MUSEUM OF NEW MEXICO
OFFICE OF ARCHAEOLOGICAL STUDIES

THE OJO CALIENTE PROJECT: ARCHAEOLOGICAL TEST EXCAVATIONS AND A DATA RECOVERY PLAN FOR CULTURAL RESOURCES ALONG U.S. 285, RIO ARRIBA COUNTY, NEW MEXICO

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ADMINISTRATIVE SUMMARY

In November 1991, and February and March 1992, the Office of Archaeological Studies, Museum of New Mexico, conducted archaeological test excavations at eight sites along U.S. 285, several miles north of its junction with U.S. 84, in southern Río Arriba County, New Mexico. The project was conducted at the request of the New Mexico State Highway and Transportation Department, which plans to realign and reconstruct portions of U.S. 285 in the lower Ojo Caliente Valley. All the sites tested during this project are on privately owned land located adjacent to the present U.S. 285 right-of-way, and test excavations were conducted with the permission of the landowners.

Sites investigated on this project include a single lithic artifact scatter (LA 83110), six lithic and ceramic artifact scatters (LA 83107, LA 83109, LA 83111, LA 83114, LA 83118, and LA 83151), and two agricultural field complexes (LA 83116 and LA 83117). Dates of occupation and use range from Early to Middle Archaic through Late Archaic-Basketmaker II (ca. 4800 B.C.-A.D. 400), and from the Coalition and Classic periods through the early historic period (ca. A.D. 1250-1750). Test excavations showed that important cultural information is contained within buried deposits at six sites in the study area (LA 83109, LA 83110, LA 83116, LA 83117, LA 83118, and LA 83151). Two sites (LA 83111 and LA 83114) were tested and found to consist primarily of redeposited surface material. These sites are not likely to yield important information and are not recommended for additional data recovery. Another site (LA 83107) is outside the construction zone and will not be affected by the present project.

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We would like to thank, first of all, local residents in the Ojo Caliente Valley, and more specifically, landowners along the project route, who were extremely cooperative and provided valuable insights into contemporary subsistence practices and the location of sites of interest, including outlaw hangouts, in the area. Special thanks go to members of the Zegerelli family who kept a midnight watch over our test pits in progress.

The authors would like to thank our field and laboratory crew for their untiring efforts and good humor despite inclement weather and frozen soil. Many thanks to John Johnson, Deborah Johnson (no relation), and Jennifer Yellen. The environmental section of this report was researched and written by John Johnson. Lithic artifact analysis was completed by Deborah Johnson, under the direction of James Moore, whose guidance in selecting analytic methods and relevant literature is much appreciated. The ceramic artifact analysis was completed and written up by Macy Mensel, who would like to acknowledge the generous assistance of Curt Schaafsma, Dean Wilson, and Daisy Levine. Mollie Toll analyzed the macrobotanical remains and Nancy Akins was responsible for the analysis and write up of the faunal material. Their expertise is greatly appreciated. The onerous job of data entry and editing was done by Deborah Johnson and John Johnson, who also washed, labeled, and inventoried the artifacts before analysis. Finally, the authors would like to thank Carl White, Glenna Dean, Sandra Turner, Jim Moore, Tim Maxwell, and Fairly Barnes for their contributions to a number of provocative discussions on the nature of prehistoric agriculture and agricultural landscapes in the Northern Río Grande.

We would like to thank Tim Maxwell for his review and helpful comments on this manuscript. The first few edits of the report were undertaken by Macy Mensel and John Ware before they voluntarily passed the duty on to Robin Gould, who is much better at it. Illustrations were drawn by Ann Noble; artifact photographs were made by Nancy Warren. The final report was produced and published by the Production Department, Office of Archaeological Studies, Museum of New Mexico.

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INTRODUCTION

Field work on the Ojo Caliente Project was conducted during two periods: a week of preliminary survey and mapping in November 1991, which was interrupted by heavy snow falls, and two additional weeks in February and early March 1992, during a brief and unexpected warming interval. At the request of Mr. William L. Taylor of the New Mexico State Highway and Transportation Department (NMSHTD), eight sites were tested on the project (see Appendix 3). All the sites were on private land adjacent to the present U.S. 285 right-of-way, and test excavations and surveys were carried out with the permission of the landowners.

Timothy D. Maxwell, acting director of the Office of Archaeological Studies, served as principal investigator on the project. John A. Ware, assisted by Macy Mensel, directed field recovery and data analysis efforts. They were assisted in the field and laboratory by Deborah Johnson, John Johnson, and Jennifer Yellen. Faunal remains were analyzed and reported by Nancy Akins; botanical remains by Mollie Toll. Assistance with interpreting the geology of the project area was provided by Lynne Drake, formerly of the Office of Archaeological Studies. Drs. Carl White, Sandra Turner, and Glenna Dean of the Department of Biology, University of New Mexico, contributed substantially to the formulation of the agricultural field research design.

The sites described in this report were first recorded during an archaeological survey of a proposed U.S. 285 right-of-way realignment in the spring of 1991 (Drake 1991). The survey revealed a total of 17 sites within the project boundaries. Eight sites were in areas that could be avoided by construction activities. Of the remaining nine sites, four (LA 83111, LA 83114, LA 83118, and LA 83151) were recommended for testing to determine the depth and areal extent of subsurface cultural deposits, and five (LA 83107, LA 83109, LA 83110, LA 83116, and LA 83117) were recommended for full-scale data recovery based on the presence of cultural features or demonstrable evidence of buried cultural deposits. On review of Drake's survey report, the State Historic Preservation Office recommended that test excavations be conducted at four additional sites (LA 83107, LA 83109, LA 83110, and LA 83117), and these sites were subsequently added to the list of sites to investigate during the testing phase of the project.

The first portion of this report provides an overview of local and regional culture history, summarizes the results of test excavations, and presents specific data recovery recommendations for each site tested. The final sections summarize important research problem domains for cultural resources in the project area, and presents a comprehensive plan for future data recovery on the project.

PROJECT ENVIRONMENT

Physiography and Geology

The project study area is in the Río Ojo Caliente Valley in southeastern Río Arriba County (Fig. 1). The locale, just north and east of the confluence of the Río Ojo Caliente and the Río Chama, is part of the Abiquiú quadrangle. Geologically, the valley is a continuation or "re-entrant" of the Española Valley and Río Grande Depression, which is placed within the Basin and Range province, but its proximity to the Southern Rocky Mountain province leads it to be alternately assigned within the Basin and Range province (Maker et al. 1973:6) and the extreme Southern Rocky Mountain province (Fiero 1978:4). This is simply because while montane influences are tapering off, the full basin has not yet been realized. The local mesas are not exactly foothills, but the effect is largely the same. Elevations range from 5,500 to 7,000 ft (1,676 to 2,134 m).

The Española Valley to the south is a basin created by late Tertiary extension, subsequently filled by alluvial sediments from the surrounding highlands. These sediments are primarily a mixture of Miocene sedimentary and Pliocene to Holocene volcanic rock and sediments (Drake 1991:4). Black Mesa shadows the area, literally in the most easterly project sites, sustaining frozen ground conditions there, while the Cerrito de la Baca ridge is the most prominent geologic feature to the west of the study area.

The Abiquiú quadrangle consists of Tertiary volcanic and sedimentary rocks overlying older rock with angular unconformity. Of the three formations that make up the quadrangle (El Rito, Abiquiú, and Santa Fe), the study area is identified as including the thickest part of the Santa Fe Formation, which extends parallel and next to the western slopes of Black Mesa (Drake 1991:4). The Santa Fe deposit is the lower end of a piedmont alluvial fan deposit extending west by southwest from the Sangre de Cristo range and is distinguished from the similarly appearing Abiquiú Formation by the absence of fossils in the latter. Fossils found in the Santa Fe Formation include mastodon, rhinoceros, camel, deer, three-toed horse, dog, weasel, oreodont, and beaver. This suggests formation during a period wet enough to sustain vegetation for this variety of fauna, a time that the fossil record places in the lower Pliocene. The formation is composed of both consolidated and unconsolidated deposits of sand, silt, clay, and pebbly beds with small amounts of calcareous and tuffaceous material locally interbedded with subsequent basalt flows. In dunes, fluvial and eolian cross-bedding and concretionary structures are many.

Irregularly placed, large, brecciated uplifts, such as Cerrito de la Baca, indicate the location of both pre- and post-Tertiary faulting. Intrusive sills and dikes, some displaced by faulting, are also present. Within the sand dunes, faults are indicated by irregularly occurring cemented zones.

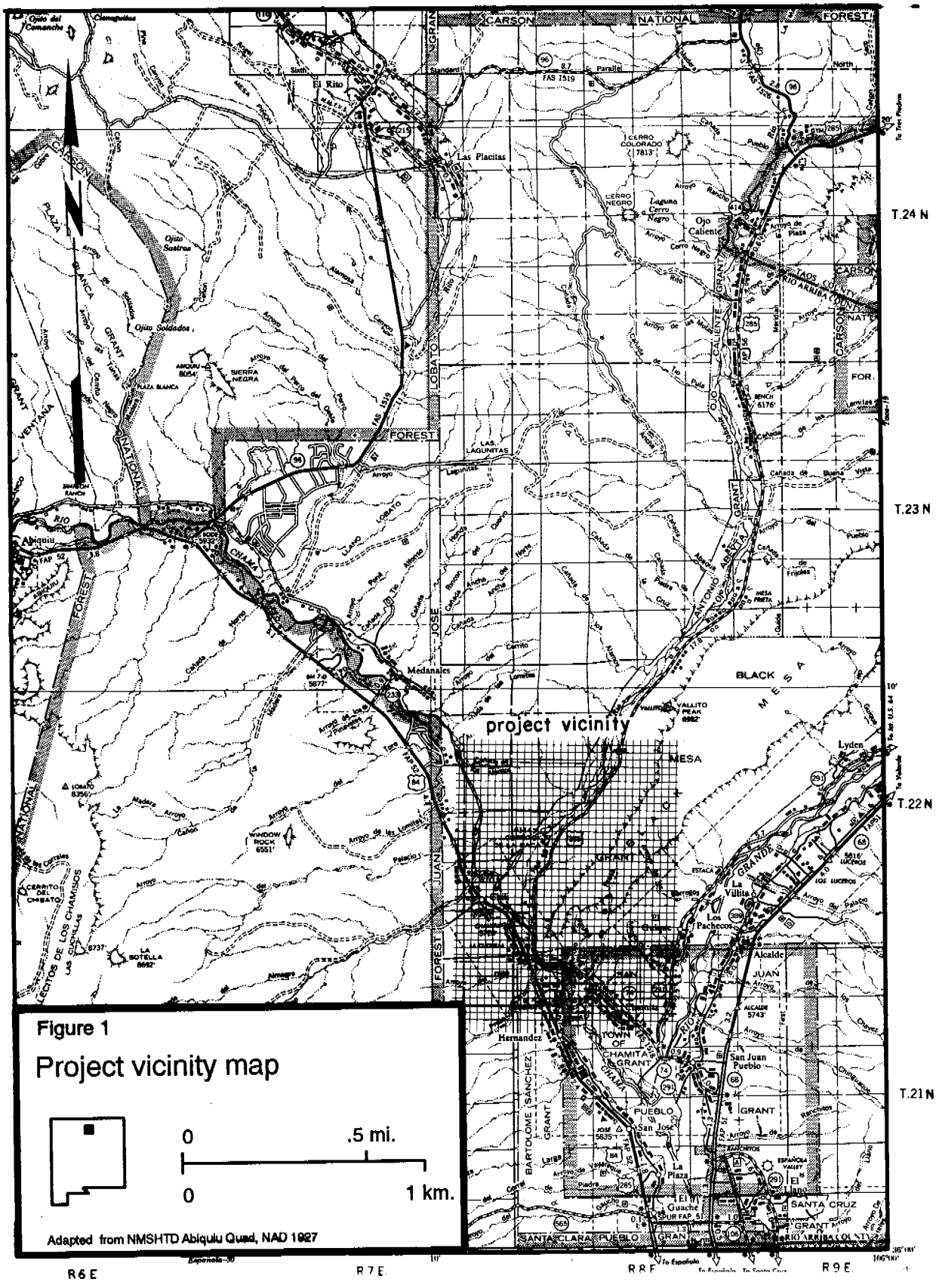

Figure 1

Project vicinity map

Soils

The predominant area soil group is classified as Pojoaque-Rough Land Association (Maker et al. 1973:33). The total association is 242,660 acres of rolling hills criss-crossed by innumerable arroyos and washes. The Pojoaque soils have a thin surface of light reddish brown sandy clay loam containing occasional rounded igneous rock (Maker et al. 1973:33). Underlying this is 5 or more feet of sand loam with small gravels comprising from 15 to 35 percent of the total soil matrix. Blowouts are very common. Rough Broken Land consists of more unconsolidated, shallow alluvial deposits of varying depth (Maker et al. 1973:33). A thin layer of soils is found on the tops of the intermittent ridges that occur throughout this type and between the outcrops of the sedimentary materials of the Santa Fe Formation (Maker et al. 1973:33). The uppermost ridge tops are typically capped with a surface layer of gravel and areas with this type are steep and widely dispersed.

Climate

The climate is semi-arid, sometimes identified with the northernmost extreme of the Sonoran life zone. Though temperatures can be extreme, there is a somewhat consistent growing season of 140-160 days a year (Tuan et al. 1973). The last killing frosts occur between mid to late April, beginning again in mid to late September (Tuan et al. 1973). A record high temperature of 106 degrees F was recorded in nearby Española in 1925, where winter temperatures frequently reach the low 20s (Wendorf 1953; Maker et al. 1973). During the summer months, temperatures are more moderate and the July daily average is recorded at 72.3 degrees F. Summer temperatures are lower in wetter years than in dry (Tuan et al. 1973).

An important factor in sustaining agriculture is the fluctuating level of rainfall throughout the valley. While average annual precipitation is 9-10 inches (229-254 mm), this measure can vary significantly from year to year (Maker et al. 1973). For example, Española received 15.38 inches (391 mm) of total precipitation in 1911 but only 3.76 inches (96 mm) in 1956 (Maker et al. 1973).

Another factor to be considered in local farming practices is the problem of cold-air drainage. Cold, heavy air blowing off peripheral mountain and mesa tops, seeps into the lower valleys on still nights, causing valley temperatures to plummet (Tuan et al. 1973). Farmers in the valley consistently lose one in three late-maturing crops a year to low temperatures caused by cold air drainage (Bugé 1984). Flooding also continues to be an occasional cause of crop loss in the area (Wendorf 1953).

Flora and Fauna

The contemporary floral environment is similar to conditions that have existed since the prehistoric period (Wendorf 1953). The highly erodible sandy soils and high elevations (5,500-7,000 ft; 1,676 to 2,134 m) in the area support the Upper Sonoran life zone subtype "juniper-piñon woodland." Considered similar to a savannah and with fewer species than other life zones, this community includes an open overstory of mixed juniper and piñon stands with pure stands of juniper occurring at the lower elevation and pure stands of piñon occurring toward the higher. The

understory typically includes several species of grama grass, Indian ricegrass, ring muhly, sand dropseed, three-awns, rabbitbush, chamisa, and yucca, several of which are edible species. Numerous blowouts in the area are attributed to overgrazing of cattle and sheep (Wendorf 1953). Cholla and snakeweed, which are indicative of overgrazing, are plentiful (Ford 1978:56).

The life zone along the river banks is a riparian woodland following the pattern typical throughout the Southwest (Lowe 1964:60). This type of woodland consists of stands of intermingling willow and cottonwood.

Comparisons between animal communities in the juniper-piñon woodland and the riparian woodland zones are hampered by the heavy incidence of contemporary farming and grazing of domesticated stocks that alters the riparian zones. It is probable that game animals were never plentiful in the area, but two important species that existed previously, elk and bighorn, have since disappeared (Wendorf 1953). Smaller animals of food value in the area include lizards, snakes (western hog-nose, prairie bull, brown garter, and prairie rattler), and leopard frogs, in addition to the suckers, minnows, dace, and fresh-water eels that are found in local streams (Wendorf 1953). Mammals presently living in the area include ground squirrels, jackrabbits, and cottontails, coyotes and mule deer (Findley et al. 1975), although no indications of the latter species were observed first hand. Seasonally, sandhill cranes are abundant, along with ravens, jays, various raptors, larks, and other small birds.

ARCHAEOLOGICAL OVERVIEW

History of Research

Recent comprehensive summaries of archaeological research in the lower Chama Valley have presented the details of nearly 100 years of archaeological investigations in the region (for example, Beal 1987; Anschuetz et al. 1985). The following overview will present only the highlights of that history as an introduction to discussions of regional cultural history and important research questions that follow. The present overview focuses on the lower or southern portion of what became known as the Chama District (Cordell 1979). The district extends from the Piedre Lumbre Valley in the north to the confluence of the Río Chama and Río Grande in the south, and from the foot of the Jemez Mountains in the southwest to the confluence of the Río Ojo Caliente and Vallecitos Creek in the northeast (Fig. 2).

The earliest recorded archaeological investigations in the lower Chama Valley are dated to the late nineteenth century. In 1874, Dr. H. C. Yarrow, a member of the Wheeler 40th Parallel Survey, visited and described the fifteenth-century pueblo of Poshueingue (Beal 1987). Eleven years after Yarrow's visit, Adolf Bandelier surveyed the lower Chama Valley and described several large Classic pueblo ruins (Bandelier 1892; Beal 1987:11). Bandelier was probably the first to describe the extensive prehistoric agricultural systems in the lower Chama district (Maxwell and Anschuetz 1987:26), and it was largely due to Bandelier's explorations that early twentieth-century archaeologists began focusing their attention on the region.

Surveys were conducted in the lower Chama in the early years of the twentieth century by Hewett and Harrington, and in the 1930s by H. P. Mera and Frank Hibben. Early excavations in the valley were carried out by Jeançon, Greenlee, and Hibben. These early studies focused on the large, Classic pueblos of the region. Surveys by Hewett in 1906 (Hewett 1906) and Harrington in 1910 (Harrington 1916) added the sites of Ku, Te'ewi, Tsiping, Yunque, Mariana, Tsama, Leafwater (Kap), Peseduingue, Nute, and Ponsipa-akeri to the inventory of ruins described by Bandelier. Harrington collected Tewa oral traditions regarding the origins of these communities and the constituency and historic disposition of their populations.

The first intensive reconnaissance of the Chama Valley was conducted in the mid-1930s by Frank Hibben of the University of New Mexico, who surveyed from the mouth of Gallina Creek on the north to the confluence of the Río Chama and Río Grande on the south. Hibben's survey defined eight general categories of archaeological sites: (1) large Biscuit Ware ruins; (2) Tewa Polychrome and historic ruins; (3) Wiyo Black-on-white or "Biscuitoid" ruins; (4) single house ruins and lodge sites; (5) tipi rings and rock shelters; (6) chipping areas and quarries; (7) garden areas and shrines; and (8) torreones and ledge houses. H. P. Mera's surveys of Biscuit Ware sites in the lower Chama established a ceramic seriation for the period from circa A.D. 1200 to 1600. With his improved chronology of the region, Mera was perhaps the first to note the large-scale depopulation of the lower Chama in the period between 1400 and 1600 (Beal 1987:12).

Although limited test excavations were apparently carried out by Yarrow and Bandelier in the late nineteenth century, the first large-scale excavations in the lower Chama were carried

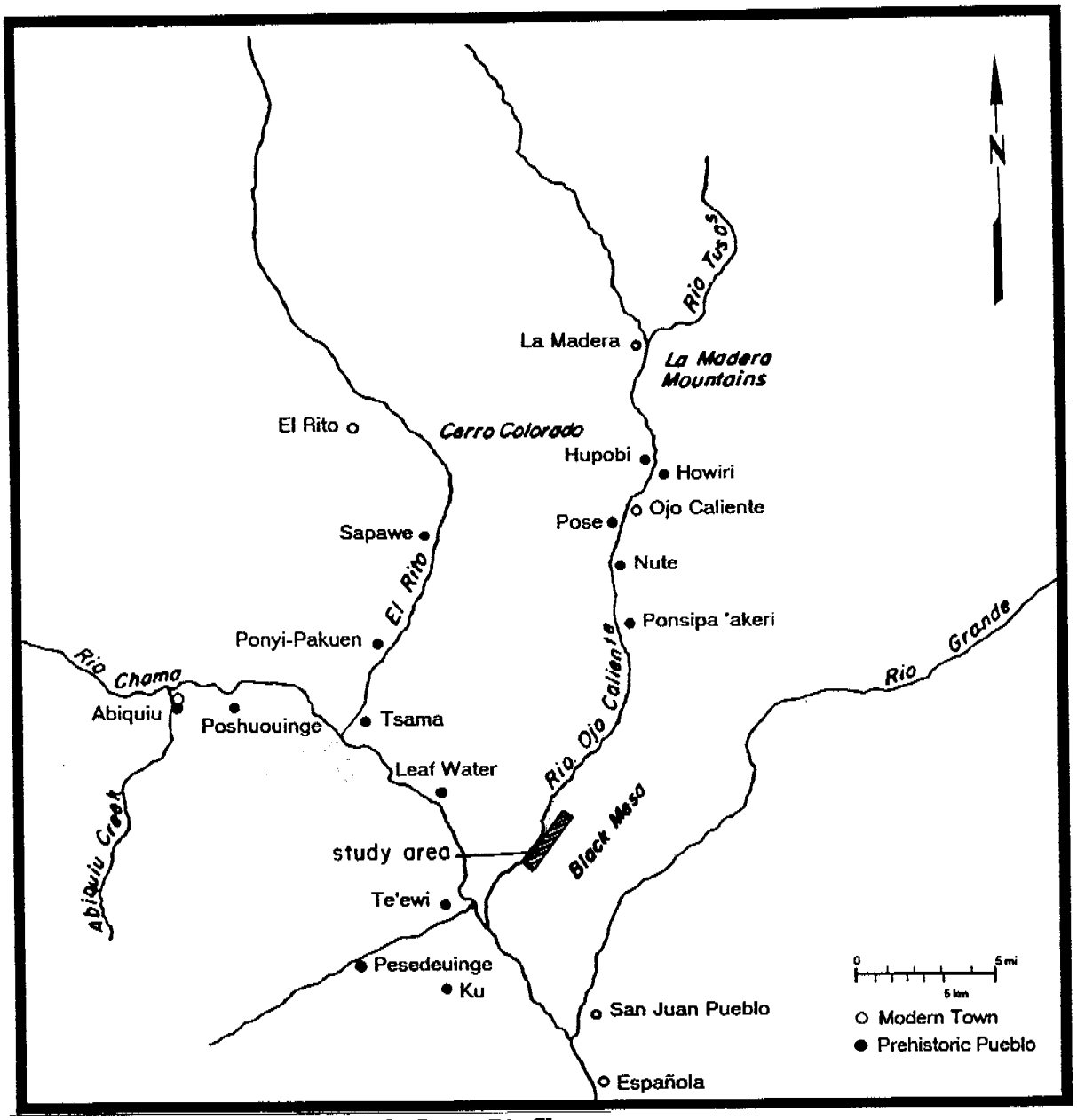

Figure 2. Major prehistoric sites in the Lower Río Chama.

out by Jeançon in 1911. Jeançon excavated 60 rooms at the site of Peseduingue on the Río del Oso (Jeançon 1912), and eight years later he cleared 130 rooms at Poshueingue, located near the confluence of the Río Chama and El Rito Creek (Jeançon 1923). During his field work at Poshueingue, Jeançon described complex linear and curvilinear stone alignments near the pueblo that he interpreted as house foundations, shrines, and symbolic figures. In retrospect, many, if not most of these features, were probably agricultural grids and garden plots.

The next excavation in the lower Chama was conducted in the early 1930s by R. Greenlee of the Museum of New Mexico, who excavated 12 rooms at the fifteenth-century pueblo of Tsama,

located near the confluence of El Rito Creek and the Río Chama. This work, which remains unpublished, was followed by Hibben's excavations at the Riana Ruin, a late Coalition period (ca. A.D. 1200-1325) village above the junction of Cañones Creek and the Río Chama (Hibben 1937).

The 1950s saw several major excavation projects associated with proposed changes in the stream flow of the Río Chama. In the summers of 1950 and 1951, Fred Wendorf of the Museum of New Mexico excavated 27 rooms and four kivas at the ruin of Te'ewi in the lower Chama Valley, the site of a proposed dam across the Río Chama. At the same time, and under the field supervision of Ralph Luebben, Wendorf opened up 18 rooms and four pit structures at the Leafwater Ruin (Kap), located across the valley and several kilometers northeast of Te'ewi. Based on these and other excavations in the Northern Río Grande, Wendorf and Eric Reed (1955) collaborated on a synthesis of Río Grande prehistory that remains one of the most influential interpretations of prehistoric change in the Eastern Anasazi region.

Later in the decade of the 1950s, Stewart Peckham of the Museum of New Mexico excavated 27 rooms and a single kiva at the Palisades Ruin in advance of construction of Abiquiú Dam. The decade also saw the creation of the Museum of New Mexico's highway salvage program when a New Mexico Highway Department construction project destroyed part of the fifteenth-century ruin of Howiri in the upper Ojo Caliente Valley.

Contract archaeological projects continued to explore the prehistoric resources of the lower Chama in the 1960s and 1970s, with a major survey and excavation project in the Abiquiú Reservoir maximum pool zone (Schaafsma 1976, 1978, 1979), and an assortment of highway and powerline construction projects. The survey of Abiquiú Reservoir was especially important because it was the first systematic intensive areal survey within the region. As such, it contributed significantly to our understanding of archaeological variability in the lower Chama, evaluating and expanding on the categories of archaeological remains identified during Hibben's less intensive surveys of 1937.

By documenting nearly 200 sites, from Middle Archaic encampments through nineteenth-century historic farmsteads, the Abiquiú surveys expanded the range of known occupation of the lower Chama by several thousand years. The surveys also showed what had only been assumed up to that time, that there is little or no evidence of Basketmaker III through the early Coalition period occupation of the lower Chama.

In the 1960s, 1970s, and 1980s several highway and powerline projects were routed through the lower Chama Valley and surveys along these transects added to the growing inventory of archaeological sites in the region. Highway surveys in the 1960s (Ingram 1962) documented a variety of lithic and lithic and ceramic scatters, small pueblo sites, and historic farming and herding sites. In the following decade, surveys of powerline corridors (Enloe et al. 1974; Lang 1979, 1980) recorded a variety of archaeological site and settlement types, with most of the occupations dating from the mid to late Archaic (ca. 3200 B.C.-A.D. 400) and the Classic Pueblo period (A.D. 1325-1540).

Highway surveys and excavations in the 1970s and 1980s documented important aspects of regional archaeological variability, especially late prehistoric agricultural systems that are concentrated along the terraced margins of the Chama and its tributaries, inevitably in the path of engineered highways. Excavations by Fiero (1978), Anscheutz and Maxwell (Anschuetz et al. 1985), and Moore et al. (n.d.), have documented extensive agricultural facilities and features associated with

the Classic period occupation of the region. The extent of these features suggests that they played an important role in the economic adaptation of Pueblo farmers in the lower Chama and an understanding of how and when they were constructed may help to explain why the systems were constructed and why they ultimately failed.

There have been other investigations in the lower Chama in recent decades, but unfortunately, few records and only a few published reports have come out of the University of New Mexico's field school excavations at Sapawe (Skinner 1965; Ellis 1970), Tsama, and Abiquiú in the 1960s, and even less can be gleaned from Occidental College's field school excavations at Ponsipa-akeri in the late 1970s. Consequently, these studies contributed little to our understanding of archaeological problems and processes in the region.

In summation, during the early years of the present century and the later years of the last, archaeologists were concerned primarily with documenting the archaeological variability contained within the large Classic Pueblo ruins that dominate the archaeological landscape of the lower Chama Valley. Most of the problems that were addressed related to the apparent sudden appearance of these large communities and to their rapid decline and abandonment at the end of the prehistoric period (or perhaps, as some have argued, the very beginning of the historic period). As a result, there is a long history of interest in the Chama region in such questions as Tewa origins, population immigration theories, and abandonment processes in the area. Unfortunately, these questions have been pursued in a region where the status of chronometrics is so poor that we know with certainty very little more today than Mera and his contemporaries knew in the 1930s. There are no good published stratigraphic excavations in the region encompassing the time periods of primary interest. Therefore, we are limited in the questions we can realistically address until the development of more than just a skeletal chronology of the region. These issues will be addressed in more detail in the data recovery plan, which is presented after this testing report.

OVERVIEW OF CULTURAL HISTORY

Early Hunters and Gatherers (10,000 B.C. to 600 A.D.)

Chert quarries on the slopes of Cerro Pedernal, located south of the Piedra Lumbre Valley above a tributary of the Río Chama called Cañones Creek, may have been in use as early as the Clovis period (Warren 1974; Cordell 1979). Although no substantiated Paleoindian sites have been documented in the lower Chama District to date, scattered surface finds of Paleoindian projectile points--some manufactured from Pedernal chert--suggest that the area was at least visited by Paleoindian and early Archaic hunters and gatherers.

The best candidate for a Paleoindian site in the lower Chama is probably AR-413, recorded within the maximum pool zone of Abiquiú Reservoir (Schaafsma 1976). The site has a cultural layer approximately 2.5 m below an Archaic horizon. No temporally diagnostic artifacts were noted within the buried component, the layer was not excavated, and no dateable materials were recovered; however, the relative stratigraphic position of the component in relation to an established Archaic horizon suggests considerable antiquity (Schaafsma, pers. comm., 1992).

There is very little evidence of Early Archaic occupation or use of the lower Chama Valley. No Jay phase (5500-4800 B. C.) material has been reported from the region and only a few Bajada points and one apparent Bajada phase site were recorded during the Abiquiú Reservoir survey. In contrast, Middle and Late Archaic (ca. 3200 B.C.-A.D. 600) materials appear to be comparatively abundant in the Chama Valley. It would be reasonable to conclude that either the frequency or intensity of use of the region increased sometime during the San Jose phase (ca. 3500 B.C.), and continued through the Late Archaic En Medio phase (Basketmaker II-A.D. 100).

Despite the early recognition of preceramic archaeological components in the lower Chama (Hibben 1937), no systematic research was conducted on early hunter-gatherer sites until the 1970s and 1980s. Surveys of the Abiquiú Reservoir showed some 56 probable Archaic sites and components (Schaafsma 1978:48), most dating to the Late Archaic En Medio phase, and the majority on terrace settings above the Río Chama floodplain. The School of American Research excavated 13 of these sites. Common features included shallow charcoal and ash-filled basins, both with and without heat-fractured rock, large cobble piles, and isolated clusters of fire-cracked rock (Schaafsma 1978:48). Schaafsma postulated that at least five Late Archaic sites in Abiquiú Reservoir were warm-season base camps focusing on the exploitation of riverine resources (1979:20). From his review of Schaafsma's Abiquiú evidence and his excavation of a Late Archaic multiactivity site in the Piedra Lumbre Valley (LA 11836), Snow (1983) argues that Schaafsma's base camps may have been temporary special-use locales with multiple superimposed occupations.

Additional Archaic sites have been recorded south of Abiquiú Reservoir to the confluence of the Chama and Río Ojo Caliente, several of which have been excavated. A survey of a 345 KV transmission line between Fruitland and Chili, New Mexico, recorded seven probable Archaic components. Most were on ridges, mesa tops, and benches on the flanks of the Chama Valley (Enloe et al. 1974:7). The sites were described as small quarry and work areas associated with concentrations of fire-cracked rock and hearths. Typical artifacts included lithic debitage, small cores, low frequencies of retouched flakes, and an occasional projectile point. No grinding

implements or pottery were noted on the sites.

In another transmission line survey near the confluence of the Río Ojo Caliente and the Río Chama, Lang (1979) reported six Archaic-Basketmaker II lithic artifact scatters and several additional sites with fire-cracked rock that may date to the Late Archaic. Most of the sites were chipped and ground stone artifact scatters associated with heat-fractured rock and surface charcoal stains.

Data recovered from three Archaic sites excavated by Lang (1980) are especially relevant for the current project because the sites are clustered on the western terrace of the Río Ojo Caliente less than a mile northwest of the current project area. All three sites have multiple temporal components, and at two sites, OC-8 and OC-9, Middle to Late Archaic components comprise most of the visible cultural assemblage. The third site, OC-7, is a large complex of Classic period agricultural fields and features that overlie a small Late Archaic encampment.

The largest of the three sites, OC-8, is particularly noteworthy. It contained 20 to 21 basin-shaped hearths associated with quantities of heat-altered rock and a feature that Lang describes as a shallow pit structure dating to the Bajada-San Jose boundary (ca. 5,200 B.P.). The feature was a shallow, oval pit measuring just over 2 m in diameter and from 10 to 20 cm deep. The floor was charcoal-stained, compacted sand. No floor features were noted, although there were several charcoal stains on or immediately above the occupation surface, and there was no evidence of a superstructure (i.e., postholes, burned roof beams, wall footings, etc.). Lang bases his age estimate of the feature on a single radiocarbon date of 5,240 $\pm$ 130 B.P., derived, not from the structure itself, but from a charcoal-filled depression located about a meter southeast of the feature. Considering the absence of a prepared floor, floor features, and tangible remains of a superstructure, Lang's interpretation of a domestic structure at OC-8 must be considered questionable. However, a site the size and complexity of OC-8 suggests a substantial Middle to Late Archaic occupation and use of the lower Ojo Caliente Valley.

To summarize, there are abundant remains of early hunters and gatherers in the lower Chama region. In fact, Middle and Late Archaic sites (ca. 3,200-1,500 B.P.), may be common archaeological manifestations in the region. Yet, we can say little with certainty about Archaic adaptations in the lower Chama because there has been very little systematic research on the period. A review of the literature suggests interesting regional variation among Archaic sites in the lower Chama. Schaafsma has argued for seasonal base camps in the Piedre Lumbre Valley and Lang believes that he has identified an Early to Middle Archaic domestic feature in the Ojo Caliente Valley. Archaic assemblages throughout the region suggest complex subsistence, settlement, and ethnic affiliation patterns in the region that persisted for at least several thousand years. Obviously, the region contains an Archaic data base that is rich in research potential, but very little research has been proposed or done, perhaps because of the historic emphasis on the spectacular Classic Pueblo remains in the region. Acknowledging this oversight, questions addressing the Archaic period adaptation in the lower Chama District will be a major part of the evolving research design on the present project.

Early Farmers (A.D. 600 to 1300)

There is a general absence of early prehistoric farming sites in the lower Chama region, a pattern that is repeated in other areas of the Northern Río Grande, including the Galisteo Basin, the

Santa Fe River Valley, and the Pajarito Plateau. Maxwell and Anscheutz (1987:25) conducted a search of the Archaeological Records Management System at the Laboratory of Anthropology in 1987 and found 110 Coalition-Classic period sites and components and only nine Basketmaker III-Pueblo II components (A.D. 600-1200), and these were isolated occurrences of early Pueblo-style projectile points. No Taos Black-on-white (ca. A.D. 1150-1250) and only a single sherd of Kwahe'e Black-on-white (ca. 1125-1200) have been discovered in the lower Chama Valley (Schaafsma 1979; Moore n.d.). The implication is that while the lower Chama was not a residential locus during the Developmental period, the area may have supported mobile bands of hunters and gatherers during the first millennium A.D. According to Beal (1987:17):

> Except for transitory Basketmaker III-Pueblo I visits, the Chama region seems to have been unoccupied by humans for nearly 900 years. . . . For all intents, the lower Chama River supported little or no appreciable population between A.D. 400 and 1250.

In other words, there may have been very little change in regional settlement and resource use strategies from the Late Archaic into the early thirteenth century A.D., long after adjacent populations on the Colorado Plateaus to the west had made substantial commitments to residential farming.

Classic Period Farmers (A.D. 1300-1600)

The first sedentary farming villages to appear in the lower Chama District were founded in the late 1200s or early 1300s, near the end of the Río Grande Coalition (Wendorf and Reed 1955). The Coalition period (A.D. 1200-1325) witnessed important changes throughout most of the Northern Río Grande. There was significant population growth throughout the region, even in areas that had little evidence of pre-Coalition population, such as the Galisteo Basin, the Pajarito Plateau, the Santa Fe, Taos, and Gallina areas, and of course, the lower Chama Valley. There appeared in these areas, without developmental antecedents, large aggregated communities. In the Chama Valley, the Palisade and Riana ruins and Leafwater Pueblo were established between A.D. 1200 and 1300, and at least five Classic period communities, including Tsiping, Te'ewi, Hupobi, Sapawe, and Ponsipa-akeri were founded about the same time. Important changes in material culture coincided with the establishment of these large population centers. Changes included the appearance of organic-painted pottery and a variety of other material culture traits that suggest important influences from the Colorado Plateau to the west.

There has been considerable debate among scholars over the causes of these processes. Some (for example, Wendorf 1953) have argued that the Río Grande Coalition was the result of growth, expansion, and diversification of a local population responding to extensive and influential contacts with Anasazi populations to the west. Other scholars attribute change during the Coalition to large-scale immigration into the Río Grande Valley from the west. Much research and debate have been directed toward identifying the cultural affiliation of these supposed migrants, with some scholars arguing for an influx of people from Mesa Verde, Chaco, and west-central New Mexico (Stuart and Gauthier 1981:51). There is general agreement that migrations of people into the Northern Río Grande province played an important role in the cultural dynamics of the region, especially at the end of the Coalition period, during the first half of the fourteenth century A.D.

Literature reviews by Maxwell and Anscheutz (1987:25) documented 15 Coalition components in the lower Chama Valley. Three of these have been excavated and published: Riana Ruin (Hibben 1937), the Palisades Ruin (Peckham 1981), and the lowest levels of Leafwater Pueblo (Luebben 1953). Regionally, Coalition period sites range from one or two rooms to over 200 rooms, with most sites falling within the 15-30 room size range (Stuart and Gauthier 1981:51). The Riana and Palisade ruins fall close to this average, with 26 and 50 rooms, respectively. The size of the Coalition component at Leafwater Pueblo and other Classic period sites in the region is unknown due to subsequent construction and remodelings during the Classic period. Luebben (1953) excavated three pit structures at Leafwater that probably date to the late Coalition period, suggested by the associated ceramics.

Based on this small and potentially unrepresentative sample of excavated sites, the "typical" Coalition site appears to consist of a rectangular block of surface rooms enclosing a plaza on three sides with a masonry or cobble palisade on the fourth side (Peckham 1981; Maxwell and Anschuetz 1987:23). Some investigators have argued that this "enclosed" community plan may have been a response to increased population density resulting in conflict over diminishing land and other resources. As Peckham (1984:279) points out, there was tremendous population mobility during the Río Grande Coalition. One dominant pattern of the late thirteenth and early fourteenth centuries was settlement abandonment, relocation, and expansion of groups into previously unpopulated areas.

The small Coalition population of the lower Chama presumably provided the seed for the dramatic growth and expansion of population during the latter half of the 1300s and early 1400s. During this period, at least 15 large pueblos with 100 or more rooms were established on the lower Chama and its tributaries, including El Rito Creek, the Río Ojo Caliente, and the Río Oso (Beal 1987:19). Maxwell (1991:2) has estimated that as many as 14,700 rooms may have been constructed during the fourteenth and fifteenth centuries in the lower Chama District.

Other areas of the Northern Río Grande saw a similar spike in population growth during the late prehistoric or Río Grande Classic period (Wendorf and Reed 1955). Traditionally, the Río Grande Classic begins around A.D. 1325 with the appearance of a distinctive red-slipped glaze-painted ceramic type, and ends at the close of the sixteenth century with the arrival of European colonists. The period was one of cultural expansion and florescence, noted primarily for its large aggregated communities and a variety of highly distinctive cultural materials. These materials included a range of new vessel forms, carved bone tools, elaborately decorated pipes, carved stone axes and effigy forms, mural paintings, and a distinctive Río Grande art style featuring masked figures (Wendorf and Reed 1955:153; Cordell 1979:58).

The hallmark of the Río Grande Classic was population growth and aggregation, typically accompanied by the construction and maintenance of large-scale agricultural and water control features, including dams, reservoirs, terrace grid gardens, and clusters of dispersed fieldhouses. Sites of the period show a distinctive bimodal distribution, with the most common sites ranging from one to four rooms or more than 50 rooms (Stuart and Gauthier 1981:53). Significantly, the average Coalition period site of 15 to 30 rooms is nearly absent in the Río Grande Classic. Masonry architecture, established as the principal construction medium at the end of the Pueblo Coalition, continued as the dominant form throughout the Classic period. Above-ground kivas eventually gave way to subterranean kivas in plazas, and great kivas appeared at many Classic sites in the Northern Río Grande (Wendorf and Reed 1955:151).

At least 15 large Classic period pueblos were occupied in the lower Chama Valley, and excavations have been conducted at eight of these: Peseduingue (Jeançon 1912), Poshueingue (Jeançon 1923), Tsama (Beal 1987:12), Te'ewi (Wendorf 1953), Leafwater (Leubben 1953), Sapawe (Skinner 1965; Ellis 1970, 1975), Ponsipa-akeri (Bugé 1984), and Howiri (Fallon and Wening 1987). The sites range from just over one hundred to several thousand rooms and are architecturally complex, with rectangular room blocks of coursed adobe masonry enclosing multiple plazas. The site of Sapawe on El Rito Creek has been described as the largest adobe ruin in New Mexico, with an estimated 2,000 ground-floor rooms enclosing seven plazas covering an area more than 25 acres (Ellis 1975).

Besides residential sites, many special activity sites dating to the Classic period have been recorded in the lower Chama. Perhaps the most ubiquitous of these sites are agricultural features and facilities. Bandelier (1890, 1892) was the first to identify extensive agricultural features in the lower Chama, but no systematic work was done on these sites until the last few decades. The most extensive survey of agricultural features conducted to date was near Ponsipa-akeri in the lower Ojo Caliente Valley by Occidental College in the late 1970s (Bugé 1981, 1984). Bugé and his students conducted extensive surveys of the Río Ojo floodplain, terrace, and terrace slopes, and recorded a variety of agricultural facilities and field types, including cobble bordered grid fields, gravel mulched fields, floodwater fields, small terrace fields, checkdams, and waffle gardens (Bugé 1984:29-31). Other extensive farming and field systems have been documented on the El Rito (Skinner 1965; Ellis 1970), on the lower Ojo Caliente (Lang 1979, 1980), and on the Chama mainstem (Fiero 1978; Anschuetz et al. 1985; Moore et al. n.d.), and excavations have been conducted at several field locations. Most of the research on agricultural systems has focused on the age of the systems, the kinds of crops grown, and the nature and extent of field variability.

The Classic period occupation of the lower Chama probably ended around the turn of the sixteenth century. There is very little evidence of new construction in the Chama after A.D. 1440 (Beal 1987:19), and although there is some evidence of ephemeral Tewa use of the Chama during the A.D. 1500s and 1600s, the area was probably abandoned as a residential focus during the early decades of the sixteenth century.

Wendorf (1953:94) believed that most of the Classic pueblos of the lower Chama were abandoned precipitously around A.D. 1500. He suggests that nomadic raiders or internecine warfare played a role in the withdrawal of population from the valley. Others (for example, Fallon and Wening 1987:48; Anschuetz and Maxwell 1987) have argued that the Chama and its tributaries were abandoned because of failure of the food production system due to population-resource imbalances.

Historic Period

The historic period on the lower Chama was the stage for interactions among several different cultures and ethnic groups. The first Spanish contact with the native populations of the region occurred in the summer of 1541 when a party from the Coronado expedition encountered the Tewa village of Yunque-Yunque, located near the confluence of the Chama and Río Grande. Sustained contact did not occur until 1598 when Oñate established the community of San Gabriel near the same river confluence. The few surviving documents from this early contact period do not mention the permanent Tewa residences upstream on the lower Chama and Ojo Caliente rivers, but some scholars

have insisted that a sizable Tewa population held out in the valley well into the historic period.

Hibben (1937) noted at least three historic Tewa Polychrome components on his reconnaissance of the lower Chama in the 1930s. Schroeder and Matson (1965) have suggested that Te'ewi, located near the confluence of the Río Chama and the Río del Oso, may have been occupied until just before the establishment of San Gabriel. Ellis (1975) has argued for a continuing Tewa occupation of the lower Chama based on her recovery of sheep and cattle bones from a trash midden at Sapawe, and historic metal artifacts from the nearby ruin of Tsama. Finally, Jeançon (1923:3) mentions that the Cordova family, owners of Poshueingue before the land was transferred to the U.S. Forest Service, claim to have found silver beads and articles of Spanish manufacture in the ruins. (He notes that in his excavations at Poshu in 1919, no metal artifacts of any kind were found and nothing suggesting Spanish contact was recovered.)

Ethnohistorical records (Wozniak n.d.; Kemrer n.d.), show that Tewa Indians were herding sheep and goats in the lower Chama as far north as the Piedra Lumbre Valley between the period 1630 and 1740, but the same records do not mention permanent Tewa residences in the valley north of San Juan.

Besides Tewa herdsmen, several other Native American groups frequented the lower Chama Valley during the early historic period, including Navajo, Ute, Comanche, and considerably later, Jicarilla Apache. The archaeological remains of these groups are problematic and have been the subject of considerable controversy. Schaafsma (1979) identified 33 sites in the Abiquiú Reservoir as seventeenth- and eighteenth-century Navajo occupations, and he recognized 17 other sites as nonhistoric Navajo Indian occupation. Recently, Kemrer (n.d.) has questioned Schaafsma's ethnic assignments, especially his Piedre Lumbre phase material. The continuing debate over ethnic affiliation of historic sites in the area underscores fundamental methodological problems associated with correlating archaeological remains with specific cultural groups. As Kemrer points out, cultural affiliation is based on linguistic criteria and shared value and belief systems, and these dimensions are normally beyond the grasp of archaeological inference.

We know from historical documents that expansion of Spanish settlement into the lower Chama did not occur until after the Pueblo Reconquest of 1692, and that throughout most of the eighteenth century, Spanish homesteading of the Chama Valley was severely curtailed by conflict with local Indian groups--notably Comanche and Ute. The genízaro settlement at Abiquiú was the northernmost European settlement throughout the Spanish period (Schroeder 1953:7). Further penetration was prevented largely because Ute and Comanche predations intensified throughout the first half of the eighteenth century following an alliance between the two tribes.

Events in the Ojo Caliente Valley paralleled those in the Chama Valley to the west. The earliest Spanish settlement on the Río Ojo Caliente was a small grant to Antonio de Abeyta on the west side of the river, established in 1736 (Jenkins 1991). The grant was abandoned in 1780 due to Comanche harassment and was reestablished by Abeyta's grandchildren and others in 1805. The Black Mesa Grant of Diego de Madera and Juan Garcia de la Mora originated seven years after the Abeyta grant and included land on both sides of the river and most of Black Mesa, all the way to the Río Grande on the east (Jenkins 1991:2). The Ojo Caliente Grant, encompassing the site of the Ojo Caliente Mineral Springs, was probably established sometime in the early 1730s, although an actual accession is not on record. These northernmost settlements on the Río Ojo Caliente were abandoned around 1748 because of Indian hostilities, and the area was not resettled by Europeans in large

numbers until the early 1790s (Jenkins 1991:9). Spanish and Mexican settlement continued north, up the river valley, in the early decades of the nineteenth century, but hostilities and resultant settlement instability persisted until the beginning of the American period (A.D. 1846).

TESTING OBJECTIVES AND METHODS

The primary objective of archaeological testing in the lower Ojo Caliente Valley was to evaluate the nature and extent of cultural remains at eight prehistoric sites and to determine the need for intensive archaeological investigations before the commencement of road construction. Testing and recording methods were designed to maximize information on the areal extent and depth of cultural deposits at the sites so that informed management decisions could be made. Besides cultural resource management concerns, data recovery strategies were developed for a variety of general questions relating to local cultural history and prehistoric adaptation and organization in the Ojo Caliente Valley. Specific questions addressed during test excavation and analysis included:

1. What were the approximate dates of occupation?
2. What were the cultural affiliations of the sites' occupants?
3. What was the structure and function of each site? Are the range of behaviors observed at each site consistent with year-round or seasonal occupation?
4. What was the nature of the technology at each site, and how does technology inform about resource procurement strategies?
5. What was the nature of economic exchange relationships? What was coming into each site, and from where was it coming?

These questions will be addressed in the interpretive discussions of each site that comprise the body of this testing report. Following is a brief overview of methods employed in the field and laboratory.

Field Methods

All sites were evaluated using the following standard testing and recording methods:

1. Sites were initially defined by intensive surface inspection during which all visible artifacts, artifact clusters, and surface features were marked with wire pin flags.

2. Artifact clusters, site perimeters, and topographic relief were mapped with the aid of an optical transit and stadia rod from a permanent datum located within the primary site cluster (primary datums were permanently marked with ½-inch steel rebar).

3. A control grid was established from a magnetic north-south baseline through the approximate center of the site and the northeast corner of 1-by-1-m test units were plotted with the aid of a transit and stadia rod. Test units were placed in areas of high surface artifact density and areas judged likely to contain buried cultural features.

4. 1-by-1-m test units were excavated by hand in 10- or 20-cm levels from a level line extending from the highest grid corner. All excavation levels were calibrated to the known elevation of the primary site datum. Grid coordinates are for the northeast corner of the test pit and elevations were recorded at present ground surface (PGS), also at the northeast corner of the test pit, unless otherwise noted. Fill from each test unit was screened through ¼-inch wire mesh and artifacts were

collected and bagged by grid and level. All test units were excavated to a depth at which culturally sterile soil or native bedrock was encountered. At the completion of excavation, all test units were recorded and photographed.

5. A soil auger was used to evaluate the areal extent of subsurface cultural deposits. Usually, auger bores were excavated to a depth of 1.0 m below PGS. Soil constituency and the presence or absence of organics and cultural materials were recorded at 10-cm levels in each auger bore.

6. At the completion of hand testing, three sites (LA 83111, LA 83114, and LA 83118) were trenched with a backhoe to obtain detailed stratigraphic profiles and to ensure that no features or cultural deposits were overlooked. All backhoe trenches were cleaned, mapped, profiled, and photographed.

Most manual and mechanical testing was confined to the U.S. 285 project area. Limited testing was performed outside of the project limits at LA 83107, LA 83109, LA 83110, LA 83111, LA 84114, and LA 83151 in order to clarify the age, cultural affiliation, and depth of site deposits at these sites. Upon completion of test excavations, all test units and backhoe trenches were backfilled, pin flags were removed, and the location of the permanent site datum was triangulated from two known points to simplify relocation.

Laboratory Methods

A total of 296 artifacts were recovered during test excavations in the Ojo Caliente Valley (Table 1). Ceramic artifacts (n=172) were sorted by type, vessel form, temper, surface treatment, and other technological and stylistic attributes. Lithic artifacts (n=99) were segregated into formal and, where possible, functional tool categories based on predefined sets of morphological attributes.

Table 1. Summary of Artifactual Data from Ojo Caliente Testing Project

Site	Ceramics	Lithics	Ground Stone	Macrobot	Bone	Other
LA 83107	7 (Survey)	1				
LA 83109	6 (Survey)	6				
LA 83110		10				
LA 83111	7 (Survey)	33	3		1	1(Shell)
LA 83114	3	8				
LA 83117	10	2	1			
LA 83118	137	20	5	7	26	1(Shell)
LA 83151	2	19				
Total	172	99	9	7	27	2

Besides ceramics and lithic artifacts, a total of 27 bones, 7 macrobotanical samples, 2 fragments of shell, and a single glass fragment were recovered during test excavations. Most of the samples were recovered from one site, LA 83118, and methods and results of analysis of these material categories will be presented in the LA 83118 site report. Following is a summary of laboratory analysis methods used during the testing phase of the project.

Lithic Artifact Analysis

All lithic artifacts were initially segregated into flaked and ground stone tools. Flaked tools were further segregated into three broad categories: cores and core tools, flake tools, and debitage. Few formal core and flake tools were recovered from the test excavations, so most of the analysis focused on the debitage assemblage. Three major dimensions of variability in lithic artifacts were monitored: variation in (1) material type, (2) reduction techniques and trajectories, and (3) retouch and utilization.

A total of 99 lithic artifacts was analyzed. The most common materials, accounting for 59.7 percent of the total assemblage, are several varieties of chert (Pedernal, red, and undifferentiated), followed by obsidian (16.7 percent). Smaller frequencies of quartzite (11.1 percent), rhyolite (8.3 percent), basalt, sandstone, and siltstone (all 1.4 percent) were recovered. Except obsidian and Pedernal chert, most of the materials recovered from the Ojo Caliente sites probably could have come from local sources, within several miles of the project area.

Lithic reduction techniques and trajectories were measured using a variety of technological attributes, including flake type, size, and characteristics of the platform and dorsal surface.

Artifact size was measured on three dimensions: length, width, and thickness. On core flakes, length was measured on an axis perpendicular to the flake platform, bisecting the bulb of force, and width was measured perpendicular to this axis. On angular debris and formal tools, length was measured on the longest extant axis of the object, and width was measured perpendicular to the long axis. All dimensions were measured to the nearest 0.1 mm with the aid of a metric dial caliper.

The percent of cortex on the dorsal surface of flakes was estimated to the nearest 10 percent of surface coverage. Cortex was also estimated on cobble tools and cores over the entire exterior surface.

Flake platforms, when present, were classified as cortical if the platform was unmodified cortex; single-faceted if the platform was a single planar surface, and multifaceted if the platform had two or more residual flake scars. There were also categories for collapsed, crushed, abraded, and retouched platforms. Abraded platforms aid in reduction and are therefore monitored to aid in estimating tool manufacture trajectory.

The last lithic attribute category distinguished utilized, unutilized, and retouched artifacts. All artifacts were examined under an optical binocular microscope (10-40x resolution) for evidence of marginal use-wear and retouch. Bidirectional utilization and retouch, or utilization/retouch along opposing surfaces of an edge, and unidirectional utilization and retouch, or utilization/retouch along a single surface of an edge, were examined, as well as battering and edge abrasion.

Ceramic Analysis

The ceramic assemblage includes 152 sherds from the testing phase and 20 sherds from the survey phase of the project, totalling 172 sherds from eight sites. The largest portion of the assemblage, (137 or 80 percent of the total), was recovered from LA 83118.

The primary objectives of the ceramic analysis were: (1) to identify temporally diagnostic ceramics that would help in the reconstruction of site occupation sequences; (2) to identify intrasite distributions of types, vessel forms, and post-firing modifications to aid in determining the structure and function of each site, its length of occupation (e.g., seasonal or year-round), and the nature of technology and resource procurement; and (3) to monitor attributes such as temper, surface treatment, and type frequencies to distinguish between locally and nonlocally manufactured ceramics to identify patterns of regional exchange. Although it would have been desirable to test hypotheses about variability in attributes such as temper, rim form, surface treatment and slip, and paste color, the sample size was not large enough to draw statistically significant conclusions about the frequencies of these attributes.

Late prehistoric decorated ceramics were typed according to criteria described by Kidder and Amsden (1931), Stubbs and Stallings (1953), and Mera (1932, 1934, 1935, 1939). Historic ceramics were typed according to attributes discussed by Mera (1935, 1939), Dick (1965; Dick et al. 1966) and Harlow (1973), with analytic conventions discussed by Schaafsma (1979). Prehistoric utility wares were typed according to descriptive categories introduced by Mera (1939), which segregate types according to surface treatments (i.e., plain, corrugated, smeared-indented corrugated). Table 2 summarizes the descriptions and references used to identify the prominent ceramic types for the project.

A total of 16 attributes was monitored during the analysis. General typological attributes such as exterior and interior pigment types and slips, surface treatment, and rim forms were recorded to track their occurrence and their conformity to specific types. General and specific ceramic types were assigned according to the presence or absence of these attributes according to the criteria summarized in Table 2.

Other characteristics such as paste and slip color, which were recorded using a Munsell soil color chart, were monitored to track variability within specific ceramic types. Variability in paste and slip color is a general indicator of clay composition and firing conditions. These aspects can aid in determining local vs. nonlocal ceramic types and the nature of the firing technology in use in the area. Temper types were recorded for all ceramics as a comparative measure of the variability in temper types among specific decorated and utility wares.

Attributes, such as vessel form, use-wear (erosion, abrasion, and sooting), and post-firing modification (repair, reuse patterns of wear), were monitored to help formulate hypotheses about site structure and function. Variations in vessel form can suggest site use and function, and temporal patterns in occupational sequences (i.e., seasonal occupation). Evidence of reuse in the form of altered or reworked sherds (ceramic scrapers, scoops, etc.) and the presence of repaired vessels can inform about the level of technology in use at each site.

Table 2. Ceramic Descriptions and Date Ranges

Ceramic Type	Date (A.D.)	References[1]	Description
Santa Fe Black-on-white	1175-1300	Sundt 1987 Stubbs and Stallings 1953	Fine, homogenous light gray to dark blue-gray paste; generally fine sand or tuff tempered. Slipped and unslipped, semi- to well-polished. Bowls and jars common. Organic painted banded designs on bowl interiors.
Biscuit A	1420-1500	Breternitz 1966 Kidder and Amsden 1931	Soft, porous dark gray to white paste; generally tuff or ash tempered. Bowl forms only. Slipped, polished and painted on interior. Carbon-painted banded or all-over designs.
Biscuit B	1411-1500+	Breternitz 1966 Kidder and Amsden 1931	Soft, porous dark to light gray paste; generally tuff or ash tempered. Slipped, polished and painted on interior and exterior of bowls, exterior only on jars. Carbon painted banded or all-over designs.
Sankawi Black-on-cream	1500-1694	Wendorf 1953 Mera 1932, 1939; Harlow 1973	Reddish fine-grained paste with chalky, textured cream-colored slip, often crackled. Bowls and jars with elongated necks. Dense black carbon-painted designs; less area painted; simplified designs of thin lines and smaller filled areas. Ceremonial break in band framing line/s. Banded design on mid-body and often found on upper part of jar neck. Tick, flat rim tops, often incurved. Concave depression in jar bases.
Tewa Red Wares	late 1600's - present	Mera 1939 Mera 1939; Harlow 1973 Dick 1965	Also known as Posuge Red (Mera 1939) and San Juan Red (Ellis 1964). Highly polished red-slipped and unpainted. Some vessels have areas of unslipped, but polished surfaces. Everted rims common.
Tewa Black Wares	ca. 1700 - present	Dick 1968 Mera 1939; Harlow 1973	Also known as Kapo Black (Mera 1939; Dick 1968). Dense black to dark gray, polished and smudged plain black ware. Tuff, fine sand and pumice temper. Smoothed and polished jar exteriors; bowls on interior and occasionally exterior. Parallel stone polishing marks often visible. Tall necked jars, ollas and bowls are known.
Tewa Series Polychrome	1600-1850	General range	Analytic convention to classify sherds that were portions of Tewa, Ogapoge, Pojoaque or Powhoge polychrome vessels but cannot be identified as any one of these types specifically. See ceramic descriptions in analysis results section for LA 83118.
Plain Micaceous	ca. 1400 - present	Mera 1935 Mera 1935; Dick 1965	Also known as Vadito Micaceous and Penasco Micaceous (Dick 1965). Mica-slipped or micaceous paste; generally tempered with quartz, mica schist or sand. Some vessels smoothed and/or polished.

[1] Top reference refers to date range; bottom references refer to description

The final variables of ceramic count and weight were recorded for lots of ceramic types that shared values in all other attribute categories. Weight was recorded in milligrams using an Ohaus 2610 g scale. Ceramic counts and weights are monitored for use in estimating comparable ceramic frequencies. No complete vessels were found during the testing phase of the project.

THE SITES

Summaries of testing procedures and results for each site are presented below. Each site description includes a discussion of site location, environmental setting, surface indications, data recovery methods, detailed descriptions of test units, auger tests, and exploratory trenches, and summaries of artifact interpretation and testing results. Recommendations for data recovery are presented in the next section.

LA 83107

Test excavation at LA 83107 confirmed the presence of three artifact scatters on the crest, saddle, and eroded slopes of a prominent sandstone ridge immediately west of the western footslopes of Black Mesa (Fig. 3). The ridge is punctuated by several chimneys of resistant sandstone rising 3 to 5 m above the ridge crest. Small niches within the sandstone outcrops, which may have been used to cache materials, were investigated and revealed the presence of packrat middens, but no artifacts.

Figure 3. LA 83107, looking north, Cluster A on eroded slope in foreground.

Figure 4. Site map of LA 83107.

The vegetation on the site is limited to a light cover of junipers on the ridge crests and slopes, with an understory of sand dropseed, blue grama, scattered rabbit brush and snakeweed, a few prickly pear cacti, and clumps of bluestem. No piñon were observed in the area. The surface of the ridge is steep and highly eroded, and ground cover in this area is less than 10 percent. In other areas that are less steep, ground cover increases to 20-30 percent.

One primary surface concentration and two secondary artifact scatters were recorded at the site. The main site scatter, which consists entirely of sherds, is on a heavily eroded southwest-facing slope, immediately north of the highest sandstone chimney (Fig. 4). The second concentration, which is a diffuse scatter composed primarily of lithic artifacts, was on the opposite, northeast slope of the ridge. The third artifact concentration, a very light scatter of four artifacts, was on the south slope of the ridge saddle. Within this scatter, a small basalt axe was point-plotted and collected for analysis (Fig. 12i). No features were observed within the project area. The steep slopes and heavy erosion at the site probably preclude substantial buried cultural deposits, but the location of the site and the views of the entire Ojo Caliente Valley suggest that the area may have been used as a temporary encampment. The total site area measures 34 m (east-west) by 45 m (north-south) and the site elevation is 1,804 m.

Test excavations were conducted at LA 83107 between February 18 and February 24, 1992. After an intensive surface inspection to flag artifacts and locate surface concentrations, the site boundaries were mapped, and a location was chosen for a 1-by-1-m test unit. Because of the steep slopes and absence of substantial soil deposition, only one test pit was excavated and soil augering was done to determine the depth and areal extent of subsurface cultural deposits on the remaining slopes. The 1-by-1-m test pit was excavated in the saddle to the northeast of the primary scatter in an area where the potential for subsurface deposition appeared to be greatest. The test pit was excavated to a depth of 40 cm below present ground surface in arbitrary 20-cm levels. At the completion of testing, seven auger tests were placed to the north, to the south, and to the east of the datum within the primary site concentration and on the surrounding slopes. Auger tests were excavated to depths of 1 m below present ground surface whenever possible.

Summary of Excavation Results

The soil profile of Test Pit 1 was a homogeneous layer of fine, tan eolian sand. No artifacts, charcoal, or other evidence of cultural remains were recovered from the test pit.

Test Pit 1:

Location:	S21.96/W1.21
Depth:	40 cm below present ground surface
Fill:	Light tan, fine-grained, eolian sand; no charcoal or cultural staining apparent.
Features:	none
Artifacts:	none
Auger test:	Tan fine-grained eolian sand to a depth of 1.9 m below base of Level 2. No artifacts or cultural staining apparent.

Table 3. Summary of Auger Tests at LA 83107

Test #	Location	Stratigraphy	Depth	Cult/Organic
1	S5.21/E9.60	10 cm tan sand over mixed gravel deposits	40 cm	none
2	S8.10/E13.57	uniform sand, darker than Test #1	108 cm	none
3	S10.97/E19.00	clean, tan sand; gravels at 95 cm	103 cm	none
4	N8.02/E16.09	clean, tan sand; gravels below 1 m	104 cm	none
5	N17.18/E19.76	clean tan sand; gravels below 1 m	105 cm	none
6	S8.43/W7.33	gravel at surface to 30 cm; gray-black soil striations at 90 cm; white clay at 1 m	106 cm	none
7	S12.05/W11.98	clean sand, white clay at 88 cm	108 cm	none

A total of seven auger tests was placed to the north, south, and east of Datum A (Table 3). All the auger profiles were tan, eolian sand to a depth of 1 m, where sandstone gravels were typically encountered. In Auger Test 6, located south of the datum in Cluster 2, gray-black soil striations occurred at .9 m and a layer of sand with white clay concretions appeared at 1.0 m. The source of these soil stains in Auger Test 6 is not known, but it is probably not cultural.

Artifact Analysis

A total of seven sherds was collected from the surface of LA 83107 during the survey phase of the project. The only temporally diagnostic ceramics were two sherds of Biscuit B, or Bandelier Black-on-gray. Both sherds were from the same jar, which was polished and slipped on the exterior and tempered with volcanic ash. In addition, three sherds of polished, unpainted white wares, one carbon-painted and polished white ware, and one sherd of plain, polished historic brown ware were found.

Biscuit B, or Bandelier Black-on-gray, is distinguished from Biscuit A because bowl forms are painted on both the interior and exterior. The type is usually assumed to postdate the appearance of Biscuit A, but conclusive evidence for the production date range of Biscuit B has not been established. For the purpose of providing a relative date for the ceramics at LA 83107, the range A.D. 1411-1500+ (Breternitz 1966) is assumed.

Summary and Discussion

The site location and topography at LA 83107, the absence of features and subsurface cultural deposits, and the paucity of surface artifacts suggest that the site was used only as a temporary encampment. Test excavations at LA 83107 suggest that cultural materials are very sparse and are confined primarily to the surface. One primary surface artifact cluster and two secondary clusters were recorded. The primary artifact cluster is on a steep, southwest-facing slope in an area of heavy erosion that appears to have very little soil deposition. The other two artifact clusters are on the

northeast slope and the south slope of a ridge where it is likely that cluster definition is primarily a function of erosional processes. No cultural features were observed within the project area. The location of LA 83107, immediately east of Black Mesa, provides a convenient location for observing activities in the foothills of Black Mesa and the floodplains of the Ojo Caliente. No cultural materials likely to yield important information are within the proposed project limits.

LA 83109

LA 83109 is a cluster of four lithic artifact scatters in a heavily eroded sand dune blowout at the base of a high sandstone ridge, near the eastern edge of a construction maintenance easement (CME) (Fig. 5). During intensive surface inspection preliminary to test excavation, four lithic artifact scatters were flagged and mapped and over 100 lithic artifacts were identified (Fig. 6). The total site area measures 65 m (east-west) by 64 m (north-south). Approximately 13 m southwest of the primary scatter are three circular charcoal stains, possibly hearths, that have been exposed by wind deflation. Only a few artifacts were found near the charcoal stains. Approximately 22 m northeast of the primary cluster is a fourth charcoal stain in a small, dispersed cluster of lithic artifacts. Besides the lithic artifact clusters and charcoal stains, there are heat-fractured chunks of basalt and sandstone scattered throughout the site.

Vegetation around the perimeter of the blowout consists of copses of juniper with very light grass and desert shrub understory. The desert shrub includes four-wing saltbush, stunted rabbitbrush, and small sagebrush. The principal grasses are sand dropseed and blue stem, and the dominant ground cover is a small composite interspersed with snakeweed.

Figure 5. LA 83109, looking west, with primary lithic scatter in foreground.

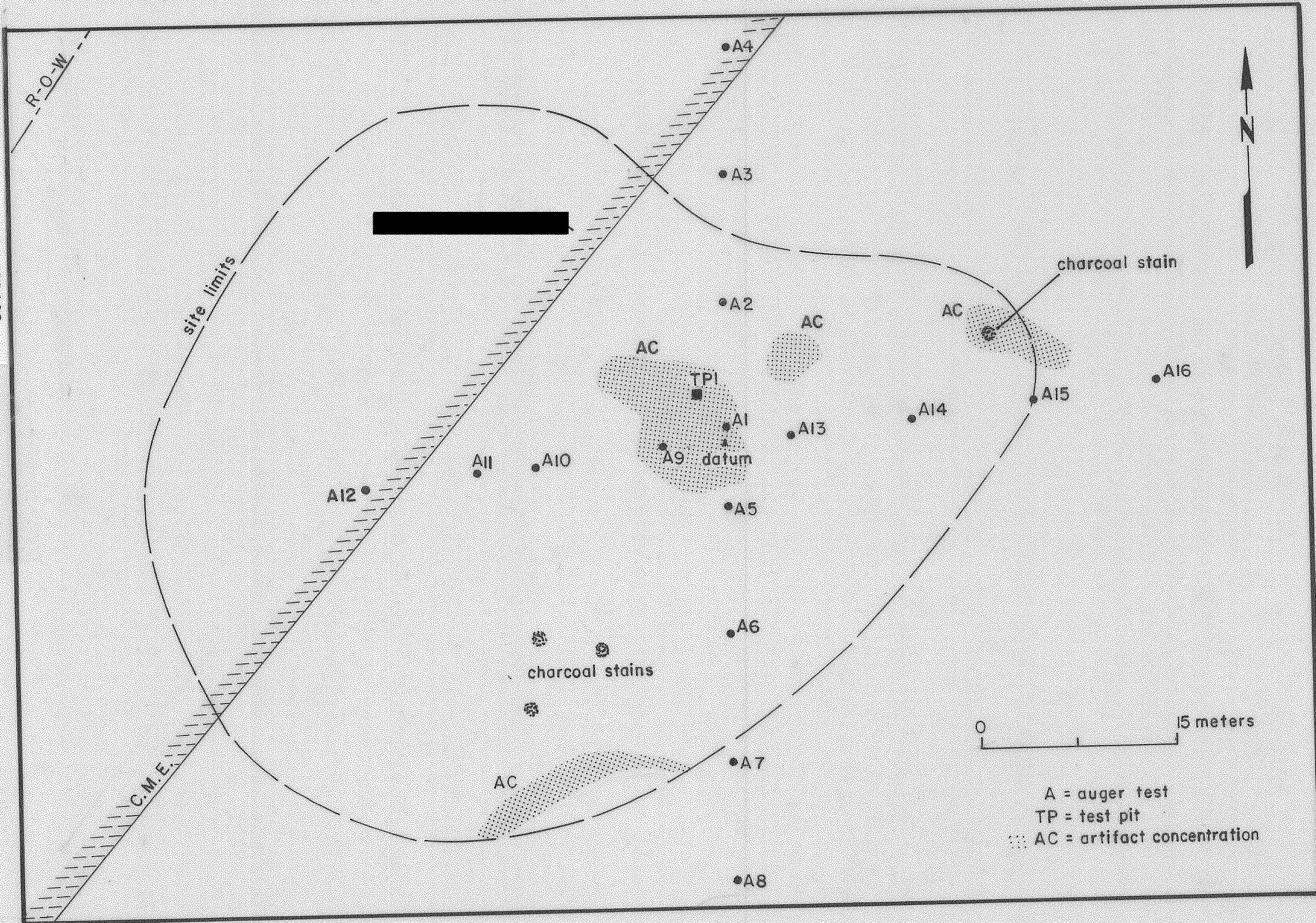

Figure 6. Site map of LA 83109.

Test excavations were conducted at LA 83109 between February 14 and February 18, 1992. Because of the presence of subsurface cultural features at LA 83109, only one test pit was opened and extensive augering was done to determine the depth and areal extent of cultural deposits. The 1-by-1-m test pit was located near the center of the primary scatter to test subsurface deposition at the site and was excavated to a depth of 40 cm below present ground surface in 20-cm levels. At the completion of testing, sixteen auger tests were made on 35-m transects extending north, south, east, and west from Datum A to depths of 1 m below present ground surface. No temporally diagnostic artifacts were found on the surface, and therefore no surface collections were made.

Summary of Excavation Results

The fill profile of Test Pit 1 was a single, homogeneous layer of fine, well-sorted eolian sand with occasional pieces of eroding sandstone at the 20 to 40 cm depth. Five lithic artifacts were recovered from Level 1 (0-20 cm) and two small pieces of charcoal were found in Level 2 (20-40 cm). The lithic artifacts were five core flakes of Pedernal and red cherts. There was no evidence of cultural staining in the test pit.

Test Pit 1:

Location:	N3.79/W2.23
Depth:	40 cm below present ground surface
Fill:	Light tan eolian sand; no cultural staining apparent
Features:	none
Artifacts:	6 lithics in Level 1; 2 pieces of charcoal in Level 2

A total of 16 auger tests was excavated in 10-m intervals on four transects radiating in cardinal directions from Datum A (Table 4). Soil profiles were similar in all auger tests, except Auger Test 11 on the west transect. Generally, auger profiles were tan, fine-grained eolian sand to a depth of 50 cm below present ground surface; below that, a lighter sand appeared that graded to sandstone bedrock at a depth of 80-100 cm. Except Auger Test 11, no positive evidence of cultural activity was found in any of the tests. The profile of Auger Test 11 was fine-grained eolian sand overlying a lens of dark brown organic soil with obvious charcoal staining at a depth of 85 cm. At a depth of 90 cm, large pieces of old wood, possibly root, appeared in the charcoal-stained soil horizon. The test was terminated at a depth of 122 cm when a light tan, compact sandstone was encountered. No artifacts were recovered from the test and it is not clear whether the test exposed a cultural level, the remains of extensive root burning, or perhaps a buried soil horizon.

Table 4. Summary of Auger Tests at LA 83109

Test #	Location	Stratigraphy	Depth	Cult/Organic
1	N1.099/E0.04	medium brown, well-sorted, fine-grained sand w/sandstone concretions	104 cm	none
2	N10.90/W0.06	same as 1	107 cm	none

Test #	Location	Stratigraphy	Depth	Cult/Organic
3	N21.09/E0.12	first 5 cm dark topsoil; tan sand 6-98 cm	98 cm	decaying organic matter in topsoil
4	N31.02/W0.54	tan fine-grained sand	109 cm	none
5	S5.00/E0.06	tan fine grained sand; lightens at 80 cm	104 cm	none
6	S15.10/E0.22	light tan fine-grained sand; lightens at 47 cm	107 cm	none
7	S25.30/E0.15	light tan fine-grained sand, lightens at 44 cm	100 cm	1 ceramic on surface
8	S34.67/E0.30	same as 7, lightens at 46 cm	106 cm	none
9	S0.40/W5.08	medium brown sand; very wet	106 cm	none
10	S1.69/W15.21	medium brown sand	102 cm	none
11	S2.26/W19.87	medium brown sand, charcoal/dark organic soils at 90 cm, light-tan fine sand begins at 106 cm	122 cm	charcoal and dark brown soil appear at 85 cm, wood and charcoal at 90-106 cm
12	S3.0/W29.0 (Estimate)	light brown fine-grained sand, sandstone layer at 42 cm	42 cm	none
13	N0.56/E5.17	medium tan fine-grained sand; lightens at 80 cm	109 cm	none
14	N1.60/E14.83	medium tan fine grained sand; lightens at 45 cm where sandstone concretions begin	107 cm	none
15	N2.80/E24.55	light tan sand w/sandstone concretions; sandstone at 84 cm	88 cm	none
16	N4.20/E34.23	light tan sand w/sandstone concretions	101 cm	none

Artifact Analysis

Five lithic artifacts were recovered from Test Pit 1 at LA 83109; they included four core flakes and one piece of angular debris. Three of the flakes and the single piece of angular debris were composed of Pedernal chert; the fourth flake was composed of red chert. None of the flakes exhibited evidence of retouch or utilization.

No ceramics were found during subsurface testing at LA 83109, but six sherds were collected from the surface of the main site scatter during the survey phase of the project. All were utility wares, with three sherds of plain, unpolished utility wares and three sherds of smeared-indented corrugated wares. Smeared-indented corrugated was first described by Mera (1935) who called the type Tesuque Smeared-indented. The type is considered a Coalition period (ca. A.D. 1175-1325) utility ware based on its frequent association with Santa Fe, Wiyo, and Galisteo Black-on-white (Mera

1935). It is not clear whether ceramics recovered from the surface of LA 83109 are contemporaneous with the lithic assemblage and charcoal stains, or whether they were deposited subsequently. Additional excavation, recovery of temporally diagnostic lithic artifacts, and dating of charcoal stains at LA 83109 will be necessary to resolve this issue.

Summary and Discussion

Resurvey and limited test excavations at LA 83109 identified four discrete surface artifact clusters and an equal number of small charcoal stains. The largest artifact cluster is in a sand dune blowout; three additional clusters are located upslope and downslope of the main site cluster.

Subsurface testing at LA 83109 suggests that the cultural occupation level is confined to the layer of fine, eolian sand that occurs in the first 50 cm below present ground surface. The lithic artifacts found in Test Pit 1 were confined to Level 1 (0-20 cm) and the few charcoal pieces found in Level 2 may have resulted from root burning. Evidence of charcoal staining and burning in Auger Test 11 at 80 cm may represent a cultural deposit that predates the primary site component and will need to be investigated further. Testing results are inconclusive with regard to dates of deposition and affiliation of cultural remains.

All of the cultural features and the overwhelming majority of surface artifacts noted at LA 83109 are located immediately outside the eastern boundary of the construction maintenance easement. Surface inspection and auger testing within the easement suggest that the boundary of the site and the boundary of the easement may be coterminous. Consequently, it appears that no cultural materials likely to yield important information are located within the proposed project limits.

LA 83110

LA 83110 is a small, heavily eroded lithic artifact scatter with associated charcoal stains, on the west face of a low sand dune (Fig. 7). The primary site scatter is on a steep, west-facing slope that is being deflated by extensive sheet and gully erosion. Several charcoal stains are exposed in shallow gully cuts. The total site area is estimated at 16 m (east-west) by 31 m (north-south). Immediately east of the site at the crest of the ridge are sandstone outcrops and low spires. To the west is a broad saddle that drains to the northwest into the Ojo Caliente River, whose floodplain is visible from the site. The primary lithic artifact scatter is in a large, oval blowout, surrounded by junipers that have trapped large quantities of wind-blown sand. Most of the site surface is without vegetation, but there is a very light understory of stunted rabbitbrush and bunch grasses, including three awn, sand dropseed, Indian rice grass, and scattered bluestem.

During intensive surface inspection prior to test excavation, the primary site scatter and five discrete charcoal stains were identified at the site (Fig. 8). One stain, identified as Feature 1 on survey (Drake 1991:24), consists of charcoal-stained soil and fist-sized quartzite river cobbles, and measures 90 cm in diameter. Feature 2 measures 55 cm (north-south) by 80 cm (east-west) and consists of a small, oval concentration of charcoal-stained soil. Feature 3 is a burned deposit exposed in a small drainage; the feature measures 90 cm (north-south) by 110 cm (east-west). Feature 4, a large circular charcoal stain that has been eroded by two converging drainages, measures 3.5 m

Figure 7. LA 83110, looking west, main artifact cluster on eroded slope in foreground.

(north-south) by 3 m (east-west). Feature 5, identified during survey (Drake 1991:24) as a small burned area eroded by a drainage on the west side, was not evident on rerecording. Feature 6 measures 160 cm (north-south) by 140 cm (east-west) and is a burned area eroded by a drainage on the west side. These features, except for Feature 4, appear to be the remains of fire hearths. Feature 4, because of its size and configuration, may be the remains of a small structure.

Test excavations were conducted at LA 83110 between February 13 and 21, 1992. After an intensive surface inspection to locate artifact clusters and features, the site boundaries were mapped and a location was chosen for a 1-by-1-m test unit. Because of the presence of surface features, only one test pit was opened and extensive soil augering was done to determine the areal extent of subsurface cultural deposits. The 1-by-1-m test pit was located near the center of the primary surface scatter and was excavated in 20-cm levels to a depth of 40 cm below present ground surface. At the completion of testing, 19 auger tests were bored on 35-m transects extending north, south, east, and west from Datum A (Fig. 8).

Summary of Excavation Results

The profile of Test Pit 1 was a single layer of a very fine, light tan, well-sorted eolian sand, with decaying sandstone particles occurring near the bottom of Level 2 (20-40 cm). Eight lithic artifacts and a single piece of heat-fractured rock were recovered from the surface of the test grid. Two lithics were recovered from the first 10 cm of Level 1, and some small pieces of charcoal were found in Level 2. Nine of the lithic artifacts found were core flakes, primarily quartzite, and the tenth artifact was a quartzite chopper. There was no evidence of cultural staining in the test pit.

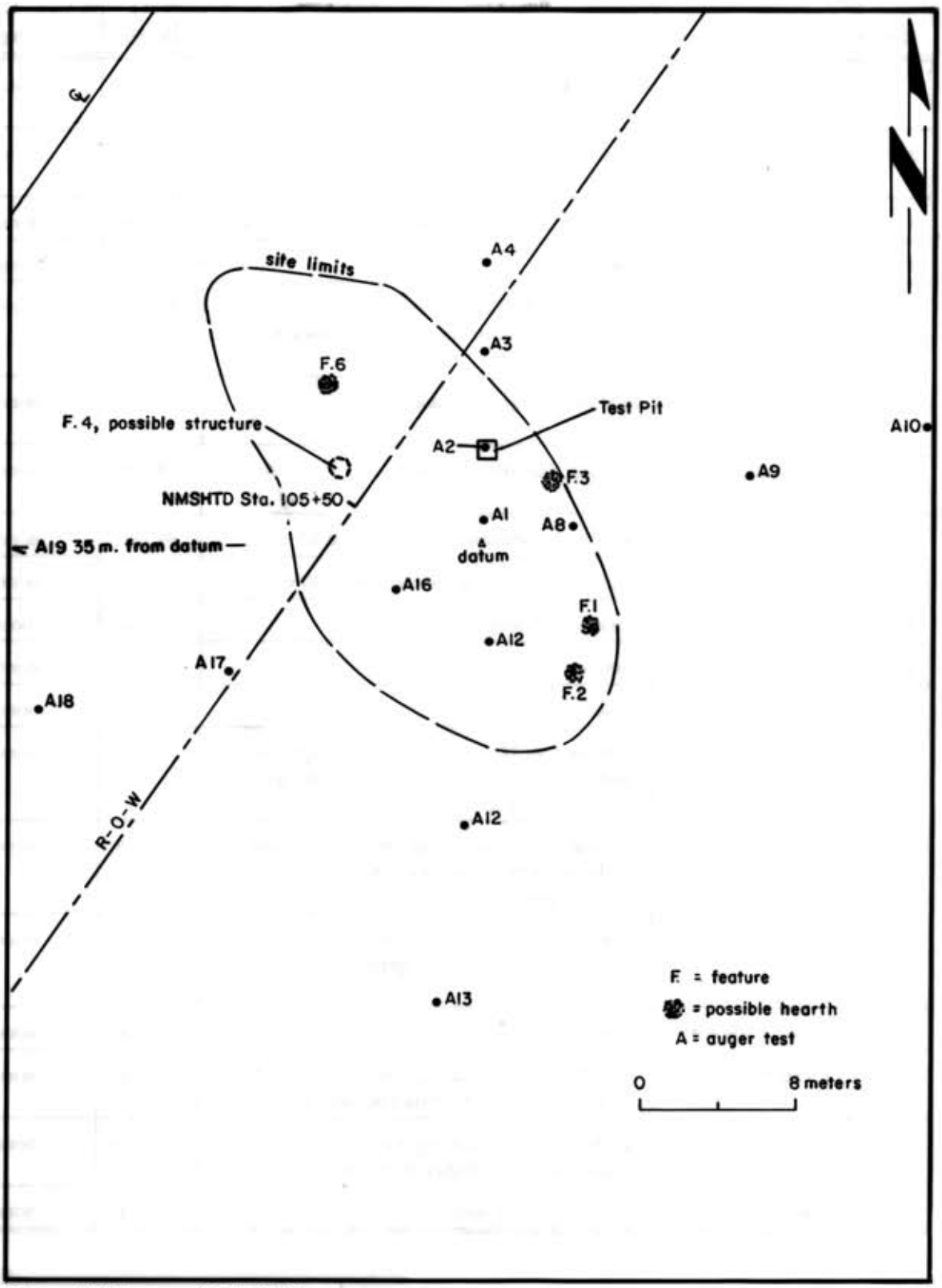

Figure 8. Site map of LA 83110.

Table 5. Summary of Auger Tests at LA 83110

Test #	Location	Stratigraphy	Depth	Cult/Organic
1	N1.40/W0.05	clean lt.tan well-sorted, fine-grained eolian sand	106 cm	none
2	N5.20/E0.00	same as 1; some sandstone concretions at 80 cm	100 cm	none
3	N10.20/E0.00	same as 1; some clay nodules at 92 cm	103 cm	none
4	N15.00/E0.04	same as 1	102 cm	none
5	N19.99/W0.52	first 15 cm dark brown topsoil w/decaying organics; below 16 cm same as 1, thick roots at 56 cm	56 cm	none
6	approx. N25/W0	light tan fine-grained sand	110 cm	none
7	approx. N30/W0	light tan fine-grained sand	100 cm	none
8	N1.07/E4.78	same as 1; sandstone concretions at 83 cm	94 cm	none
9	N3.80/E14.20	sand as 1; sandstone concretions at 90 cm	103 cm	none
10	N6.42/E23.69	same as 1; heavy roots at 63 cm	63 cm	roots
11	N9.50/E33.14	same as 1	104 cm	none
12	S5.09/E0.36	same as 1	107 cm	none
13	S14.79/W 0.86	same as 1 to 38 cm; at 38 cm sand lightens and sandstone content increases; at 92 cm clay nodules appear in sand	100 cm	none
14	S24.09/W2.25	tan fine-grained sand; lightens at 40 cm and sandstone content increases; at 73 cm clay nodules appear	103 cm	none
15	approx. S35/W0	first 5 cm medium brown sandy soil; 6-64 cm lt tan fine-grained sand; lightens at 65 cm; clay nodules at 77 cm	110 cm	none
16	S2.33/W4.65	same as 1	108 cm	none
17	S6.82/W13.47	tan fine-grained sand; lightens at 39 cm; clay nodules at 71 cm; hard-packed sand at 80 cm	107 cm	none
18	S8.83/W23.61	tan fine-grained sand; lightens at 86 cm, whitish fine sand begins at 90 cm	103 cm	none
19	approx. S0/W35	tan fine-grained sand	103 cm	none

Test Pit 1:

Location:	N4.49/W0.25
Depth:	40 cm below present ground surface
Fill:	Light tan eolian sand; no cultural staining apparent
Features:	none
Artifacts:	8 lithics on surface; 2 lithics in Level 1; small pieces of charcoal in Level 2

Nineteen auger tests was placed at 5-m and 10-m intervals on four 35-m transects that bisected the site (Table 5). Soil profiles did not vary across individual auger tests, except for borings placed within juniper clumps, where a thin layer of topsoil had formed. Generally, the profiles were a layer of light tan, fine-grained eolian sand to a depth of 40 cm immediately over a layer of lighter sand containing small fragments of sandstone. In most of the auger tests, sandstone bedrock was encountered at 80-100 cm below present ground surface. No evidence of cultural activity was found in any of the tests.

Artifact Analysis

Nine core flakes and a single quartzite chopper were recovered from the test pit at LA 83110. Eight of the core flakes were quartzite, and one flake was chert. None of the flakes had evidence of retouch or utilization. The single quartzite chopper measured 7.7 cm in length, 2.8 cm in thickness, and exhibited battering scars on one end. No ceramics were recovered at the site.

Summary and Discussion

LA 83110 is a large surface artifact cluster and five charcoal stains of varying sizes, is located in a low, heavily eroded sand ridge. Several cultural features are exposed in the sides of shallow arroyo channels. No temporally diagnostic artifacts were recovered at LA 83110. The absence of ceramics and the presence of burned hearths--at least one of which is associated with fire-cracked rock--suggests a "pre-ceramic" occupation of the site. Based on comparative data from the lower Ojo Caliente and Chama Valley (Lang 1980; Enloe et al. 1974; Schaafsma 1978), it appears likely that LA 83110 was occupied during the Middle-Late Archaic period (ca. 3800 B.C.-A.D. 400).

LA 83110 is essentially bisected by the U.S. 285 construction right-of-way. Features 1, 2, 3, along with the site's primary artifact scatter, are located just outside the eastern edge of the right-of-way; Features 4 and 6, and a light artifact scatter eroding downslope from the primary lithic concentration, are located within the construction zone. Data recovery within the construction zone should yield information on several important questions relating to early hunter-gatherer adaptations during the late Archaic period. The presence of burned features within the highway right-of-way promises to yield chronometric samples that will inform about the age of site occupation. Burned cultural features are also excellent contexts for the preservation of perishable food and other remains, so that excavations at LA 83110 may provide important information on hunter-gatherer subsistence and economic organization. The presence of a possible architectural feature at the site implies some degree of residential sedentism. Analyses of architectural form, the quantity and variety of economic

remains, and aspects of the technological assemblage at LA 83110 may provide important insights into patterns of seasonal mobility during the terminal Archaic.

LA 83111

LA 83111 was described during the survey as a Río Grande Classic period (A.D. 1325-1540) lithic and ceramic artifact scatter, with limited evidence of a historic component (Drake 1991). Test excavations at LA 83111 revealed that the site contains at least two large, diffuse artifact scatters in a heavily dissected landscape of stabilized sand dunes and low sandstone outcrops (Fig. 9). The total site area is estimated at 114 m (east-west) by 94 m (north-south). An arroyo channel bisects the site north to south, trending to the southwest, and the local bedrock, which is exposed in parts of the arroyo and in several local outcrops, is a sandy limestone of the Santa Fe Formation. Vegetation on the site consists of juniper woodland with an understory of desert shrub composed of scattered rabbitbrush, snakeweed, prickly pear, and a variety of grasses including blue grama, black grama, sand dropseed, Indian rice grass, and large clumps of blue stem and three-awn.

During resurvey, preliminary to testing in 1992, only two artifact concentrations were identified. There was very little evidence of the cluster identified as Concentration 1 during the initial survey (Drake 1991:25). Only four core flakes and an Archaic projectile point were found in the area of Concentration 1. As a result, the area was auger tested, but no test pits were excavated.

Figure 9. LA 83111, looking north-northeast, wash bisects primary surface clusters.

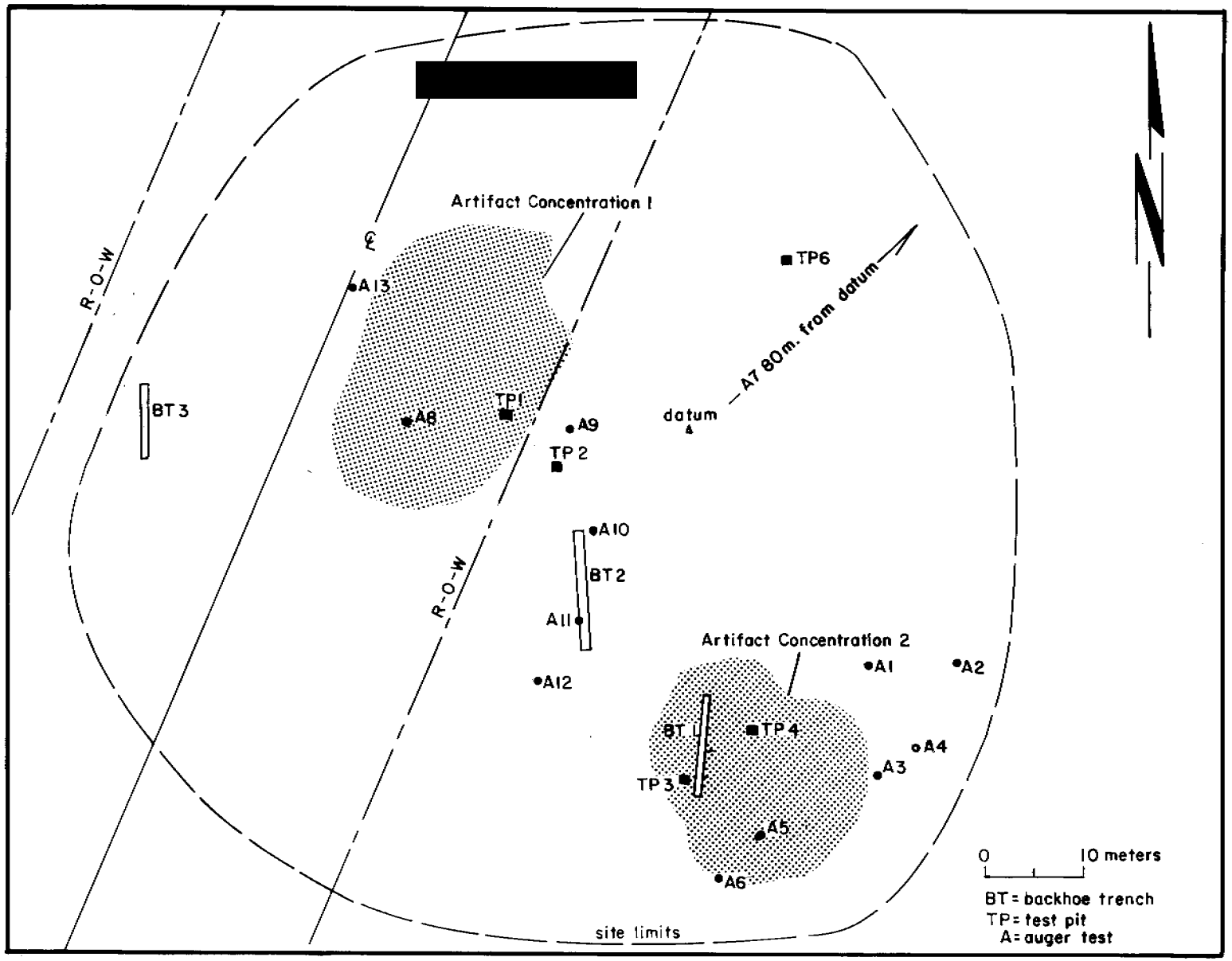

Figure 10. Site map of LA 83111.

Test excavations were conducted at LA 83111 between November 11 and 13, 1991, and February 20 and 24, 1992. After intensive surface inspection to locate artifacts and features, the site boundaries were mapped, and locations were chosen for six 1-by-1-m test units (Fig. 10). Because of the paucity of subsurface cultural remains, only five test pits were excavated. In addition to test pits, auger tests were bored to determine the areal extent of the site. At the conclusion of hand testing, three backhoe trenches were excavated in areas of high surface artifact density to delineate site stratigraphy and search for buried cultural features.

Test pits at LA 83111 were placed within major artifact concentrations on surfaces that appeared to be comparatively stable and likely to yield intact subsurface cultural deposits. Test Pit 1 was placed over a small cluster of obsidian flakes and quartzite and granite cobbles in the eastern portion of Concentration 3. Test Pit 2, also in Concentration 3, was placed 7 m southeast of Test Pit 1 on the edge of a large gravel deposit, near the head of a shallow arroyo tributary. Several flakes of chert were located within the gravel concentration and some of the gravel, which consists primarily of quartzite, appears to have been tested or worked. Test Pit 3, in the western portion of Concentration 2, was placed in an uneroded area between two small rivulets and was selected because of the potential for undisturbed subsurface deposits. A large quartzite bifacial chopper was collected from the surface within the 1-by-1-m grid. Test Pit 4 was located north and slightly upslope from Test Pit 3, near the northern edge of Concentration 2 in another area that is comparatively uneroded. Test Grid 5 was located near the center of Concentration 1 and because of the paucity of surface artifacts, the grid was not excavated. Instead, an auger test was bored near the center of the proposed test pit. One diagnostic artifact, a lanceolate-shaped Middle Archaic projectile point, was collected from surface of Test Grid 5. Test Pit 6 was located in an area within a concentration of large cobble cores of quartzite, on the west slope of a low ridge, 8 m west of the northwestern edge of Concentration 3.

Thirteen auger tests were excavated at LA 83111 to test areas on the periphery of major artifact concentrations. Auger test depths ranged from 1.05 m to 1.96 m and did not yield any additional evidence of subsurface cultural activity.

Summary of Excavation Results

Similar stratigraphy was observed in all the test pits at LA 83111. The upper 20 cm was a layer of fine, well-sorted, tan eolian sand with occasional gravel lenses appearing near the bottom of the level. Level 2 generally had the same fine, well-sorted, tan sand, with a decrease in gravel and particles of white caliche-type material interspersed with the sand. No cultural staining or burning was evident in any of the test pits. Lithic and ground stone artifacts were most abundant in the upper 15 cm of fill. In Test Pit 4, artifacts were recovered at a depth of nearly 1.0 m below present ground surface.

Test Pit 1:

Location:	N1.50/W19.74
Depth:	39 cm below present ground surface
Fill:	Light tan eolian sand; non-cultural compact surface at 37 cm of a light brown sand marbled by white caliche; no cultural staining apparent
Features:	none
Artifacts:	10 lithics on surface

Test Pit 2:

Location:	S4.08/W14.23
Depth:	30 cm below present ground surface
Fill:	Light tan eolian sand with very little gravel, root burn and small white clay particles appearing in Level 2.
Features:	none
Artifacts:	3 lithics, 1 ground stone in first 10 cm of Level 1

Test Pit 3:

Location:	S37.30/W0.54
Depth:	60 cm below present ground surface
Fill:	Light tan eolian sand with small water-worn gravels in bottom 5-10 cm of Level 1; Level 2 was the same layer of tan eolian sand with increasing gravels, a few cobbles and large chunks of sandstone caliche; Level 3 was same layer of tan sand and gravels with a surface of compact, lighter sand and white caliche particles beginning 10 cm into the Level.
Features:	none
Artifacts:	1 lithic on surface, 2 lithics and 1 NH bone in Level 1; 8 lithics in Level 2; 5 lithics in top 10 cm of Level 3
Auger:	Total depth 140 cm below bottom surface of Level 3. Light tan eolian sand with white caliche particles. No gravels.

Test Pit 4:

Location:	S32.08/E6.82
Depth:	100 cm below present ground surface
Fill:	Level 1 was a layer of light tan eolian sand with several large cobbles (non-cultural) near center of grid; Level 2 was the same layer of light tan sand with traces of root burn and weathering sandstone; Level 3 was same light tan sand; Level 4 was same light tan sand with increasing amounts of gravel; Level 5 was same light tan sand with a lens of gravel isolated to northwest corner of test unit.
Features:	none; cobbles in Level 1 did not appear to be cultural
Artifacts:	1 ground stone and an ethnobotanical sample in Level 1, 1 lithic in Level 2; 2 lithics, 1 ground stone in Level 3, 2 lithics and 1 piece of shell in Level 4, 2 lithics in Level 5; 1 lithic in the auger test
Auger:	Total depth 180 cm below bottom surface of Level 5. Light tan sand with a lens of gravel at 110 cm and a 10 cm thick layer with white clay particles at 140 cm. Clean sand below this level to 180 cm.

Test Pit 6:

Location:	N16.21/W3.10
Depth:	40 cm below present ground surface
Fill:	Light tan eolian sand through Levels 1 and 2.
Features:	none
Artifacts:	none

Thirteen 13 auger tests were excavated in areas peripheral to the major artifact concentrations to evaluate the extent of subsurface cultural deposits (Table 6). In general, the profiles consisted of a layer of light tan, fine-grained eolian sand with gravel lenses appearing at a depth of 35-40 cm and a sand layer with white clay particles appearing at an average depth of 120-130 cm. No evidence of cultural activity (artifacts, organics, etc.) was found in any of the tests.

Site Stratigraphy

At the completion of hand excavations, three backhoe trenches were excavated at LA 83111. All of the trenches were oriented roughly north-south, and they were situated in order to examine the stratigraphy of surface artifact clusters and to search for buried cultural features and deposits. Backhoe Trench 1 was excavated in the western half of surface Concentration 2. The trench measured 10 m long and averaged 1 m in depth. Backhoe Trench 2 was excavated along the southeastern edge of surface Concentration 1, through a gravel terrace remnant. The trench measured 13 m long and averaged 0.8 m in depth. Backhoe Trench 3 was excavated through a surface gravel deposit near the crest of a ridge approximately 20 m west of surface Concentration 2. Trench 3 measured 8 m long and averaged less than 0.5 m in depth. No artifacts, features, or cultural deposits were recorded in any of the backhoe trenches, but the trenches exposed profiles that yielded

Table 6. Summary of Auger Tests at LA 83111

Test #	Location	Stratigraphy	Depth	Cult/Organic
1	S24.54/E18.94	clean sand; small sandstone pebbles in final 10 cm	196 cm	none
2	S24.57/E28.77	clean tan sand; 10 cm thick hard lens at 40 cm (frozen aquifer?)	130 cm	small roots
3	S39.61/E20.58	clean tan sand	40 cm	large root at 40 cm
4	S35.94/E20.75	clean tan sand	188 cm	none
5	S41.91/E12.81	clean tan sand	135 cm	none
6	S43.38/E7.39	clean tan sand; frozen water lens at 25-50 cm; white clay nodules at 136 cm	136 cm	none
7	N54.91/E59.58	clean tan eolian sand	150 cm	none
8	N 0.96/W29.88	clean tan sand	137 cm	none
9	N 0.51/W12.49	tan eolian sand; sandstone at 78 cm	78 cm	one small root
10	S10.47/W10.17	clean tan sand	100 cm	none
11	S20.16/W16.40	clean tan eolian sand; gravel lens at 35 cm	110 cm	none
12	S26.42/W16.40	clean tan sand	105 cm	none
13	N15.13/W35.63	clean tan sand; finer grained sand below 90 cm	111 cm	none

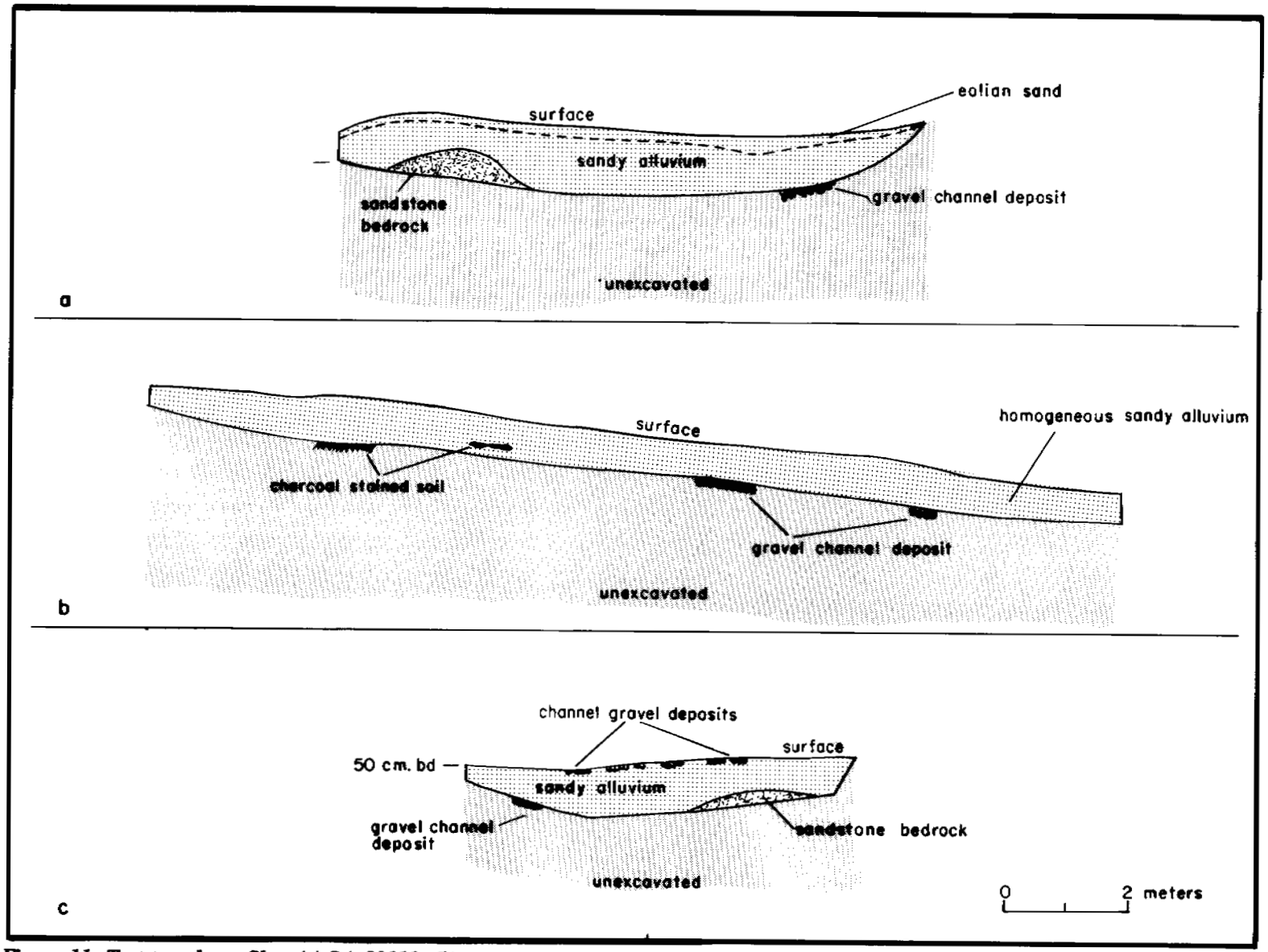

Figure 11. Test trench profiles; (a) LA 83111, (b) LA 83118, (c) LA 83114.

information on site stratigraphy and geological processes that have an important bearing on the interpretation of archaeological deposits at LA 83111 and an adjacent site, LA 83114.

The stratigraphy of LA 83111 is exemplified in the profile of Backhoe Trench 1 (Fig. 11). The upper 10-20 cm of the trench profile consists of fine-grained, well-sorted, tan eolian sand. This wind-blown sand layer overlays a layer of sandy alluvium, averaging a meter in thickness, with occasional interbedded gravel lenses and a very weak soil development--no A horizon is present, there is a very weak B horizon, and a discontinuous C horizon, appearing at the very bottom of the trench profile, consists primarily of weathered sandstone bedrock. The lack of soil development in the alluvial section may be attributable to climatic and biotic conditions not conducive to soil development, or it may be that the alluvial surfaces were so rapidly covered by shifting sand dunes that there was insufficient time for soils to develop. Whatever the case, in all of the backhoe trenches excavated at LA 83111, cultural material appears to be confined to the eolian deposit overlying the alluvium. This was clearly evident in Backhoe Trench 1, where there were flakes and some sherds mixed in the eolian layer, but no evidence of artifacts or organics in the underlying alluvial stratigraphy. Presumably, the alluvium at LA 84111 is comparatively old, predating all of the observed archaeological deposits.

Lithic Artifacts

A total of 33 lithic artifacts was recovered during test excavations at LA 83111 (Table 7). Core flakes and flake fragments account for 84.8 percent and angular debris for 9.1 percent of the assemblage. A cobble tool and a single formal flaked tool were recovered. Twenty-five (76 percent) of the lithic artifacts were recovered from subsurface proveniences within test pits; the remainder was collected from the surface of test pits. No artifacts were recovered from soil auger or backhoe tests at the site.

Table 7. LA 83111 Lithic Assemblage

Material	Angular Debris	Core Flake	Cobble Tool	Late Stage Biface	Total	Percent
Chert	0	7	0	0	7	21.2
Pedernal Chert	1	16	0	1	18	54.5
Quartzite	1	0	1	0	2	6.1
Obsidian	0	3	0	0	3	9.1
Basalt	0	1	0	0	1	3.0
Sandstone	0	1	0	0	1	3.0
Siltstone	1	0	0	0	1	3.0
Total	**3**	**28**	**1**	**1**	**33**	**100.0**
Percent	9.1	84.8	3.0	3.0	100	

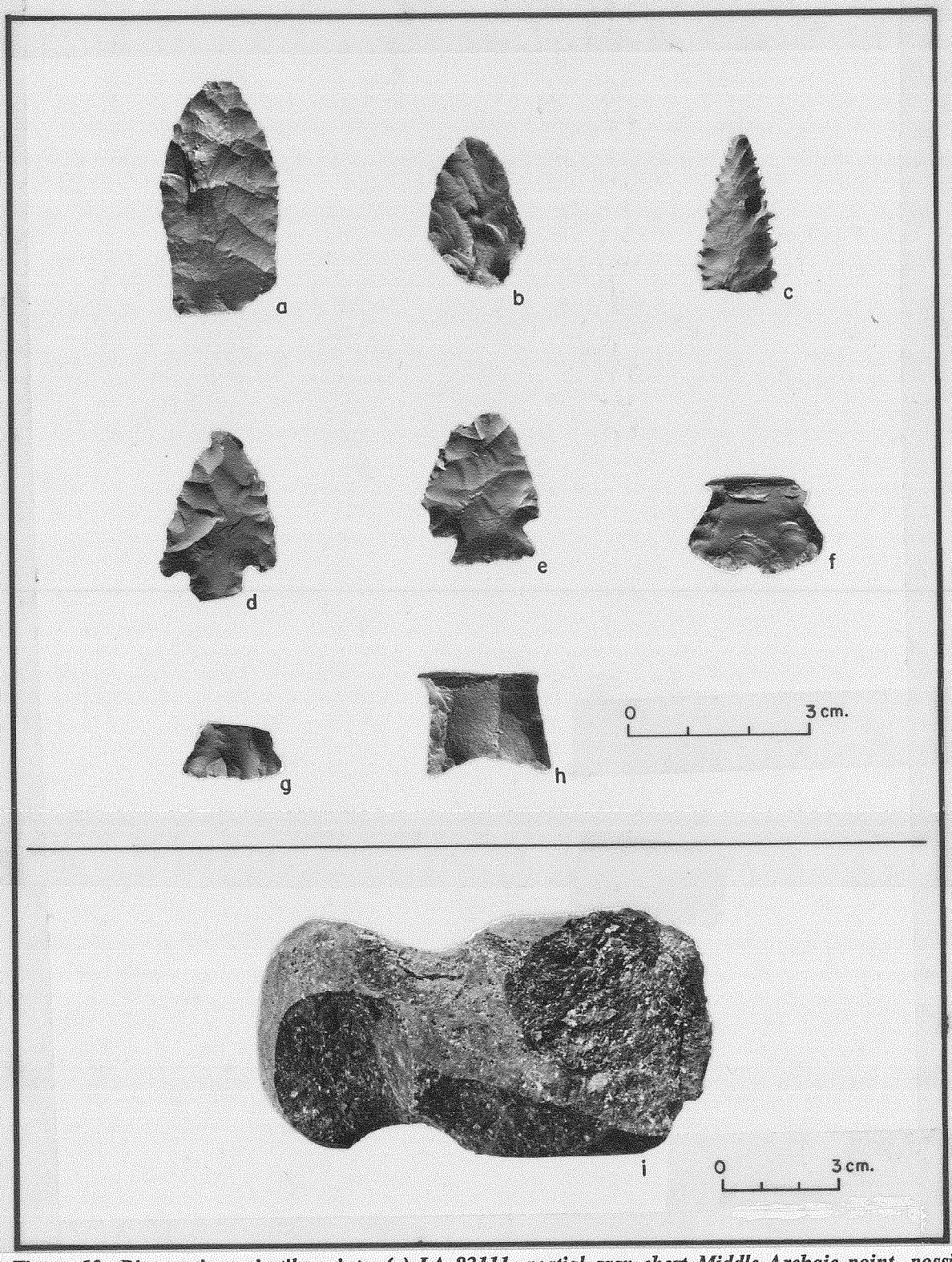

Figure 12. Diagnostic projectile points; (a) LA 83111, partial gray chert Middle Archaic point, possibly Bajada; (b) LA 83118, unfinished corner-notched Polvadera obsidian point, late BM-early Pueblo I (ca. A.D. 500-900); (c) LA 83151, serrated obsidian blade, missing base; (d) LA 83117, cross-notched obsidian point, Basketmaker II-III (ca. A.D. 0-600); (e) LA 83114, partial corner-notched obsidian point, BM II-III (ca. A.D. 0-600); (f-g) LA 83151, obsidian point bases Late Archaic-BM II; (h) LA 83114, fragmentary base and partial shoulder of stemmed fine-grained black basalt, San Jose phase (3800-1800 B.C.); (i) LA 38107, basalt axe.

Pedernal chert, which can be obtained from several sites in the lower Río Chama Valley, is the most common lithic raw material in the assemblage (55 percent). Smaller frequencies of generic chert (21 percent), obsidian (9 percent) quartzite (6 percent), sand and siltstone (6 percent), and basalt (3 percent) were recorded. Obsidian was probably obtained at least 20-30 km from the site; all other materials probably could have been obtained from local terrace gravels and other sources. The somewhat high proportion of imported raw material (ca. 64 percent) is consistent with the low frequency of cortical flakes in the assemblage (6.4 percent).

Twenty-seven (82 percent) of the lithic artifacts show no evidence of retouch or use. Three flakes (9 percent) show evidence of use-wear, and three other artifacts have marginal retouch on one or more edge. One of the retouched artifacts is a side scraper on a large primary flake of pink quartzite. Two lateral edges have been retouched and exhibit evidence of heavy use. The artifact measures 9.2 cm long, 9.0 cm wide, and 3.8 cm thick. The only other formal flaked stone tool is a nearly complete Middle Archaic projectile point, recovered from the surface near the northern extremity of the site scatter (Fig. 12a). The point is constructed from a flake of gray chert and measures 3.7 cm long by 1.9 cm wide by 0.8 cm thick. The point is slightly shouldered and has a flat, unground base and stem. The general size and shape is reminiscent of a Bajada point (Irwin-Williams 1973), but the presence of several missing or unfinished elements suggest the point may have been discarded in manufacture. The only core tool recovered during test excavations is a small, ovoid hammerstone on a quartzite river cobble. The cobble is unmodified except battering scars on both ends. The hammerstone measures 90.0 cm long, 64.5 cm wide, and 36.0 cm thick.

Ceramic Artifacts

No ceramics were recovered in subsurface testing at LA 83111, but seven sherds were collected from the surface of LA 83111 during the survey phase of the project (Drake 1991). Diagnostic ceramics included one sherd of Santa Fe Black-on-white and two sherds of Biscuit A. The sherd of Santa Fe Black-on-white is a tapered bowl rim with a thin framing line and ash and pumice temper. The two Biscuit A sherds were from bowls with volcanic ash and sand temper. In addition, three nondiagnostic ceramics were collected from the surface. One sherd was a rounded rim from a plain, unpolished utility ware jar that was tempered with quartz. Two sherds were from polished, unpainted white ware bowls, and one additional white ware sherd was from a polished, unpainted jar with a straight, flat rim. Two of these sherds were tempered with volcanic ash and one was tempered with volcanic ash and pumice.

Santa Fe Black-on-white dates to the Coalition period and was widely produced in the Northern Río Grande between A.D. 1190 and 1350 (Stubbs and Stallings 1953). Regarded as the predecessor to Wiyo Black-on-white, the distribution of Santa Fe Black-on-white in the Chama Valley was limited to the few sites with occupations that predated the introduction of Wiyo Black-on-white in that area. At Te-ewi, a site located at the confluence of the Río Oso and Río Chama, Wendorf (1953) estimated a date range of A.D. 1225-1325/1350 for the type.

Biscuit A, or Abiquiu Black-on-gray, was a common locally produced type found on sites dating to the 1400s in the Chama Valley and Pajarito Plateau areas (Mera 1934). Generally assigned to a date range of A.D. 1420-1500 (Breternitz 1966) based on indirect association with tree-ring dates, the type is known to have been traded extensively with pueblos south of Santa Fe (Kidder and Amsden 1931; Warren 1977). The date range for the production of Biscuit A within the biscuit ware

center has never been conclusively established, however, and for the purposes of identifying a temporal association for the type at LA 83111, the range A. D. 1420-1500 (Breternitz 1966) is assumed.

Summary and Discussion

LA 83111 contains two highly diffuse lithic and ceramic scatters covering an area over 10,000 sq m. Test excavations at the site suggest that cultural materials are concentrated in eolian sand deposits that occur in varying depths across the heavily-eroded site surface. Six 1-by-1-m test pits, 13 soil auger tests, and three backhoe trenches were excavated within areas of high surface artifact density. In some areas, notably Concentration 2, artifacts were found nearly a meter below the surface, but no cultural features or discrete cultural layers were discovered. Much of the cultural material recorded in the excavations appears to have been redeposited by a combination of eolian and fluvial processes. Significantly, despite the presence of occasional artifacts, no evidence of charcoal or other organics were recorded in any of the excavations at LA 83111 or its adjacent site, LA 83114. The lack of organic staining contributes to the general impression that cultural deposits at the two sites have been redeposited and are heavily mixed. LA 83111 is not likely to yield information beyond what has already been recovered.

LA 83114

LA 83114 is approximately 50 m south of LA 83111 in a heavily dissected landscape of stabilized sand dunes, arroyos, and low sandstone outcrops (Fig. 13). The site scatter measures 52 m (east-west) by 72 m (north-south). A deep arroyo channel bisects the site north to south, with two smaller tributary channels running northeast. The area of highest artifact density lies between these two secondary tributaries, on a surface littered with terrace gravels and quartzite river cobbles. The local bedrock, which is exposed in parts of the arroyo and in several local outcrops, is a sandy limestone of the Santa Fe Formation. Vegetation on the site is comparable to LA 83111, consisting mostly of juniper copses with a light understory of desert shrub, predominately rabbit brush and bunch grass.

Test excavations were conducted intermittently at LA 83114 between February 5 and February 24, 1992. During intensive surface inspection before test excavations at the site, the boundaries of the primary artifact scatter were relocated and mapped, and locations were chosen for six 1-by-1-m test units (Fig. 14). Test Pit 1 was located near the northern edge of the primary lithic artifact scatter on the north side of a small secondary drainage channel. Immediately next to the test pit was a large quartzite cobble with extensive flake removal on one end and one lateral edge. Because of the limited information provided in the excavation of the first five test pits, Test Grid 2 was not excavated. Test Pit 3 was placed near the center of the cobble and lithic artifact scatter to test the depth of the deposit. Test Pit 4, located along the east edge of the primary artifact scatter, was in an area that was somewhat undissected and had potential for yielding uneroded deposits. Test Pit 5 was placed south of the primary artifact scatter, across a small arroyo and near the surface projectile point finds. The area around Test Pit 5 appeared to be heavily alluviated, and immediately south of the test pit was a small, discrete concentration of flaked quartzite cobbles. Test Pit 6 was located north of the primary site scatter in an area of moderate slope roughly midway between LA 83114 and LA 83111.

Figure 13. LA 83114, looking southwest, main artifact cluster in foreground.

The purpose of the test was to evaluate the stratigraphic relationship between the two sites. In addition to the test pits, seven auger tests were placed around the perimeter of the surface scatter to determine the extent of subsurface cultural deposits, and a single backhoe trench was excavated through the northern half of the primary artifact scatter.

Summary of Excavation Results

Test pit profiles at LA 83114 were somewhat homogeneous and consisted of a layer of fine, well-sorted tan eolian sand, with gravel lenses appearing in the first 10 cm of Level 1 (0-20 cm). Level 2 (20-40 cm) generally consisted of the same fine, well-sorted, tan sand, usually with smaller amounts of gravel. No cultural staining or evidence of burning was found in any of the test pits. Test Pit 3 was the only test unit that yielded artifacts: three lithic artifacts and one sherd were found in Level 1, and nine lithic artifacts were recovered from Level 2.

Test Pit 1:

Location:	N11.20/W1.65
Depth:	40 cm below present ground surface
Fill:	Light tan eolian sand with mixed gravels in Level 1; Level 2 consisted of light tan sand with fewer gravels; no cultural staining apparent
Features:	none
Artifacts:	none

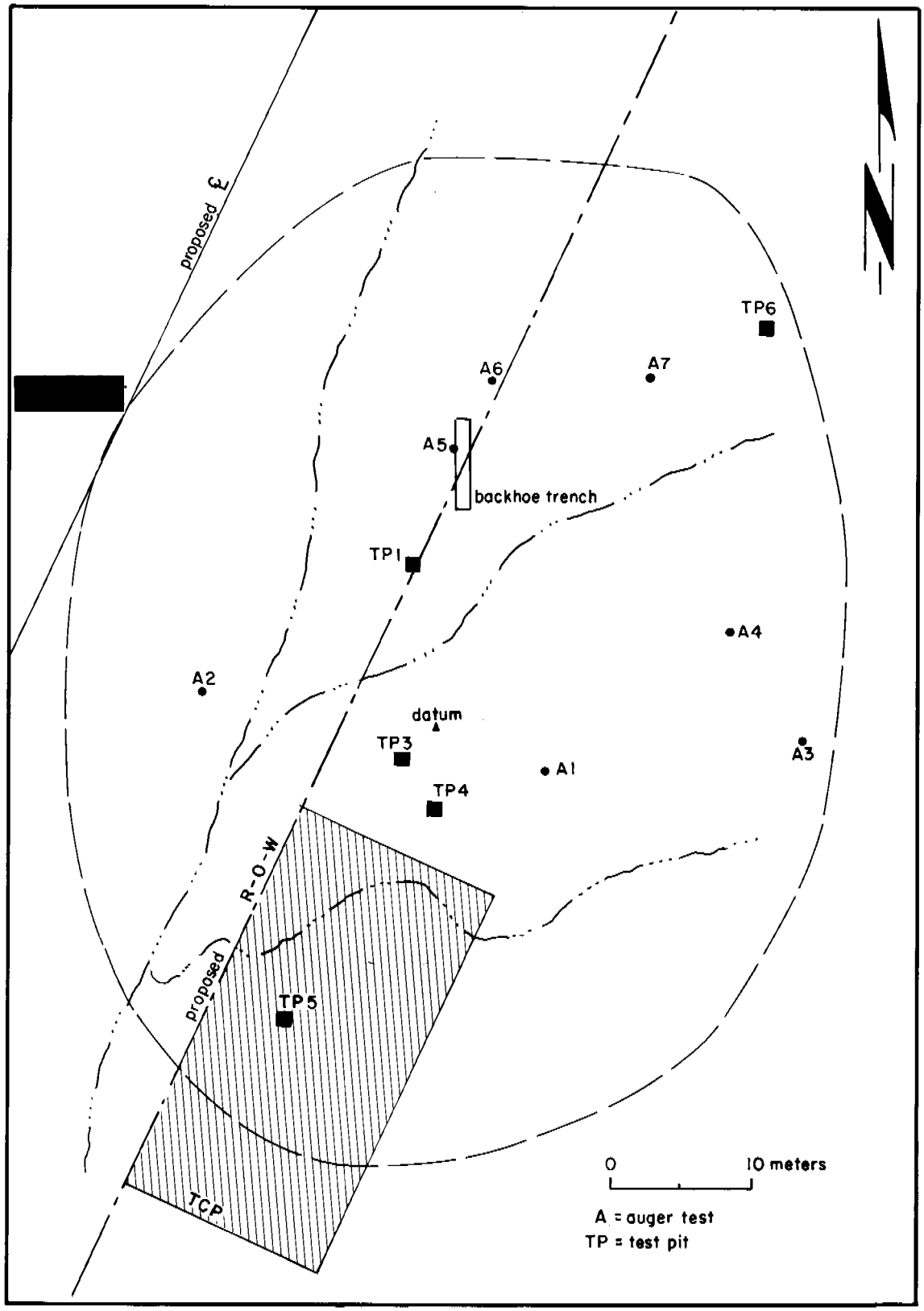

Figure 14. Site map of LA 83114.

Test Pit 3:

Location:	S2.45/W2.36
Depth:	44 cm below present ground surface
Fill:	Light tan eolian sand with mixed gravels in Level 1; Level 2 was the light tan sand with a gravel lens in the NW corner of the unit approximately 10 cm into the level; no cultural staining was apparent
Features:	none
Artifacts:	3 lithics and 1 ceramic in Level 1; 9 lithics in Level 2

Test Pit 4:

Location:	S5.90/W0.09
Depth:	40 cm below present ground surface
Fill:	Light tan eolian sand with gravel lens in upper 10 cm of Level 1; Level 2 was the light tan sand with no gravel but small dark concretions of unknown material appeared in upper 10 cm of Level 2; no cultural staining was apparent
Features:	none
Artifacts:	none

Test Pit 5:

Location:	S20.70/W10.70
Depth:	20 cm below present ground surface
Fill:	Light tan eolian sand with very little gravel; no cultural staining apparent
Features:	none
Artifacts:	none

Test Pit 6:

Location:	N27.82/E23.34
Depth:	21 cm below present ground surface
Fill:	Light tan eolian sand; no cultural staining apparent
Features:	none
Artifacts:	none

A total of seven auger tests was excavated around the site perimeter to test the depth and areal extent of subsurface cultural deposits (Fig. 14). No evidence of cultural disturbance was found in any of the tests. The results are summarized in Table 8.

At the completion of testing, a 1 m (east-west) by 6 m (north-south) backhoe trench was excavated to an average depth of 1.2 m in the northern portion of the site, approximately 4 m northeast of Test Pit 1 (Fig. 11). The stratigraphic profile in the trench was similar to the trench profiles at LA 83111. The upper few centimeters of the trench profile consisted of a discontinuous layer of recent eolian sand. Immediately below the sand layer is an alluvial deposit of unknown age that consists primarily of fine-grained tan sand interbedded with small gravel lenses. Some gravels are composed primarily of large, fist-size cobbles, which could only have been deposited by competent stream channels. There is little or no soil development in the alluvial section. The alluvial deposit grades into a highly weathered sandstone bedrock. All the artifacts observed in the trench profile came from the surface eolian deposit or the upper surface of the alluvial deposit.

Table 8. Summary of Auger Tests at LA 83114

Test #	Location	Stratigraphy	Depth	Cult/Organic
1	S3.35/E7.70	clean, well-sorted tan eolian sand	120 cm	none
2	N2.21/W16.05	same as 1	100 cm	none
3	S 0.23/E26.37	same as 1, bedrock at 30 cm	30 cm	none
4	N6.53/E20.72	same as 1	105 cm	none
5	N19.37/E1.13	same as 1, near surface concentration of river cobbles	102 cm	possible cultural cobbles at surface
6	N24.00/E3.80	same as 1, one rock at 80-90 cm	110 cm	none
7	N24.25/E15.15	same as 1	107 cm	none

The stratigraphy at LA 83114 is identical with the adjacent site, LA 83111, except that LA 83114 is more extensively eroded and does not have substantial eolian deposits. Most of the surface of LA 83114 is covered by an extensive channel gravel deposit that forms an erosion-resistent cap over the site surface. Mixed with these gravels are artifacts associated with several different temporal components, from Middle Archaic through late prehistoric. Based on the stratigraphic evidence, it appears that LA 83114 was once covered by eolian sand that incorporated archaeological deposits from several different time periods. Subsequently, these eolian deposits eroded off the site and the heavy artifact fraction contained within them migrated down to the erosion-resistent gravel surface and accumulated at that level. The absence of charcoal and other forms of organic staining, and the obvious mixing of cultural materials from several different time periods on one surface, is consistent with this hypothesis.

Lithic Artifacts

Only six lithic artifacts were recovered during test excavations at LA 83114: four unutilized core flakes and two small chert cores. Two of the flakes are composed of quartzite, one is made of Pedernal chert, and the fourth flake is composed of basalt. All the lithic artifacts were recovered from the first two levels of Test Pit 3, located near the center of the primary surface scatter.

In addition to the lithic artifacts recovered during test excavations, two fragmentary projectile points were found on the surface of LA 83114 when the site was first recorded in the spring of 1991 (Drake 1991). One is a nearly complete corner-notched obsidian point that measures 24.7 mm long, 18.5 mm wide, and 4.5 mm thick (Fig. 12e). The point is triangular in outline, with deep corner notches and a straight base, and probably dates to the Basketmaker II-III period (ca. A.D. 0-600). The other point is fragmentary, consisting of the base and part of a shoulder of a stemmed projectile point that measures 16.7 mm long (fragmentary), 20.4 mm wide, and 5.0 mm thick (Fig. 12h). The point is manufactured on a flake of fine-grained black basalt. The point has a slightly expanding stem and concave base, and both stem and base edges are slightly ground. The point style is reminiscent of the San Jose phase of the Archaic, dating to approximately 3800-1800 B.C.

Ceramic Artifacts

Although no ceramics were recovered during subsurface testing, three sherds were collected from the surface at LA 83114 during survey (Drake 1991:35). One sherd was a slipped and polished carbon-painted white ware with volcanic ash and sand temper that was too small to type accurately. The other two ceramics were Biscuit A bowl sherds. One sherd was tempered with volcanic ash, the other was tempered with volcanic ash and sand.

Biscuit A, or Abiquiu Black-on-gray was a common locally produced type found on sites dating to the 1400s in the Chama Valley and Pajarito Plateau areas (Mera 1934). Generally assigned to a date range of A.D. 1420-1500 (Breternitz 1966) based on indirect association with tree-ring dates, the type is known to have been traded extensively with pueblos south of Santa Fe (Kidder and Amsden 1931; Warren 1977). For the purposes of identifying a temporal association for the type at LA 83114, the range A.D. 1420-1500 is assumed.

The presence of Biscuit A at both LA 83114 and neighboring LA 83111, and Santa Fe Black-on-white at LA 83111, suggests that the two sites may have been used by late Coalition or early Classic period populations (ca. 1250-1450).

Summary and Discussion

Lithic and ceramic artifacts recovered at LA 83114 suggest that as many as three separate temporal components may be present. Fragmentary projectile points recovered from the site appear to date to the late Basketmaker--Early Pueblo period (A.D. 600-900) and to the Middle Archaic period (3200-1800 B.C.). Two Biscuit A (ca. A.D. 1420-1500) bowl sherds and an unidentified black-on-white ware were also recorded. No evidence of cultural features was recovered, and although artifacts are present in substantial numbers, there is evidence of serious erosion and redeposition of cultural deposits.

Test excavations at LA 83114 suggest that cultural materials located within the highway right-of-way are confined primarily to the first 10-20 cm of surface eolian deposits overlying an extensive channel gravel deposit. Artifacts of varying age were apparently deposited on a shifting eolian surface. As dunes shifted, artifacts worked their way down to a stable alluvial surface of fine-grained alluvial sand mixed with coarse gravels.

There appears to be very little intact cultural stratigraphy at LA 83114. No cultural features were recorded, and artifacts present on the surface of the site have probably been mixed by a combination of eolian and fluvial processes. Consequently, there seems to be little point in conducting further investigations at the site. The cultural materials are not likely to yield information beyond what has already been recovered.

LA 83116

LA 83116 is a late prehistoric agricultural field and associated lithic scatter located on a prominent gravel-covered hilltop within the project construction zone. Because of the nature and

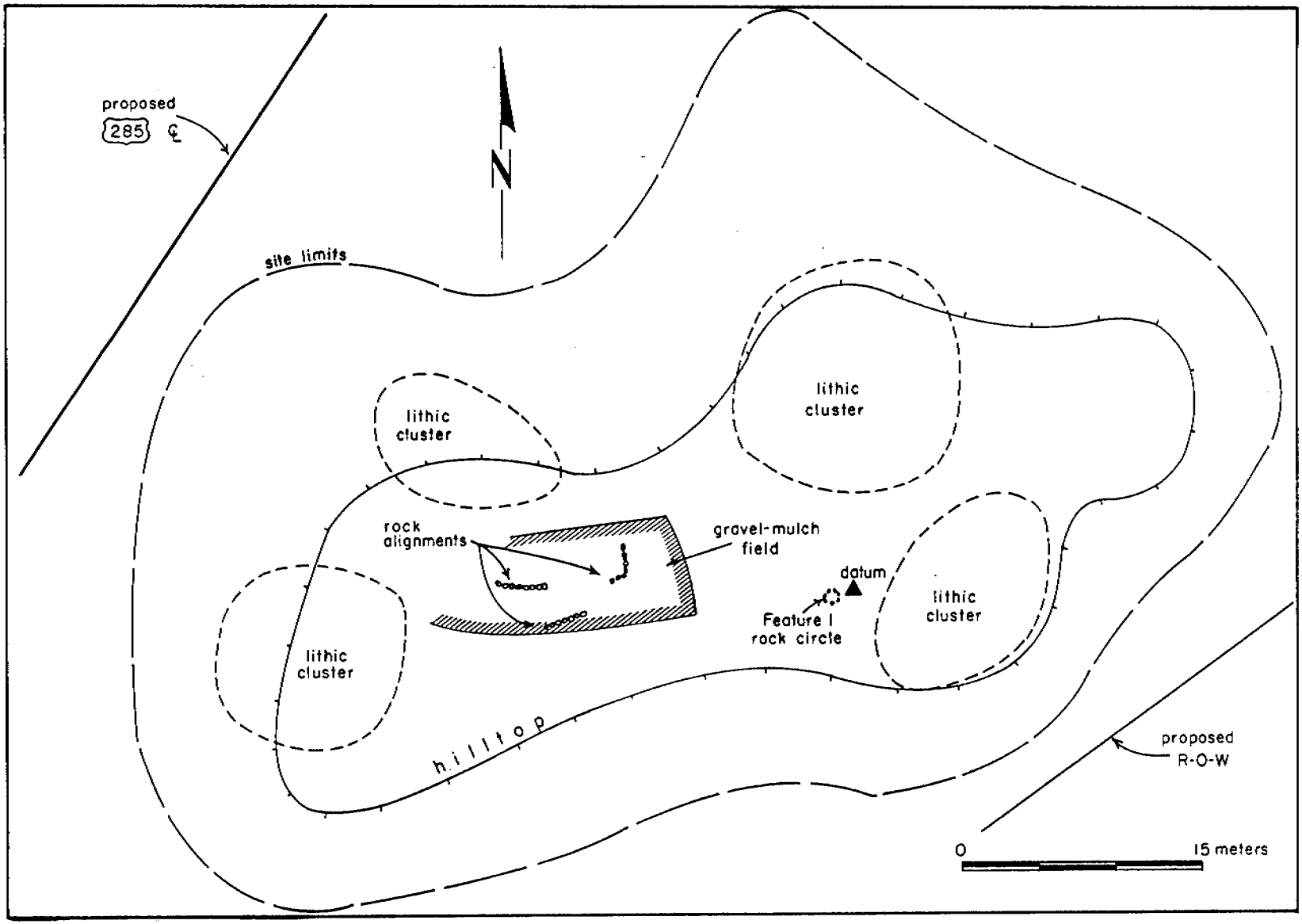

Figure 15. Site map of LA 83116.

density of the cultural remains at the site and the high potential for information yield, it was determined in consultation with the New Mexico Historic Preservation Officer that the site was likely to yield important information. Consequently, no test excavations were conducted at LA 83116. Following is a summary of cultural features recorded at the site during the initial site survey conducted in the spring of 1991 (Drake 1991:39-41).

The principal site component consists of a series of rock alignments enclosing a gravel-mulched agricultural field in a shallow swale near the crest of the hill (Fig. 15). The rock alignments are constructed of rounded river gravels measuring 10-15 cm in diameter. In addition to the cobble borders, several upright pieces of basalt may delineate field corners or boundaries. A terrace-shaped depression, which may have served as a gravel borrow pit, is located on the eastern edge of the hill.

Approximately 10 m east of the eastern field edge is a small circular ring of river cobbles, possibly the remains of a fire hearth, measuring less than a meter in diameter. No obvious evidence of burning was observed in the interior of the feature. In addition to the cobble feature, at least four diffuse clusters of flaked stone artifacts were observed on the hill crest, all peripheral to the gravel-mulched garden plot (Fig. 15). All of the site components lie within the project construction zone.

Table 9 summarizes the results of an in-field debitage analysis of the lithic scatters. In addition to debitage, 21 chert cores, 1 quartzite core, 3 basalt cores, and 2 silicified wood hammerstones were recorded. The formal tool inventory consisted of four unifacially retouched quartzite hoes, a bifacially retouched basalt hoe, and an end scraper of chert. Only three potsherds were recovered from the site surface: two sherds of Biscuit B and a single sherd of unifentified utility ware. The presence of Biscuit B suggests that the site was utilized during the Pueblo IV period (ca. 1425-1550).

Table 9. Lithic Artifact Inventory, LA 83116

Material	Primary	Secondary	Tertiary	Total
Chert	33	32	47	112
Quartzite	2	-	-	2
Basalt/igneous	1	3	13	17
Petrified wood	1	2	2	5
Obsidian	-	-	-	-
Total	37	37	62	136

Summary and Discussion

LA 83116 is a large hill-top agricultural complex with associated artifact scatters and a possible extramural fire hearth. The field is well preserved and has important information potential. Specifically, intensive data recovery at LA 83116 has the potential to inform about: (1) the dates of field construction and use; (2) the kinds and varieties of economic plants grown in the field; (3) microclimatic effects of elevated direct rainfall agriculture in the lower Ojo Caliente Valley; and (4) the structure and morphology of gravel-mulched field systems in the northern Río Grande.

Investigation of associated activity areas also has the potential to inform about the range of activities associated with dry-land farming during the late prehistoric period.

LA 83117

LA 83117 is a large, hilltop agricultural field complex with extensive gravel-mulched fields, associated borrow pits, a rectangular rock feature in the bottom of one borrow pit, and a diffuse lithic and ceramic artifact scatter (Fig. 16). Only one feature at the site, the rectangular rock alignment, was recommended for subsurface testing to determine its age and relationship to other site components. The remainder of the site within the highway construction zone (approximately 20-30 percent of the prehistoric field complex) was recommended for data recovery. The site is on the top of a steep-sided gravel terrace remnant that rises approximately 30 m above the surrounding valley floor. Vegetation on the site consists of low scrubby junipers with an understory of blue grama, snakeweed, narrow leaf yucca, scattered prickly pear, some hedgehog cacti, and a few scattered rabbitbrush. There is, noticeably, a higher density of grama grass in the surface gravel-mulched fields compared with off-field surfaces. Outside the perimeters of the fields and in the terrace slopes, sheet erosion has removed much of the vegetation and topsoil.

Figure 16. LA 83117, looking northwest, north edge of large gravel-mulched agricultural field in foreground.

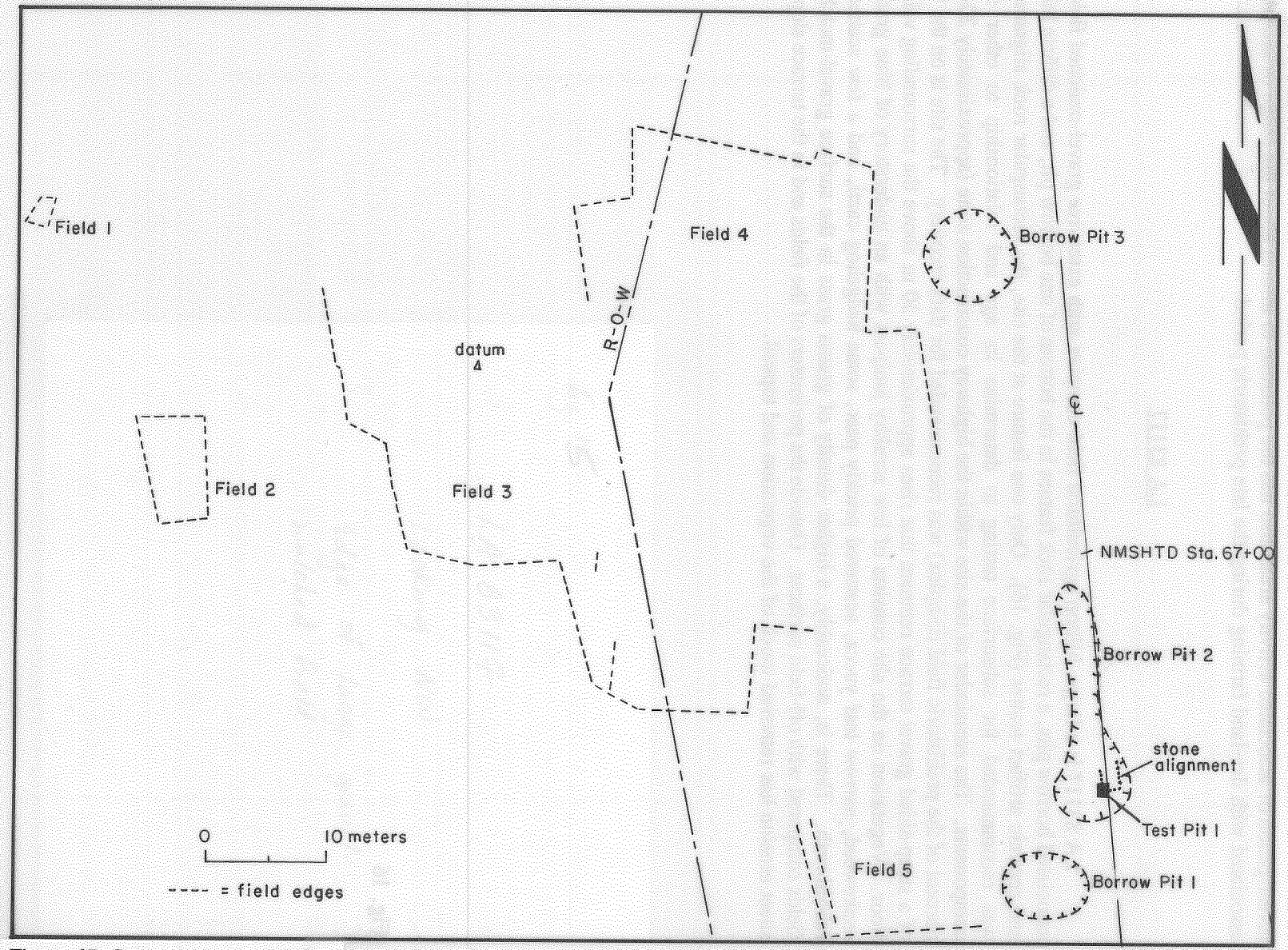

Figure 17. Site map of LA 83117.

Figure 18. LA 83117, looking east-southeast, rectangular rock alignment in borrow pit depression.

The total site area measures approximately 158 m by 98 m (Fig. 17). The rock feature, which was the focus of test excavation in 1992, is in the interior of Borrow Pit 2, on the southeast edge of the gravel terrace (Fig. 18). The feature is a rectangle of river cobbles, approximately 2 m long (north-south) by 1 m wide, and open at the north end. The cobbles are resting on or near the surface within a topographic depression, suggesting that the feature may have been constructed in recent times (Drake 1991).

Test excavations were conducted at LA 83117 on November 14, 1991, February 13, 1992, and April 10, 1992. After an intensive surface inspection designed to locate diagnostic artifacts and additional cultural features, the site boundaries were mapped, and a location was chosen for a 1-by-1-m test unit on the southeast corner of the rock feature. The 1-by-1-m test pit was oriented to bisect the southwest corner of the rock alignment, which would permit an evaluation of the feature's depth and stratigraphy. The test unit was excavated to a depth of 40 cm below present ground surface in two 20 cm levels.

Summary of Excavation Results

The upper 6 cm of fill in Test Pit 1 was light tan sandy soil with small gravel inclusions. Below 6 cm, sandy soil was mixed with increasing amounts of gravel and cobbles ranging from 5 to 15 cm in diameter. One lithic flake was found in the first 10 cm of the test pit. No other cultural materials were found.

Test Pit 1:

Location:	S33.98/E50.29
Depth:	40 cm below present ground surface
Fill:	Level 1 was a light tan sandy soil (0-6 cm) changing to a medium brown sandy soil (7-10). Level 2 was the same medium brown sandy soil with a heavy concentration of gravel and large cobbles.
Features:	The test pit investigated a single course of river cobbles that was apparently laid down in recent times
Artifacts:	1 lithic in Level 1

Artifact Analysis

A single piece of rhyolite angular debris was recovered in the first 10 cm of Test Pit 1. There was no evidence of use-wear on the fragment, and with no obvious bulb or platform, there is no way to know if the fragment resulted from intentional stone knapping. No other artifacts were recovered from test excavations at LA 83117, but intensive surveys of the agricultural field surface before testing recovered several sherds and a corner-notched obsidian projectile point. The style of the projectile point (Fig. 12d) suggests a Basketmaker II-III (ca. A.D. 0-600) date. It is possible that the artifact may predate the construction of the agricultural fields by more than a millennium.

Ceramic artifacts collected from the surface of the site included seven Biscuit A sherds, one Biscuit B sherd, one Sankawi Black-on-cream, and an unidentified organic-painted white ware (Table 2). Of the seven Biscuit A sherds found, all were from bowls and five sherds were from the same vessel. Two sherds were tempered with volcanic ash and five were tempered with volcanic ash and sand.

The Biscuit B sherd found at LA 83117 was a bowl sherd with volcanic ash temper that was polished and painted on both sides of the vessel. Biscuit B, or Bandelier Black-on-gray, is distinguished from Biscuit A by painting on the interior and exterior of bowl vessels. The type is usually assumed to postdate the appearance of Biscuit A; however, conclusive evidence for the date range of production of Biscuit B has not been established and the range of A.D. 1411-1500+, as proposed by Breternitz (1966), is only approximate.

The jar sherd identified as Sankawi Black-on-cream at LA 83117 is tempered with volcanic ash and sand and was polished on the interior and exterior of the vessel. Sankawi Black-on-cream was originally described by Mera (1932, 1939) as the successor to the biscuit wares, and is distinguished by a thick cream-colored slip, a trend to more simplistic design and line work, and variation in forms, most notably in elongated olla necks. Harlow (1973:27) has proposed A.D. 1525 as a reasonable inception date for Sankawi Black-on-cream based on the absence of this type in association with Potsuwi'i Incised in components dated to the early 1500s. A general date range of A.D. 1500-1694 (Wendorf 1953) can be assumed for the Sankawi Black-on-cream sherd found at LA 83117.

The estimated date range for the small sample of ceramics found at LA 83117 covers the period from A.D. 1411-1694, which suggests a late prehistoric or early historic occupation of the site.

Summary and Discussion

Test excavations at LA 83117 were confined to a single test pit in a rectangular rock alignment located within Borrow Pit 2. A heavy concentration of terrace gravels and cobbles was encountered at a depth of 10 cm within the feature, and excavation continued through a heavy gravel deposit for another 30 cm with no evidence of cultural disturbance. The function of the rock alignment remains unclear, but the depositional context of the feature suggests that the rocks were placed in their present position within the last 50 years.

Ceramics recovered from the surface of the fields at LA 83117 suggest that the fields were probably in use between approximately A.D. 1420 and 1694. The presence of a Basketmaker II-III projectile point on the same surface is clearly anomalous, and may represent a curated artifact.

LA 83117 has a data and research potential similar to the adjacent agricultural site, LA 83116. Data recovery will focus on determining the dates of field construction and use, the kinds and varieties of prehistoric crops grown, and how the fields were constructed and used. The elevated terrace topography that supports LA 83117 will also permit us to address issues relating to cold air drainage and other microclimatic effects on growing season in the lower Ojo Caliente Valley. Because of the size and comparative complexity of the field systems at LA 83117 (compared with the systems at LA 83116), we may expect to see more variability in such attributes as field structure and crop mix at LA 83117. The presence of well-defined borrow pits at LA 83117 provides the additional opportunity to investigate the nature and variability of these ubiquitous features.

LA 83118

Prior to test excavations at LA 83118, the site was reexamined and found to consist of three discrete artifact scatters on a low terrace overlooking the Río Ojo Caliente floodplain (Fig. 19). The total site surface area was calculated at 57 m (east-west) by 72 m (north-south). Most of the surface of the site is a sandy alluvium mixed with gravels, and portions of the site are covered by active sand dunes. Based on test excavation results, the entire site appears to be within the project right-of-way.

An east-west trending arroyo defines the northern edge of the site; in the southern portion of the site are low, partially stabilized sand dunes. Vegetation consists of juniper, rabbitbrush, staghorn cholla, narrow leaf yucca, snakeweed, and grama grass. The low density of understory vegetation shows the effects of recent overgrazing.

Test excavations were conducted at LA 83118 between November 14 and 18, 1991, and February 7 and 20, 1992. After an intensive surface inspection to locate artifacts and features, the site boundaries were mapped, and locations were chosen for six 1-by-1-m and one 1-by-2-m test units (Fig. 20). Test Grids 1 and 3 were not excavated because of data returns from other test excavations.

In addition to the test pits, seven soil auger tests were excavated around the periphery of the surface artifact scatters and two backhoe trenches were excavated in areas of high artifact density to delineate site stratigraphy.

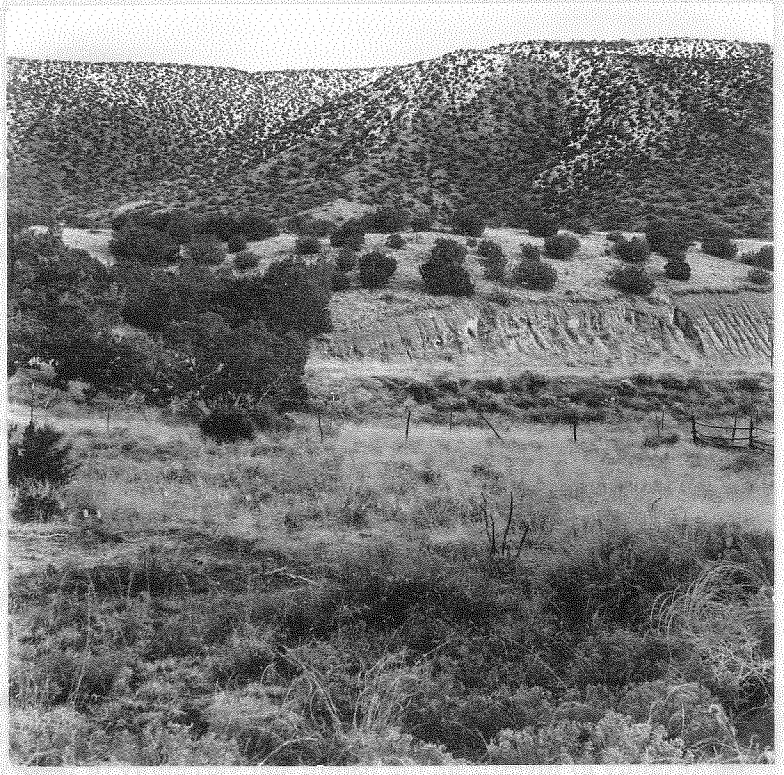

Figure 19. LA 83118, looking east, primary site scatter in the foreground and Black Mesa in background. The U.S. 285 roadcut is evident in the center of the frame.

The testing strategy at LA 83118 involved placing test pits in or near major artifact concentrations in areas judged likely to yield uneroded subsurface cultural deposits. Test Grid 1 was located near the northern edge of the primary site scatter but was not excavated. Test Pit 2 was placed in a light scatter of sherds and lithic artifacts in the northeastern portion of the site, next to an area that has been altered by road construction and maintenance activities. Test Grid 3, although not excavated, was located near the extreme southern edge of the site in a heavily alluviated area within a small lithic and ceramic scatter. Test Pit 4 was located near the center of the primary scatter, in a small blowout. A small concentration of sherds was located within 1 m of the test pit. Test Pit 5 was located within a concentration of river cobbles near the crest of a low sand ridge upslope and west of the principal artifact scatter. Test Pit 5 was extended 1 m to the north to expose the remainder of the cobbles. The cobble concentration is roughly 10 m southeast of a recent water well, and one objective of Test Pit 5 was to evaluate the relationship between the well and the cobble concentration. Test Pit 6 was located within a dense concentration of surface artifacts, on the east flank of a low sand ridge. Erosion has deflated the surface eolian deposit and left many artifacts exposed in the immediate area of the grid.

Summary of Excavation Results

Fill from all the test pits at LA 83118 was somewhat homogeneous, consisting of mixed eolian and alluvial deposits. Test Pits 4 and 6 exhibited evidence of charcoal staining and small amounts of burning. Artifacts most frequently occurred in the upper 15 cm of fill; in Test Pits 2 and 6, a few artifacts occurred below 20 cm.

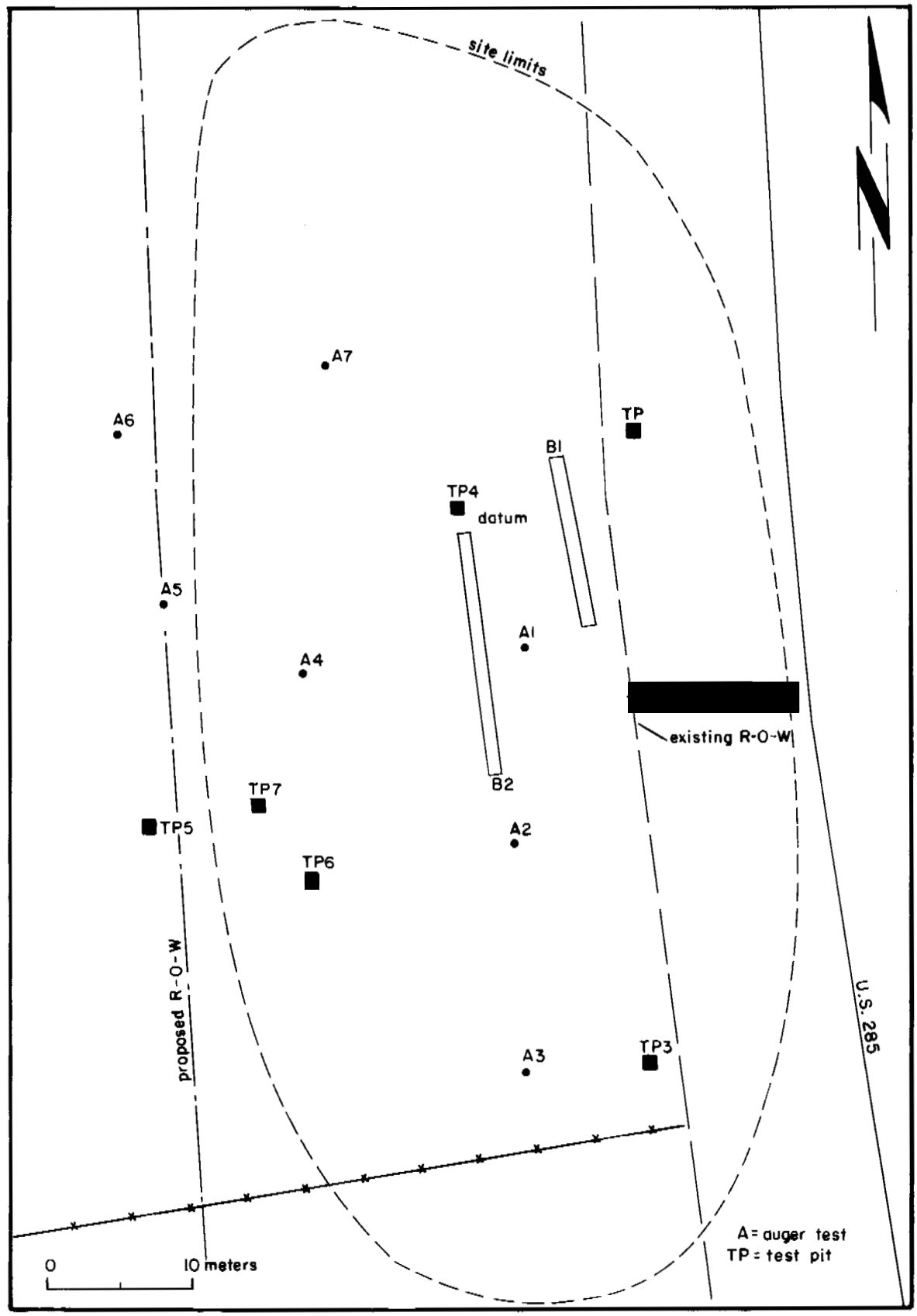

Figure 20. Site map of LA 83118.

Test Pit 2:

Location:	N6.73/E9.20
Depth:	40 cm below present ground surface
Fill:	Level 1 was a light tan eolian sand with some white clay and charcoal; Level 2 was a tan sand with clay particles and some gravel; no cultural staining was apparent in either level
Features:	none
Artifacts:	15 ceramics, 1 lithic, 1 groundstone, 4 macrobotanical samples, charcoal and 1 piece of glass in Level 1; 1 ceramic in Level 2

Test Pit 4:

Location:	N1.48/W3.06
Depth:	46 cm below present ground surface
Fill:	Level 1 was a light tan eolian sand with gravel, white clay particles and charcoal staining and burned wood at bottom of level; Level 2 was a tan sandy soil with increased clay content, less gravel and some charcoal staining.
Features:	none
Artifacts:	1 ceramic on surface; 2 ceramics, 1 lithic, 6 fragments NH bone and 1 macrobotanical sample in Level 1

Test Pit 5:

Size:	1 by 2 m
Location:	S19.69/W24.51 to S20.69/W24.51
Depth:	20 cm below present ground surface
Fill:	Cobble configuration exposed on surface; Top 5 cm of Level 1 was a light brown sandy soil with gravel in the last 6-20 cm of the level; 5-18 cm of Level 1 was a layer of dark brown sandy soil with small roots, water worn pebbles and sandstone particles. 18-20 cm in Level 2 was a light brown sand. Charcoal and artifacts limited to the first 10 cm of Level 1
Features:	none
Artifacts:	2 ceramics on surface; 3 ceramics and 4 lithics in Level 1
Auger:	Total depth 107 cm below bottom surface of Level 1. Light brown sand with gravels increasing at 55 cm; clay content increasing at 77 cm and sandstone bedrock at 107 cm.

Test Pit 6:

Location:	S22.24/W13.16
Depth:	42 cm below present ground surface
Fill:	Level 1 was a layer of tan sand with charcoal flecks; Level 2 was the same light tan sand with some clay and large amounts of gravel and charcoal; Level 3 was a brown sandy soil with clay, gravel and charcoal
Features:	none
Artifacts:	4 ceramics and 10 lithics on surface, 61 ceramics, 1 groundstone, 6 fragments of NH bone, charcoal and 1 macrobotanical sample in Level 1; 3 ceramics in Level 2; 1 ceramic in Level 3

Test Pit 7:

Location:	S19.21/W16.89
Depth:	40 cm below present ground surface
Fill:	Light brown very fine eolian sand in first 7 cm of Level 1 and medium brown sandy soil in last 8-20 cm of level. Charcoal and artifacts limited to first 15 cm of Level 1 and ash pocket in SE corner in first 5 cm. Level 2 was a continuation of the medium brown sandy soil in Level 1. No charcoal or artifacts in Level 2.
Features:	none
Artifacts:	18 ceramics on surface; 34 ceramics, 4 lithics, 3 ground stones, 59 fragments of NH bone, and 1 macrobotanical sample in Level 1.

Seven auger tests were systematically placed in areas peripheral to the primary artifact concentrations (Fig. 20). Auger test depths ranged from 1.00 m to 1.18 m, profiles varied little across the tests, and they did not yield any additional evidence of subsurface cultural activity. No artifacts or evidence of any features were found in the tests (Table 10).

Table 10. Summary of Auger Tests at LA 83118

Test #	Location	Stratigraphy	Depth	Cult/Organic
1	S8.24/E1.63	clean, brown, fine-grained, sandy loam; some pebbles	100 cm	none
2	S21.78/E0.82	fine brown sand; small fraction 1-2 cm pebbles, soil fungus at 30-50 cm suggests recent deposition over stable level, gravel lens at 60-70 cm	110 cm	none
3	S37.66/E1.64	clean brown sand in slight topo depression; large rock in gravel lens at 105 cm	105 cm	burned wood fragments at 30-40 cm, very little charcoal
4	S9.93/W13.67	brown sandy loam; higher clay concentration than other tests; becomes very sandy at 80 cm	112 cm	none
5	S5.19/W23.43	fine sandy loam with small pebble fraction	106 cm	none
6	N6.50/W26.72	upper 50 cm sandier w/ larger gravel fraction than other tests; substantial gravel lens at 50-80 cm. Test terminated by lens.	80 cm	none
7	N11.25/W12.35	soil as #6; gravel lens at 70-80 cm then drops off; soil very sandy at 110 cm	118 cm	none

Site Stratigraphy

Two backhoe trenches were excavated at LA 83118 to define site stratigraphy and search for buried cultural features and deposits. Backhoe Trench 1 was excavated immediately west of the highway right-of-way fence in an area of light surface artifact scatter. The trench measured 12 m long and was excavated to a maximum depth of 1 m below present ground surface. Backhoe Trench 2 was excavated parallel to Trench 1, approximately 8 m to the west, and measured 17 m long and 70-80 cm deep. No obvious cultural features were recorded in either of the test trenches. A small organic soil stain measuring approximately 1 m in diameter was recorded in the floor of the trench, near its northern end. No artifacts were recovered in association with the stain, and its origin and importance are unknown.

The surficial geology of LA 83118, as exposed in Backhoe Trench 2 (Fig. 11), consists of a surface deposit of eolian sand overlying sandy alluvium. Within the alluvial profile are many small gravel lenses, marking small channel deposits. There is no apparent soil formation within the alluvial section, and no artifacts were recovered below the eolian surface layer. Along the western edge of the site is a low, partially stabilized sand dune that appears to contain the deepest, intact cultural deposits at the site. In other, more eroded portions of the site, cultural material is confined to the upper few centimeters of surface eolian deposits.

Lithic Artifacts

Twenty lithic artifacts were recovered during test excavations at LA 83118. The assemblage is dominated by core flakes (40 percent) and angular debris (45 percent); formal tools included a hammerstone, a chert core, and a small, corner-notched obsidian projectile point. Half (10) of the artifacts were recovered from the surface of test pits; the other half came from subsurface proveniences, most from the first 10 cm below present ground surface. Additional lithic artifacts were noted on the surface of the site but were not collected. Attributes of the lithic assemblage are presented in Table 11, and general patterns are summarized below.

The most common lithic raw material is chert, comprising 60 percent of the total assemblage. Two flakes are composed of Pedernal chert; the remaining flakes are of materials that are variable in texture, quality, and color, and most could have been obtained from gravel deposits or other local sources. Four flakes and a small hammerstone are composed of fine-grained quartzite. Quartzite is one of the most common constituents of terrace gravel deposits in the study area, and it is perhaps the most abundant local raw material for flint knapping. One of four quartzite flakes in the assemblage is a primary flake struck from a small river cobble, and the quartzite hammerstone is a small, water-worn cobble with battering marks along one edge. Rounding out the assemblage are two small interior flakes of obsidian and a projectile point on a flake of Polvadera obsidian. The nearest source for Polvadera obsidian and other undifferentiated obsidians in the assemblage is the Jemez Mountains, approximately 30 km west and southwest of the project area.

Based on such a small sample, it is difficult to make reliable statements about flaked stone technology and use at the site. The ratio of flakes to angular debris (1:1.1), the high frequency of cortical flakes among core flakes at the site (50 percent), and the extremely low frequency of bifacial tools and reduction debris in the assemblage suggest that simple core reduction and the production of expedient tools was the primary focus of lithic reduction strategies. Edge wear was detected on

Table 11. LA 83118 Lithic Assemblage

Material	Angular Debris	Core Flake	Core Undiff.	Cobble Tool Undiff.	Late Stage Biface	Total	%
Chert	6	3	1	0	0	10	50.0
Pedernal Chert	1	1	0	0	0	2	10.0
Quartzite	1	3	0	1	0	5	25.0
Obsidian	1	1	0	0	0	2	10.0
Polvadera Peak Obsidian	0	0	0	0	1	1	5.0
Total	**9**	**8**	**1**	**1**	**1**	**20**	**100**
Percentages	45.0	40.0	5.0	5.0	5.0	100	

two flakes and the hammerstone, marginal retouch is present on only two artifacts, and the remaining 15 flakes exhibit no evidence of use.

The only formal flaked stone tool in the LA 83118 assemblage is a small corner-notched projectile point of Polvadera obsidian (Fig. 12b). The triangular point measures 2.5 cm long by 1.6 cm wide by 0.6 cm thick, and is unfinished--perhaps discarded in manufacture because of some flaw in the material or its manufacture. The style of the projectile point is reminiscent of the late Basketmaker or early Pueblo period (ca. A.D. 500-900).

Ceramic Artifacts

A total of 143 sherds was collected during survey and subsurface testing at LA 83118 (Table 12). Ceramic types were identified and sorted based on a complex of attributes that are summarized in Table 2.

The ceramics recovered from LA 83118 suggest a date range spanning 400-500 years, from approximately A.D. 1400 to 1850-1900. The relative frequencies of various types allow us to bracket the occupation a little more closely. The largest percentage of ceramics is plain micaceous utility wares that were manufactured in the Northern Río Grande from the fifteenth century to the present. However, the absence of any type of corrugated utility ware, especially the absence of Sapawe Micaceous Washboard, which is a contemporary of the Biscuit Wares (Mera 1935), suggests that the site was probably occupied sometime after A.D. 1600. The second largest ceramic component is represented by the Tewa plain, polished, and slipped wares, which were manufactured from the late 1600s to the present. Their relative abundance, and their association with micaceous utility wares and Tewa polychromes sherds (ca. 1600-1850), suggests that LA 83118 was most likely occupied in the late seventeenth or early eighteenth century A.D.

A review of the frequencies of ceramic types and forms represented at LA 83118 suggests a variety of activities relating to food processing and preparation. Fifty-five percent of the ceramics from the site are utility wares and 44 percent are plain, polished, or decorated wares. Seventy-five percent of the sherds are from jars or ollas, 19 percent are bowl sherds, and 4 percent are from indeterminate forms (Table 13). Although the precise function of each type and form cannot be deduced from the sherds, these percentages suggest that a

Table 12. LA 83118 Ceramic Inventory by Type

Ceramic Type	Frequency	percent
Utility Wares		
Plain Micaceous	72	50 percent
Plain unpolished	4	2 percent
Plain polished	1	<1 percent
Plain polished smudged	3	2 percent
Tewa Plain Polished		
Black Wares	34	23 percent
Red Wares	13	9 percent
Brown Wares	4	2 percent
Painted Wares		
Biscuit A	1	<1 percent
Biscuit B	1	<1 percent
Biscuit (undiff)	2	1 percent
Sankawi Black-on-cream	1	<1 percent
Carbon-on-white	1	<1 percent
Carbon-on-white w/red	2	1 percent
Tewa Series Polychrome	4	2 percent
Total	**143**	100 percent

range of domestic activities (cooking, storage, and serving) is represented and may have taken place at the site. In addition, the ranges of ceramic types present indicate that the location may have been used or reoccupied over an extended period. Too little is known, however, about the function of the site and its occupation history to speculate about the nature or duration of these activities.

Intrasite distributions of vessel forms and types do not show any obvious functional patterns. The southwest portion of the site, specifically the area around Test Pits 6 and 7, has the highest density of ceramic artifacts (n=108 or 79 percent), and ceramics were more likely to occur at greater depths in that area. Only four sherds were recovered below Level 1, indicating that cultural deposits are within the top 10-20 cm throughout most of the site. A review of the stratigraphic relationship of ceramic types reveals no apparent pattern in the deposition of ceramic types at LA 83118, although it is difficult to make any conclusions because of the small size of the sample. Micaceous utility wares occurred throughout all three levels, with Tewa plain wares, Tewa polychromes, and Biscuit wares occurring on the surface and in Level 1.

Table 13. LA 83118 Vessel Forms by Ceramic Type

Type	Bowl	Jar/Olla	Bowl or Jar
Plain micaceous		72	
Plain unpolished		4	
Plain polished	1		
Plain, polished, smudged	1	2	
Black wares	9	18	7
Red wares	8	5	
Brown wares	1	3	
Biscuit A	1		
Biscuit B	1		
Biscuit (undiff)	2		
Sankawi Black-on-cream		1	
Carbon-on-white	1		
Carbon-on-white w/red		2	
Tewa Series Polychrome	3	1	
Total	28 (19 percent)	108 (75 percent)	7 (4 percent)

Very little has been documented on regional patterns of Classic period and early historic trade and exchange in the Chama Valley since Mera's original observations on ceramic distributions in the area (Mera 1934). The ceramic inventory at LA 83118 shows a high degree of variability in tempering materials within and across ceramic types (Table 14). The variety of temper types may show local preferences, availability of materials, or patterns of intervillage production. In the data recovery analysis phase, petrographic analysis and a geological survey of material sources in the area is needed to make any definite conclusions about exchange on this level. No glaze wares or any other type of trade ware was recovered during testing at LA 83118. Without more information on the site's occupational components, it is difficult to interpret this absence of trade wares; however, it is an important aspect of analysis that will be investigated further in the data recovery phase of the project.

Macrobotanical Analysis

Very few macrobotanical specimens were recovered from test excavations at LA 83118. Test Pits 4 and 6 yielded carbonized and uncarbonized juniper *(Juniperus monosperma)* seeds and the fill of Test Pit 7 contained five carbonized corn *(Zea mays)* cob fragments and a monocot stem fragment and caryopsis parts that may be from a domestic cereal grain. Results of identification and analysis of this small botanical sample are summarized in Appendix 1.

Table 14. LA 83118 Tempering Material by Ceramic Type

Ware Type	Tuff	Sand	Sand-stone	Mica & Quartz	Mica & Sand	Igneous	Vol. Ash	Vol. Ash & Sand	Vol. Ash & Pumice	Self temp.	Total
Plain micaceous			2	44	26						72
Plain unpolished		2				2					4
Plain polished		1									1
Plain, polished, smudged		1					2				3
Black wares	2	27			2			2		1	34
Red wares	1	9						2		1	13
Brown wares		1			3						4
Biscuit A	1										1
Biscuit B	1										1
Biscuit (undiff.)								2			2
Sankawi Black-on-cream	1										1
Carbon-on-white		1									1
Carbon-on-wht/red										2	2
Tewa Series Poly		1							1	2	4
Total	**6**	**43**	**2**	**44**	**31**	**2**	**2**	**6**	**1**	**6**	**143**
% of Total	4%	30%	1%	30%	21%	1%	1%	4%	<1%	4%	100%

Faunal Analysis

A total of 26 animal bones was recovered from three test excavation proveniences at LA 83118, and egg shell was recovered from a fourth. In addition, and somewhat surprisingly, a total of 18 fossil bone and antler elements was recovered from two proveniences at LA 83118. Counts and percentages of various faunal elements are summarized in Table 15.

Most of the bones were recovered in such fragmentary condition that accurate species identification was impossible. A single element from a domestic sheep *(Ovis aries)* was recovered from Test Pit 7, and a total of 13 bone fragments was in the medium mammal size range suggesting sheep, goat, or perhaps large rabbit. Five large mammal bones were recovered, but their condition was too fragmentary to make species identifications. A single bone fragment from a medium to large bird and a chicken-size egg shell was also recovered.

The fragmentary condition of individual bone elements, the presence of butchering marks or knife cuts on at least three bone elements, and the occurrence of charred bone in the assemblage indicate that animal processing and consumption is taking place on the site or nearby. The presence of domestic sheep in the assemblage suggests a post-sixteenth-century A.D. date for the deposits and is entirely consistent with the site ceramic assemblage. The meaning of the fossil bone in the assemblage is not immediately clear.

Table 15. LA 83118 Faunal Remains

Taxon	Common Name	T.P. 4	T.P. 6	T.P. 7	T.P. 5	Total	Knife Cuts
cf. *Ovis aries*	domestic sheep			1		1	
Medium artio.	sheep/goat size			1		1	
Medium mammal	rabbit to sheep size			12		12	2
Large mammal	sheep or larger	5	5			10	
Medium-large bird	chicken or larger			1		1	1
Egg shell	chicken size				1	1	
Totals		5	5	15	1	26	3
percent Burned				13.3		7.7	
percent Root etched				13.3		7.7	
percent Eroded			20	13.3		11.5	
percent Checked		100	60	60		57.7	
Fossil Bone							
Large mammal element							

Taxon	Common Name	T.P. 4	T.P. 6	T.P. 7	T.P. 5	Total	Knife Cuts
Horn or antler			4				
Long bone shaft			10		1		
Flat bone			4				
Totals			18		1		

Summary and Discussion

The majority of cultural materials recovered during test excavations at LA 83118 came from eolian deposits that comprise the upper 10-20 cm of site stratigraphy. In the north end of Backhoe Trench 2 is an organic stain at a depth of 1.0 m that may represent an earlier occupation component. Although no artifacts were found in association with the stain, the recovery of a late Basketmaker-early Pueblo-style projectile point from the surface of LA 83118 supports the hypothesis of an earlier occupation.

The ceramic assemblage at LA 83118 is dominated by seventeenth- and eighteenth-century Tewa pottery, and test excavations recovered the remains of charred corn cobs, an unidentified cereal grain, and the butchered and charred remains of domestic sheep and other medium to large animals, including a chicken-sized bird and eggshell fragments. The accumulated evidence suggests an early historic occupation dating to the late seventeenth or early eighteenth centuries. No cultural features were found during test excavations, but the kinds and quantities of cultural refuse recorded at the site suggest a broad range of domestic activities and at least seasonal occupation of the locality. With expanded excavation during data recovery, it is likely that cultural features or facilities will be located.

The cultural affiliation of the historic component at LA 83118 is not known and may be difficult to ascertain. There is ethnohistorical evidence of continued Tewa use of the lower Chama region at least until Spanish land grants were established in the 1730s (Wozniak n.d.). LA 83118 may represent a Tewa herding camp, fieldhouse, or other type of temporary encampment. Alternatively, the site could be a Spanish encampment. The absence of European artifacts in the assemblage does not rule out the possibility of Spanish occupation, since early Spanish settlers in the Northern Río Grande relied heavily on the Pueblos for foodstuffs, pottery containers, and other domestic items. Since refuse produced by Spanish and Pueblo communities during the early historic period may be indistinguishable (especially the refuse produced in a temporary encampment), assignment of cultural affiliation to early historic sites in northern New Mexico is often problematic. This issue will be addressed in more detail in the project data recovery plan.

Although we do not know the precise age or extent of the buried prehistoric component at LA 83118, they are potentially very important. All other early prehistoric components identified in the project area have been subjected to heavy erosion and, in some cases, substantial redeposition. The buried component at LA 83118 may represent the only undisturbed Archaic-Basketmaker deposits in

the project area, and as such, it may provide important insights into the nature and extent of disturbance at other early prehistoric sites in the project area.

The historic component at LA 83118 is especially rich in economic data from the early historic period. An important research issue of the early historic period in northern New Mexico is the nature and extent of Spanish-Pueblo contacts. Political relationships between various ethnicities on the Spanish frontier are fairly well documented in the literature, but a great deal of basic research still needs to be accomplished on the nature of economic relatinships and patterns of economic dependency, especially for the period preceding the Pueblo Revolt of 1680. LA 83118 may yield important data on these issues. In addition, excavations of the historic component at LA 83118 will attempt to determine the cultural affiliation of the site occupants and the approximate date of site occupation. Resolving these issues will have an important bearing on our understanding of early historic dynamics in the lower Ojo Caliente Valley.

LA 83151

During resurvey of LA 83151 prior to test excavation, four discrete artifact scatters and three charcoal stains were recorded in an area roughly 90 m (east-west) by 70 m (north-south). The site is deeply dissected by arroyo channels approximately 4-5 m in depth that flow onto the Ojo Caliente floodplain immediately west of the site (Fig. 21). Surface artifacts are concentrated in deflated areas on slopes between entrenched arroyos. Vegetation on the site consists of low, stunted junipers and a solitary piñon, with an understory of snakeweed, narrow leaf yucca, some prickly pear, and scattered rabbitbrush. A heavy grass cover consists primarily of blue grama, with some side oats grama, sand dropseed, and Indian rice grass. The ridge supporting the site overlooks the Ojo Caliente floodplain approximately 50 m to the west and northwest where a band of riparian vegetation is dominated by cottonwood and willows.

Test excavations were conducted at LA 83151 between November 18-19, 1991, and February 13 and 21, 1992. During intensive surface inspection, four artifact concentrations and two charcoal stains were flagged and mapped (Fig. 22). Concentration 1, measuring 10-15 m in diameter, is on both sides of a low sandstone outcrop. The scatter consists of six sherds, primarily plain gray utility wares, and multiple flakes of a banded chert or metamorphic rock. Concentration 2, also measuring 10-15 m in diameter, is a light scatter bisected by an actively eroding arroyo channel. Two plain gray utility ware ceramics and multiple flakes of Pedernal chert, red chert, and quartzite dominant the scatter. Fragmentary basalt and fire-cracked rock are also interspersed with artifacts in the scatter. Concentration 3, located on a north-facing slope cut by two deep drainage channels, is the densest surface artifact cluster, and measures 20-25 m in diameter.

Several large blocks of detached sandstone bedrock ring the northeastern edge of the cluster. Two charcoal stains, possibly the remains of fire hearths, are located near the center of Concentration 3. Fractured quartzite river cobbles, which do not appear to be local, rest on the surface. Quartzite, white chert, and obsidian flakes are the predominant artifact types in the scatter. No ceramics were found in Concentration 3. Concentration 4 is a light scatter of lithic artifacts on a narrow tongue of land bounded on the north and south by deep arroyo cuts. The cluster consists primarily of obsidian and white and tan chert flakes associated with several large quartzite and basalt cores. A large charcoal stain, approximately 1.5-1.7 m in diameter, is within Concentration 4.

Figure 21. LA 83151, looking west-northwest, primary site scatter in the foreground and the Río Ojo Caliente floodplain in the background.

Five 1-by-1-m test pits were excavated at LA 83151. Test Pit 1 was located 19 m northwest of Concentration 1. Test Pit 2 was placed on the northeastern edge of Concentration 1. Test Pit 3 was in the south-central portion of Concentration 2. Test Pits 4 and 5 were established within Concentration 3 and were located to bisect the two charcoal stains within the cluster. Because of the information resulting from the excavation of Test Pit 5, Test Grid 4 was not excavated. Test Pit 6 was excavated near the northern edge of Concentration 4, approximately 3 m southeast of the charcoal stain. At the completion of testing, soil auger tests were excavated to determine the areal extent of subsurface cultural deposits.

Summary of Excavation Results

The soil profiles found in Test Pits 1, 2, 3, and 5 were a layer of light tan eolian sand with very little gravel. Artifacts were limited to the surface and the upper 10 cm of Level 1. In Test Pit 6, in the northeastern portion of the site, the upper layer was a light brown sandy soil overlying a light tan sand. Evidence of cultural features was limited to the charcoal and ash staining in Test Pit 5, the location of which was chosen to test an exposed charcoal stain in Concentration 3.

Test Pit 1:

Location:	N1.28/W29.26
Depth:	20 cm below present ground surface
Fill:	Light tan eolian sand; no cultural staining apparent
Features:	none
Artifacts:	none

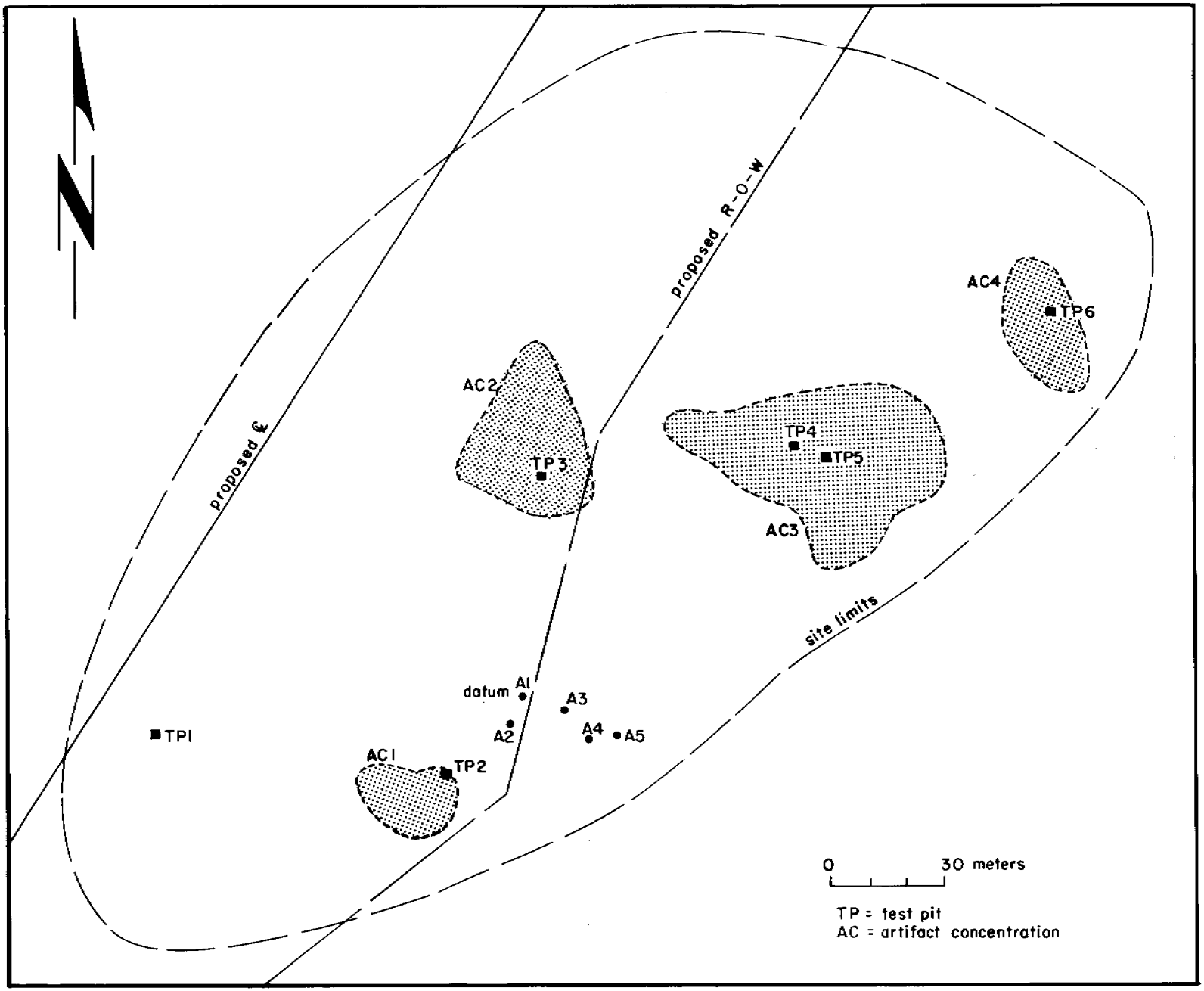

Figure 22. Site map of LA 83151.

Test Pit 2:

Location:	S5.45/W3.54
Depth:	20 cm below present ground surface
Fill:	Light tan eolian sand; no cultural staining apparent
Features:	none
Artifacts:	6 lithics on surface; 2 lithics within first 0-10 cm of Level 1.

Test Pit 3:

Location:	N20.06/E5.88
Depth:	25 cm below present ground surface
Fill:	Light tan eolian sand with very little gravel and large roots; no cultural staining apparent
Features:	none
Artifacts:	1 lithic on surface

Test Pit 5:

Location:	N20.98/E30.91
Depth:	19 cm below present ground surface
Fill:	Tan eolian sand with large charcoal and ash stain
Features:	indeterminate
Artifacts:	1 ceramic and 1 lithic on Surface; 7 lithics in Level 1

Test Pit 6:

Location:	N33.22/E51.04
Depth:	35 cm below present ground surface
Fill:	Light brown sandy soil 0-10 cm in Level 1 and light tan sand with small charcoal pieces in 10-20 cm of Level 1; Level 2 was light brown sand with small charcoal pieces
Features:	none
Artifacts:	1 ceramic and 1 lithic on surface

Five auger tests were excavated east and upslope from Datum A, along the crest of a ridge in areas judged likely to yield buried cultural features (Fig. 22). Auger test depths ranged from 1.0 m to 1.12 m below present ground surface. Soil profiles did not vary significantly throughout the auger tests and was clean, fine-grained, well-sorted eolian sand. No artifacts, organic materials, or cultural staining were found in any of the tests (Table 16).

Lithic Artifacts

Nineteen lithic artifacts were recovered during test excavations at LA 83151. Slightly over half (58 percent) were from the surface of test grids; the remainder were from subsurface levels. The assemblage is dominated by core flakes (63 percent) and angular debris (16 percent). A single biface

Table 16. Summary of Auger Tests at LA 83151

Test #	Location	Stratigraphy	Depth	Cult/Organic
1	N0.97/E12.32	clean, well-sorted, fine-grained eolian or residual sand	107 cm	none
2	S3.51/E7.19	same as 1; sandstone bedrock at 105 cm	105 cm	none
3	S1.18/E21.27	same as 1	112 cm	none
4	S8.14/E30.03	same as 1	100 cm	none
5	S7.44/E37.11	same as 1	108 cm	none

flake was recovered and three fragmentary obsidian projectile points were collected from the surface of the site. Details of the flaked stone assemblage are presented in Table 17, and briefly summarized below.

The lithic assemblage at LA 83151 is evenly divided among chert, obsidian, and rhyolite (32 percent each), with a single flake of quartzite. Except for obsidian, all the raw materials in the assemblage probably could have been obtained from local sources. The nearest obsidian source is in the Jemez Mountains, approximately 30-50 km to the west and southwest. Cortex is present on only two flakes: a secondary flake of rhyolite has water-worn cortex on its dorsal surface, and a flake of obsidian has a cortical platform. Besides the projectile points that were recovered, only two flakes, both of obsidian, exhibited evidence of use-wear or marginal retouch.

The only formal lithic tools recovered at LA 83151 were three partial, obsidian projectile points (Fig. 12c, f, g). The first point was the base of a large, triangular, corner-notched dart point that measures 1.6 cm long (fragmentary) by 2.2 cm wide by 0.4 cm thick. The tip and an

Table 17. LA 83151 Lithic Assemblage

Material	Angular Debris	Core Flake	Biface Flake	Biface Mid Stage	Biface Late Stage	Total	%
Chert	0	2	0	0	0	2	10.5
Pedernal Chert	0	4	0	0	0	4	21.1
Quartz	1	0	0	0	0	1	5.3
Obsidian	0	2	1	2	1	6	31.6
Rhyolite	2	4	0	0	0	6	31.6
Total	**3**	**12**	**1**	**2**	**1**	**19**	**100**
Percent	15.8	63.2	5.3	10.5	5.3	100	

indeterminate amount of the projectile blade are missing. The second point, which is similar in size and form to the first, was the base of a large, corner-notched dart point measuring 1.0 cm long (fragmentary) by 2.4 cm wide by 0.3 cm thick. The style of both points suggests a late Archaic-Basketmaker II date. The third artifact was a deeply serrated obsidian blade measuring 2.6 cm long by 1.3 cm wide by 0.4 cm thick. The point base is missing and what remains of the point is too fragmentary to classify with any degree of certainty.

Ceramic Artifacts

Two sherds from Smeared-Indented corrugated jars were recovered from the surface of 1-by-1-m test units at LA 83151. One sherd was tempered with volcanic ash and the other was tempered with sand. No decorated ceramics were noted on the surface of the project area. Smeared-Indented corrugated was first described by Mera (1935), who called the type as Tesuque Smeared-Indented. The type is considered a Coalition period (A.D. 1175-1325) utility ware based on the association of this type with Santa Fe, Wiyo, and Galisteo Black-on-white (Mera 1935).

Summary and Discussion

Test excavations at LA 83151 investigated four surface concentrations of artifacts, two of which were associated with small, charcoal-stained features. Excavations revealed that most of the cultural materials are contained in a surface layer of fine, wind-blown sand. The site is heavily eroded and few artifacts or other cultural materials were recorded below a depth of 20 cm below present ground surface. There appear to be at least two discrete temporal components at the site: (1) a late Archaic or Basketmaker II component, probably associated with Concentrations 3 and 4, and possibly 2; and (2) a late Coalition or early Classic period component (ca. 1200-1350) in the vicinity of Concentration 1. The presence of charcoal stains in at least two of the surface concentrations suggests buried cultural surfaces and features, although extensive erosion at LA 83151 may have taken out large portions of the site.

The project right-of-way essentially bisects LA 83151. Artifact Clusters 1 and 2 are located within the project construction zone; Clusters 3 and 4 are located just east of the project area and will not be affected by construction activities. A necessary preliminary goal of data recovery at LA 83151 will be to determine the age and cultural affiliation of the clusters. Based on preliminary testing results, Cluster 1 appears to date to the late prehistoric period (ca. 1200-1350). Cluster 2 may overlap in age with Cluster 1, but it may also contain an earlier Archaic component. Beyond these preliminary objectives, information on hunter-gatherer subsistence-settlement strategies, mobility patterns, and economic organization. LA 83151 is especially important because of the apparent spatial juxtaposition of similar components of radically different ages, permitting a direct comparison of assemblages from the early and late prehistoric periods. How were late Archaic and late Pueblo resource procurement strategies different, and how were they the same? These and other comparative questions will be addressed during data recovery efforts at LA 83151.

SUMMARY OF TESTING RESULTS AND RECOMMENDATIONS

This section begins with a brief summary of test excavation results and concludes with recommendations for data recovery at each site in the project area.

The most common site type is a surface artifact scatter. The only features observed on these sites were small charcoal stains. Some of these charcoal stains were associated with fire-cracked rock, but this association was not common. Artifact scatters with charcoal stains included LA 83109, LA 83110, and LA 83151. Artifact scatters without any obvious charcoal stains or other cultural features included LA 83111, LA 83114, and LA 83118. In the case of LA 83111 and LA 83114, extensive erosion and redeposition on the sites have probably obliterated or obscured the remains of any cultural features. At LA 83118, the kinds and quantities of cultural refuse observed in the test units strongly suggests the presence of cultural features, but except for an amorphous organic stain in the bottom of a backhoe trench, no features were found.

The other major category of site in the study area is late prehistoric agricultural fields and associated features. LA 83116, which was not tested, and LA 83117, which was subjected to only restricted testing, are two large agricultural complexes that are within the construction zone of the project. The sites contain rectilinear cobble alignments enclosing gridded, gravel-mulched field plots. On the edges of the terraces that support the fields are clusters of pits from which, presumably, gravel was extracted for use as a surface mulch. These "borrow pits" also may have served a variety of secondary functions, for example, growing pits, water catchment basins, and fieldhouses. No evidence of domestic features such as fieldhouses and fire hearths was noted at the agricultural sites.

Sites investigated on the Ojo Caliente testing project span nearly 7,000 years of occupation and use, from approximately 5000 B.C. to A.D. 1700-1750 (Fig. 23). The majority (67 percent) of sites appear to have multiple occupation components. The most common component dates to the late Coalition-Classic period (A.D. 1250-1598). Seven of nine sites (78 percent) have evidence of late prehistoric (Pueblo III-Pueblo IV) occupation or use--either intensive agricultural activities or extensive hunting, collecting, or other resource procurement activities. Clearly, the study area was exploited intensively during the fifteenth and sixteenth centuries and it is noteworthy that within an 8-mile radius of the current project area are at least seven large ancestral Tewa pueblos (Te'ewi, Ku, Leafwater, Peseduingue, Tsama, Yunque, and Ponsipa'akeri).

The second most common temporal component is late Archaic-Basketmaker II (ca. 800 B.C.-A.D. 600). Four sites (LA 83114, LA 83117, LA 83118, and LA 83151) appear to have late Archaic components based on the recovery of diagnostic projectile points, and at least two sites (LA 83109 and LA 83110) may have substantial Archaic components but did not yield temporally diagnostic artifacts. The recovery of two Bajada-style projectile points from LA 83111 and LA 83114 suggests the possibility of Early to Middle Archaic components at these adjacent sites. This is the earliest evidence of prehistoric occupation recovered thus far from the study area.

The final component, which comprises the bulk of cultural materials recovered from LA 83118, dates to the early historic period. The archaeological remains from LA 83118 include domestic sheep and possibly goat and chicken, and the remains of a domestic grain, possibly wheat. These items were found in association with historic Tewa ceramics whose relative type frequencies

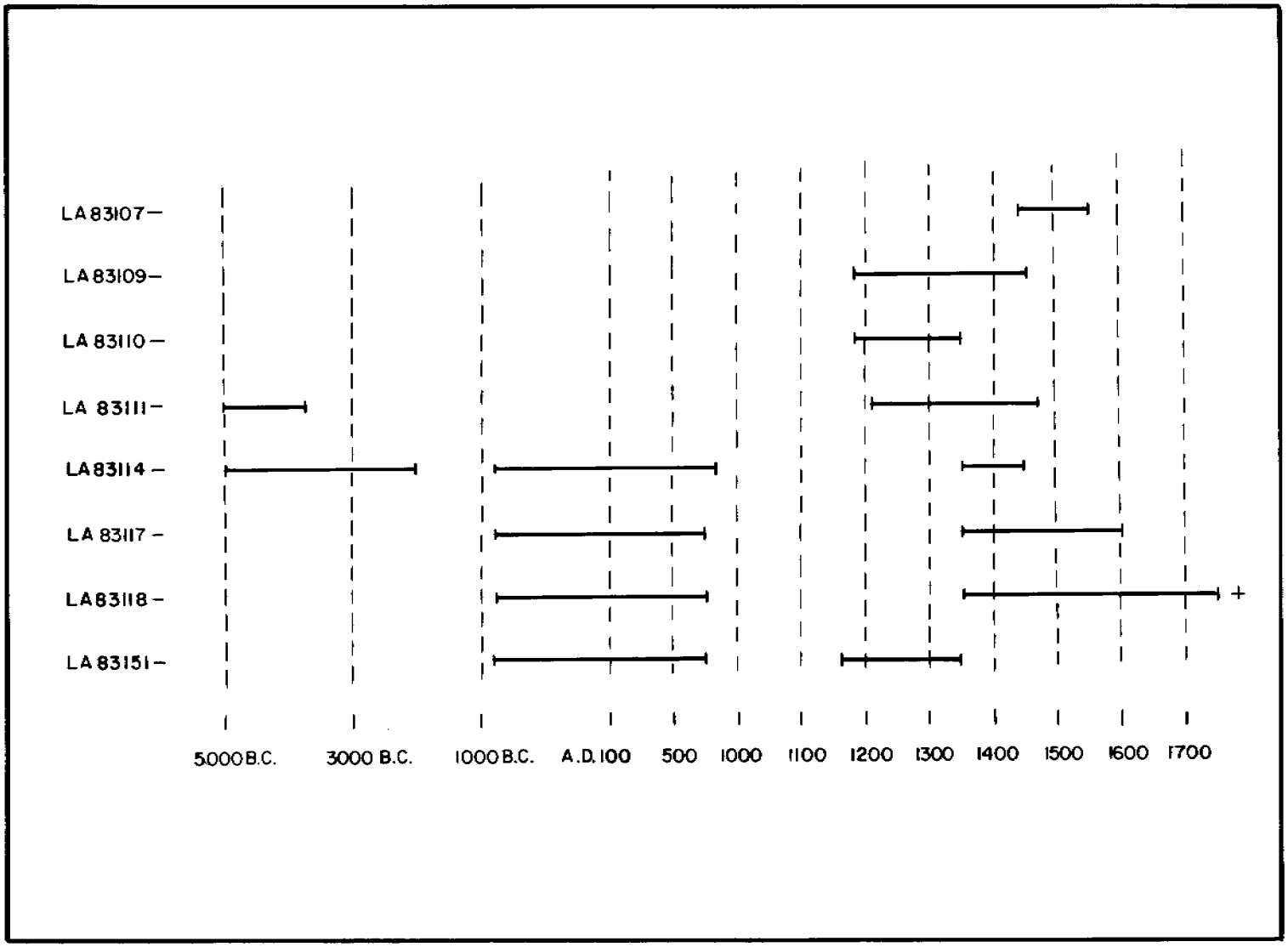

Figure 23. Time line of Ojo Caliente diagnostic artifacts found at each site.

suggest an occupation occurring near the end of the seventeenth or beginning of the eighteenth century. The cultural affinity of the site occupations is not known and may be difficult to determine, but the most likely occupants of LA 83118 were either Tewa or Spanish.

Many sites tested appear to contain important information regarding local and regional history and culture processes. Specific treatment recommendations for each site follow.

LA 83107

This late prehistoric lithic and ceramic scatter is outside the current project boundaries and will not be affected by the proposed construction project. Unless the scope of the project changes, no further action is recommended.

LA 83109

This late Archaic lithic scatter consists of several burned cultural features and evidence of a buried cultural horizon at a depth of 20-40 cm below the present ground surface. The western edge of the lithic scatter appears to be coterminous with the eastern edge of a construction maintenance easement (CME). Unless the boundaries of the CME change, the site should not be affected by the proprosed construction project, and no further action is recommended.

LA 83110

LA 83110 contains of four discrete "hearth-size" charcoal stains and a large stain that may be the remains of some form of domestic architecture. Although no temporally diagnostic artifacts were recovered from the site, the apparent absence of ceramic artifacts in the assemblage suggests that the remains are preceramic in age. A single 1-by-1-m test pit was excavated near the center of the primary surface artifact scatter and 19 soil auger tests were excavated along four radiating transects from the center to beyond the periphery of the surface scatter. All the auger tests were negative and only two small lithic flakes and a single piece of charcoal were found during excavation of the test pit. The site is severely eroded and potential cultural information may already have been lost. The presence of intact cultural features requires, in our estimation, a full-scale data recovery effort at LA 83110 within the proposed project limits. The presence of a possible architectural feature at LA 83110 may be extremely important, especially if the site is preceramic in age, as preliminary indications suggest. Charcoal from several burned cultural features promises to yield chronometric samples that will aid in dating the site deposits.

LA 83111 and LA 83114

These adjacent and, for the most part, contemporaneous sites have similar data potential and data recovery recommendations. Extensive surface mapping and test excavations were conducted at both sites. The two sites were explored with a total of ten 1-by-1-m test pits, 20 soil auger tests, and four backhoe trenches. No evidence of cultural features was recorded on the sites, and only four test pits yielded subsurface cultural materials. Cultural materials were restricted to a surface eolian sand layer that varies from a few centimeters to over a meter in depth on the sites, depending on surface erosion conditions. The highest concentrations of surface artifacts are resting on gravel terrace remnants and appear to have been concentrated on these alluvial surfaces because of deflation of overlying eolian deposits. Because of extensive erosion and redeposition of cultural materials, the apparent absence of intact cultural features, and the paucity of subsurface cultural deposits at LA 83111 and LA 83114, are not likely to yield information beyond what ahs already been recovered. No additional investigations are recommended.

LA 83116 and LA 83117

LA 83116 and LA 83117 are large, terrace-top, gravel-mulched agricultural complexes dating to the Classic or late prehistoric period. No test excavations were conducted at LA 83116 and only a single 1-by-1-m test pit was excavated at LA 83117 to investigate what appears to be a recent rectangular alignment of cobbles in the interior of a terrace-edge borrow pit. Both sites are well preserved and they have information potential. Very few of these features have been intensively investigated to date, and it is recommended that a full-scale multidisciplinary data recovery program be implemented at both agricultural field sites within the proposed project limits.

LA 83118

LA 83118 is an early historic ceramic and lithic artifact scatter on a low terrace overlooking the Río Ojo Caliente floodplain. Six 1-by-1-m test pits, seven soil auger tests, and two backhoe trenches were excavated at the site to search for buried cultural features and deposits. No cultural features were found during test excavations, but artifacts were recovered from all the test pits, and two test pits yielded large quantities of processed animal bone, corn cob fragments, and the remains of an unidentified domestic cereal grain. The ceramic assemblage suggests that the site was occupied in the late seventeenth or early eighteenth century and is most likely a historic Tewa or Spanish encampment. The quantity of cultural refuse recovered strongly suggests the presence of buried cultural features that probably will only be uncovered if large areas of the site are stripped of recent eolian sand overburden. Few early historic sites have been excavated in northern New Mexico, and the excellent preservation of economic data at the site suggests that the information potential is great. In addition, there is a possible buried late Archaic-Basketmaker component at LA 83118. A full-scale data recovery program is recommended for the site within the proposed project limits.

LA 83151

This is a multiple component lithic and ceramic scatter on a heavily eroded ridge in the northern portion of the study area. Survey and test excavations defined four discrete surface artifact clusters. One cluster is dominated by smeared indented corrugated ceramics and probably dates to the late Coalition-early Classic period (ca. A.D. 1200-1350). The other three scatters consist primarily of lithic debitage. Two of these scatters contain small charcoal stains--probably the remains of fire hearths. Projectile points found near the lithic artifact scatters suggest a late Archaic-Basketmaker II age for the deposits. Two of five 1-by-1-m test pits excavated at the site recovered subsurface artifacts and charcoal-stained soil. Although LA 83151 is heavily eroded, the presence of subsurface cultural deposits and potential intact cultural features warrants, in our estimation, a full-scale data recovery effort. Data recovery should concentrate on areas of the site that appear to have some depth, stratigraphic integrity, and are within proposed project limits (i.e., the northern half of the site is within the proposed right-of-way).

RESEARCH ORIENTATION

Archaeological research in the lower Chama and Ojo Caliente Valleys during the past 100 years has documented a pattern of intermittent use by early hunters and gatherers, little if any use by early farmers, and intense occupation and use by late prehistoric Pueblo groups in the fourteenth and fifteenth centuries A.D. Archaeological resources evaluated during test excavations along the proposed right-of-way of U.S. 285 appear to date to the late Archaic, late prehistoric, and early historic periods. As such, the remains conform generally to expectations derived from prior research in the lower Chama District. Although the broad outlines of this occupation history are generally known, intensive excavation of sites in the present study area will allow us to address several important issues of local and regional importance.

The periods of time represented in the study sample saw important changes in the occupation and use of the Chama and Upper Río Grande Valley. In the late Archaic period, domesticated plants were gradually being added to a diverse assemblage of wild plant and animal foods, and prehistoric settlement patterns, population distributions, technologies, and architecture were changing in response to these important changes in the subsistence economy. In the late prehistoric period, large aggregated populations of Anasazi farmers who had, several centuries before, made important commitments to food production and settled village life, were adopting new technologies and experimenting with new organizations in a new environment following the structural collapse of Anasazi systems on the Colorado Plateaus to the west. In the early historic period, Pueblo people experienced the affects associated with European contact, which would radically and permanently alter centuries-old trajectories of culture change in the northern Southwest. Because of the size of the sample and the nature of the assemblages under investigation, the following research design breaks the archaeological record of the project area into three discrete temporal units, and presents specific research questions and data recovery strategies for each period.

Archaic Occupations

Two of the five sites recommended for excavation on this project include probable Archaic period components (LA 83118 and LA 83151, see Fig. 23), and one site, LA 83110, appears to be a single component Archaic occupation. Archaic research on the Ojo Caliente Project will focus on the following general issues:

1. Dating and chronology refinement
2. Archaic subsistence and settlement systems
3. Hunter-gatherer mobility and its measurement
4. Archaic period economic organization

The following section will briefly summarize Archaic period culture history and chronology in the northern Southwest and, specifically, the lower Chama District, and will conclude with a discussion of important Archaic research issues and problem domains.

Culture History and Chronology

The Archaic is traditionally defined as the cultural stage immediately preceding the evolution of formative farming societies in which human adaptive strategies were centered on diversified hunting and collecting. In the northern Southwest, the Archaic period dates from approximately 5500 B.C. to A.D. 400 (Irwin-Williams 1973).

Intensive research in the last two decades in northwestern and western New Mexico has collected more information on Archaic culture change and adaptive strategies than the preceding sixty years of research in the northern Southwest. One of the earliest and most influential research projects was conducted by Cynthia Irwin-Williams (1973) in the Arroyo Cuervo region west of Albuquerque. Irwin-Williams documented and characterized nearly 6,000 years of Archaic culture change in the Arroyo Cuervo, and the chronology that grew out of her work is still in use today.

Irwin-Williams's Oshara Tradition is divided into five temporal phases: the Early Archaic Jay and Bajada phases date from approximately 5500 to 3200 B.C.; the Middle Archaic San Jose phase is radiocarbon dated between 3200 and 1800 B.C.; and the Late Archaic Armijo and En Medio phases date between 1800 B.C. and A.D. 400. In the Arroyo Cuervo region, the earliest Jay and Bajada phases are characterized by small lithic artifact scatters that tend to cluster in canyon heads and on mesa tops. Common artifacts of the period include large shouldered projectile points and a variety of bifaces and well-made side scrapers. Sites of the Bajada and subsequent phases are often littered with fire-cracked rock, and excavations reveal cobble filled fire pits and earth ovens.

There is a marked increase in the number and size of sites during the Middle Archaic San Jose phase, which Irwin-Williams (1973) suggests is the result of population growth and a sustained increase in effective moisture during the second and third millennia B.C. Basin metates and one-hand manos appear during the San Jose, projectile points become smaller, sites are larger and more widely dispersed, and structures may become common during this period. The following Armijo phase saw the introduction of corn horticulture in the northern Southwest. Coincident with the introduction of farming is an apparent increase in population, sites with storage facilities appear, and the structure and distribution of sites suggest a shift toward seasonal aggregation and dispersal of population. The terminal En Medio phase of the San Juan Archaic, which is coincident with the Basketmaker II phase of the Anasazi cultural tradition, saw the establishment of at least seasonally sedentary farming communities in many areas of the San Juan Basin and Colorado Plateaus.

General temporal trends in the Oshara Tradition include a gradual increase in population throughout the Archaic and an increase in economic intensity, social complexity, and by the beginning of the first millennium B.C., a growing dependency on agriculture that would eventually culminate in the early formative farming cultures of the San Juan Anasazi.

Irwin-Williams's work in Arroyo Cuervo established the continuity of Archaic and Anasazi cultural traditions, and it gave archaeologists the first effective temporal framework for 6,000 years of Archaic prehistory. Perhaps most important, the Arroyo Cuervo chronology enabled archaeologists to begin to focus on a much broader range of research issues. Besides sustained efforts to resolve chronological problems, post-Arroyo Cuervo Archaic research has focused primarily on two related issues: the modeling of hunter-gatherer settlement and subsistence behavior, and the introduction, dispersal, and impact of early farming technologies. Most of this research has been conducted in the San Juan Basin of northwest New Mexico where several large-scale survey and

excavation projects have been conducted since the early 1970s in advance of regional energy and agricultural development.

In recent years, archaeological surveys on the margins of the San Juan Basin have documented many Middle-Late Archaic sites at localities such as Hovenweep, the Dolores Plateau, Ute Mountain, Durango, the Navajo Reservoir District, the Chama Valley, and other areas (Winter 1975, 1976; Hibbets and Wharton 1980; Fuller 1984, 1988; Fetterman and Honeycutt 1986; Winter et al. 1986; Hefner 1987; Reed and Horn 1987; Shields 1990). Most of the upland Archaic sites appear to be temporary encampments, but several Late Archaic sites with architectural remains have been excavated on the Dinetah Plateau in northwestern New Mexico, and it has been suggested that these sites may have functioned as logistical base camps (Bradley 1989).

Archaic Period Occupation of the Lower Chama

Hibben (1937) was perhaps the first to record and describe the lithic artifact scatters of Archaic hunters and gatherers in the lower Chama Valley. Hibben noted that lithic "workshops" tended to be on bluffs overlooking the Chama River, and his survey recorded many large scatters several acres in extent (1937:3). Systematic surveys by the School of American Research in the Abiquiú Reservoir floodpool in the mid-1970s contributed significantly to our understanding of Archaic culture history and archaeological variability in the region (Schaafsma 1976, 1978). The surveys covered over 30 sq km and recorded 176 lithic sites ranging from Archaic through early Pueblo. Recent contract surveys and excavations in the lower Chama (Enloe et al. 1974; Anschuetz et al. 1985; Moore et al. n.d.) and Ojo Caliente Valleys (Lang 1979, 1980; Drake 1991) have recorded additional Archaic sites in the region.

Only a few isolated Early Archaic (5500-3200 B.C.) projectile points have been recovered to date in the lower Chama Valley, suggesting a pattern of ephemeral use similar to the preceding Paleoindian period (Beal 1987:16). Lang (1979) reported a possible Jay phase (5500-4800 B.C.) basalt preform from a site in the lower Ojo Caliente Valley, and Bajada (4800-3200 B.C.) projectile points have been recovered from the Piedre Lumbre Valley (Schaafsma 1976), Cerro Pedernal (Warren 1974), and from the present project area (Drake 1991).

Middle to Late Archaic sites are well represented in the lower Chama, the Ojo Caliente Valley, and the Río Grande Valley to the east (Beal 1987:16). In Schaafsma's Abiquiú Reservoir surveys, Middle and Late Archaic period lithic artifact scatters were the most common sites recorded within the reservoir's maximum pool zone (Schaafsma 1976). Schaafsma documented a gradual increase in site frequency through time, beginning in the San Jose phase (ca. 3200-1800 B.C.) and culminating in the En Medio or Basketmaker II phase (ca. 800 B.C.-A.D. 400). After the Archaic period the lower Chama District appears to have been depopulated, and the region apparently did not support a resident Anasazi population until the end of the Coalition period, or early fourteenth century A.D.

Archaic sites have been excavated at Abiquiú Reservoir and the Piedre Lumbre Valley, near Medanales in the lower Chama Valley, and in the lower Ojo Caliente Valley. Features common on excavated sites include shallow basins filled with ash-stained soil fire-cracked rock, basins lined with cobbles or slabs, and large piles of fire-cracked rock (Schaafsma 1978:48). Artifact assemblages tend to be dominated by bifaces, light-duty scrapers, and utilized flakes. Several investigators (Schaafsma

1976; Enloe et al. 1974) have reported a paucity of manos, metates, choppers, hammerstones, and other heavy food processing tools. Lang (1980) reported a possible Late Archaic pit structure in the Ojo Caliente Valley (just a mile north of the present project area), and Schaafsma (1979:20) reported evidence of late Archaic "base camps" in the Piedre Lumbre Valley north of Abiquiú.

Research Problems and Problem Domains

Major research questions of the Archaic period are rapidly evolving, and syntheses of the period become just as rapidly obsolete. Most research of the last decade, however, has focused on a few general problem domains that will help guide Archaic research on the Ojo Caliente Project:

Research Issue 1: Dating and Chronology Refinement. The problems of dating and chronology refinement are, and will no doubt continue to be, important issues in Archaic research, primarily because only the last few centuries of the six-millennia Archaic time-continuum overlaps with the master tree-ring chronology for the northern Southwest. As a result, archaeologists must rely on C-14 and other less accurate dating techniques for dating Archaic assemblages, and most of the known Archaic sites are dated only on the basis of artifact associations, if they are dated at all. Developing ways to more accurately date Archaic sites and assemblages and refining local and regional chronologies is a critical need in Archaic research, primarily because so many other research problems are difficult to address without fine-grained temporal control.

A major objective of Archaic research on the Ojo Caliente Project will be to recover chronometric samples that will allow us to more accurately date Archaic occupation of the study area. Excavation strategies will emphasize the recovery of carbon samples for C-14 dating, buried obsidian flakes for hydration dating, and fired clay samples for archaeomagnetic dating. Dating Archaic horizons will be especially important on multicomponent sites to separate different occupation assemblages. Fine-grained spatial and stratigraphic data recovery and analysis techniques will be necessary to identify and segregate discrete occupations. It may also be necessary to characterize single-component sites of various time periods in the study area in order to develop temporal/functional signatures to aid in identifying discrete occupations at multicomponent sites.

All three Archaic components in the project area (LA 83110, LA 83118, and LA 83151) are expected to yield information relevant to this research issue. LA 83110 and the buried Archaic-Basketmaker component at LA 83118 are both associated with substantial amounts of charcoal that will be collected for C-14 age determination. The eroded condition of LA 83151 may preclude the preservation of sufficient quantities of charcoal for dating within the project limits.

Research Issue 2: Subsistence and Settlement Systems. Another perennial problem in Archaic research is the nature of Archaic subsistence-settlement systems. How, before the advent of horticulture, did Archaic hunters and gatherers subsist, how did they organize the food quest, how did they adapt to changes in their environment, what resources did they obtain during what times of the year, what kinds of family and settlement organizations existed, and how did these organizations vary in time and space?

Most of the recent research on Archaic settlement-subsistence systems has taken place in the San Juan Basin of northwestern New Mexico, and this research has important implications for regions

that are peripheral to the basin, such as the Chama Valley. Toll and Cully (1983) examined the distribution of key plant food resources in the greater San Juan Basin and concluded that most of the resources in the central basin are abundant between the early spring and fall, but may have been in critically short supply from late fall through early spring. From these observations they constructed a hypothetical seasonal round for the San Juan Archaic that postulated a late fall and winter occupation of upland forested regions on the northern and eastern periphery of the basin. Following Toll and Cully's arguments, Vierra (1988) proposed that basin-centered Archaic groups used a residentially mobile forager strategy from the spring through early fall in the central San Juan Basin, and moved to the peripheral uplands in the late fall where they implemented a base-camp-centered logistical or collector strategy (Binford 1980).

Were Archaic occupations in the lower Ojo Caliente Valley part of a regional Archaic settlement system that encompassed many hundreds of square kilometers and extended west into the San Juan Basin? Or was the study area more sporadically used by local or regional populations responding to fluctuations in resource abundance or population pressure? If the lower Chama Valley was part of the greater San Juan Basin settlement system, when and how intensively was it utilized? If it was not part of that system, was it part of another, perhaps smaller-scale system? Were Archaic populations in the lower Chama Valley relying primarily on local resources, or were they acquiring certain resources outside the study area? Were Late Archaic populations in the lower Chama District engaged in food production?

Addressing questions such as these will require detailed information on subsistence resources and resource extraction strategies, which will require, in turn, detailed recovery and analysis of ethnobiological and technological data. Analysis of ethnobiological data will permit inferences regarding the kinds and varieties of resources that were procured, processed, and consumed by Archaic populations in the study area, and how the relative proportions of these resources changed through time. Analysis of economic faunal remains may shed light on patterns of seasonal occupation and use of the study area. Analysis of subsistence extraction, processing, consumption, and storage technologies will provide information that will complement the ethnobiological data base, contributing to a general understanding of Archaic subsistence-settlement patterns in the study area.

The most promising locality to address issues relating to subsistence and settlement systems is LA 83110, which contains, within the proposed project boundaries, extensive burned cultural deposits associated with at least two kinds of domestic features: an apparent extramural fire hearth or roasting pit and a large charcoal stain that may be the remains of a shallow pit structure. Both kinds of features are excellent archaeological contexts for the preservation of perishable ethnobotanical and zoological remains. The extent of intact early prehistoric deposits at LA 83118 is not known, and so its potential for yielding data relevant to settlement and subsistence issues is unknown. The preservation of perishable economic data is exceptional from the upper early historic deposits at LA 83118, and it is hoped that similar preservation conditions exist within the substrate containing the early prehistoric materials. Preservation conditions appear to be poor within the Archaic components at LA 83151, however, the technological assemblage at LA 83151 is fairly extensive and may make it possible to address a number of resource extraction and processing hypotheses.

Resolving issues of Archaic settlement and subsistence requires that we address the closely related issues of hunter-gather mobility, economic organization, and the nature and scale of external relations.

Research Issue 3: Hunter-Gatherer Mobility and Its Measurement. The dynamic phenomenon of population mobility is difficult to estimate from the static remains of hunter-gatherer encampments. With the low level of temporal control over the Archaic, even detailed and rigorous spatial and stratigraphic studies may shed very little light on Archaic mobility patterns. Our dating systems will perhaps never be powerful enough to resolve an event of a week or two in duration, and highly mobile populations may simply not have produced what we would perceive as an archaeological "site."

Recent research on hunter-gatherer mobility patterns has shifted focus from settlement to technological variability. A promising avenue of inquiry was recently explored using Archaic hunter-gatherer remains from the Carson Sink in western Nevada (Kelly 1988). Kelly argues that lithic bifaces played at least three different organizational roles in hunter-gatherer technology: (1) they were used as cores; (2) they were used as long-use life, specialized tools; and (3) they were created, used, and discarded as by-products of the tool manufacture process (i.e., hafting notches). Kelly contends that biface use and discard is primarily responsive to tool needs, raw material availability, and, by inference, population mobility patterns (1988:719). He predicts that in regions where suitable lithic raw material is scarce, we may expect residentially mobile hunters and gatherers to make use of bifaces as cores, "since they will maximize the total amount of stone cutting edge while minimizing the amount of stone carried" (1988:719). Conversely, in logistically organized systems, biface core use-frequency may be a function of the distance and duration of the logistical foray--the longer the foray, the heavier the reliance on biface cores. Kelly goes on to construct a suite of archaeological expectations based on differential biface use, most of which have important implications for the structure of hunter-gatherer settlement behavior and mobility patterns. Although the majority of Kelly's postulates have not been adequately tested, investigators in the northern Southwest are beginning to address many of the implications of the model (Moore 1989).

Technological models such as Kelly's, combined with studies of lithic raw material sources and use frequencies (where was material obtained, how far and in what form was it transported, and so forth), and evidence of seasonal occupation derived from ethnobiological and architectural observations will provide data that, we hope, will converge to form an accurate characterization of Archaic mobility patterns in the Ojo Caliente Valley.

At least two of the three Archaic components on the project can be expected to yield important information on hunter-gatherer mobility patterns. The primary lines of inquiry will involve technological and raw material source analyses of lithic artifact assemblages, and these data are abundant on at least two of the sites in the sample, LA 83110 and LA 83151. Because the exact nature and extent of the Archaic component at LA 83118 is unknown, its data potential relevant to this and many other research issues remains problematic.

Research Issue 4: Economic Organization. In addition to analyzing Archaic period mobility patterns, research on the Ojo Caliente Project will collect data relevant to a variety of questions relating to Archaic period economic organization. There is considerable overlap between organizational questions and questions relating to research issues 2 and 3 above, but questions in this problem domain focus specifically on the ways in which hunter-gatherer groups were organized to exploit resources in their environment. Key research questions involve the internal organization of Archaic occupations, as well as the way in which sites are distributed over the landscape, especially in relation to the distribution of key resources such as water, raw materials, food, and shelter. Economic organization questions have implications for site function, internal differentiation,

occupation intensity and duration, and seasonality of occupation. They also involve questions regarding population size, occupational history, and frequencies and intensities of occupational use.

For example, how did Archaic hunters and gatherers organize activities related to the food quest? Were groups organized in residentially mobile bands, moving frequently from one resource patch to another, or were groups exploiting local resources via logistical forays from central base camps? Or, alternatively, was some intermediate strategy being employed? Prior research in the lower Chama District suggests some specific hypotheses relating to these issues that might be addressed on the current project. Schaafsma (1978) found evidence of seasonal Archaic base camps in the Piedre Lumbre Valley, and Lang (1980) has reported the discovery of what he believes to be Late Archaic domestic architecture in the lower Ojo Caliente Valley. Other investigators (Enloe et al. 1974) have suggested that the relative paucity of grinding tools from Archaic assemblages in the Chama District suggests an occupation focus during seasons when plant resources were unavailable. These data suggest that Archaic groups may have been "wintering over" in the Chama District, utilizing a logistical base camp settlement strategy, and subsisting off a combination of stored foods and logistical trips to hunting sites and food caches (Vierra 1988).

Fuller (1988, 1989), among others, has discussed several expectations for Archaic winter base camps: they should be in close proximity to water, fuel, and shelter resources, abundant faunal resources, and late-ripening nut and other vegetal resources. In addition, they should contain some form of substantial architecture, they should have facilities for the storage of perishable food stuffs, and there should be evidence of comparatively long-term occupation in the form of accumulated refuse, worn and discarded tools, and so on. The degree to which these expectations are met or not met by Archaic components in the Ojo Caliente Valley will allow us to test the hypothesis of winter base camps and refine current models of Archaic adaptation and organization in the lower Chama District.

It is possible that only one site, LA 83110, will yield data that is directly relevant to these research issues. The presence of a possible architectural feature at LA 83110 suggests the possibility of at least seasonally sedentary residence at the site. Excavations at the site will focus on the recovery of ethnobiological and other data that will permit the testing of hypotheses regarding seasonal use and resource extraction strategies. Many of Fuller's (1988, 1989) criteria for winter base camps, (water, fuel, shelter, etc.) are satisfied by the locality of LA 83110; it remains to be seen whether the various archaeological expectations of winter occupation are met at the site.

Late Prehistoric Occupations

The preponderance of archaeological components in the project study area date to the Pueblo III-Pueblo IV period (A.D. 1250-1598). Of the nine sites investigated on this testing project, seven (78 percent) have evidence of late prehistoric occupation or use in the form of Pueblo III-Pueblo IV ceramic and lithic remains (LA 83107, LA 83109, LA 83111, LA 84114, and LA 83151) or agricultural features and facilities (LA 83116 and LA 83117).

Investigation of late prehistoric ceramic and lithic scatters will address many of the same questions that are outlined above for Archaic period sites and components, with the expectation that use patterns during the late prehistoric period will be quite different than patterns of use during the

Archaic. Presumably, during the Archaic period, populations were small and highly mobile, whereas late prehistoric populations were comparatively large and sedentary. Even when the same economic behaviors are being practiced and the same resources are being exploited, such differences in population density and settlement pattern can be expected to result in significant differences in archaeological deposition patterns.

Within an 8-mile radius of the current project area are seven large late prehistoric communities, some with over 2,000 rooms and resident populations estimated in the hundreds. Such large, sedentary communities typically serve as central nodes for dispersed scatters of "satellite" resource procurement and processing sites. If satellite sites are sufficiently close to the central node to permit daily commutes from the center, there is little need for permanent facilities for habitation, food storage, or defense at the satellite sites. Specialized tools are often carried into the field to perform specialized tasks and transported back to the center when the tasks are completed. The kinds of material residues that accumulate in such logistical sites can be expected to be quite different from the material remains of mobile hunters and gatherers, even when the same or similar resources are being exploited.

Past attempts to discriminate between the remains of Archaic and Pueblo hunter-gatherers have emphasized differences in lithic assemblage technology and raw material selection (Moore et al. n.d.; Kelly 1988). One influential hypothesis argues that mobile hunter-gatherer assemblages will be characterized by extensive bifacial reduction and a high proportion of nonlocal or "exotic" materials, whereas sedentary hunters and gatherers will rely more on local materials and expedient tool manufacture and use.

In addition to technological approaches to component discrimination, our proposed research design will also address the problem empirically by examining differences in material assemblages between excavated sites of known age and cultural affiliation in the region. Sufficiently large samples of Archaic and late prehistoric material assemblages have been excavated in the lower Chama District to permit such systematic comparisons. Using statistical techniques such as discriminant analysis will allow us to quantify these comparisons and, we hope, discriminate between various temporal components within the project study area. Beyond the issue of component discrimination, most of the problems and research issues identified for Archaic lithic scatters apply equally well to later prehistoric lithic and ceramic scatters. Investigations at both kinds of site will address a range of issues dealing with subsistence and settlement patterns, seasonality, resource extraction patterns, the nature, scale, and scope of external relations, and so on.

Investigation of late prehistoric agricultural field sites requires a significant departure in research methods in order to address a variety of different research issues. The remainder of this discussion of research issues and problem domains of the late prehistoric period will focus on these unique archaeological sites. Specific problems to be addressed include:

1. Field dating and chronometrics
2. The kinds and varieties of crops that were grown
3. The nature of microclimatic variation in the study area
4. Questions regarding prehistoric field dynamics: how gravel mulch fields may have functioned, their potential productivity, life expectancy, and other functional characteristics

Agricultural Fields

LA 83116 and LA 83117 are typical of late prehistoric agricultural fields from several localities in the Northern Río Grande region, especially the lower Chama Valley (Ellis 1970; Fiero 1978; Anschuetz et al. 1985), the Ojo Caliente Valley (Lang 1980; Bugé 1984; Fallon and Wening 1987), and the northern Galisteo Basin (Lightfoot 1990). The fields contain rectangular cobble grids filled with pebble-size gravel mulch, and most fields are on high outwash gravel terraces some distance from the nearest permanent water. The following section begins with a brief discussion of past research on these features, and concludes with an examination of important research issues and problem domains.

Research History and Summary of Research Results

The earliest descriptions of agricultural features in the lower Chama Valley appear in Bandelier's journals of 1892. In the following decade, Edgar L. Hewett of the School of American Archaeology located an extensive agricultural field complex on Abiquiu mesa that he mistakenly identified as wall footings for a pueblo that he estimated must have been over 2,000 rooms in extent (Hewett 1906). Hewett's error was duplicated in the next decade by Jeançon (1923) who interpreted various agricultural features near Poshu'eingue as wall foundations and religious shrines.

Although subsequent archaeological surveys of the lower Chama Valley accurately identified extensive garden plots and other agricultural features (Hibben 1937), detailed investigations of these features did not occur until the early 1950s. In his 1951 excavations at Leafwater Pueblo in the lower Chama Valley, Luebben (1953) identified three different types of "masonry alignments" along the edge of the low mesa that supports the site: (1) geometric rock alignments; (2) enclosed rectilinear alignments with interiors filled with small gravels of homogeneous size; and (3) rock-lined terraces along the edge of the mesa. In addition, Luebben noted several small pits resembling "kiva depressions" along the edge of the mesa that he speculated were associated with the agricultural features (Luebben 1953:13-15). Luebben excavated a test trench through one depression, but found no evidence of cultural materials. He concluded that the pits were probably a source of soil and gravel for adjacent agricultural terraces (1953:16).

In the 1960s the University of New Mexico archaeological field school under the direction of Florence Hawley-Ellis conducted extensive surveys of garden terraces and gravel-mulched fields near Sapawe on El Rito Creek, just a few miles north of its confluence with the Río Chama. Although some extensive agricultural features around Sapawe were probably mistaken for field houses (Skinner 1965), other fields and field systems were correctly identified, and Ellis (1970), and subsequently Vivian (1974), were probably the first investigators to describe prehistoric gravel mulch as a water conservation technique.

In the 1970s and 80s several contract archaeology projects in the lower Chama Valley began accumulating detailed information on the form and structure of prehistoric grid fields in the region. The first detailed excavation of a gravel-mulched garden plot was conducted in 1977 by Kathleen Fiero of the Museum of New Mexico (1978). In 1979-1980, Richard Lang of the School of American Research investigated several large gravel-mulched field complexes on a powerline construction project in the lower Ojo Caliente Valley. Lang noted the presence of many large depressions associated with the gravel fields, and he speculated that the features may have been used

as growing pits: "There is every reason to suspect that these features were excavated as loci for limited water and soil retention and the planting of some cultigen" (Lang 1979:19).

The late 1970s also saw intensive archaeological surveys of the Ojo Caliente Valley by Occidental College, under the direction of David Bugé (1981; 1984). Bugé's principal research interest was the large Classic pueblo of Ponsipa'akeri, on the east terrace of the Río Ojo Caliente, but besides test excavations at Ponsipa'akeri, Bugé and his students conducted extensive surveys of the Ojo floodplain and terraces north of Ponsipa'akeri. Bugé's surveys documented a variety of agricultural features. The most common field type was a rectangular grid averaging 30 m on a side and filled with pebble-size gravel. These fields were typically bordered by large cobbles and filled with quantities of gravel sufficient to raise the field level several centimeters above the surrounding ground surface. Besides gravel-mulched fields, Bugé described small rectangular grid fields with and without gravel mulch, a variety of check dams, terraced fields, and waffle gardens with internal water distribution channels (Bugé 1984:31).

Based on his surveys in the Ojo Caliente, Bugé concluded that the extensive dry-farmed field systems in the valley represented attempts by prehistoric farmers to adapt to a temporally and spatially variable precipitation regime. According to Bugé, terrace-top dryland fields served as insurance against crop loss on the floodplain, where the primary risk was a short and unpredictable growing season more than water availability: "Prehistoric farmers of the region . . .distributed their crops between fields on the valley floor and fields on the terraces. This strategy involved the labor of permanent field systems, but minimized the risk involved in concentrating on a single zone of production" (1984:34). In support of his argument, Bugé pointed out that the diversity of field types is greatest in the northern part of the Ojo Caliente Valley where the highest population densities were concentrated and where, presumably, there would have been higher risks of crop failure from early and late killing frosts due to the higher elevation (1984:34).

There was a flurry of activity on agricultural fields in the lower Chama in the 1980s. Because of road construction on U.S. 84 between Medanales and Abiquiú in 1985, the Museum of New Mexico mapped and excavated a series of late prehistoric agricultural fields and associated facilities (Anschuetz et al. 1985; Anschuetz and Maxwell 1987; Maxwell and Anschuetz 1987; Maxwell 1991; Moore et al. n.d.). The agricultural sites are on high gravel terraces above the Río Chama floodplain and a variety of field types were tested or excavated, including cobble-bordered fields with and without gravel mulch, checkdams, several varieties of floodwater fields, miscellaneous linear rock features, rock piles, and the ubiquitous terrace-edge borrow pits. Although final reports on these excavations are still in preparation, preliminary results have been published in several papers (Anschuetz and Maxwell 1987; Maxwell and Anschuetz 1987; Maxwell 1991).

Detailed excavations of grid fields on the Medanales project provided important information on the internal structure and organization of individual grid fields. Patterns of internal field divisions, including rock and cobble alignments, grid blocks, etc., were extremely complex, and suggest a variety of specialized functions. Some of the excavated plots had internal compartments that were reminiscent of Zuni waffle gardens. Using the analogy of historic Pueblo kitchen gardens, Maxwell and Anschuetz (1987:32) postulate that the extreme compartmentalization of fields into internal cells suggests crop diversity. Consistent with this hypothesis, investigators recovered small frequencies of both corn and cotton pollen from fields on the project (Clary 1987). The cultivar pollen counts are extremely low, suggesting the fields may have been used for very short periods of time (Maxwell and Anschuetz 1987:34; Clary 1987).

One important question addressed by recent investigators is the way in which dryland farming strategies evolved, the role that these systems played in the general subsistence strategy of the late prehistoric farmers, and the reasons why the systems failed, or at least, were abandoned at the close of the prehistoric period. Citing the extensive literature on rock and gravel mulch in modern agronomy research, several investigators (Anschuetz et al. 1984; Moore et al. n.d.; Lightfoot 1990) have pointed out that the benefits of gravel mulch are offset by some important long-term risks. Principal among these is the fact that surface layers of gravel may interrupt the soil nutrient cycle leading to vital nutrient depletion within a comparatively short period. Modern experimental studies of gravel mulch have also shown the importance of periodic rejuvenation of the gravel layer to remove the fine wind and water-born sand and silt fraction from the pore space of the gravel (Corey and Kemper 1968; Fairbourn 1973). Moore et al. (n.d.) speculate that the need to periodically rejuvenate gravel mulch fields may have been so costly that it was easier to build a new field than to rejuvenate an old one. According to several investigators (Moore et al. n.d.; Lightfoot 1990), this process may help to account for the rapid growth and proliferation of gravel-mulched fields during the fourteenth and fifteenth centuries.

In addition to excavations on the lower Chama, the Museum of New Mexico conducted surveys of field systems near the site of Howiri in the upper Ojo Caliente Valley (Fallon and Wening 1987). Although the surveys were not systematic, investigators detected a pattern of field placement that seemed to favor north-facing slopes. According to Fallon and Wening (1987:139): "Utilization of north-facing slopes may have had several advantages. Less solar exposure may have been suitable for certain crops, and also would decrease the amount of moisture evaporation." North slope placement of gravel-mulch fields has not been reported in other areas of the Northern Río Grande, but there may be unusual edaphic or other environmental conditions in the upper Ojo Caliente Valley that influenced the observed pattern.

By far the most ambitious study of dryland farming strategies and gravel-mulch technologies in the Northern Río Grande was carried out by a graduate student in geography in the late 1980s. Dale Lightfoot's (1990) investigations of the San Marcos gravel mulch field systems in the northern Galisteo Basin were the basis of a doctoral dissertation at the University of Colorado (Lightfoot 1990). Lightfoot's analysis of the San Marcos field systems addressed four primary questions (1990:103): (1) What was the effectiveness of gravel mulch as a dryland farming strategy? (2) What criteria were used in the placement or sighting of gravel-mulch fields? (3) How were gravel-mulch fields constructed? And, (4) How and when were gravel-mulch fields used?

To assess the effectiveness of gravel as a mulch medium, Lightfoot collected plant biomass samples and soil moisture and temperature data from a random sample of gravel mulch fields and off-field control sites in the San Marcos system. Lightfoot found major differences in plant biomass and soil moisture levels between fields and off-field controls. Gravel mulch fields supported significantly more plant biomass than surrounding off-field control sites, and as much as 3.5 times the soil moisture level of off-field controls. Significantly, grasses and shrubs growing on gravel mulch fields exhibited much larger and more extensive root systems than off-field plants. Lightfoot reasoned that the greater depth of root systems in the gravel mulch would have provided a more effective buffer against the affects of localized drought. Based on his analyses, Lightfoot concluded that gravel mulch was an extremely effective strategy in the Northern Río Grande, especially during years of below-average precipitation. Using comparative data from a 1973 study of gravel-mulch effects on maize yields in eastern Colorado (Fairbourn 1973), Lightfoot estimated that San Marcos gravel-mulch fields would have produced approximately 1.5 times the yield of other fields in wet years, 2 times the yield

of nonmulched fields in average years, and as much as 4 times the yield of other fields in drought years (Lightfoot 1990:150).

Lightfoot analyzed field citing criteria by plotting field locations against such landscape variables as soil group, vegetation pattern, etc., and found a perfect correlation between field sites and Pleistocene glacio-fluvial outwash gravel exposures. These sediments, part of the Panky-Pojoaque soil group (SCS 1975), are exposed primarily to the south and west of San Marcos Pueblo. Within this soil group, 74 percent of the gravel-mulch fields have a general southern exposure, while only 6 percent are facing northward (compare with apparent field orientations in the northern Ojo Caliente Valley). Lightfoot concludes that the presence of outwash gravels was the primary criterion of field location, and that slope and aspect were secondary considerations (Lightfoot 1990:158).

The questions of how and when the San Marcos gravel-mulched fields were constructed and used were addressed using data from sample excavations and intensive surface collection. Lightfoot estimated that gravel was derived from two primary sources: (1) from borrow pits excavated peripheral to the fields, and (2) from scraping and concentrating the surface gravels immediately next to the fields. Test trenches excavated through a sample of gravel mulch fields were profiled and mulch thickness was shown to vary between 5 and 11 cm. Lightfoot also used graded geological sieves to estimate the relative proportions of gravels of varying size. The data on gravel size distributions suggests, among other things, that there may have been very little intentional sorting of gravel as it was transported from the gravel source to the field (Lightfoot 1990:176).

Dating of the San Marcos gravel-mulch fields was accomplished by examining temporally diagnostic ceramics recovered from fields and nearby surfaces. Lightfoot concluded that most of the San Marcos fields were constructed and used during the early decades of the fifteenth century A.D., a period that coincides with a serious drought episode (Rose et al. 1981) and a major population growth spurt at the San Marcos Pueblo (this growth was likely the result of large-scale population immigration following abandonment of peripheral regions). Lightfoot argues that investment in gravel-mulch technology was probably a direct response to population-resource imbalances created by a decline in precipitation coincident with local population growth.

Recent and, for the most part, ongoing and unpublished research on gravel-mulch fields in the Northern Río Grande include two doctoral dissertation projects (Maxwell 1991; Anschuetz 1992) and an aerial survey of prehistoric gardens on La Bajada Mesa, south of Santa Fe (Wills et al. 1990).

Problem Domains and Research Strategies

Research outlined above has delineated several important problem domains and research issues relating to prehistoric dry farming and gravel-mulch technology in the Northern Río Grande Valley. Investigators have been concerned with when fields were constructed, used, and abandoned; how fields were constructed, how they functioned, and how variation in field form and structure relates to variation in field function; what crops were grown and the productive capacity of gravel-mulched fields; the geographical extent of gravel-mulch fields and the environmental parameters that encouraged the use of gravel-mulch technology; and finally, a variety of questions addressing important causal relationships within late prehistoric Pueblo food production systems. Were, for example, gravel-mulch fields part of a diversified agricultural strategy designed to reduce subsistence risk in marginal agricultural environments? Were gravel mulch fields a response to a particular kind

of environmental perturbation, such as drought? Was gravel-mulch technology valued because it conserved moisture, reduced the risk of frost damage to crops, or for other reasons?

Because of the nature of the field sample available for study on this project, many of these issues, though important, cannot be realistically addressed. The proposed research will focus, instead, on four specific research issues and problem domains: (1) dating and chronometrics; (2) crop mix; (3) microclimatic effects on growing season; and (4) characterization of field structure. In the following sections we will discuss approaches to these problem areas and identify specific issues that will be addressed on the current project. Our primary objective will be to collect basic data about gravel-mulch fields that will contribute to a general understanding of how, when, and why these systems were constructed and used. Unlike prior research on prehistoric dry farming technology in northern New Mexico, the approach proposed on this project will be explicitly multidisciplinary. The design of research that is proposed, the suite of problems that will be addressed, the methods employed to address those problems, and the interpretation of research results will be a multidisciplinary effort by specialists in archaeology, ecology, soil science, palynology, and agronomy. We believe that only in this way will gravel-mulch systems be understood in their entirety.

Research Issue 1: Dating and Chronometrics. Although there is some evidence of late Coalition (late 1200s-early 1300s) and early Historic period (late 1500s) use of gravel-mulch fields in the lower Chama Valley (Anscheutz and Maxwell 1987:22), there is general agreement that most of the gravel fields were constructed and used during the Pueblo IV or Classic Pueblo period (ca. A.D. 1325-1598). Beyond a general assignment of fields to the Classic period, however, there is little, if any, agreement on more precise dating of fields and field systems, and all too often field construction and use dates have been postulated based on the timing of various external events (i.e., droughts, populations shifts, etc.), rather than on independent dating criteria. Lightfoot's study of the San Marcos field system is a case in point.

Lightfoot argued, on the basis of ceramic associations, that most of the San Marcos fields were constructed in the early decades of the 1400s, a period that coincided with a severe regional drought and rapid population growth at San Marcos Pueblo. Significantly, Lightfoot admits that he found very few ceramics in direct association with gravel fields in his study area--the sample was so small, in fact, that he felt compelled to increase the sample by examining sherds from local private collections (a dubious approach considering the lack of provenience control in most private collections). Unfortunately, Lightfoot's assertion of a causal relationship between gravel-mulch agriculture and population-resource imbalance in the Galisteo Basin is impossible to evaluate because he fails to publish any of his ceramic data--he even fails to distinguish between ceramics found on fields and ceramics examined in private collections. One is left with the impression that Lightfoot developed a theory for gravel-mulch development that was too compelling to dismiss simply because he lacked chronological control over field construction!

Lightfoot (1990:181-182) argued that the paucity of potsherds on San Marcos fields was the result of recent surface collecting. This may be true, but investigations of field systems in other parts of the Río Grande Valley have also documented extremely low frequencies of surface ceramics, and it may simply be that activities associated with the construction, use, and maintenance of gravel-mulch fields did not result in the breakage of large numbers of pottery vessels. Moreover, even when ceramics are recovered from agricultural fields, the Río Grande Utility and Biscuit Wares that

comprise the bulk of most fourteenth- and fifteenth-century ceramic assemblages in the lower Chama Valley, are, for the most part, inadequately described and poorly dated. It is clearly beyond the scope of the present study to resolve fundamental issues of ceramic typology and chronology in the Biscuit Ware region of the Northern Río Grande. However, a major objective of the current project will be to maximize the recovery of temporally diagnostic artifacts and to explore other methods for dating prehistoric agricultural fields.

The low density of ceramics and other artifacts on agricultural fields is not unexpected. The fields within the current project area are more than 3 km from the nearest large Classic period community (Te'ewi), there is no evidence of fieldhouses or other residences in the immediate vicinity of the fields, and consequently, we would expect a small amount of occupation debris to accumulate on the sites. However, ceramics *have* been recovered from agricultural fields in the project area, and based on surveys conducted during the testing phase, artifact recovery rates seem to correlate well with survey intensity. In other words, artifact "visibility" on the surface of agricultural fields is apparently low, due, we believe, to at least two factors: (1) plant density, which tends to be much higher on fields than adjacent surfaces, may be obscuring low-density surface artifact scatters, and (2) a dark gravel background may not provide sufficient contrast to recognize easily potsherds and other artifacts.

We propose to intensify and extend survey coverage of agricultural fields in the project area to maximize the recovery of temporally diagnostic artifacts. Our approach will be twofold: (1) intensify pedestrian coverage of the field surface by slowing the pace and shortening the transect interval; (2) extend survey coverage beyond agricultural surfaces to include field margins and the slopes of the gravel terraces that support the fields.

Specific survey and artifact recovery methodologies will be addressed in more detail in the field methods section of the data recovery plan that follows, but a brief discussion of point 2, above, is appropriate here. If, as some investigators have suggested (Anschuetz and Maxwell 1987; Lightfoot 1990), the Anasazi were practicing "pot irrigation" of their dry-farmed terrace fields, the steep terrace slopes might be the most likely location for pots to break and for potsherds to accumulate. Near Ponsipa'akeri, an obvious trail was cut into the sides of an agricultural terrace. Similar trails were located at LA 48679 and LA 6909 on the Medanales Project (T. Maxwell, pers. comm., 1992). Trail features have not been observed in the present project area, but an intensive pedestrian survey of the terrace slopes would be the only way to document such features, and this has not been done. If trails exist, they might be associated with higher densities of artifacts that could provide important clues to when the fields were in use.

Few, if any, chronometric dating techniques appear to be applicable to agricultural fields. The new and highly controversial rock varnish dating technique (Dorn 1983) may be applicable and should be explored. Flaked stone artifacts and debitage have been noted at both of the fields in the project area, with the highest concentrations occurring around the field margins. Depending on the surface frequency of obsidian flakes in these assemblages, it may be worthwhile to conduct sample excavations of field edges to recover subsurface obsidian flake samples for hydration dating.

With the exception of a possible extramural hearth at LA 83116, no evidence of prehistoric architecture or other cultural features has been noted in the vicinity of the fields in the current project area. The cobble ring at LA 83116 will be carefully profiled and excavated in an attempt to recover charcoal for C-14 dating. If additional cultural features are encountered during excavations at LA

83116 and LA 83117, an important objective of their excavation will be to recover chronometric samples (i.e., radiocarbon, tree-ring, archaeomagnetic samples, and obsidian for hydration dating) that will aid in dating field construction and use.

In summary, uncertainty about the age of agricultural fields and features in the Northern Río Grande frustrates a variety of processual studies. Hypotheses regarding field use-life, field system expansion through time, and correlations between gravel-mulch technology and various environmental perturbations such as drought (Lightfoot 1990) and the onset of the Little Ice Age (Anscheutz and Maxwell 1987), cannot be tested and refined without more precise dating of field construction, use, and abandonment events. The present project will not resolve these problems, but it is our objective to test a variety of methodologies that we hope will bring us closer to an understanding of when field systems were constructed and used.

Research Issue 2: Crop Mix. Perhaps the greatest problem associated with the analysis of cultivar pollen from field sediments is that the pollen of Southwestern cultivars is extremely rare, even in sediment samples from active agricultural fields (Martin and Byers 1965). As a result, many attempts to recover domestic pollen from presumed farming features have yielded either negative results or such small frequencies of domesticates that interpretation of the results is difficult (Moore et al. n.d.:30). To date, both corn and cotton pollen have been recovered from gravel-mulch fields in the lower Chama Valley, but the frequencies are extremely low and difficult to interpret.

Dean (1991) has proposed a new method called "intensive systematic microscopy" (ISM) that is designed to identify rare pollen types. We propose to use the ISM technique on all pollen studies on the present project. The technique goes beyond the standard 200-grain pollen count, and was used successfully to identify corn and cotton pollen from prehistoric fields in the final stages of the Medanales Project and subsequent test excavations northwest of Abiquiu (Moore et al. n.d.). Dean describes the method as follows (1991:9):

> Pollen grains from plants grown in prehistoric agricultural features are usually rare in sediment samples from those features, and finding a rare pollen type in a sample requires a different approach than the standard 200-grain count.... Recently I developed a regimen of intensive systematic microscopy to search for rare pollen types at 200X magnification. As a result, very low concentrations of cotton and corn pollen grains were detected in pollen samples from high-altitude prehistoric field features in northern New Mexico.... According to the refined method, the number of spike grains present on each entire microscope slide determines how many slides must be completely examined in order for a rare grain occurring in a given abundance to be seen.

In addition to using ISM to identify rare cultivar pollens, we propose to collect pollen samples from both on and off agricultural fields to evaluate the significance of on-site pollen frequencies. We also propose to collect pollen samples from a representative sample of borrow pits in the project area. Several investigators (Bugé 1981; Lang 1979, 1980; Lightfoot 1990) have suggested that these ubiquitous pits may have been used for localized water and soil retention and for the growing of some cultigen. We hope that ISM pollen analysis of sediments from a representative sample of borrow pits in the project area will help to resolve this issue.

Pollen samples will be systematically collected from both field systems in the project area (LA 83116 and LA 83117). Sampling of borrow areas will occur primarily at LA 83117 where these features are especially well defined.

Research Issue 3: Microclimatic Effects on Growing Season. The moisture conservation characteristics of rock and gravel mulch have been understood for some time and are extensively documented. Experimental studies dating back to 1943 have demonstrated the ability of a surface gravel layer to "capture" and retain moisture (Lamb and Chapman 1943; Benoit and Kirkham 1963; Corey and Kemper 1968; Fairbourn 1973). Early archaeological interpretations of gravel fields also emphasized the water conservation properties of gravel mulch (Ellis 1970; Vivian 1974).

Another potentially important characteristic of gravel mulch is its effect on soil temperatures and temperature variation. In a 1973 experiment, Fairbourn (1973) compared soil temperatures under a gravel-mulch layer with an adjacent bare soil control plot and found temperatures ranging from 2 to 4 degrees C higher under the gravel mulch. Several years earlier, Fairbourn and Kemper (1970) noted that a layer of black gravel mulch helped to prevent frost damage on an experimental crop of tomatoes in eastern Colorado. A frost in late May that killed 60 percent of the tomato plants on a bare soil control plot killed only 12 percent of the plants on an adjacent black gravel-mulched plot. Later in the growing season tomatoes averaged 2.25 inches in diameter on the gravel-mulched plot and only 1.0 inches in diameter on unmulched control plots.

It is well known that *Zea mays*, the most important cultivar in the Southwest, is extremely sensitive to soil temperature variation, in part because the shoot apex and the root system are located in the soil (Walker 1969:732). Experiments by Fairbourn (1973) show that a gravel-mulch layer can hasten the germination of corn by 2-3 days and tasseling by as much as 7-10 days. Walker (1969) demonstrated that as little as a 1 degree C difference in soil temperature can have a significant effect on the growth and nutritional behavior of maize seedlings. As soil temperatures increase from 12 to 26 degrees C there is a dramatic increase in seedling dry weights--an average of 20 percent for each degree increase in soil temperature.

Soil temperature could be an extremely important agricultural variable in the lower Chama Valley where, for the past 50 years, the frost-free growing season has varied between 86 and 134 days (Cordell et al. 1984:237). Since corn requires a minimum growing season of 110-120 days with average temperatures no lower than 10 degrees C (Chang 1968:77), the lower Chama is clearly marginal for successful corn horticulture. The higher soil temperatures associated with a gravel-mulch layer can be expected to extend the effective growing season for corn and reduce the risk associated with subsistence corn farming in such a marginal environment.

In addition to the solar gain properties of gravel mulch and its positive effects on soil temperature, several investigators (Bugé 1981; Anschuetz et al. 1985; Moore et al. n.d.) have pointed out the advantages of planting subsistence crops on elevated topography because of cold air drainage effects and shortened growing seasons in low-lying areas, such as stream floodplains. According to Bugé (1984:32), dry fields on terrace tops in the Ojo Caliente Valley buffered the very risky lowland growing systems where the primary risk was a short growing season rather than water availability. Moore and others (n.d.:42) made a similar argument when they postulated that dry farmed fields in the Chama Valley may have had a significantly longer growing season than irrigated fields on the floodplain due to cold air drainage effects.

There are several published studies of cold air drainage effects on prehistoric settlement patterns in the northern Southwest (Eddy 1973; Adams 1975), and Adams (1979) has shown that cold-air drainage in the Hopi Mesas of northeastern Arizona can shorten growing seasons by as much as 10 to 30 days, depending on relative elevation and local topographic relief:

> The effect of cold air subsiding into topographically low areas is to shorten the growing season by 10 to 30 days. In an agriculturally marginal area with a growing season of 150 days or less, narrow valley areas would be avoided for agricultural activity in favor of more open or high areas. (1979:293)

Whereas the soil temperature effects of gravel mulch are well understood based on several controlled agricultural experiments, the same cannot be said of cold air drainage and other microclimatic effects, since these may vary according to local climate and topography. Austin (1957:12) notes that cold air thermoclines may reach depths of 50-100 m, and the terraces in the Ojo Caliente Valley are, at most, only 20-30 m above the floodplain. Was the height of gravel terraces above the Ojo Caliente floodplain sufficient to moderate the length of the local growing season? This question can only be answered empirically, based on comparisons between floodplain and terrace top temperatures and temperature variation within the project area. An important objective of our research in the Ojo Caliente will be to collect detailed data on temperature gradients in the valley so that we can reconstruct differences in growing season length between terrace top and floodplain fields. Studies of vertical temperature gradients will be conducted primarily at LA 83117, the slopes of its supporting terrace, and the adjacent floodplain of the Río Ojo Caliente. Temperature readings will also be made on the field surface at LA 83116 for direct comparison with the surface of fields at LA 83117.

Research Issue 4: Characterization of Field Dynamics. Questions about prehistoric field dynamics, how gravel-mulch fields may have functioned, their potential productivity, their life expectancy, and other characteristics, are important issues that have not been adequately addressed. Critical unanswered questions about gravel-mulched fields fall under the general categories of understanding the energy, nutrient, and hydrologic budgets of the features, and how the techniques employed differed under different situations. These questions include: (1) Site selection criteria; were only certain substrates, soils, and locations used? (2) If sites differed, were slightly different techniques used at different sites? (3) What are the energy budgets of these sites, and how did the energy budgets differ with different sites and different mulch types? (4) What are the nutrient cycling characteristics of these fields? Were the sites sustainable or were extra nutrients required? (5) What was the hydrology of the fields? How much water was conserved by the mulch? And, (6) were different mulch techniques used for different crops? For example, some crops are susceptible to stem rot after germination; did they leave these plants uncovered by gravel until the plants were older and less susceptible?

Most investigators who have addressed issues such as these have relied on data from modern agricultural experiments on gravel mulch, especially the work of Corey and Kemper (1968) and Fairbourn (1973), and simply extrapolated from these present experiments to past field dynamics. None of these modern experiments were designed, however, to replicate prehistoric field systems in northern New Mexico. Consequently, published experiments on gravel-mulch can serve only as general guides--and important sources of hypotheses--about prehistoric field dynamics.

Dale Lightfoot's (1990) investigation of the San Marcos field systems is the only published attempt to address important questions about field dynamics, but his study is based on some questionable assumptions. Lightfoot's strategy was to compare soil and plant biomass characteristics between a sample of gravel fields and off-field control sites. Based on these comparisons, he estimated the relative productivity of gravel-mulch technology. The results of these comparisons were discussed above. To review briefly, Lightfoot found significantly higher soil moisture and plant biomass levels on gravel-mulch fields compared with bare soil controls, and he concluded that gravel-mulch fields might have produced as much as four times the yield of nonmulched fields during years of below average precipitation (1990:147-150).

Although we do not dispute Lightfoot's field measurements, we question whether his approach yields an accurate measure of prehistoric field function or productive potential. The implication of Lightfoot's research is that fifteenth-century gravel-mulch fields are still functioning nearly 600 years after they were abandoned. Yet, Lightfoot himself points out that gravel-mulch fields have a short life expectancy due to the combined effects of sedimentation and interruption of the nutrient cycle.

As discussed above, sedimentation of the pore spaces within gravel-mulch effectively "short circuits" the mulch effect (Fairbourn 1973; Corey and Kemper 1968). Lightfoot acknowledges the problem of sediment accumulation and suggests that regeneration of gravel-mulch (which would entail removing the silt and sand from the gravel layer) probably would have been required every five to ten years (1990:220). The additional problem of nutrient cycling is summarized by Lightfoot (1990:55) as follows: "a permanent gravel mulch on the surface would discourage the return of crop wastes following harvest and could lead to a disruption of nutrient cycles and an eventual depletion of essential soil nutrients." Because of the tremendous labor involved in mulch regeneration, Lightfoot argued that the Anasazi probably used their gravel fields until they became exhausted after a couple of decades of intensive farming, and then abandoned the fields and built new ones: "The quantity of pebble-mulch gardens in any area could be related to the continuous building of new PMG as old ones began to play out; perhaps analogous to the building of new rooms at a pueblo as old rooms are left to decay" (Lightfoot 1990:129; see a similar argument by Moore et al. n.d.).

If, as Lightfoot argues, gravel-mulch fields "played out" after only a few decades, why, after nearly 600 years, do gravel-mulch fields still support comparatively dense stands of biomass? We suggest that what Lightfoot was actually measuring near San Marcos Pueblo was the differential effect of livestock overgrazing on rocky versus sandy soil, and that the measurements have little to do with the function of gravel mulch, per se, except insofar as a surface gravel layer stabilizes the soil, helps to prevent sheet erosion, and protects the soil from the adverse affects of overgrazing and the tromping of cattle hooves.

We believe that the best way to address issues regarding field function and field dynamics is by experimental studies that simulate, as realistically as possible, field structures, soil types, and climate and radiation regime of late prehistoric fields in the lower Chama Valley. Experimental studies were proposed and initiated by Maxwell and Anschuetz in 1987, but funds were not available for adequate design and completion of the experiments. In order to design a simulation experiment, we need detailed data on field structure such as soil character and depth, gravel-mulch depth, gravel size variation, gravel color, and other detailed field characteristics. An important objective of the current project will be to collect sufficient data to accurately characterize field form and structure so that experimental studies can be designed to investigate a variety of questions about field dynamics.

Detailed studies of field form and structure will be carried out at both LA 83116 and LA 83117. Experimental studies will be undertaken after the completion of this project. It is hoped that these studies will be accomplished with funds provided by federal grants, with additional support from the private sector. The actual experimental studies are not considered necessary to complete the investigations proposed in this report or to provide the information needed to address the questions that are currently proposed.

Historic Occupations

A single historic site was recorded and tested on the current project. LA 83118 is a multiple component site with a buried Basketmaker or early Pueblo horizon of unknown extent, and an early historic component covering an area approximately 4,000 sq m. No evidence of historic architecture was noted during test excavations at the site, but significant quantities of occupational refuse of domestic plant and animal remains, historic potsherds, and assorted chipped and ground stone artifacts were recovered. The function of the historic component is unknown; the best estimate for an occupation date, based on ceramic cross dating, is the late 1600s or early 1700s.

As the only historic component on the project, LA 83118 requires somewhat different treatment than prehistoric sites on the project. Important problems to be addressed at LA 83118 are:

1. Site cultural affiliation
2. Site dating and chronometrics
3. Characterization of economic patterns and external relationships

The following discussion begins with a review of early historic cultural dynamics in the lower Chama District and concludes with a presentation of relevant research issues and problem domains.

Summary of Historic Interactions

The early historic period saw several different and often competing ethnic groups in the lower Chama District. In addition to the Tewa, whose ancestral home was the southern half of the Chama Valley, there were Spanish and Genízaro settlers, Ute, Comanche, and Navajo raiders and traders, and after 1850, bands of Jicarilla Apache camped in the lower Chama Valley (Ellis 1975; Schaafsma 1979; Wozniak n.d.).

The Utes and their linguistic cousins, the Comanche, held sway over the region north of the Tewa Basin for most of the first half of the eighteenth century. As highly mobile hunters and raiders, it is unlikely that they would have produced an archaeological assemblage similar to LA 83118, which contained abundant Pueblo potsherds and domestic food remains. The Navajo, who probably adopted animal husbandry in the decades immediately following the Spanish reconquest of 1692, may have made commitments to farming even earlier, could conceivably have produced such an assemblage. No Navajo ceramics were recovered at LA 83118 and the site is only a few miles north of San Juan Pueblo. Considering the frequent strains in relationships that existed between Navajos and Tewas--and, for that matter, between Navajos and Utes--LA 83118 must be considered an improbable location for a seventeenth- or eighteenth-century Navajo encampment.

A much stronger case can be made for Tewa or Spanish occupation of LA 83118. There is evidence of a substantial Tewa presence in the lower Chama District throughout the seventeenth and for the first few decades of the eighteenth century. Tewa Polychrome sites and components have been recognized in the lower Chama Valley since the 1930s (Hibben 1937), and domestic sheep and cattle bones and metal artifacts have been recovered from at least two large ruins in the Chama Valley (Ellis 1975). Wozniak (n.d.) has argued from historical documents that Tewa Indians were herding Spanish sheep and cattle in the lower Chama Valley throughout the seventeenth and early eighteenth century, and that intensive utilization of the lower Chama by Tewas did not end until several decades into the eighteenth century following the expansion of Spanish settlements and land grants into the region (n.d.:13-51).

Spanish occupation and use of the lower Chama and Ojo Caliente Valleys began in earnest in the early eighteenth century. The village of Chamita was founded in 1714, just a few miles north of San Juan Pueblo (Beal 1987). Spanish land grants were established in the lower Ojo Caliente Valley in the 1730s and 1740s (Jenkins 1991), Abiquiú was settled on the lower Chama in the 1740s (Ellis 1975), and Spanish land grantees were herding cattle and sheep as far north as the Piedre Lumbre Valley in the 1740s and 1750s (Beal 1987; Schaafsma 1979). Presumably, once Spanish communities were established and land grants were developed, continued Tewa use of the lower Chama District for farming, herding, mining, and trading, would have been restricted (Wozniak n.d.:13-51). Despite the rapid settlement of the lower Chama during the eighteenth century, frequent hostilities between Spanish settlers and Ute and Comanche raiders created settlement instabilities that continued until the beginning of the American period.

Problems and Problem Domains

Three primary problems will be addressed during excavation of the historic component at LA 83118: (1) determination of site cultural affiliation; (2) collection of chronometric data for more accurate determination of occupation date; and (3) analysis of economic data from site deposits. A corollary of problem 3 will be to determine the function of the site--was it a herding camp, a seasonal fieldhouse, etc.?

Research Issue 1: Site Cultural Affiliation. Determining the cultural affiliation of the site occupants at LA 83118 will be problematic. Pueblo Indians rapidly incorporated European crops, livestock, and various manufactured goods into their material culture inventory during the early Historic period. At the same time, Spanish settlers were heavily reliant on Pueblo food crops, pottery containers, construction materials, and other items of material culture. In consequence, early historic Pueblo and Spanish archaeological remains can be difficult to distinguish (especially the remains of ephemeral camp sites).

An important objective of data recovery at LA 83118 will be to obtain a sufficiently large sample of cultural materials to make systematic comparisons between LA 83118 and contemporaneous assemblages of known cultural affinity from the Northern Río Grande. Using numerical classification techniques such as discriminant analysis, it may be possible to assign the site to a specific cultural group. Collecting a larger material culture sample also will increase the likelihood of recovering culturally and temporally sensitive artifacts that may aid in cultural affiliation classification. Expanded excavations at LA 83118 will also maximize the probability of locating buried cultural features that may also aid in identifying the cultural affinity of the site occupants.

Research Issue 2: Chronometric Studies. Another objective of data recovery efforts at LA 83118 will be to obtain chronometric samples to aid in dating site deposits. If cultural features are encountered during excavation, every effort will be made to locate and collect tree-ring and archaeomagnetic samples. More accurate dating of occupation events at the site may, among other things, shed important light on the cultural affinity of the site occupants. Historical records suggest that Spanish settlers did not occupy the lower Ojo Caliente Valley north of Chamita until the 1730s, when the Abeyta and Black Mesa land grants were first awarded (Jenkins 1991). Presumably, with the establishment of land grants in the lower Ojo Caliente, Tewa occupation and use of the valley would have been severely curtailed. It is likely, therefore, that if the occupation of LA 83118 dates much before the 1730s, it is most likely associated with a continued Tewa use of the valley; however, if the site dates after the 1730s, Spanish occupation and use is more likely than Tewa.

Research Issue 3: Economic Analysis. A third major objective of data recovery efforts at LA 83118 will be to collect data that will permit a characterization of early historic economic adaptations in the lower Ojo Caliente Valley. From only a few test pits excavated thus far at the site, a substantial amount of economic data has already been recovered, and the preservation of perishable materials, including food stuffs, is excellent. Future excavations at the site will focus on the recovery and analysis of additional ethnobiological (flora, fauna, pollen) and technological data. Data analysis will address the following general economic questions: (1) What plants, animals, and other resources were being processed at the site? (2) What was the subsistence mix, and did that mix vary through time or across space? (3) Were food and other economic resources obtained locally, or were they being obtained via long distance exchange? (4) What was the nature of economic exchange relationships--what was coming in, from where, and what was going out? (5) What is the nature of economic technology at LA 83118, and how does that technology inform about economic procurement and exchange strategies during the early historic period?

Questions 1 through 4 will be addressed by means of the recovery, classification, and analysis of ethnobiological data. Soil samples will be collected from all proveniences and macrobotanical fractions will be separated using standard water flotation techniques. Faunal remains will be collected and bagged separately in the field for analysis to species diversity and consumption patterns in the lab. Macrobotanical and faunal specimens will be sorted by taxa and analyzed for their contribution to the early historic economy, the diversity of taxa present, the relative proportions of native versus European domesticates, and variations in taxa frequency through time and across space. Addressing question 5 will require a detailed analysis of technological variability at LA 83118 in order to determine what tools were being manufactured and used at the site, and the degree to which Spanish-introduced technologies played a role in resource procurement and processing.

FIELD AND ANALYTIC METHODS

Data recovery and analysis methods on the Ojo Caliente Project will be designed to ensure the collection and analysis of data relevant to the problems and research issues outlined above. The following section outlines proposed methods of recovery and analysis on the project.

Excavation

Excavation strategies on the Ojo Caliente Project will be designed to accommodate differences in two major categories of archaeological sites: lithic and ceramic scatters and agricultural fields and associated features. Lithic and lithic-ceramic scatters cross-cut all the major temporal components in the study area and, in fact, most of the sites in this category exhibit artifactual evidence of multiple temporal components. As a result, similar data control and recovery strategies will be implemented for all artifact scatters, despite age. Due to the nature of the resource and the specific questions that have been posed, agricultural field investigations and data recovery strategies will be very different from those used on surface artifacts scatters. These differences are detailed below.

Lithic and Ceramic Scatters

A general objective of the excavation strategy at all surface artifact scatters (LA 83110, LA 83118, and LA 83151) will be to distinguish among the various temporal components present, which will require strict spatial and stratigraphic controls over all excavations. Several categories of data are relevant across all temporal components, requiring that similar data recovery strategies be used on all three sites in this category.

Excavation strategies will be designed to maximize the recovery of chronometric samples such as radiocarbon, tree-ring samples, archaeomagnetic samples, obsidian samples for hydration dating, and temporally diagnostic artifacts for cross-dating. Dating and chronology refinement are important objectives for all temporal components--Archaic, Classic, and historic.

Special emphasis will be placed on the recovery of macrobotanical and other perishable food remains. Soil and pollen samples will be collected from all cultural features, occupation surfaces, and stratigraphic profiles. Standard water flotation techniques will be used to separate organic components from soil samples, and macroplant remains will be analyzed for species diversity and processing and consumption patterns. Faunal remains will be collected from all archaeological contexts and analyzed for species diversity, butchering and processing methods, and other attributes that will aid in the reconstruction of faunal procurement patterns at the sites. These data will have an important bearing on questions regarding subsistence and settlement systems, mobility patterns, and the structure of economic organizations from the Archaic through the early Historic period.

Artifact recovery and analysis strategies will attempt to maximize information related to resource procurement and processing, patterns of trade and exchange, and the spatial and temporal distribution of economic activities at the sites. Studies of lithic and ceramic technology will

contribute to our understanding of hunter-gatherer settlement subsistence systems and mobility patterns, resource exploitation strategies, and changes in local and regional external relationships through time.

The following staged excavation strategy will be employed at each lithic and lithic-ceramic scatter:

1. *Preexcavation recording and preparation* will include photographic documentation of the site and the immediate surroundings, establishment of a mapping datum and subdatums, construction of a 1-by-1-m surface control grid system over the entire site, and completion of a topographic map of the site area.

2. *Surface collection and exploratory excavation* will begin with an intensive inventory and collection of surface artifacts by grid provenience. Artifacts will be bagged by unit to allow subsequent spatial analyses that may reveal specialized activity areas or discrete temporal occupations. A sample of 1-by-1-m test pits will then be excavated by hand in controlled levels to document site stratigraphy and obtain representative samples of artifacts from across the site. Test grids will be placed in areas of high surface artifact density; additional randomly placed test pits also will be excavated. Following completion of the controlled tests, a backhoe may be used to excavate exploratory test trenches in areas of the site judged likely to yield buried cultural features and deposits. At the completion of the trenching operations, test trenches will be cleaned, profiled, and recorded.

3. *Intensive excavation* will include hand excavation of cultural features and occupation surfaces discovered during exploratory testing. Excavation of features will be in natural stratigraphic units or arbitrary 10-20 cm levels depending on stratigraphic definition. 1-by-1-m horizontal controls will be maintained during the excavation of cultural fill; artifacts resting on or near cultural occupation surfaces will be point-plotted in three dimensional space.

Nonartifactual samples (soil, flotation, pollen, macrobotanical, faunal, C-14, tree-ring) will be collected from all stratigraphic sections and cultural features. All undisturbed cultural fill will be screened through ¼-inch mesh hardware cloth and all artifacts and nonartifactual materials will be collected, bagged, and labeled by unit, stratigraphic level, date, excavator's name, and other appropriate provenience information. Information derived from these data will help us to resolve questions relating to prehistoric subsistence, settlement and mobility patterns, and the nature and scope of economic organization during the prehistoric and early Historic periods.

At the completion of excavation of the cultural features, unexcavated areas between features will be stripped to culturally sterile soil to locate additional features and define occupation surfaces next to cultural features. In areas of high feature density, surface stripping will be conducted by hand and horizontal/vertical controls will be strictly maintained. In low feature density areas, overburden will be mechanically removed and final excavation and feature definition will be done by hand using standard horizontal (1-by-1 m) and vertical (natural strata or 10-20 cm) controls.

A site map will be prepared with the aid of an optical transit and metric tape (or stadia rod), and will include plans and profiles of cultural features and excavation units. Standard recording forms (feature, stratigraphic record, field specimen record, etc.) will be completed for each excavation unit, and all cultural features will be photographed before, during, and after excavation. Excavators will maintain narrative records of excavation activities that will be cross-referenced with

recording forms and provenience collections upon completion of the field phase of the project.

In addition to the general data recovery procedures outlined above, the following specific excavation strategies will be employed at the three lithic and ceramic scatters recommended for data recovery:

LA 83110. Only a small portion of the LA 83110 scatter is located within the proposed right-of-way (approximately 120 sq m, or about 30 percent of the total site area). Excavation will begin with carefully controlled hand excavations in the vicinity of the cultural stains identified as Features 4 and 6, and expand out from those (see Fig. 8, pg. 35). Once the features are delineated, hand excavations will be conducted in the intervening space. If additional features or a recognizable occupation surface are identified in areas peripheral to Features 4 and 6, these will be excavated by hand using 1-by-1 or 2-by-2-m horizontal and the appropriate vertical controls. If large quantities of sterile overburden are encountered in these excavations, at the discretion of the excavation supervisor, mechanical equipment may be used to remove the overburden.

The extent of hand excavation in the threatened portions of LA 83110 will be determined by feature and artifact density and the results of early data returns. At the conclusion of hand excavations, extensive backhoe testing will be conducted within the construction zone to rule out the presence of deeply buried cultural deposits.

LA 83118. Controlled hand excavations at LA 83118 will focus on the area around Test Pits 7 and 8, in the southwest quadrant of the site (see Fig. 20, pg. 61). During test excavations at the site, these test pits yielded a surprisingly high concentration of perishable organic remains. Because of these initial returns, we believe this area has the highest potential for yielding subsurface cultural features. Hand excavation will proceed in a fashion similar to LA 83110: once features are identified, block excavations will be expanded to include peripheral occupation surfaces and cultural associations. Mechanical equipment will probably not be used in this area due to the fragile nature of the cultural remains.

The remainder of LA 83118 within the construction zone will be subjected to extensive backhoe testing in order to search for deeply buried cultural features and deposits. A possible buried cultural horizon was identified in the north end of Backhoe Trench 2 during test excavations at LA 83118. Due to the depth of the deposits, the nature and extent of this horizon can only be adequately explored with the aid of mechanical equipment. If additional features or occupation surfaces are identified during the course of systematic backhoe excavation, blocks of sterile overburden will be removed with the backhoe shovel and excavation of all features and surfaces will be conducted by hand using standard horizontal (1-by-1 or 2-by-2 m) and vertical (10-20 cm) controls.

In addition to excavation at LA 83118, relevant historical and ethnohistorical data will be collected and interpreted by a professional Southwestern historian or ethnohistorian. Historic documents, land grant records, parish records and so forth, as well as any relevant secondary sources, will be consulted at the New Mexico State Records Center and Archives and other historic repositories. Historical research will focus on reconstructing the social and economic history of the lower Ojo Caliente Valley and its relationship to historic Pueblo and Spanish communities in the Tewa Basin to the south.

LA 83151. Controlled hand excavations at LA 83151 will be limited primarily to Surface Clusters 1 and 2, located within the proposed construction right-of-way (see Fig. 22, pg. 73). These areas will be subjected to extensive block excavation in order to delineate any buried cultural features and occupation surfaces and to recover a representative sample of artifacts and nonartifactual materials. Much of the ground surface outside the primary artifact concentrations is heavily eroded and will not be excavated. Uneroded areas within the right-of-way, especially in the vicinity of Test Pit 1 (Fig. 22), will be trenched with a backhoe to rule out buried cultural deposits. If cultural features or deposits are identified during backhoe trenching, excavation will proceed by hand using appropriate horizontal and vertical controls.

We believe there is a very low probability of encountering human remains on the Ojo Caliente Project. However, should human remains be discovered during excavation, local law enforcement officials and the State Historic Preservation Officer will be notified and consultations completed before the remains are excavated. Treatment of human remains and other sensitive cultural materials will be governed by Museum of New Mexico policy regarding the *Collection and Display of Sensitive Material* (SRC Rule 11) and its *Policy on Collection, Display and Repatriation of Culturally Sensitive Materials* (MNM Rule No. 11, January 1991) (Appendix 3). If such materials are discovered, members of the public will not be allowed to handle or photograph the remains and no photographs of sensitive materials will be released to the media or general public.

Standard archaeological excavation techniques will be employed to remove any human remains discovered on the project. The burial pit will be defined, hand tools will be used to expose the skeletal parts, the skeleton and grave goods will be mapped, recorded, and photographed, and pollen, flotation, and relevant chronometric samples will be collected.

If unanticipated discoveries at any of the sites on the Ojo Caliente project warrant significant alteration of the scope and intent of this plan, the New Mexico State Highway and Transportation Department and the State Historic Preservation Officer will be consulted prior to implementing any substantive changes.

Agricultural Sites

Data recovery strategies at the two agricultural sites on the Ojo Caliente Project (LA 83116 and LA 83117) will be designed to collect data relevant to four principal problem domains: (1) dating and chronometrics, (2) crop mix, (3) microclimatic variation, and (4) field structure. A brief summary of methods and approaches follows.

1. **Dating and Chronometrics.** Very few dating techniques are applicable to agricultural fields. Attempts will be made to recover buried obsidian samples for hydration dating, and if any evidence of buried cultural features is noted during data recovery, a high priority will be placed on the recovery of chronometric samples (C-14, tree-ring, archaeomagnetic samples). The primary focus of data recovery efforts, will be to intensify and extend survey coverage of field and off-field surfaces to maximize the recovery of temporally diagnostic artifacts. Recognizing that artifact visibility is extremely low on field surfaces, we will intensify pedestrian coverage of fields by slowing the pace of survey and shortening the transect interval. Artifacts will be flagged and "piece-plotted," and areas of field surface that have higher than average artifact densities will be gridded and subjected to detailed examination. Optionally, a selected sample of grids will be stripped of surface gravel and

screened to maximize artifact recovery. Intensive surveys also will be conducted of field margins and terrace slopes. Depending on artifact density, off-field areas and terrace slopes may be mapped, gridded, and sample excavated.

2. **Crop Mix.** The problem of what crops were grown on agricultural fields in the project area will be addressed by intensive pollen sampling from both on and off-field surfaces. In areas where fields are gridded or compartmentalized in another fashion, pollen samples will be collected from a representative sample of compartments and from different locations within each compartment. Pollen samples will be taken from off-field surfaces, including terrace-edge borrow pits, so that pollen spectra from different on and off-field locations can be systematically compared. In addition, we will collect pollen samples from modern agricultural fields to enlarge our comparative data on pollen production in fields (Dean 1992). All pollen samples will be analyzed using the intensive systematic microscopy technique (ISM), a technique designed by Dean (1991) to maximize the recovery and identification of rare cultivar pollen grains.

3. **Microclimatic Studies.** Several investigators (Bugé 1981; Anschuetz et al. 1985; Moore et al. n.d.) have suggested that terrace-top dry-farmed fields in the lower Chama District may have had longer growing seasons than floodplain fields because of cold air-drainage effects in the valley bottoms. Detailed temperature and moisture measurements will be made at intervals on terrace top and valley bottom locations in the study area to estimate the effects of cold air drainage on growing season length and agricultural production. These measurements will be compared with temperature and climatic records from regional weather stations to construct a model of microclimatic variation in the area, using techniques developed by Adams (1979) and others.

4. **Field Dynamics.** We have proposed that questions regarding prehistoric field dynamics, field function, field productivity, and field life expectancy can be adequately addressed only by controlled experimental studies that simulate, as realistically as possible, key parameters of late prehistoric gravel-mulched field systems in the lower Chama District. A primary goal of the proposed research is to collect sufficient data on how gravel-mulch fields were prepared, constructed, and used so that realistic experimental studies can be designed. During excavation, particular attention will be paid to the alignment and orientation of cobbles on the surface, pollens at particular locations within the fields, soil texture differences within the soil profile, and general stratigraphy of the area. Data collection strategies will be designed to characterize both spatial and stratigraphic variation in field structure.

The fields in the project area are very large--in the case of LA 83117, the primary garden plot measures more than 10,000 sq m. The most effective and least expensive method of investigating spatial structure within such a large area would be low-level aerial photography. We propose to conduct overflights of varying scales at both fields in the project area as a first step in identifying internal field structures such as grid borders, water drainage features, and other forms of internal field compartmentalization. Patterns detected on the imagery will be examined and mapped on the ground with the aid of an optical transit.

Field stratigraphic structure will be examined by multiple linear test trenches. A backhoe will be used to excavate test trenches through field segments and detailed profiles will be recorded, measuring such parameters as soil depth and constituency, gravel-mulch thickness, gravel size variation, characteristics of soil chemistry and morphology, and soil moisture and temperature parameters. Trenches will bisect field edges and extend beyond field margins so that off-field soil

and other profile characteristics can be measured to form a baseline for estimating cultural modifications to the soil within the fields. Collection of profile data and measurement of field structure and soil variables will be carried out by a multidisciplinary team comprised of an archaeologist, a field ecologist, and a soil scientist.

Besides the specific data recovery approaches outlined above, field work at agricultural sites in the project area will include most of the standard data recovery and recording procedures outlined above for lithic and ceramic scatters. Preexcavation recording and preparation will include photographic documentation, establishment of mapping datums, construction of a 1-by-1-m surface control grid system over the entire site, and completion of a topographic map. Nonartifactual samples (soil, flotation, pollen, macrobotanical, faunal, C-14, tree-ring) will be collected from all stratigraphic sections and any cultural features that might be encountered in association with the agricultural fields. Samples of undisturbed cultural fill will be screened through ¼-inch mesh hardware cloth and all artifacts and nonartifactual materials will be collected, bagged, and labeled by unit, stratigraphic level, date, excavator's name, and other appropriate provenience information. A site map will be prepared of the agricultural field with the aid of an optical transit and metric tape (or stadia rod), and will include plans and profiles of all excavation units and cultural features. Standard recording forms (feature, stratigraphic record, field specimen record) will be completed for each excavation unit, and all cultural features will be photographed before, during, and after excavation. Excavators will maintain narrative records of excavation activities that will be cross-referenced with recording forms and provenience collections upon completion of the field phase of the project.

Analysis

Before analysis, all recovered materials will be cleaned and materials requiring conservation will be treated. Nonartifactual samples will be inventoried and prepared for shipment to appropriate analysis laboratories. The artifact assemblage will be analyzed by general artifact categories: lithic artifacts, ceramics, wood, bone, etc. Artifact attributes will coded for computerized cataloging and statistical analysis. Samples of representative artifacts will be photographed or drawn for inclusion in the final report. At the conclusion of the analysis, all artifacts, nonartifactual samples, and site documentation will be curated at the Archaeological Repository, Museum of New Mexico. Descriptions of analytical procedures for the major categories of artifactual and nonartifactual data follow.

Lithic Artifacts

Lithic artifacts will be classified according to tool form, function, and material type. Formal artifacts will segregated into formal or functional categories and subjected to detailed attribute analyses. Attributes to be monitored will include characteristics of the parent material (material type, flake form, platform treatment), reduction techniques, retouch and edge angles, evidence of use wear, and material alterations such as thermal treatment. Functional analyses of formal tool use will be conducted in an attempt to correlate tool forms and technologies with resource procurement strategies. Cores and debitage will be analyzed to characterize lithic reduction trajectories, expedient tool use, and raw material source localities. Special emphasis will be placed on identifying nonindigenous lithic materials for determining prehistoric and early historic trade and interaction networks.

Analyses of lithic artifacts relate directly to several specific research problems and issues identified in this report. Dating and chronology refinement are important objectives for all temporal components on the project--Archaic, Classic, and Historic--and an important objective of lithic analytical design will be to recover obsidian flakes for obsidian hydration dating. This will be especially important for nonceramic sites and components that are not associated with charcoal and other datable organics. Functional attributes of site and component lithic assemblages will be correlated with other economic data (macrobotanical specimens, pollen, faunal remains, etc.) to arrive at a more comprehensive understanding of economic adaptations and changes in economic strategies in the study area. Analysis of lithic raw material types will provide important insights into regional trade and interaction, and settlement and mobility patterns. Questions regarding hunter-gatherer mobility will be addressed primarily through the analysis of lithic assemblages--especially with regard to differential biface use (Kelly 1988) and cortical frequencies. Analysis of lithic tools and debitage from agricultural sites will attempt to reconstruct the role of lithic tools in field construction and crop maintenance activities.

Ceramic Artifacts

Ceramic artifacts will be classified by ware, type, and vessel form. Other attributes to be monitored will include sherd weight, paste and slip color, temper type, surface treatment, design style and paint type, rim form, secondary alterations such as reuse and mending, and function. A variable power binocular microscope will be used to measure all microscopic attributes. To isolate local versus nonlocal ceramic materials and technologies, representative samples of sherds will be subjected to trace element analyses (X-ray diffraction, microprobe, etc.) as an aid in determining the origin of their constituent parts. In addition, data will be collected from material sourcing and refiring experiments to identify potential clay, slip, and temper sources and local firing technologies.

These analyses will be supplemented by comparative studies of ceramic types and frequencies from contemporaneous sites in the lower Chama District to test hypotheses regarding regional trade and interaction. Special emphasis will be placed on identifying and determining the frequency and origin of various trade wares.

Intrasite seriation studies will be conducted and correlated with chronometric and stratigraphic dates as an aid in determining construction and abandonment sequences at each site. Seriation studies of specific ceramic types will help to identify trends in ceramic production, which can be compared to existing seriation studies to test hypotheses concerning relative dates of production and trade patterns outside the Chama Valley.

Ceramic functional studies will attempt to discriminate between storage and nonstorage vessels for estimating changes in ceramic storage volumes through time, and as an aid in determining site structure and function, length of occupation, and the nature of technology and resource procurement patterns at each site.

Floral and Faunal Remains

Analyses of floral and faunal materials will be undertaken by specialists under contract to the Laboratory of Anthropology. Faunal studies will focus on species identification and diversity, age

and minimum numbers of individuals, butchering and processing methods, and other attributes that will aid in reconstructing faunal procurement and consumption patterns at the sites. Macrofloral specimens recovered using water flotation methods will be analyzed for species mix, collecting and processing methods, and seasonality. Special emphasis will be placed on determining species diversity and changes in species diversity through time. On- and off-site pollen samples will be examined and compared to provide a clearer picture of plant use and availability during the site occupations.

Historic Artifacts

No historic artifacts of obvious European manufacture were noted during test excavations in the lower Ojo Caliente Valley. If historic artifacts are recovered during data recovery phases of the project they will be segregated into functional categories that will allow insights into the behavioral contexts in which the artifacts were used, maintained, and discarded. The following generalized functional categories will be used to sort artifacts into behaviorally meaningful groups: Foodstuffs, Indulgences, Domestic Routine, Construction and Maintenance, Personal Effects, Entertainment and Leisure, Arms, Animal Husbandry, Other, and Indeterminate. These preliminary categories will be refined or expanded as necessary.

Research Results

A final report on the excavation and analysis of all sites will be published in the Office of Archaeological Studies' *Archaeology Notes* series. The report will present important excavation, analysis, and interpretive results. Included will be a narrative description of work performed, site and artifact photographs, maps, and data summaries in the form of tables, charts, and graphs. All field notes, analysis notes, maps, and photographs will be deposited with the Archeological Records Management System of the New Mexico State Historic Preservation Division, in the Laboratory of Anthropology in Santa Fe. Artifacts will be curated at the State Archaeological Repository, Laboratory of Anthropology, in Santa Fe.

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APPENDIX 1. MACROBOTANICAL REMAINS FROM LA 83118

Mollie S. Toll

Test excavations of a shallow, eroded site bordering U.S. 285 near the floodplain of the Río Ojo Caliente netted several items submitted as macrobotanical remains. LA 83118 contains both Late Archaic-Basketmaker and Historic (ca. A.D. 1600-1800) components, but the elements are inseparable in any given provenience. All specimens came from the upper 10 cm of fill, where disturbance is highest and cultural context most suspect.

From Test Pit 4, FS 11 was a carbonized berry and seed of *Juniperus monosperma* (one-seed juniper), a tree species common in the immediate site area. Recovered about 20 m from the present roadway, fenced within private land, we can be reasonably sure that this specimen was not charred during roadside burning for weed control. References to ethnobotanical uses of juniper are abundant, and include use of the berries for dye (Navajo, Elmore 1944:18), medicine (Elmore 1944:18; Santa Clara, Robbins et al. 1916:39), and food (Apache, Reagan 1928:158; Keres, White 1944:561). Because of their strong, resinous taste, juniper berries were largely relegated to flavoring (Keres, Swank 1932:50) or famine food (Castetter 1935:31-32), and were also "considered more palatable when heated in an open pan over the fire" (Robbins et al. 1916:40; see also Castetter 1935:32). Juniper berries might also find their way into a hearth any of the many times branches were used: for numerous and varied medicinal purposes, for ceremonial decoration, for bedding, for summer construction. Juniper remains in general tend to go along with sites of any prehistoric period, when they are located within the piñon-juniper vegetation community, and in most historic sites within a reasonable truck-distance of piñon-juniper woodland. Charcoal is the most common juniper remain, followed by twigs and scale leaves, and far fewer berries and/or seeds.

An uncarbonized *Juniperus monosperma* berry/seed was found in Test Pit 6 (FS 17); this may be a contemporary intrusive. Test Pit 7 (FS 10) contained five carbonized *Zea* cob fragments (totaling 0.6 g, too small for measuring any sensible attributes) and a scat with monocot stem fragments and caryopsis parts. These caryopses were large enough (about 9 mm in length) to suggest some domesticated grain crop, but lacked diagnostic features that would help in further identification.

In summary, cultural plant materials from this small assemblage include a one-seed juniper berry and corn cob fragments, either of which could derive from prehistoric or historic components of LA 83118.

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APPENDIX 2. TEST EXCAVATIONS IN BORROW PIT A

In June 1991, the Office of Archaeological Studies accomplished pedestrian surveys of two material borrow pits associated with proposed upgrade and realignment of U.S. 285 north of Chamita, New Mexico.

Borrow Pit A is situated in a series of low, undulating sand dunes on the west side of the Río Chama, immediately east of U.S. 84 within the village of Hernandez. Pit A is rectangular in shape, measuring 1,150 ft (east-west) by 250-300 ft (north-south) and covers 2.84 ha (7.01 acres). Vegetation consists of scattered junipers with a light understory of rabbitbrush, snakeweed, Indian ricegrass, and various species of *Opuntia.* Much of the surface of the pit has been disturbed by vehicle traffic and earth-moving activities.

Borrow Pit B is situated on the east floodplain of the Río Ojo Caliente, approximately 4 miles north of the village of Chamita. The proposed pit is rectangular in shape, measuring 1,316 ft (north-south) by 900-1,200 ft (east-west), and covers 12.43 ha (30.71 acres). Most of the area is covered by dense stands of riparian vegetation, dominated by willow, tamarisk, and cottonwood, with an understory of rabbitbrush, several varieties of grasses, and various species of *Opuntia.* The entire area of Pit B has been subjected to heavy alluviation from the Río Ojo Caliente in recent decades.

The surveys were conducted by John Ware and Lynne Drake of the Office of Archaeological Studies. Surveyors walked abreast following a series of parallel linear transects until the entire pit areas were inspected. Spacing between crew members varied between 15 and 20 m, depending on terrain and vegetation cover. A small lithic scatter of unknown age and cultural affiliation was recorded near the northern edge of Borrow Pit A; no evidence of cultural resources was noted in Borrow Pit B. The lithic scatter, designated LA 86214, was subjected to limited test excavation on June 17, 1991, to determine the extent and integrity of subsurface cultural remains. The results of test excavations are summarized below.

LA 86214

LA 86214 is a diffuse lithic scatter located in a series of low sand dunes on the west side of the Río Chama. The scatter occupies an area roughly 7.5 m north-south by 5 m (east-west, and on first inspection contained a very diffuse distribution of artifacts that included four flakes, a single core, and a small bone fragment. No cultural features were noted on the surface, and there was no evidence of charcoal or other cultural staining. Vegetation on the site is sparse and consists primarily of rabbitbrush, snakeweed, and scattered clumps of Indian ricegrass and cholla; a few stunted junipers are present on adjacent sandy slopes. The surface around the site has been disturbed by vehicle traffic, and the area appears to be heavily overgrazed. Approximately 6 m north of LA 86214 is the southern edge of a large excavation; a material borrow pit excavated during the construction of U.S. 84.

Test excavations were conducted at LA 86214 on June 17, 1991, under the supervision of Lynne Drake of the Office of Archaeological Studies. Two contiguous 1-by-1-m test pits were excavated in the northern half of the surface concentration, in the area of highest surface artifact density (Fig. 24). Both tests were excavated to depths of 25 cm below present ground surface.

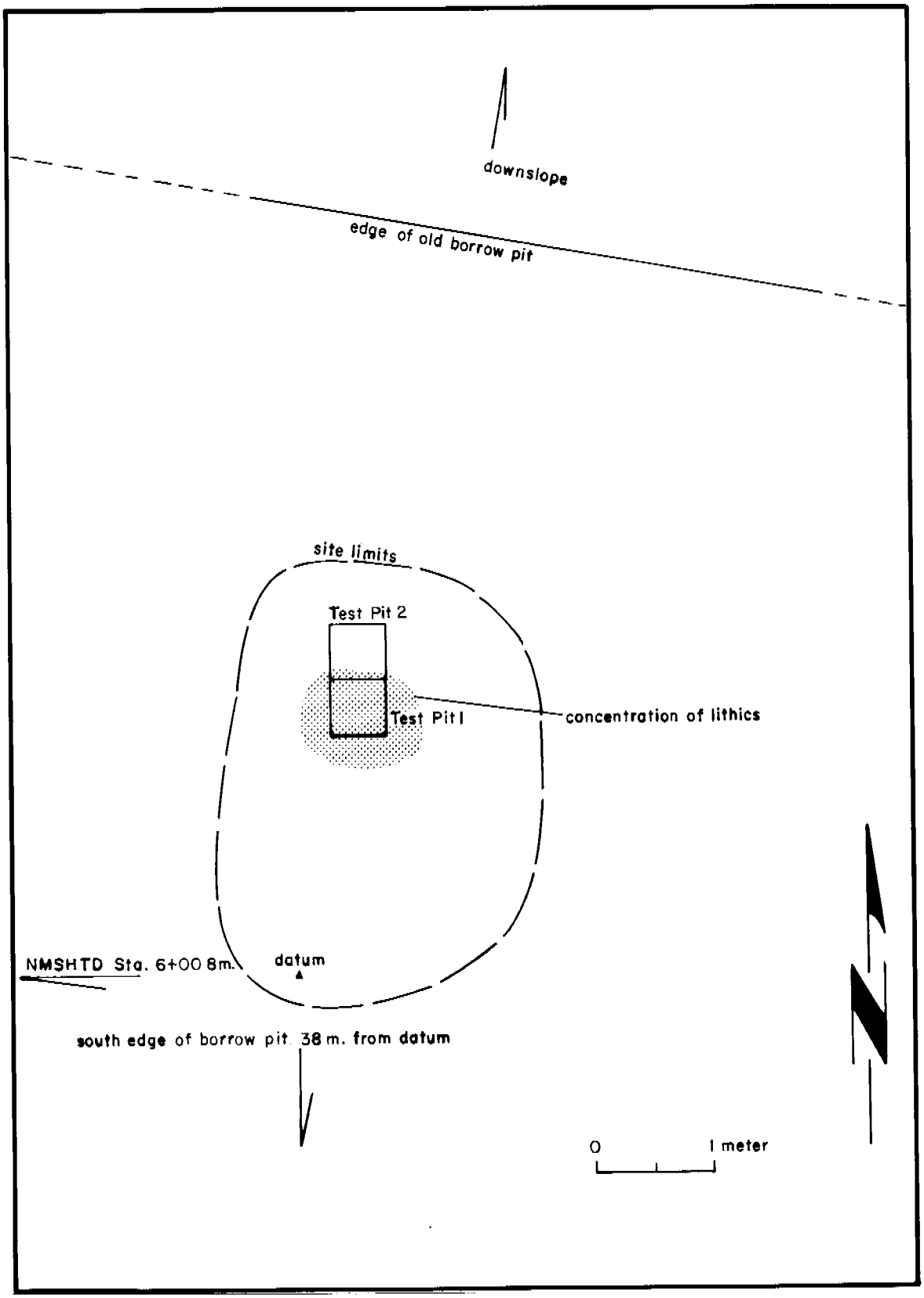

Figure 24. Site map of LA 86214, Borrow Pit A.

Summary of Excavation Results

The fill of both test pits consisted of fine-grained, well-sorted, tan eolian sand. The sand was massive and homogeneous, with no visible stratigraphy. Both test pits were excavated by hand in two metric levels; from surface to 15 cm (Level 1), and from 15 to 25 cm below present ground surface (Level 2). Fill from each level was screened through ¼-inch wire mesh. Subsurface artifacts consisted primarily of secondary and tertiary obsidian flakes. There was no evidence of cultural staining in either test pit.

Test Pit 1

Location:	N4.0/E1.4
Depth:	25 cm below present ground surface
Fill:	tan eolian sand; no cultural staining present
Features:	none
Artifacts:	7 flakes from surface; 12 flakes from Level 1; 1 flake from Level 2

Test Pit 2

Location:	N5.0/E1.4
Depth:	25 cm below present ground surface
Fill:	tan eolian sand; no cultural staining present
Features:	none
Artifacts:	1 flake from Level 1; 3 flakes from Level 2

Artifact Analysis

A total of 24 lithic artifacts was recovered during test excavations at LA 86214. The assemblage consists entirely of debitage; no formal lithic tools were recovered and no evidence of ceramics was noted either on the surface or during subsurface excavations. Attributes of the debitage assemblage are presented in Table 18, and general patterns are summarized below.

The most common lithic raw material at LA 86214 is Jemez obsidian, comprising 88 percent of the total debitage assemblage. In addition, two flakes and a single piece of angular debris of white chert were recovered at the site. No other raw materials were observed at the site or recovered in the test excavations. The ratio of flakes to angular debris (3.4:1) and the high frequency of small interior flakes in the assemblage suggests a lithic reduction strategy that was focused on the final stages of core reduction and artifact manufacture or rejuvenation. The presence of at least two biface reduction flakes in the small assemblage is consistent with this pattern.

Despite indications from the debitage assemblage for biface reduction and formal tool manufacture, no formal lithic tools were recovered at the site, only one flake showed evidence of marginal use-wear, and there were no retouched flakes in the assemblage. The apparent absence of cultural stratigraphy and cultural features at the site combined with the small numbers of artifacts and the lack of raw material and morphological variability in the lithic assemblage are all consistent with a short-lived, activity-specific occupation.

Table 18. LA 86214 Lithic Assemblage

Material	Angular Debris	Core Flake	Biface Reduce	Utilized	Total	%
Obsidian	4	15	2	1	21	88
Chert	1	2	0	0	3	12
Total	5	17	2	1	24	100
%	21	71	8	-	100	

Discussion and Recommendations

Test excavations at LA 86214 yielded a small assemblage of lithic debitage. The assemblage does not include temporally diagnostic artifacts, and no chronometric samples were obtained during test excavations. Thus, the age of the deposits is unknown. The absence of pottery and the possiblity of extensive biface reduction at the site is suggestive of a preceramic occupation, but the evidence is far from conclusive. LA 86214 lacks definable cultural stratigraphy and there is no evidence of cultural features at the site. These facts, combined with the small and homogeneous character of the artifact assemblage, suggest that LA 86214 was probably an ephemeral camp site or chipping station. Given the quantity, character, and apparent lack of integrity of cultural remains at LA 86214, they are not likely to yield information beyond what has already been recovered. No additional investigations are recommended.

APPENDIX 3. POLICY ON COLLECTION, DISPLAY AND REPATRIATION OF CULTURALLY SENSITIVE MATERIALS

Office of Cultural Affairs
Museum Division
(Museum of New Mexico)
P.O. Box 2087, 113 Lincoln Ave.
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Rule No. 11 POLICY ON COLLECTION, DISPLAY AND REPATRIATION OF CULTURALLY SENSITIVE MATERIALS Adopted: 01/17/91

I. INTRODUCTION

The policy of the Museum of New Mexico is to collect, care for, and interpret materials in a manner that respects the diversity of human cultures and religions.

Culturally sensitive materials include material culture as well as the broader ethical issues which surround their use, care, and interpretation by the Museum. The Museum's responsibility and obligation are to recognize and respond to ethical concerns.

II. DEFINITIONS;

A. "Culturally sensitive materials" are objects or materials whose treatment or use is a matter of profound concern to living peoples; they may include, but are not limited to:

1. "Human remains and their associated funerary objects" shall mean objects that, as a part of the death rite or ceremony of a culture, are reasonably believed to have been placed with individual human remains either at the time of death or later;

2. "Sacred objects" shall mean specific items which are needed by traditional religious leaders for the practice of an ongoing religion by present-day adherents;

3. Photographs, art works, and other depictions of human remains or religious objects, and sacred or religious events; and

4. Museum records, including notes, books, drawings, and photographic and other images relating to such culturally sensitive materials, objects, and remains.

B. "Concerned party" is a museum-recognized representative of a tribe, community, or an organization linked to culturally sensitive materials by ties of culture, descent, and/or geography. In the case of a federally recognized indian tribe, the representative shall be tribally-authorized.

C. "Repatriation" is the return of culturally sensitive materials to concerned parties. Repatriation is a collaborative process that empowers people and removes the stigma of cultural paternalism which hinders museums in their attempts to interpret people and cultures with respect, dignity, and accuracy. Repatriation is a partnership created through dialogue based upon cooperation and mutual trust between the Museum and the concerned party.

D. The Museum of New Mexico's Committee on Sensitive Materials is the committee, appointed by the Director of the Museum of New Mexico, that shall serve as the Museum of New Mexico's advisory body on issues relating to the care and treatment of sensitive materials.

III. IDENTIFICATION OF CONCERNED PARTIES

A. The Museum shall initiate action to identify potentially concerned parties who may have an interest in culturally sensitive material in the museum's collections.

B. The Museum encourages concerned parties to identify themselves and shall seek out those individuals or groups whom the Museum believes to be concerned parties.

C. The Museum's sensitive materials committee shall review all disputed individual claims of concerned-party status in consultation with the tribe, community, or organization which the individual(s) claims to represent.
The Museum's sensitive materials committee shall assist, when necessary, in designating concerned parties who have an interest in culturally sensitive materials contained in the collections of the Museum of New Mexico.

D. The Museum shall provide an inventory of pertinent culturally sensitive materials to recognized concerned parties.

E. The Museum shall work with concerned parties to determine the appropriate use, care and procedures for culturally sensitive materials which best balance the needs of all parties involved.

IV. IDENTIFICATION AND TREATMENT OF CULTURALLY SENSITIVE MATERIALS

A. Within five years of the date of adoption of this policy, each Museum unit shall survey to the extent possible (in consultation with concerned parties, if appropriate) its collections to determine items or material which may be culturally sensitive materials. The Museum unit shall submit to the Director of the Museum of New Mexico an inventory of all potentially culturally sensitive materials. The inventory shall include to the extent possible the object's name, date and type of accession, catalogue number, and cultural identification. Within six months of submission of its inventory to the Director of the Museum of New Mexico, each Museum unit shall then develop and submit, a plan to establish a dialogue with concerned parties to determine appropriate treatment of culturally sensitive items or materials held by the unit.

B. As part of its treatment plans for culturally sensitive materials, the Museum reserves the right to restrict access to, or use of, those materials to the general public. The Museum staff shall allow identified concerned parties access to culturally sensitive materials.

C. Conservation treatment shall not be performed on identified culturally sensitive materials without consulting concerned parties.

D. The Museum shall not place human remains on exhibition. The Museum may continue to retain culturally sensitive materials. If culturally sensitive materials, other than human remains, are exhibited, then a good-faith effort to obtain the advice and counsel of the proper concerned party shall be made.

E. All human skeletal remains held by the Museum shall be treated as human remains and are de facto sensitive materials. The Museum shall discourage the further collection of human remains; however, it will accept human remains as part of its mandated responsibilities as the State Archaeological Repository. At its own initiation or at the request of a concerned party, the Museum may accept human remains to retrieve them from the private sector and furthermore, may accept human remains with the explicit purpose of returning them to a concerned party.

IV. REPATRIATION OF CULTURALLY SENSITIVE MATERIALS

A. On a case-by-case basis, the Museum shall seek guidance from recognized, concerned parties regarding the identification, proper care, and possible disposition of culturally sensitive materials.

B. Negotiations concerning culturally sensitive materials shall be conducted with professional discretion. Collaboration and openness with concerned parties are the goals of these dialogues, not publicity. If concerned parties desire publicity, then it will be carried out in collaboration with them.

C. The Museum shall have the final responsibility of making a determination of culturally sensitive materials subject to the appeal process as outlined under section VII A.

D. The Museum of New Mexico accepts repatriation as one of several appropriate actions for culturally sensitive materials only if such a course of action results from consultation with designated concerned parties as described in Section III of this policy.

E. The Museum may accept or hold culturally sensitive materials for inclusion in its permanent collections.

F. The Museum may temporarily accept culturally sensitive materials to assist efforts to repatriate them to the proper concerned party.

G. To initiate repatriation of culturally sensitive materials, the Museum of New Mexico's current deaccession policy shall be followed. The curator working with the concerned party shall complete all preparations for deaccession through the Museum Collections Committee and Director before negotiations begin.

H. Repatriation negotiations may also result in, but are not limited to, the retention of objects with no restrictions on use, care, and/or exhibition; the retention of objects with restrictions on use, care and/or exhibition; the lending of objects either permanently or temporarily for use to a community; and the holding in trust of culturally sensitive materials for the concerned party.

MNM: Rule No. 11 Adopted 01/17/91

I. When repatriation of culturally sensitive materials occurs, the Museum reserves the right to retain associated museum records but shall consider each request for such records on an individual basis.

VI. ONGOING RECOVERY OR ACCEPTANCE OF ARCHAEOLOGICAL MATERIALS

A. In providing sponsored archaeological research or repository functions, the Museum shall work with agencies that regulate the inventory, scientific study, collection, curation, and/or disposition of archaeological materials to ensure, to the extent possible under the law, that these mandated functions are provided in a manner that respects the religious and cultural beliefs of concerned parties.

B. When entering into agreements for the acceptance of, or continued care for, archaeological repository collections, the Museum may issue such stipulations as are necessary to ensure that the collection, treatment, and disposition of the collections include adequate consultation with concerned parties and are otherwise consistent with this Policy.

C. In addition to the mandated treatment of research sites and remains and in those actions where treatment is not mandated, defined, or regulated by laws, regulations, or permit stipulations, the Museum shall use the following independent guidelines in recovering or accepting archaeological materials:

1. Prior to undertaking any archaeological studies at sites with an apparent relationship to concerned parties, the Museum shall ensure that proper consultation with the concerned parties has taken place.

2. When so requested by concerned parties, the Museum shall include an observer, chosen by the concerned party, in the crew of an archaeological study.

3. The Museum shall not remove human remains and their associated funerary objects or materials from their original context nor conduct any destructive studies on such remains, objects, and materials, except as part of procedures determined to be appropriate through consultation with concerned parties, if any.

4. The Museum reserves the right to restrict general public viewing of in situ human remains and associated funerary objects or items of a sacred nature and further shall not allow the public to take or prepare images or records of such objects, materials, or items, except as part of procedures determined to be appropriate through consultation with concerned parties. Photographic and other images of human remains shall be created and used for scientific records only.

5. The Museum reserves the absolute right to limit or deny access to archaeological remains being excavated, analyzed, or curated if access to these remains would violate religious practices.

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