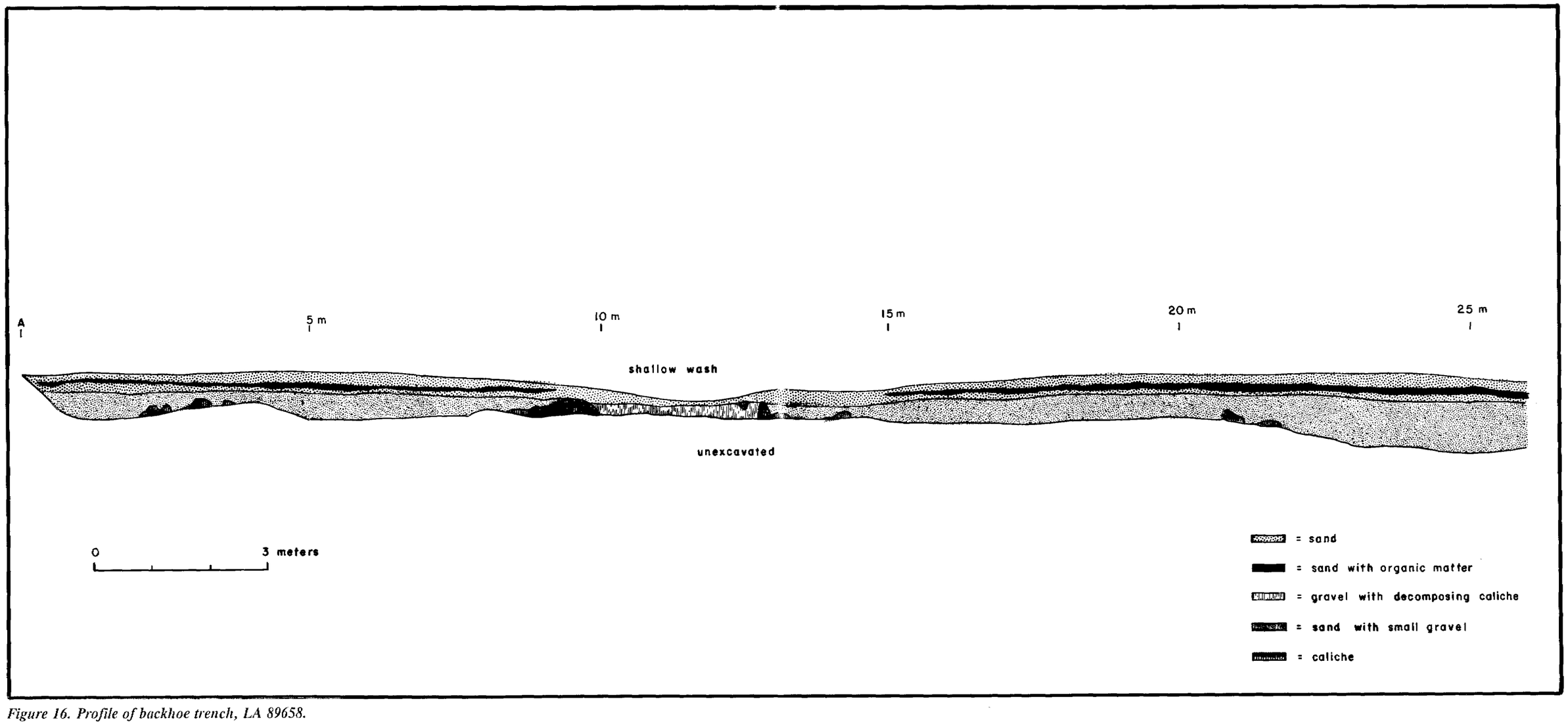

Figure 16. Profile of backhoe trench, LA 89658.

Analysis of Cultural Material

Dating the Site. Given the lack of temporally diagnostic artifacts and materials amenable to chronometric dating techniques, it is not possible to provide a date for the occupation of LA 89658.

Fire-cracked Rock. Thirteen pieces of fire-cracked limestone were collected from the surface and Level 1 of the excavation unit. Their total weight is 3,467.5 g, of which 3,162.4 g (91.2 percent) is from five pieces weighing more than 400 g each. Of the remaining eight pieces, one weighs 150.6 g, and the rest weigh less than 70 g. Three weigh less than 1 g. Ten pieces were collected from Level 2 of the excavation unit. Their total weight is 21g, of which 20.2 g (96.2 percent) is from a single piece. The remaining pieces weigh less than 1 g. The assemblage probably represents six or seven large limestone rocks that once ringed the south side of the hearth. These rocks cracked from the heat of the fire, resulting in the numerous small pieces that now make up most of the fire-cracked rock assemblage.

Ground Stone. Other than fire-cracked rock, the only artifact collected from LA 89658 is a ground stone fragment found on the surface just south of the hearth area. Made from a thin slab of medium-grained sandstone, the artifact appears to be from a mano, based on its convex ground surface. Although only a portion of one edge is present, the artifact appears not to have been intentionally shaped. Production input was minimal. The ground surface is moderately gritty, indicating that it was not extensively used. This is supported by the fact that the primary and secondary wear patterns, striations and polish respectively, are only faintly visible. Because the artifact is small, only 93 by 53 mm by 23 mm thick and its edges are missing, its original shape cannot be defined. Nonetheless, its presence indicates plant food processing at the site.

Macrobotanical Remains. A sample of soil was collected for macrobotanical analysis. Table 4 shows that a single seed from a plant in the mint family was present. Toll (1993:2) identifies this as a recent intrusive. Macrobotanical analysis provides no evidence supporting O'Laughlin's contention that such features were used to process succulents. This does not, of course, discredit his interpretation, and is probably related to the short duration of site occupation.

Conclusions

LA 89658 is a small concentration of fire-cracked rock representing a hearth. No chronometric or relative date can be given for the site. Excavations revealed that the shape and dimensions of the hearth cannot be defined, although a lens of possible burned sand suggests a depth of about 20 cm. This information indicates that the hearth was not used for a long time, a conclusion supported by the paucity of artifacts associated with the feature. The hearth appears to correspond to O'Laughlin's (1981:115) dispersed class of hearths. He describes them as "those hearths with a dispersed or random placement of rock. . . . Most of the rock in these hearths is fire-cracked, and the rock is generally closely spaced without noticeable arrangements of differently sized rocks. In some cases the outermost rocks show some alignment which followed the presumed curvature of pit walls." They were, he argues, used for pit-baking of leaf succulents such as agave, sotol, and yucca. The site was probably a short-term campsite.

RECOMMENDATIONS

The simple hearth at LA 43315 cannot be expected to yield additional data beyond that which has been gained through analyses of the collected flotation and radiocarbon samples. No other features or deposits were found within project limits at the site. The concentration of fire-cracked rock at LA 89658 represents a hearth. No chronometric or relative date can be given for this shallow, eroded feature. Hand and mechanical excavations at LA 89658 revealed that it is very unlikely that other features or cultural deposits are buried in the shallow soil at the site. Given the extent and results of archaeological test excavations at LA 43315 and LA 89658, we feel that the goals of testing as specified in the testing design have been met. Extensive testing has failed to reveal the presence of significant cultural deposits or features at either site. No further studies at the sites are recommended in conjunction with this project.

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APPENDIX 2
LOCO HILLS TESTING RESEARCH DESIGN: A PROPOSAL FOR TEST EXCAVATIONS AT SITES ALONG U.S.82, EDDY COUNTY, NEW MEXICO
(NMSHTD Project F-028-2(5))

A recent archaeological survey along U.S. 82 near Artesia, Eddy County, New Mexico, recorded two archaeological sites and relocated two others (Marshall and Evans 1992). The survey was conducted by the New Mexico State Highway and Transportation Department (NMSHTD) in advance of planned reconstruction of a portion of U.S. 82. Of the four sites, all located on land administered by the USDI, Bureau of Land Management, Carlsbad Resource Area, two are beyond the project limits and will be avoided by NMSHTD planned activities. The remaining two, LA 43315 and LA 89658, extend into the project limits and cannot be avoided. A program of archaeological testing was recommended to determine the extent and data potential of the portions of these sites found within project limits.

LA 43315

Marshall and Evans (1992:4) provide the following description of LA 43315:

> LA 43315, as rerecorded, is a probable campsite measuring 60 meters north-south by 60 meters east-west and located in blowouts among semi-stabilized dunes. Visible remains include three large charcoal stains, and charcoal brought up by rodents in several other places, El Paso and Alma Plain brownware sherds, simple lithic artifacts, and fire-cracked rock.

Their site map shows that the site consists of a large, irregularly shaped blowout area bounded on the north by highway pavement and on three sides by dunes. To the west and south are five smaller blowout areas, four of which contain cultural material, as does the large blowout. The large charcoal stains are found in two small blowout areas on the south side of the site. The site map also indicates that about one-third of the site is within project limits.

LA 89658

LA 89658 is a "temporary campsite consisting of a cluster of approximately 16 fire-cracked rocks in a small drainage and four more scattered up- and downstream. No other artifacts are present" (Marshall and Evans 1992:4). Although the concentration of fire-cracked rock is located outside the right-of-way fence, it is within project limits.

General Testing Procedures

Archaeological testing is designed to provide information on the nature and data potential of those portions of the sites found within NMSHTD project limits. Specifically, testing is intended to determine the actual size of each site and to reveal whether subsurface features or deposits of cultural

material are present.

On each site, the distribution of surface cultural material will be defined by marking the locations of artifacts, fire-cracked rocks, and observable features with pinflags. The site as defined by this distribution will then be mapped using a transit and stadia or tape. Artifacts that may provide chronological data, such as ceramic sherds and projectile points, will be collected after their locations are recorded. Mapping the site in this way will show the locations of artifact concentrations and features. A datum will be established and a grid system oriented to cardinal directions imposed over each site.

Schutt et al. (1991) outline different test excavation strategies for blowout areas and dunes. They emphasize hand excavation in blowouts and mechanical excavation in dunes and are designed to provide maximum information from the two different depositional situations. We will follow these strategies, with some modifications, at the Loco Hills sites. If at any time human remains are encountered, excavation will stop, and we will notify the Historic Preservation Division. The remains will be recorded as found, covered, and left for data recovery investigations.

Testing Procedures for Blowouts

In blowout areas, 1 by 1 m test units will be excavated by hand in areas of relatively high cultural material density. Vertical control will be established by using 10 cm arbitrary levels. Soil will be screened and all artifacts collected by level. Excavation will continue until sterile soil is reached. Profiles will be drawn as appropriate. The goals of this activity are twofold: to search for and identify possible subsurface features associated with surface concentrations and to search for and identify past occupational surfaces. If features are encountered, they will be recorded and cross-sectioned to determine whether they are intact and if cultural material useful for chronological, environmental, and subsistence analysis is present. Samples of feature deposits removed during excavation will be saved for laboratory analysis. The features will then be covered and left for data recovery investigations. If past occupational surfaces can be defined by association with features, they will be recorded as found, covered, and left for data recovery investigations. If surfaces can be defined by association with artifacts but not features, they will be recorded. If a surface is near the modern ground surface (less than 20 cm deep), an area 1 m wide surrounding the discovery unit will be stripped to search for features. If features are found, they will be treated as discussed above. If a surface is more than 20 cm below modern ground surface, it will be recorded as found, covered, and left for data recovery investigations.

Selected portions of blowouts will be stripped of loose blow sand to search for shallow buried features that are not revealed by the presence of cultural material concentrations or by controlled excavation. Surface stripping will proceed in 1 by 1 m units. The size of surface-stripped areas will depend on the size of blowouts and the extent of cultural material.

In addition to hand excavation, hand or power augers may be used to search for subsurface features or deposits not revealed by concentrations of cultural materials or by excavations. All excavation units and auger tests will be recorded on the site map.

Testing Procedures for Dunes

Backhoe trenches will focus on dunes surrounding blowouts. The goals of mechanical excavation are fourfold: to define on-site stratigraphy, to identify strata associated with surface artifacts and features or past occupational surfaces, to search for and identify features or deposits of cultural material buried in or beneath dunes, and to identify strata associated with buried features or deposits (Landis 1987:5, 10-11). Backhoe trenches will radiate from blowouts into surrounding dunes so that the trenches reach "outward from the blowout perimeter in a spoke-like fashion" (Schutt et al. 1991:196). They can then be used to examine relationships between blowout assemblages and adjacent dune deposits (Landis 1987). Profiles of the trenches will be drawn to record on-site stratigraphy. Also, as appropriate given the information revealed by radial trenches, longer trenches will be excavated parallel to the length of the project limits. These trenches will be used to search for and identify buried features or deposits and to examine relationships between past and present site topography. Profiles will be drawn as appropriate when information about on-site stratigraphy is revealed that was not learned from radial trenches.

If features or past occupational surfaces are found, they will be treated as discussed above. If backhoe trenches reveal the presence of subsurface deposits in dune areas without the definition of features or past surfaces, shovel test pits will be used to examine the deposits. Schutt et al. (1991:196) found that

> Shovel test pits represent an extremely successful hand excavation technique that can be used to assess stratigraphy, identify features, and isolate potential cultural levels in a relatively short period of time. . . . Shovel test pits are a sensitive indicator of the presence of cultural remains because excavated soils are screened, thus recovering artifacts that are generally not recovered from backhoe trenches or auger holes.

These benefits come from the informal but relatively controlled nature of shovel test pits (Schutt et al. 1991:196): "The circular test pits are hand excavated, and are just wide enough to allow the excavator to dig down 1 m. Excavated soils are screened. Since STPs [shovel test pits] are not square and do not require straight walls they can be excavated quickly."

Artifacts recovered from shovel test pits will be collected. The locations of backhoe trenches and shovel test pits will be recorded on the site map.

Off-Site Testing

Because "the presence or absence of artifacts on the ground surface [is] *not* useful in predicting the presence or absence of artifacts beneath the ground surface" (Schutt et al. 1991:192; see Landis 1987), definitions of site boundaries based on surface distribution of cultural materials may be spurious. Consequently, backhoe trenches will be excavated within project limits but beyond the limits of surface artifact distributions to search for buried features or deposits of cultural materials. In this way, the actual site boundaries as defined by the limits of artifact and feature distribution can be determined. If features, past occupational surfaces, or deposits are found, they will be treated as discussed above.

Site-Specific Procedures

LA 43315

Testing at LA 43315 will follow the procedures for blowout, dune, and off-site areas outlined above. The site map shows that one small blowout and most of the large blowout are within project limits. Because surface artifacts were not observed in the small blowout, we will strip the loose sand from the center of the blowout. The size of the stripped area will depend on the results of this activity. If features or an occupational surface are found, they will be treated as discussed above. No more than three radial backhoe trenches will be excavated to examine the surrounding dunes. One of these may connect the small and large blowouts. If the trenches reveal subsurface deposits, we will use shovel test pits to investigate them. If features or surfaces are found, they will be treated as discussed above.

The site map shows that lithic artifacts were observed within project limits in the large blowout. If mapping the surface artifact distribution shows that concentrations are present, we will excavate 1 by 1 m test units as discussed above. The map also shows that one concentration of fire-cracked rock is located just outside project limits. If it is actually within project limits or if others are discovered, 1 by 1 m test units will be excavated as discussed above. The number of 1 by 1 m test units will depend on the number of concentrations of cultural material found in the blowout. If features or occupational surfaces are found, they will be treated as discussed above. If no cultural material concentrations are found, we will strip the loose sand from selected areas within the blowout to look for shallow features. The number and size of surface strip areas will depend on the results of this activity. If features or surfaces are found, they will be treated as discussed above.

No more than six radial backhoe trenches will be used to examine the dunes surrounding the large blowout. If features or surfaces are found, they will be treated as discussed above. One of these may connect the large and small blowouts. If the radial trenches provide a comprehensive view of on-site stratigraphy, a long trench through the site may not be necessary.

LA 89658

LA 89568 as currently defined consists of a concentration of fire-cracked rock in a small drainage. Testing will involve procedures combined from the strategies discussed above. After mapping the site, a 1 by 1 m test unit will include about half of the concentration. It will be excavated in 10 cm levels. If a feature such as a hearth or roasting pit is present, it will be treated as discussed above. If an occupational surface can be defined, it will be treated as discussed above.

A backhoe trench will be excavated paralleling the length of the project limits through the site. Based on the results of hand and mechanical testing, shovel test pits may be used to examine deposits if found. If excavation shows that the site is larger than currently defined, additional backhoe trenches may be placed beyond the limits of the site to aid in defining site limits. If features or past surfaces are found, they will be treated as discussed above.

Laboratory Procedures

Artifacts collected during testing will be returned to the Office of Archaeological Studies for analysis. Lithic artifacts will be analyzed using standardized analytical formats (OAS n.d.a and n.d.b). Ceramic artifacts will be examined for information on ceramic types, vessel forms, surface treatment or decoration, and temper materials. Samples such as radiocarbon, flotation, and pollen will be returned to the Office of Archaeological Studies, processed as appropriate, and submitted for analyses.

When laboratory analyses are complete, a report will be written and published in the Office of Archaeological Studies's Archaeology Notes series. The report will discuss the testing program, field and laboratory procedures, results at each site, analytical results, and recommendations concerning the data potential of each site and the need for data recovery investigations.