Terminal Archaic/Late Prehistoric Cooking Technology in the Lower Pecos:

Excavation of the Lost Midden Site (41VV1991), Seminole Canyon State Park and Historic Site, Val Verde County, Texas

BY TIM ROBERTS AND LUIS ALVARADO

WITH CONTRIBUTIONS BY LESLIE BUSH AND ED HAJIC

TEXAS ANTIQUITIES PERMIT NO. 4862

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TEXAS PARKS & WILDLIFE

Texas Parks and Wildlife Department
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TABLE OF CONTENTS

List of Figures

List of Tables

ABSTRACT

In September 2007, a previously unrecorded burned rock midden site, 41VV1991 (Lost Midden Site), was encountered by a Texas Department of Transportation contractor while conducting a backhoe excavation of a pit for a recreational vehicle dump station under construction at Seminole Canyon State Park and Historic Site, Val Verde County, Texas.

Following this accidental site discovery, the profiles of the backhoe pit were examined, and shovel tests and mechanical auger tests were conducted by the senior author and other Texas Parks and Wildife Department (TPWD) staff across the surrounding area. These investigations revealed that additional portions of the midden site remained intact, much of which was buried within a large natural soil-filled depression, possibly a partially collapsed sinkhole. Preliminary testing also revealed that the site measured approximately 15 by 26 meters, and included at least two burned rock middens. Cultural deposits averaged approximately 40 to 50 centimeters in thickness.

Subsequent mitigation of the site included the excavation of 13 one by one meter test units within the larger of the two burned rock middens, and five test units within the smaller midden. Two smaller 50 by 50 centimeters shovel tests were also excavated along a proposed septic line. These excavations revealed an intact roasting pit within the larger burned rock midden, and produced numerous lithics including 11 diagnostic projectile points and projectile point fragments. Among these artifacts were one Darl dart point, one Ensor dart point, three untyped dart points, two Perdiz arrow points, two Sabinal arrow points, one Scallorn arrow point, and one untyped arrow point. The projectile points and eight radiocarbon assays indicate that the site was utilized between approximately 1,170 and 690 years ago, during the Flecha subperiod of the Late Prehistoric period and perhaps during the very end of the Blue Hills subperiod of the Terminal Archaic.

The macrofloral analysis indicated that sotol and lechuguilla were the likely food sources being roasted in the burned rock middens at 41VV1991, and that a wide variety of plants were utilized as fuel sources. The location of the roasting pit in an area protected from prevailing southerly winds may suggest that roasting events at the site were conducted in the spring to early summer. If so, it is possible that the site served as a 'summer kitchen', or warm weather kitchen, for inhabitants of the nearby Fate Bell Shelter (41VV74) and Fate Bell Annex (41VV73). Based on the lithic assemblage recovered from the Lost Midden site, other activities conducted at the site included the manufacture of both expedient and non-expedient chipped stone tools, seed processing, and the processing of animal hides.

The plant analysis, as well as analysis of mollusks recovered from the Lost Midden site support previous findings that the environment in the Lower Pecos during the time that 41VV1991 was utilized was much the same as it is today.

ACKNOWLEDGMENTS

The excavation of 41VV1991 was accomplished largely with the help of volunteers, including Jack Johnson, archeologist at Amistad National Recreation Area, Val Verde County, Texas, Joseph (Joe) Labadie, recently retired site archeologist at Amistad National Recreation Area, and Elton Prewitt, Shumla School, Comstock, Texas. Numerous other volunteers, as well as park staff at Seminole Canyon State Park and Historic Site, Val Verde County, and members of the TPWD cultural resources program from around the state also contributed to the successful completion of the fieldwork for this project.

Among the interesting and important aspects of the present project was the geological and geomorphological setting of the Lost Midden site, and the macrofloral assemblage recovered from the site. Dr. Michael Collins, Texas Archaeological Research Laboratory (TARL), The University of Texas at Austin, and Elton Prewitt, Research Fellow at TARL and President of the Shumla School Board, Comstock, Texas, provided helpful comments regarding the possible geological/geomorphological setting of the site during the early stages of this investigation. Dr. Edwin (Ed) Hajic, Santa Fe, New Mexico, provided the results of detailed geomorphological and geological analyses, and wrote some of the related sections of the present report. Dr. Leslie Bush, Macrobotanical Analysis, Manchaca, Texas, analyzed the macrofloral specimens from 41VV1991, and wrote the related sections of this report.

Other artifact analyses, and the curation of all materials recovered from 41VV1991, benefited from the expert assistance of several individuals at the TPWD Archeology Laboratory, Austin. Preliminary sorting and cataloging of cultural material recovered from the site was conducted by Marni Francell and Stephen Garrett. The lithic analysis and related write-up was undertaken by Luis Alvarado, as was the Feature 3 discussion in Chapter 7 of this report. Tim Roberts, the Principal Investigator for this project, analyzed the materials recovered during the preliminary testing at the Lost Midden site, and the faunal material recovered during the test unit excavations at the site.

Contractor Mark Willis, Austin, conducted low altitude kite and blimp aerial photography of the site, providing the resulting imagery for this report and producing a related poster for use in public outreach for this project. Several people contributed to the mapping of the Lost Midden site, including TPWD personnel Rich Mahoney, Logan McNatt, and Kent Hicks, and former TPWD employee Todd McMakin. Margaret Howard, also with TPWD, reviewed a draft copy of this report and provided helpful comments and advice, as did Luis Alvarado. Avram Dumitrescu, with the Center for Big Bend Studies, Sul Ross State University, Alpine, Texas, drafted several of the figures in this report.

A sincere thank you is extended to all of these individuals and any others that may have inadvertently been omitted for all of their work in completing this project and help in shedding light on the lives of the former inhabitants of the Lost Midden site.

CHAPTER 1: INTRODUCTION

1.1 Project Background

In September 2007, a previously unrecorded archeological site, 41VV1991 (Lost Midden Site), was encountered by a Texas Department of Transportation (TxDOT) contractor while conducting a backhoe excavation of a pit for a recreational vehicle (RV) dump station under construction at Seminole Canyon State Park and Historic Site, Val Verde County, Texas (Figures 1.1-1.4). At the time of discovery, this site was believed to consist of at least one burned rock midden, one possible hearth feature, and associated artifacts.

The area in which the RV dump station was being constructed has been subjected to at least three archeological examinations prior to the accidental site discovery, including an investigation by then Texas Parks and Wildlife Department (TPWD) archeologist Ron Ralph prior to the 1979 construction of the nearby Visitor's Center and related infrastructure in the area, a 100 percent pedestrian survey of the state property by the Texas Archeological Survey, The University of Texas at Austin, in 1980 (Turpin 1982), and a walkover of the present project area in 2007 by Tim Roberts, the Texas Parks and Wildlife Department's Cultural Resources Coordinator for the region. These investigations revealed no archeological resources within or adjacent to the area of the proposed RV dump station. A fourth archeological investigation of the Seminole Canyon State Park and Historic Site property, prior to its acquisition by the TPWD, was also conducted by then TPWD archeologist George Kegley in the mid-1970s (Carelock et al. 1976:18-19); but, the extent to which Kegley's investigation specifically included the present project area is uncertain. Kegley's investigation, however, did indicate that no evidence of archeological resources had been identified on the upland landform that includes the location of site 41VV1991 (Carelock et al. 1976:18-19).

At the time of the 2007 archeological reconnaissance, the surface of the proposed project area had the appearance of having been previously impacted; the area appeared unusually level, with occasional small berms of gravel and little or no vegetation. It was believed that the disturbed appearance of this location was related to one or more of several previous impacts in the general area, including the placement of a nearby septic field, sewer line, fiber optic line, park road, and parking area. It was also subsequently discovered that the present project area had been previously bladed so that it could be used to accommodate overflow parking during the dedication of Bill Worrell's shaman-like sculpture 'Maker of Peace', erected at the park in 1994. During this time, no archeological resources were noted in the area. Because of the upland setting of the project area, the shallow nature of most archeological sites in such settings, the previous disturbance in the area, and the apparent absence of archeological deposits on the surface of the proposed project area, cultural resource approval was given for the construction of the proposed RV dump station to proceed.

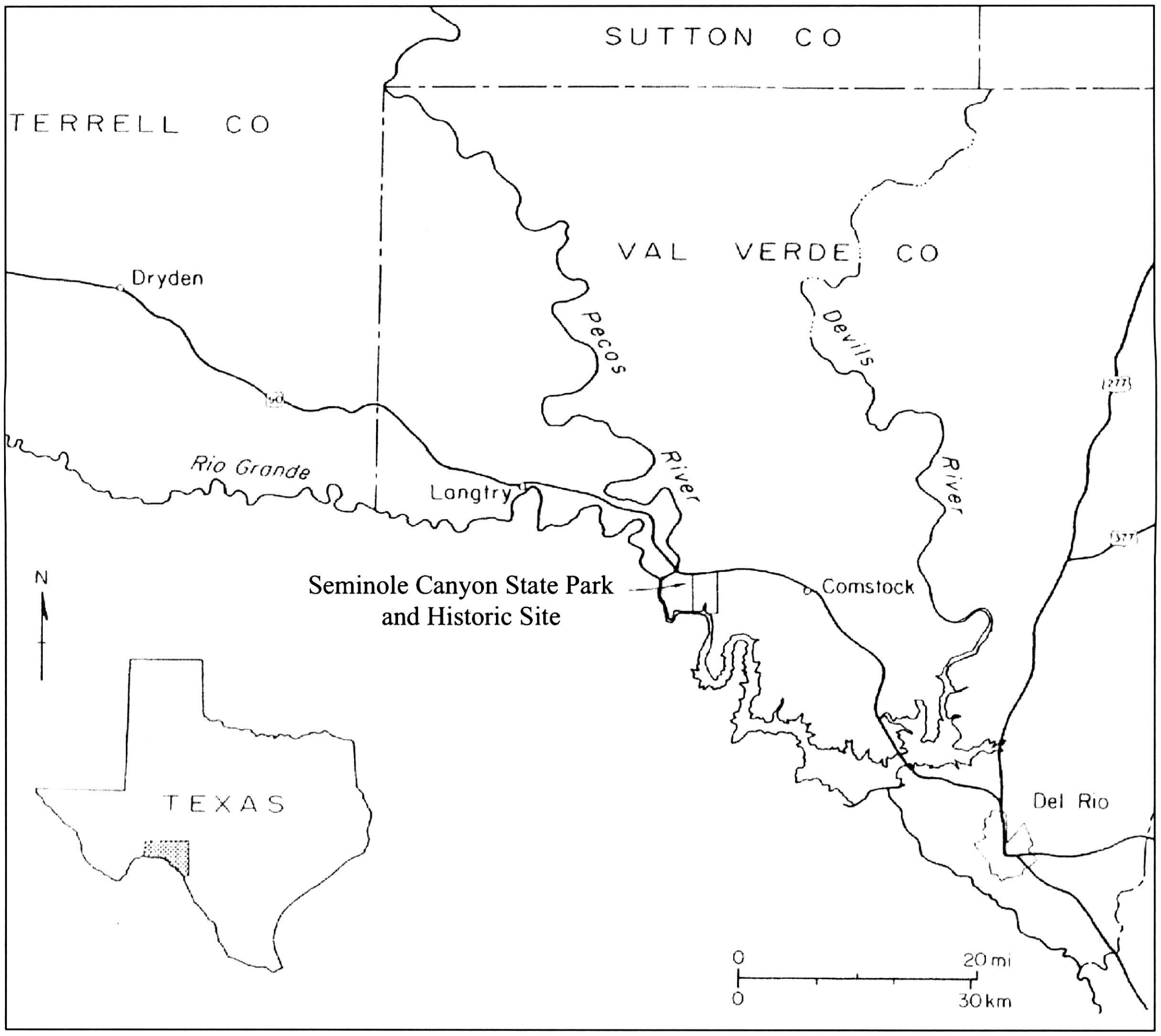

Figure 1.1. Location of Seminole Canyon State Park and Historic Site (Base map source: Turpin 1985:Figure 1).

Figure 1.2. Aerial view that includes the location of 41VV1991 prior to the present impact (noted with arrow). Looking west.

Figure 1.3. Backhoe excavation at previously unknown site 41VV1991, looking northwest.

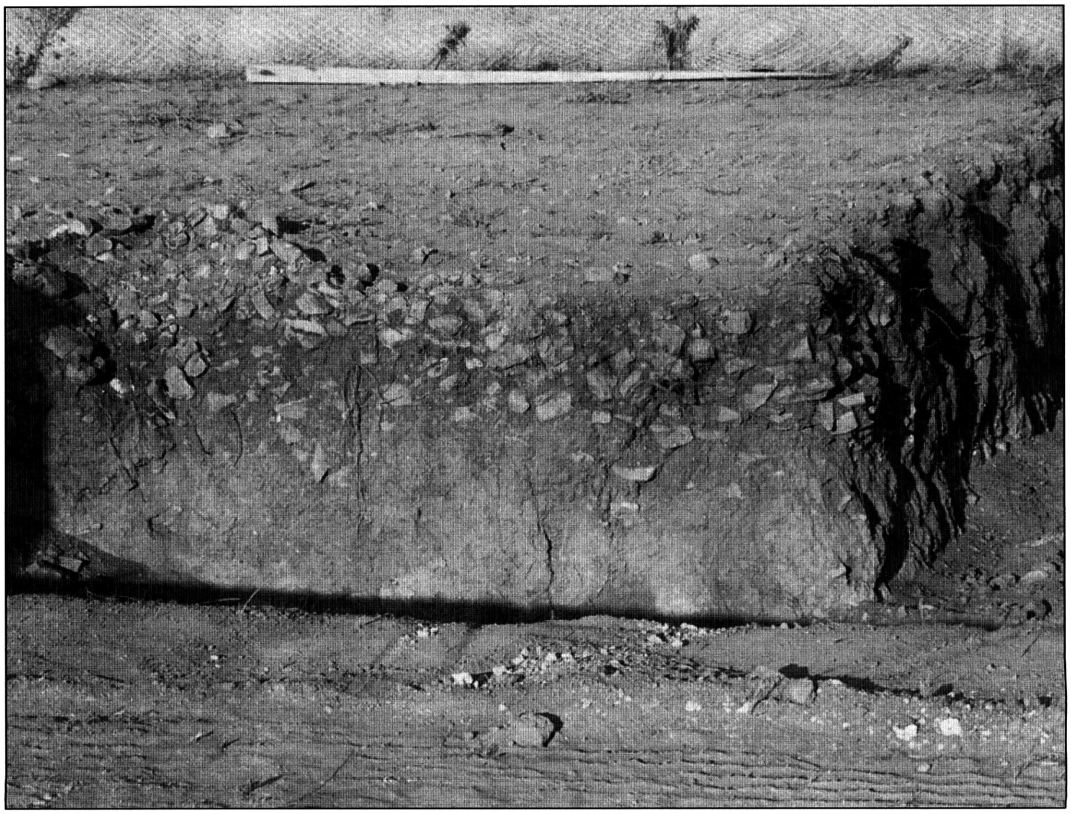

Figure 1.4. Concentration of burned rock in southwest wall of backhoe excavation at 41VV1991, looking west. Overburden in this area was removed by TxDOT contractor.

Despite the history of negative cultural resource investigations within the proposed project area, in September 2007, while excavating the pit for the proposed dump station, the TxDOT contractor encountered a burned rock midden and what was thought at the time to be a hearth feature at the previously unknown Lost Midden site (41VV1991; Figures 1.3-1.4). Evidence of the midden and possible hearth (later found to be a cluster of burned rock associated with the midden) were recognized by park staff in the walls of the excavation the following day, and work on the construction project was stopped. An initial examination by park staff of the portion of the site exposed by the backhoe excavation revealed extensive burned rock, occasional chipped stone artifacts, and flecks of charcoal in the walls of the excavation. Additional cultural material was evident in the backdirt from the excavation. The profiles of the open backhoe excavation indicated that approximately 25 centimeters (10 inches) of soil had been covering the site, prior to removal of the overburden by the TxDOT contractor, and that the backhoe had excavated through the 40-50 centimeter (16-20 inches) thick archeological deposit into underlying sterile soil and into occasional pockets of what appeared at the time to be caliche or weathered limestone.

On September 25, 2007, the senior author traveled to the site and conducted a series of shovel tests (n=9) at five meter (16.4 feet) intervals in cardinal directions from the open backhoe pit to try to determine the size of the site. Based on the presence of cultural material (burned rock) in only one of the shovel test excavations east of the backhoe excavation, the site appeared at that time to be approximately 22 meters (73 feet) north-south by 16 meters (53 feet) east-west, encompassing about 0.04 hectar (0.09 acre). Using these figures, approximately 256.2 square feet of the estimated 3,869 square feet site (6.6 percent) appeared to have been impacted by the backhoe excavation. In addition, it also appeared that any potential interior pit features were likely to have been located within this area of impact.

On September 26, 2007, Jack Johnson, then with Seminole Canyon State Park and Historic Site, prepared profile plans of the walls of the backhoe excavation, and on October 6, 2007, 14 volunteers, including archeologists Joe Labadie, Amistad National Recreation Area, Elton Prewitt, Shumla School, and Jack Johnson, screened over 50 percent of the backdirt from the backhoe excavation. Among the artifacts recovered were scrapers, utilized flakes, and chipped stone debitage and debris. Fragments of Tampico pearlymussel (*Cyrtonaias tampicoensis*) shells and the shells of two species of terrestrial snails, including *Rabdotus dealbatus* and *Polygyra texasiana*, were also recovered (Table 4.1). But, the overall artifact density was sparse. Also during this time, other possible burned rock was observed on the ground surface west of the present project area, suggesting that the site area was perhaps larger than originally estimated, despite the results of the previous shovel testing.

Between November 4 and 5, 2007, the senior author, park staff, and other volunteers, excavated a series of 29 mechanical auger tests across the newly discovered archeological site area and beyond. Thirteen of the auger tests produced positive results, revealing additional chipped stone debitage and debris, as well as burned rock. These tests also resulted in the identification of an additional burned rock midden west of the original midden and possible hearth feature (Figure 1.5). As a result, the boundaries of the site were expanded. The site had a revised maximum north-south dimension of approximately 15 meters (50 feet) by a maximum east-west dimension of about 26 meters (85 feet), encompassing an area of 0.04 hectare (0.10 acre). Based on the revised site dimensions, the percentage of the total site impacted by the backhoe excavation was determined to be approximately 6.0 percent, down slightly from the original 6.6 percent estimate.

At this early stage of the project, no diagnostic projectile points had yet been recovered from 41VV1991; however, end scrapers, which had been recovered, were/are known to be one of four diagnostic artifact classes that typify Late Prehistoric Flecha subperiod (1320 – 450 B.P.) and Infierno phase or interval (450 – 250 B.P.) sites in the region. Flecha and Infierno sites, but especially Infierno sites, tend to be found in upland settings such as the one upon which the present site is situated. When encountered, these sites generally produce a paucity of cultural material, most of which is recovered from within cultural features. Areas between features are often nearly void of artifacts.

1.2 Scope and Purpose of 41VV1991 Site Mitigation

Burned rock midden sites are not uncommon in the Lower Pecos or surrounding regions (see Black et al. 1997:91; Dering 2002:6.3), but these sites, unlike 41VV1991, are often found exposed on the surface of stable upland landforms and the materials recovered from these sites is very difficult to temporally separate (Dering 2002:6.4). Furthermore, burned rock midden sites that date to the Late Prehistoric period or include a Late Prehistoric component

Figure 1.5. The second burned rock midden at 41VV1991, designated as Feature 2, after being exposed. Looking west.

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are relatively rare in the Lower Pecos in comparison to those dating to the previous Middle or Late Archaic periods (cf. Dering 2002:5.8). Because of the buried context of the present burned rock midden site, and the preliminary assessment that the site contained Late Prehistoric deposits, the Lost Midden site was considered to have the potential to contribute important information about the Late Prehistoric Tradition in the Lower Pecos.

Given the apparent research potential of 41VV1991, and that damage to the site was done and that the site would be further impacted by the additional work that would be necessary for the completion of the RV dump station, the Texas Parks and Wildlife Department, in coordination with the Texas Historical Commission, pursued mitigation of the site. As will be discussed in later sections of this report, this site mitigation included extensive excavation, geomorphological and paleobotanical studies, and other analyses. The fieldwork for the mitigation of 41VV1991 was conducted by TPWD staff and a number of volunteers during March, May and November of 2008, under Texas Antiquities Permit No. 4862.

The focus of the excavation of 41VV1991 was the recovery of data that were sufficient to address six critical research questions about burned rock middens posed by Black, et al. (1997) in their burned rock midden study *Hot Rock Cooking on the Greater Edwards Plateau: Four Burned Rock Midden Sites in West Central* Texas. These questions, as they pertain to the Lost Midden site, are:

1) When did the burned rock middens at this site accumulate?
2) How did these middens form?
3) What foods were processed and cooked in these middens?
4) How did the middens function within the context of the site?
5) How can we explain the midden to midden variation that appears to exist between the two middens at the present site?
6) Why did these middens form where they did on the landscape?

CHAPTER 2: ENVIRONMENTAL OVERVIEW

2.1 Physiography

The Lost Midden Site is located within the 2,173-acre (880 hectares) Seminole Canyon State Park and Historic Site, in southern Val Verde County, Texas. Situated in the northeastern Chihuahuan Desert, the landscape in this part of Val Verde County is characterized by narrow drainageways that have eroded and deeply dissected the uplifted and inclined limestone bedrock in the region, creating steep canyon walls in many places (Cliff et al. 2003:3; Figure 2.1). Fittingly, the term Lower Pecos Canyonlands has been applied to this area (Black 1989:7). The state property is bisected by two primary canyons—Seminole and Presa Canyons—and is bounded on the south by the Rio Grande (now part of Lake Amistad in this area). Site 41VV1991 is situated on what today is a relatively level upland summit near the western wall of Seminole Canyon, at an elevation of about 1,384 to 1,385 feet (422 meters; Figure 2.2).

2.2 Climate

The modern climate of Val Verde County can be characterized as a semiarid, continental climate with dry winters and hot summers (Golden et al. 1982:2). The prevailing winds in the area are southeasterly from April through October, and northeasterly from November through March. Cold periods in winter have strong, dry, dusty northerly to northeasterly winds. Winters, however, are generally mild; the average winter temperature in Val Verde County is 53 degrees Fahrenheit. The average daily maximum summer temperature is 98 degrees Fahrenheit.

The average annual rainfall at Del Rio, approximately 43 miles (69.19 kilometers) southeast of the present project area, is 18.38 inches (46.69 centimeters); about two-thirds of this rainfall occurs between April and October (Golden et al. 1982:2; Bowmar 1983; Labus 1989:14). Annual rainfall amounts diminish as one moves westward across Val Verde County (Boyd and Dering 2003:1; Kochel and Baker 1982).

2.3 Geology and Geomorphology

The geology of Val Verde County includes sedimentary rocks from three different geological systems—the Cretaceous, the Tertiary, and the Quaternary (Golden, et al. 1982:83, 85-86). Within Seminole Canyon State Park and Historic Site, only Cretaceous materials are represented. Materials of Cretaceous age date from 75 to 135 million years ago, and were deposited in a marine environment. Within the park, Cretaceous materials include the Salmon Peak limestone, formerly known as the Georgetown Formation (Turpin 1982:5; Labus 1989:6), which characterizes the canyons on the property.

Figure 2.1. Seminole Canyon, looking upstream from Fate Bell Shelter (41VV74).

Figure 2.2. Location of 41VV1991 on upland landform west of Seminole Canyon. Looking west-southwest.

This material consists of granular, cross-bedded limestone and mudstone with large chert masses (UTA, BEG 1977). These chert masses produce a chert type commonly identified as 'Edwards chert', the name widely given to the somewhat variable gray, fine-grained, cherts that occur across much of the Edwards Plateau and into the southeastern Trans-Pecos. This chert would have been readily available to prehistoric inhabitants in the Seminole Canyon area via five known prehistoric quarry sites within the boundaries of the state property and other quarries documented outside the park. Other chert sources in the area would have included Quaternary Pleistocene fluviatile gravel deposits in the uplands, and the gravel bars that would have been found in the Rio Grande prior to the impoundment of Amistad Reservoir in 1969.

The Lost Midden site itself is situated almost entirely within a large sediment-filled basin of carbonate bedrock. The bedrock floor of the basin, located approximately 1.2 meters (3.9 feet) below the present ground surface, is nearly level, while the sides of the basin are more irregular and marked by occasional calcium carbonate 'bubbles' (Figures 1.3, 2.3). Subsequent testing of these bubbles, which are a meter or so in diameter and rise up to about 0.5 meter, showed them to be small algal mounds (Ed Hajic, personal communication October 22, 2009). These algal mounds were formed by calcareous *Halimeda* macroalgae when the area was covered by water, during the Cretaceous period. This indicates that the basin formation, within which the Lost Midden site is situated, has considerable age to it. The process by which the basin formed remains uncertain, but it may represent a partially collapsed sinkhole. Sinkholes are not uncommon in the region. Seminole Sink, a vertical shaft solution cavity, is located on the east side of Seminole Canyon, within the state property. However, Seminole Sink is reported to have opened during a time of severe erosion only about 8,000 years ago (Byrd 1988), much more recently than the present feature. The present basin could also represent a *tinaja*, but it lacks the characteristic form and smoothed surfaces of most features of this type in the area.

More recent Holocene or Pleistocene materials within Seminole Canyon State Park and Historic Site consist of sand, silt, clay, and gravel deposited on fluviatile terraces and floodplains (UTA, BEG 1977, 1981). The general soils association in the area of the park has been mapped as Langtry-Rock outcrop-Zorra soils. Langtry soils consist of cobbly, stony, and very stony loamy soils on tops and sides of ridges on uplands. These well-drained soils formed in material weathered from massive limestone bedrock (Golden et al. 1982:72).

The Zorra soil series consists of very stony and stony loamy soils on uplands. These soils are well drained, and are underlain by a thin layer of caliche above limestone bedrock (Golden, et al. 1982:81). Both Langtry and Zorra soils are described as very shallow to shallow in depth, and range in slope from one to 40 percent (Golden et al. 1982:72).

Rock outcrop refers to the aforementioned Cretaceous limestone exposures located mainly on hilly to very steep sides of canyons in the area. This thick-bedded limestone provided the canvas for the rock imagery found on the state property. The light gray to light olive gray limestone weathers to medium gray on exposed surfaces (Freeman 1968). An exposure of this weathered gray limestone is evident just east of 41VV1991, and shows some similarity with the burned limestone on the site.

Figure 2.3. Profile view of algal mounds within original backhoe excavation at the Lost Midden site.

The nature of the soils specific to the Lost Midden site excavations is discussed in Chapter 7 of this report.

2.4 Water Resources

Water was in relative abundance in the Lower Pecos region of the Chihuahuan Desert throughout prehistory, and undoubtedly played a major role in the habitation of the area. Three major rivers, including the Rio Grande, Pecos, and Devils Rivers, flow through the region. As previously noted, the Rio Grande forms the southern boundary of Seminole Canyon State Park and Historic Site, and is located approximately 2.7 miles (4.3 kilometers) south of 41VV1991. The Pecos River is situated about 2.5 miles (4.0 kilometers) west of the site. Closer to the Lost Midden site, water from Seminole Watering Hole, a permanent spring, would have been available about 1,214 feet (370 meters) northeast of the site. Water-holding *tinajas*, or natural depressions, in the bottom of Seminole Canyon or perhaps even in some upland areas could have provided temporary sources of water following rains.

2.5 Flora and Fauna

The Lower Pecos region is situated at the junction of the Tamaulipan, Balconian, and Chihuahuan Biotic Provinces (Blair 1950). As a result, the mesquite-blackbrush acacia, shortgrass savannah that is typical of southern Texas is also found across the eastern part of the Lower Pecos (Blair 1950; Hatch, et al. 1990; Boyd 2003:11), while the juniper-oak and shortgrass savannah in the northern part of the Trans-Pecos reflects its proximity to the Edwards Plateau (Amos and Gehlbach 1988; Hatch, et al. 1990). Xeric vegetation common to the Chihuahuan Desert, especially sotol-lechuguilla-creosote brush, is found in the lower canyonlands of the Devils River, Pecos River, and the Rio Grande (Boyd 2003:11; Brown 1982).

Many of the plant species that are present in the Lower Pecos today, including yucca (*Yucca* spp.), sotol (*Dasylirion texanum*), lechuguilla (*Agave lechuguilla*), prickly pear (*Opuntia* spp.), and beargrass (*Nolina texana*), were used by prehistoric inhabitants as sources of food and medicine, for ceremonial purposes, and for the manufacture of utilitarian items (cf. Brown 1991; Sobolik 1991).

Other plants that are common in the region today include several species of acacia (*Acacia* spp.), whitebrush (*Aloysia grattisima*), creosote (*Larrea tridentate*), ceniza (*Leucophyllum frutescens*), blue sage (*Salvia ballotiflora*), leatherstem (*Jatropha dioica*), coyotillo (*Karwinskia humboldtiana*), tasajillo (*Opuntia* spp.), wild oregano (*Lippia graveolens*), guayacan (*Porlieria angustifolia*), mesquite (*Prosopis glandulosa*), lotebush (*Ziziphus obtusifolia*), various buckthorns (*Condalia* spp.), spiny hackberry (*Celtis pallida*), Texas persimmon (*Diospyros texana*), little leaf walnut (*Juglans microcarpa*), Texas mountain laurel (*Sophora secundiflora*), Gregg ash (*Fraxinus greggii*), Mexican buckeye (*Ungnadia speciosa*), various oaks (*Quercus* spp.), Texas mulberry (*Morus microphylla*), tanglehead grass (*Heteropogon contortus*), and common reed (*Phragmites communis*) (Boyd and Dering 2003; Dering 2003:11-12).

These plant species represent only a small sample of the 395 species in 74 families that were recently identified within Seminole Canyon State Park and Historic Site during a baseline vegetation inventory of the property (Hedges and Poole 2002:3).

The fauna of the Lower Pecos include a variety of animals from subtropical and temperate climates. At least 60 species of mammalian invertebrates have been documented in the Amistad National Recreation Area, including ringtails (*Bassariscus astutus*), collared peccary or javelina (*Tayassu tajacu*), black-tailed jackrabbits (*Lepus californicus*) and desert cottontails (*Sylvilagus audubonii*), raccoons (*Procyon lotor*), whitetail deer (*Odocoileus virginianus*), and porcupines (*Erethizon dorsatum*); mountain lions (*Felis concolor*) and black bears (*Ursus americanus*) are occasional visitors to the area (Davis and Schmidly 1994; Ditton and Schmidly 1977). In addition, fifty-two species of amphibians and reptiles have been recorded in the area (Raun 1966). As evidenced within the archeological deposits and rock imagery of the Lower Pecos, prehistoric inhabitants of the region utilized many of these same species. However, small game, birds, rodents, snakes, lizards, fish, and mussels appear to have been most prevalent in the diets of Native Americans in the area (cf. Alexander 1970:77-82; Saunders 1986).

As will be further discussed in subsequent sections of this report, two species of land snails—*Rabdotus dealbatus* and *Polygyra texasiana*—were recovered from the Lost Midden site.

While there are ethnographic accounts in Texas of Native Americans consuming snails (Clark 1969:43, 1976; Hester and Hill 1975), there is no indication that the inhabitants of 41VV1991 were doing so. Irregular-shaped holes were evident in many of the *Rabdotus dealbatus* shells, including very small specimens. There is no evidence that these holes were created by the human occupants of 41VV1991. Instead, these holes may have been caused by carnivorous *Euglandina rosea* snails (Joseph Labadie, personal communication November 11, 2008); however, no specimens of *Euglandina rosea* were recovered from the site to confirm the presence of this species. In addition to snail shells, Tampico pearlymussel (*Cyrtonaias tampicoensis*) shells and shell fragments were also recovered from the Lost Midden site, and may have been consumed or otherwise utilized by inhabitants of the site.

Of notable exception to the apparent prevalence of small game in the diet of prehistoric inhabitants of the Lower Pecos was the utilization of a now extinct form of bison (*Bison antiquus* or *Bison occidentalis*) by Paleoindian inhabitants of Bonfire Shelter, a bison-kill and butchering site located near Langtry, Texas (Anderson 1974; Dibble 1965, 1970; Dibble and Lorrain 1968). Bison bones of this species have also been recovered from the Paleoindian deposits of Cueva Quebrada and Arenosa Shelter (Collins 1994:26-28; Dering 2002:3.5; Dibble 1967; Lundelius 1984:456-481), both of which are deeply stratified habitation sites located in Val Verde County. There is also evidence that the subsequent Early Archaic inhabitants of Bonfire Shelter utilized modern bison (*Bison bison*; Black 2004). Nonetheless, bison were probably available to inhabitants of the Lower Pecos only on a limited basis, as no other bison-kill sites have yet been recorded in the region.

2.6 Paleoenvironment

Geomorphological, pollen, and macrobotanical studies provide evidence about the paleoenvironment of the Lower Pecos and the nearby Chihuahuan Desert. This evidence suggests that beginning at least as early as 33,500 B.P. and continuing to perhaps 11,500 years ago, the environment across what is now west Texas, including the present project area, was cooler and wetter than today, and woodland species flourished at much lower elevations than at present (Bryant and Holloway 1985:41, 44; Van Devender and Spaulding 1979). Packrat midden research has indicated that as recently as 11,470 years ago, xeric woodlands with pinyon pine (*Pinus cembroides*, var. *remota*), juniper (*Juniperus* sp.), and Hinckley oak (*Quercus hinckleyi*) were located as low as 600 meters elevation (1,968 feet AMSL) in Maravillas Canyon, within present-day Big Bend National Park in southern Brewster County (Van Devender et al. 1978:289). This represents a "pluvial" lowering of the pinyon-juniper-oak woodland zone by 800 meters (2,625 feet) from its present-day elevation (Wells 1966:970). These late Pleistocene woodlands, or at least portions of them, occurred in association with lechuguilla (*Agave lechuguilla*) and althorn (*Koeberlinia spinosa*) (Van Devender 1986:99). Below the wooded elevations, grassland savannah communities appear to have been present in the Big Bend during this time. It has been suggested that similar cool, moist grassland, largely treeless, may have extended from the High Plains to the Lower Pecos beginning at least as early as 30,000 years ago (Shafer and Zintgraff 1986:40). In the Lower Pecos, between 14,000 and 12,000 years ago, based on the occurrence of grazer and non-grazer animal species among the archeological deposits at Cueva Quebrada (41VV162A), as well as the presence of grass, pine and spruce pollen, it appears that grasslands or savannah continued to cover the uplands at this time, while trees or brushy vegetation dominated the canyons (Bryant 1966; Lundelius 1984).

Beginning after 11,500 years ago and persisting until sometime after 9,870 years ago, a xeric oak-juniper woodland, without pinyon, characterized the Big Bend landscape (Van Devender et al. 1987:332). Following the disappearance of oak and juniper from these woodland areas, silver wolfberry (*Lycium puberulum*) and Chihuahuan crucifixion thorn (*Castela stewarti*) were key plants in these areas, followed by a more xeric desert scrub after 8,560 years ago (Van Devender et al. 1987:332). Based on the presence of lagged carbonate nodules dating to 9,000 years ago (Monger 1993; Monger and Buck 1995), the gradual increase in aridity, as evidenced by these changes in vegetation, appears to have been accompanied during its initial stages by a major erosional event in the region. Within the Lower Pecos, the beginning of this period of gradually increased aridity appears to correspond more or less with Bryant's (1966) Sonora Interval and ending with what he refers to as the Stockton Stage. However, Bryant (1966) identified a brief intervening mesic period—the Medina Stage—beginning about 10,000 years ago. Bryant noted an increase in pine and riparian tree pollen in the Lower Pecos during this mesic period.

By about 8,000 years ago, the Chihuahuan Desert plant communities had reached their northern limits (Van Devender 1977; Van Devender et al. 1978:298). After about 4,330 B.P., except for a brief interval approximately 3,000 to 2,500 years ago (Dering 1999:660; Labadie 1993:9) and perhaps other shorter intervals since about 760 years ago (Cloud 2004:155; Mauldin 1995; Miller 1996), modern environmental conditions (i.e. warm and dry conditions) were firmly established across the Chihuahuan Desert (Van Devender 1990; Van Devender et al. 1987:332). These modern environmental conditions apparently included, and continue to include extended periods of drought. Erosional evidence from Black Cave (41VV76) and the Devil's Mouth site (41VV188) indicates that a widespread drought occurred in the Lower Pecos region, and presumably in surrounding areas, sometime during the Middle Archaic period (Labadie 1993:9; Sorrow 1968:65; Turpin 1982), between about 5,500 and 3,200 years ago. Other researchers place the beginning date of this very dry period in the Lower Pecos at closer to 6,800 years ago (Dering 1999:660). Regardless, this drought, which falls within the climatic periods that Bryant (1966) identified as the Ozona Erosional and Sanderson Stage, respectively, ended by at least 2,500 to 3,000 years ago, when the region experienced a short period of moister, cooler climatic conditions (Dering 1999:660; Labadie 1993:9; Sorrow 1968:65-68). This change in climate, identified by Bryant (1966) as the Frio Interval, was relatively brief, but was of sufficient duration to temporarily allow the advancement of grasslands and the herd animals that they supported into the Lower Pecos. During the Late Archaic period, there appears to have been a gradual return, which was occasionally interrupted, to warmer and more arid conditions (Alexander 1970:6; Bryant 1969). This period, which corresponds to Bryant's (1966) Juno Stage, is marked by an increase in ephedra, cactus, oak, cedar and mesquite pollen in the Lower Pecos. By about 1,400 years ago, including the period of time during which the Lost Midden site was inhabited, the environmental conditions were probably much as they are today across much or all of the Trans-Pecos and Lower Pecos regions (cf. Charles 1994:218).

Numerous shells of *Rabdotus dealbatus* and *Polygyra texasiana* terrestrial snails (Figure 2.4), as well as several Tampico pearlymussel (*Cyrtonaias tampicoensis*) shells or shell fragments (Figure 2.5) have been recovered from the entire deposition sequence at the Lost Midden site. These same species of snails continue to thrive in the area today, and the Tampico pearlymussel is still found in the Rio Grande and Amistad Reservoir. And, there does not appear to be any obvious differences in the sizes of the shells recovered from archeological contexts and living samples. These findings would suggest that the environmental conditions in the area of the Lost Midden site have indeed not changed demonstrably since the earliest occupation(s) of the site during the Late Archaic period. *Rabdotus* snails are found throughout south-central and western Texas today, and inhabit semi-aboreal, grass, and shrub environments (Hubricht 1985). *Polygyra* snails are distributed across all parts of the state today except for the plains and far western Texas, and occur in woodland or prairie settings (Hubricht 1985). The combination of the two snails in the area would suggest that grasses have been the dominant vegetation in the area at least since 41VV1991 was initially occupied and, based on the other previously discussed paleoenvironmental data, for thousands of years prior to human presence in the region.

The Tampico pearlymussel species, which occurs from northeastern Mexico into central Texas today, evolved as a riverine mussel, but has adapted well to historic man-made impoundments. These mussels sometimes occur at substantial depths, but most usually inhabit waters less than 20 feet (6.1 meters) deep. They seek out substrates of sand, mud and fine- to moderate-sized gravel and avoid deep-shifting sands, very soft silts, and hard cobble and bedrock. This suggests that there were no sources for this mussel closer to the Lost Midden site than the Rio Grande or Pecos River, and that the specimens recovered from the site were harvested from one of these sources and transported inland to 41VV1991, a minimum distance of at least 2.5 miles (4.0 kilometers).

Since the return to a modern xeric environment, there have been cycles of cooler, wetter conditions in the region. According to Mauldin (1995) and Miller (1996), brief intervals of more extensive rainfall occurred between 1,560 and 60 years ago, at least in the western Trans-Pecos. Using tree-ring sequences and historic precipitation and temperature records, Mauldin identified these intervals of generally higher precipitation, and greater stability in climate, as occurring between A.D. 500-700, 1000-1300, and 1550-1950 (Mauldin 1995). In the Big Bend, based on analyses of phytoliths recovered from the Arroyo de la Presa site (41PS800) in Presidio County, there appears to have been a brief period of slightly cooler and possibly wetter conditions about 760 B.P. (Cloud 2004:152-155). But, these conditions at the Arroyo de la Presa site were entirely reversed within a period of about 170 years (Cloud 2004:155).

Despite the establishment of modern xeric conditions in the region over 4,000 years ago, the prevalence of some of the desert scrub plants seen today, such as mesquite and creosote, is generally thought to have resulted from the introduction of livestock into the region historically, and the subsequent extensive grazing that occurred. The impact to the land was made worse by long periods of drought. Despite the aforementioned findings by Cloud (2004:152-155), Mauldin (1995), and Miller (1996) of periods of generally higher precipitation in the western Trans-Pecos and the Big Bend between 1550 and 1950, long periods of drought have also been documented historically in these regions and surrounding

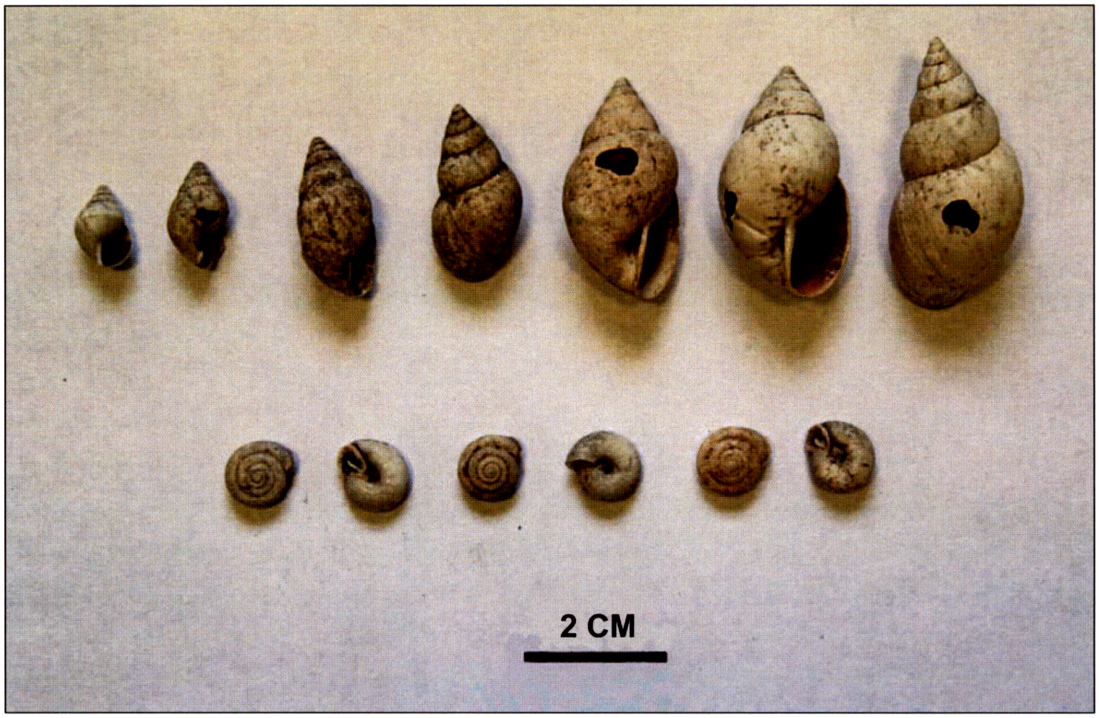

Figure 2.5. Representative sample of *Rabdotus dealbatus* shells (top row) and *Polygyra texasiana* shells recovered from 41VV1991.

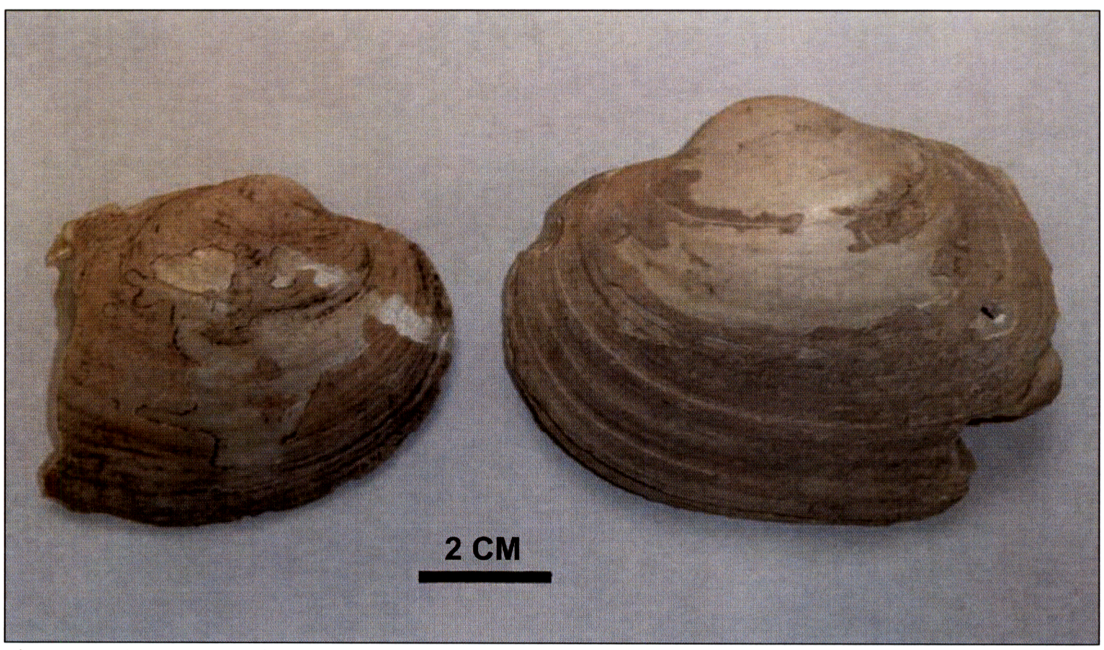

Figure 2.6. Two of the several Tampico pearlymussel (*Cyrtonaias tampicoensis*) shells and shell fragments recovered from 41VV1991.

areas. Such droughts are known to have occurred in northern Mexico between 1640 and 1645, the Lower Pecos in the 1880s (Labadie 1993:2), and in west Texas in the 1890s, 1930s, and 1950s (Collinson 1963:212-213; Dunn 1961; Gardinier 1989:39; Holden 1928; National Climatic Data Center 2011).

CHAPTER 3: CULTURAL OVERVIEW

3.1 Previous Investigations in the Lower Pecos Region

3.1.1 Previous Investigations In and Near Seminole Canyon State Park and Historic Site

By the mid-nineteenth century, the Lower Pecos region had become known as Painted Caves (Young 1853; Emory 1857), and many of the investigations that have been conducted in the region, including those in what is now Seminole Canyon State Park and Historic Site, have focused on the rock imagery in the area. However, the first professional excavations within what is now the state property were conducted by James E. Pearce and A. T. Jackson in 1932. Sponsored by the University of Texas, Pearce and Jackson trenched Fate Bell Shelter (Pearce and Jackson 1933; Thomas 1933). During this time, Jackson also documented the rock imagery within Fate Bell Shelter (41VV74), initiating the first photographic record of pictograph sites on what would become the state property (Jackson 1938).

Following World War II, Herbert C. Taylor introduced to the field of archeology the now common technique of precise gridded excavations with strict vertical control, using site 41VV84 as an example. Taylor attempted to fit his findings and those of others in the Lower Pecos into the same cultural sequence being proposed at the time for the Big Bend region of west Texas. Suhm, Krieger and Jelks (1954) continued Taylor's proposed association between the two regions when they summarized the Lower Pecos cultural sequence as the southeastern area of the Trans-Pecos.

Archeological investigations in the Lower Pecos in the 1950s and 1960s were primarily associated with the salvage operations that were being conducted in advance of the impoundment of the Diablo Reservoir, now known as Amistad Reservoir. The archeological deposits in two sites within Seminole Canyon State Park and Historic Site, Black Cave (41VV76) and Fate Bell Shelter, were tested as part of the Amistad salvage efforts (Parsons 1962, 1965). Despite years of extensive vandalism by relic hunters at Fate Bell Shelter, excavations showed that much of the archeological deposit remained intact, especially at lower depths. Excavations at Black Cave also identified *in situ* cultural deposits, dating to the Middle and Late Archaic periods; however, evidence of Historic Native American occupation, such as that reported by the landowner at the time, was never encountered.

During the 1970s, much of the archeological work that was reported for the park and the Lower Pecos in general was in the form of dissertations (cf. Alexander 1974; Collins 1974; Lord n.d.; Marmaduke 1978; Maslowski 1978; Williams-Dean 1978), masters theses (cf. Chadderdon 1983; Dering 1979), or other papers (cf. Kochel and Baker 1982; Patton and Dibble 1982; Shafer 1975, 1976, 1977, 1980, 1981; Turpin et al. 1979). Of notable importance to the study of archeology and to the regional prehistoric record, however, were excavations undertaken by Texas A & M University at Hinds Cave (Shafer and Bryant 1977; Shafer et al. 1975). This project marked a change in the way that many American archeologists in the 1970s were using environmental data. At the time, many archeologists were utilizing environmental data to explain perceived changes through prehistory, but the Hinds Cave researchers used such data to try to explain stability within the archeological record of that site.

In 1980 and 1981, a three-pronged research effort, led by the University of Texas at Austin, was undertaken at Seminole Canyon State Park and Historic Site. Turpin and others conducted a systematic archeological survey of the property during this time, identifying 38 previously unknown sites and reevaluating 32 previously recorded sites. The site reevaluations included the placement of test units in Fate Bell Shelter and the recovery of datable charcoal samples from the deposits cemented to the rear wall of Black Cave. Also as part of this research effort, a possible burial cairn was dismantled and analyzed, and seven major rock imagery sites on the state property were documented using stereophotogrammetric and conventional photography (Turpin 1982).

Concurrent with the field work by the Texas Archeological Survey, but unrelated to the project, the Texas Department of Public Safety, Division of Highway Design, reconstructed historic site 41VV850, a railroad era baking oven, on the grounds of the park (Patterson 1980; Turpin 1982:23-24). The feature was removed from its original location near U.S. Highway 90 to allow the highway to be widened.

In 1984 and 1985, the Texas Archeological Survey, The University of Texas at Austin, conducted the last major archeological excavation at Seminole Canyon State Park and Historic Site until the present project (Turpin 1985). During the 1980s excavation, the remains of at least 22 individuals were exhumed from Seminole Sink (41VV620), a vertical shaft opening to a subterranean solution cavity. The broken and dispersed skeletal material of 21 Early Archaic individuals was compacted into one stratum, within a talus cone located beneath the shaft opening. Radiocarbon dates indicated that these burials were over 7,000 years old. The burned fragments of a cremated adult male, dropped into Seminole Sink nearly 420 years ago, were found on the crest of the talus cone. Childhood stress, anemia and minor trauma were detected among the early skeletal remains, but the major pathologies were high caries rates and early tooth loss with concomitant transference of stress attributable to a high carbohydrate diet based largely on fibrous desert succulents.

Since the 1980s, several cultural resource investigations have been conducted elsewhere in the Lower Pecos and adjacent Edwards Plateau regions that have direct relevance to the present project. In 1997, the Texas Archeological Research Laboratory and the Texas Department of Transportation, Austin, published the findings from archeological excavations of four burned rock midden sites in the Edwards Plateau region of west central Texas (Black, et al. 1997). These burned rock middens all dated to the Late Prehistoric period (A.D. 800 – A.D. 1700), which overlaps with the period of occupation for the present Lost Midden site. Of special importance to the present project are the guidelines provided by Black, et al. (1997:308-310) for evaluating the research potential of burned rock midden sites, and the research questions that should be addressed with the data gathered from such sites.

Burned rock middens are cumulative features comprised of burned rocks and dark organic soils resulting from construction, firing, maintenance, and expansion of earth ovens over periods of time. Over the years, a variety of terms have been applied by archeologists to earth ovens and the debris associated with these feature—roasting pits, baking pits, sotol pits, mescal pits, ring middens, crescent middens, burned rock middens, pit hearths, and large hearths—depending on the specific context of a feature, its inferred function, and the author's preference (cf. Greer 1967; Black and Dering 2001). Regardless of the terminology used, these are all reflective of earth oven roasting and the feature formation process that results from this form of cooking (described in greater details in following paragraphs). When reviewing archeological sites in the Lower Pecos with features described by these various terms, remnants of earth oven technology are found in almost every prehistoric archeological site in the region (Black and Dering 2001).

However, the abundance of burned rock middens appears to perhaps vary by region and temporal period. An overview by Phil Dering (2002), Center for Ecological Archaeology, Texas A & M University, College Station, of 500 archeological sites in the vicinity of Amistad National Recreation Area, Val Verde County, provides more specifics on the frequency of burned rock midden sites in the area and the research potential of these sites. Among the sites reviewed by Dering were 68 burned rock midden sites, containing a total of 92 burned rock middens, that were situated in open settings (Dering 2002:5.8, 6.3). Additional burned rock middens were located in rockshelters or caves (Dering 2002:6.3). Dering found that the frequencies of burned rock midden sites in open settings during the Early Archaic and Late Prehistoric periods in this area of the Lower Pecos were low when compared to the Middle Archaic and Late Archaic periods, which were both more abundant than the other temporal periods by a magnitude of nearly four to one (Dering 2002:5.8). But, while plant baking or roasting may have peaked during the Late Archaic in the Lower Pecos, as well as along the eastern edge of the adjacent Edwards Plateau, the use of earth ovens reportedly did not peak across the remainder of the Edwards Plateau until about 1200 to 600 years ago (i.e. the Late Prehistoric period; Black and Dering 2001).

Though referring to the the southwestern and western reaches of the Edwards Plateau rather than the present study area, Dering suggested that burned rock midden sites in open settings was an understudied site type (Dering 2002:6.12). He further noted that burned rock midden sites should be considered to have a high data potential if they contain subsurface deposits and if the fine fraction remains, such as is the case at 41VV1991.

In 2003, PBS&J, Austin, Texas, conducted emergency data recovery investigations at four burned rock midden sites in northeastern Val Verde County (Cliff et al. 2003). These sites were located in open settings adjacent to Hwy 277, and were discovered during the course of highway construction. In an effort not to hold up highway construction, machine trenching was used to expose the vertical structure of each midden, and a series of small 50 centimeter by 50 centimeter control columns were excavated at intervals along each trench. Excavated matrix was screened through 1/8-inch hardware mesh. The investigators subsequently suggested, however, that interval flotation sampling and abandonment of the recovery of debitage and other high-frequency material from the 1/8-inch screens would probably have been more productive with regard to gathering subsistence data (Cliff et al. 2003:28). The mitigation strategy utilized at 41VV1991 was based largely on the research efforts of PBS&J during their data recovery investigations.

3.1.2 Previously Recorded Archeological Sites at Seminole Canyon State Park and Historic Site

Although numerous archeological sites, including burned rock midden (BRM) sites, have been recorded throughout Val Verde and the broader Lower Pecos region (cf. Dering 2002; Johnson and Johnson n.d.; Tennis, et al. 1996), the present overview of previously recorded archeological sites focuses primarily on those that have been documented within Seminole Canyon State Park and Historic Site. Presently, there are 83 known archeological sites that occur within or partially within the state park. These sites range in age from possibly the Paleoindian period to the Historic era, and include rockshelters, a burial sinkhole, rock overhangs (with rock imagery), burned rock middens, rock cairns, rock alignments, open campsites, hearthfields, isolated hearths, lithic scatters, quarries, railroad camps and other railroad-related features, an historic dam, and a windmill. Rock imagery, consisting primarily of pictographs but also including some petroglyphs, has been documented at 24 sites within the state property. As shown in Table 3.1, 34 of the archeological sites within Seminole Canyon State Park and Historic Site include burned rock middens. All archeological resources within the park are encompassed within the Seminole Canyon Archeological District, which was listed in the National Register of Historic Places in 1971. In 1985, after the acquisition of additional adjacent property by the TPWD, the boundaries of the Seminole Canyon Archeological District were increased.

Based on the review of known archeological sites within Seminole Canyon State Park and Historic Site that have burned rock middens, or potentially include burned rock middens, these features appear to be much more common within or immediately adjacent to rockshelters than in upland settings. However, this pattern of burned rock midden distribution differs from that found within the adjacent 57,292-acre Amistad National Recreation Area, where 92 burned rock midden sites were located in open contexts and 34 such features were identified in rockshelters or caves (Dering 2002:6.3). A survey of the approximately 2,855-acre Laughlin Air Force Base and 45-acre Air Force Recreation Area and Marina, both located in Val Verde County, did not identify any burned rock

Table 3.1. Previously Recorded Sites with Burned Rock Middens or Scattered Burned Rock (Remnants of Possible Burned Rock Features) at Seminole Canyon State Park and Historic Site.

Site # (VV*)	Site Type	Land-form	Distance to Water	Cultural Features	Cultural Material	Temporal Period
72	Rock-shelter and adjacent BRM	Canyon wall	On site	Pictographs, BRM, bedrock mortar	None within shelter	Late Prehistoric; Historic

Site # (VV*)	Site Type	Land-form	Distance to Water	Cultural Features	Cultural Material	Temporal Period
74	Rock-shelter	Canyon wall	Unknown	Pictographs, petroglyphs, bedrock mortar, cupules, grinding facet, hearth, burned rock scatter, sotol pits, prepared floor surfaces, alignment of upright stakes, burials	Chipped stone debitage, projectile points, other chipped stone tools, ground stone items, painted/etched pebbles, basketry and other fiber items, bone tools, conch and mussel shell items	Possible Paleoindian through Historic Native American
75	Rock-shelter	Canyon wall	Unknown	Burials, bedrock mortars, cupules	Perishable items, a Middle Archaic Pandale dart point and other lithic artifacts	Middle Archaic; Late Archaic; Transitional Archaic; possibly Late Prehistoric
76	Rock-shelter	Canyon wall	Unknown	Pictographs, bedrock mortars, hearth, sooted ceiling, burials	Middle and Late Archaic dart points, Historic metal arrowpoints, bifaces, chipped stone debitage and debris, burned rock, basketry and other fiber items	Early Archaic through the Historic period
77	Rock-shelter and adjacent BRM	Canyon wall	Unknown	Pictographs, bedrock mortars, burned rock scatter, BRM	Possible Abasolo dart point	Middle Archaic; Late Prehistoric; Historic Native American
83	Rock-shelter	Canyon wall	Unknown	Pictographs, bedrock mortars, burned rock scatter	Burned rock, chipped stone debitage, chopper	Middle Archaic; Late Archaic; Transitional Archaic; Protohistoric; Historic Native American
84	Rock-shelter	Canyon wall	Unknown	Former pictographs, ashy midden fill	Burned rock, chipped stone debris	Undetermined
140	Rock-shelter	Canyon wall	Unknown	Pictographs, bedrock mortar, burned rock scatter, sooted ceiling	Deposits have been destroyed by flooding	Middle Archaic
141	Rock-shelter	Canyon wall	Unknown	Burned rock talus	Burned rock	Undetermined

Site # (VV*)	**Site Type**	**Land-form**	**Distance to Water**	**Cultural Features**	**Cultural Material**	**Temporal Period**
145	Rock-shelter	Canyon wall	Unknown	Pictographs	Biface fragments, chipped stone debitage, burned rock	Middle Archaic
146	Rock-shelter	Canyon wall	Unknown	Midden, burned rock scatter, sooted ceiling	Chipped stone debitage, burned rock	"American Indian"
212	Rock overhang	Canyon wall	Unknown	Pictographs, bedrock mortars and cupules, previous BRM	Chipped stone debitage and debris, burned rock	Middle Archaic
214	BRMs	Terrace near canyon headwal l (in canyon)	Unknown	BRMs	Chipped stone debitage and various tools	Undefined Archaic
217	Rock-shelters	Canyon wall	Unknown	Pictographs, burned rock midden, burned rock scatter	Dart points, chipped stone debitage	Middle Archaic
220	BRM	Near base of canyon wall	Unknown	BRM	Chipped stone debitage, mussel shell	"American Indian"
222	BRM	In canyon	Unknown	BRM	Burned rock, chipped stone debitage, bone, mussel shell	"American Indian"
335	Rock-shelter	Canyon wall	Unknown	Pictographs, bedrock mortar, grinding facet, burned rock scatter	Late Archaic dart point, chipped stone debitage and tools, mano and metate fragments	Middle Archaic; Late Archaic
336	Rock-shelter	Canyon wall	Unknown	BRM, burned rock scatter, bedrock mortar	Langtry and Frio-like dart points, chipped stone debitage and tools, mano, groundstone fragments, burned rock, mussel shell	Middle Archaic; Transitional Archaic
370	BRMs	Lower slopes of canyon	25	BRMs	Langtry dart point, Ensor-like dart point, Abasalo dart point, chipped stone debitage, burned rock	Early to Late Archaic
372	BRM	Sloping projecti on in canyon	20	BRM	Dart point, biface tip, utilized flake, chipped stone debitage, burned rock	Late Archaic (?)

Site # (VV*)	Site Type	Land-form	Distance to Water	Cultural Features	Cultural Material	Temporal Period
377	Rock-shelter	Canyon wall	10	Pictographs	Chipped stone debris, burned rock	Middle Archaic
394	Open campsite	Along slope of mesa	50	BRMs	Burned rock, tabular sandstone slab, chipped stone debitage, mussel shell, tin can	Undetermined
396	Open campsite, railroad camp	Summit of knoll on interfluvial divide	30	BRM (?)	Dart point base, endscraper, chipped stone debitage, various historic artifacts	Undefined Archaic; possibly Late Prehistoric; Historic (1880s)
398	Open campsite	Caliche flat on rim above rockshelter at VV226	50	BRMs, cairns, stone ring	Ensor dart point, arrowpoint fragments, uniface and biface fragments, chipped stone debris, burned rock, mussel shell	Late Archaic; Late Prehistoric; Historic
410	Rock-shelter	Canyon wall	250	Remnant pictograph	Chipped stone debitage. Burned rock, mussel shell	Probably Middle Archaic
416	Open campsite	Alkali flat overlooking canyon	50	None reported	Ensor dart point, biface fragments, chipped stone debitage, burned rock, mussel shell	Late Archaic
541	Lithic scatter, 1882 railroad grade	Flat upland area overlooking canyon	Unknown	Railroad grade	Chipped stone debitage and debris, dart point and other chipped stone tools, burned rock, historic metal items	Undefined Archaic; Historic (1882)
542	Open campsite	On flat land overlooking canyon	Unknown	Burned rock ring midden, hearths	Chipped stone debitage, unifaces, burins, burned rock	Undefined Archaic
587	Rock-shelter	Canyon wall	Unknown	None reported	Chipped stone debitage, burned rock	Unknown prehistoric

Site # (VV*)	Site Type	Land-form	Distance to Water	Cultural Features	Cultural Material	Temporal Period
625	BRM	On flat overlooking canyon	500	BRM	Medial dart point fragment, biface blade, uniface fragment, chipped stone debitage, burned rock, mussel shell	Unknown prehistoric
1285	Rock overhang	Canyon wall	Unknown	Pictographs	Chipped stone debiatge and debris, burned rock	Late Prehistoric
1819	Rockshelter	Canyon wall	Unknown	Burned rock talus, bedrock mortars, abrading marks, red pigment splotches	Burned rock, flake	Unknown prehistoric
1825	Rockshelter	Canyon wall	Adjacent	Burned rock talus	Burned rock, chipped stone debitage	Unknown prehistoric
1827	Rockshelter	Canyon wall	Unknown	None observed	Burned rock, possible burned chert cobble	Unknown

midden sites (Tennis, et al. 1996), suggesting a great deal of variability in the frequency and location of burned rock midden sites across the Lower Pecos.

In general, burned rock middens in the region appear to be more common on sites dating from the Middle to Late Archaic periods (cf. Dering 2002:5.8). But, among the seven known upland sites at Seminole Canyon State Park and Historic Site that include burned rock middens or possible remnants of burned rock middens, two had unidentified prehistoric components, three had undefined Archaic components, two had Late Archaic components, and two had Late Prehistoric deposits. This data is insufficient to suggest a preference during any particular time period for placing burned rock middens in open contexts, specifically uplands, verses within rockshelters or caves in the Seminole Canyon area.

3.1.3 Intact Rock-Lined Earth Ovens in Texas

Earth ovens have been used all over the world. Although there are many variations of these features (see Ellis 1997:43-81), the basic technology is the same. First a pit is dug. A fire was then built within the pit, upon and within which large rocks were placed. These rocks would become very hot and, as the fire burned down, a long pole was used to arrange these rocks along the floor of the pit, creating a flat or concave cooking surface. This cooking surface was quickly covered with a thick layer of green vegetation, referred to as packing material. In the Lower Pecos, this material often consisted of wet grass or prickly pear pads. This layer prevented the food from coming into direct contact with the hot rocks and burning, and it released steam, helping to keep the food moist while cooking. The food was then added and covered over by another layer of packing material. Finally, soil was placed over the top of the entire pit to hold the steam and heat within this earthen oven. These ovens could stay hot for considerable periods, providing up to three days of cooking time. After the desired cooking time had elapsed, the earthen cap, upper layer of packing material, and the cooked food were removed from the pit. The bottom layer of packing material and burned rocks were left in place. These pits were often reused, during which time the remaining ash and burned rocks would be removed. Any of the rocks that could still be used as heating elements were saved for that purpose, while the smaller ones (generally fist-sized or smaller) that could not effectively retain heat were discarded around the pit. This process eventually formed debris piles or rings around the pit. The relative sizes of the burned rock deposits may be indicative of the durations or intensities of food cooking activities at specific sites.

While burned rock middens and other debris from earth ovens is not uncommon on archeological sites in the Lower Pecos and surrounding regions of Texas and northern Mexico, intact rock-lined earth ovens such as the one uncovered at the Lost Midden site are less often identified and even less often thoroughly investigated.

Among the oldest earth ovens known in Texas are multiple, large, rock-lined examples that were discovered at the Wilson-Leonard site, an open, multi-component site located in Williamson County, in the central part of the state. These features were radiocarbon dated to the beginning of the Archaic Tradition, about 8,000 years ago (Collins and Weir 2011). At least one of the ovens contained a number of charred wild hyacinth bulbs (*Camassia scilloides*).

Following their initial appearance during the Early Archaic period, earth ovens were used throughout the extensive Archaic Tradition and into the following Late Prehistoric period, changing relatively little during this time. Similar to the dimensions reported ethnographically for roasting basins used by the Mescalero and Chiricahua Apache, and the Tarahumara (Howard-Hines et al. 1994:19), the diameters of prehistoric earth ovens in Texas appear to generally range from less than 1 meter to a few meters (cf. Black et al. 1997:115-124, 261-266; Cliff et al. 2003:43, 153; Howard-Hines 1994:100-107; Laurence and Thoms 2011; Weir 1979:19). Though the sample size is relatively small, the depths of prehistoric roasting pits may be somewhat more consistent than their diameters, generally having a maximum extent of not much more than 1 meter (cf. Black et al. 1997; Collins and Weir 2011; Laurence and Thoms 2011; Weir 1979:19-20). Again, this is similar to the ethnographic accounts of roasting basins among the aforementioned Native American groups (Howard-Hines et al. 1994:19). The form of these features is usually basin shaped, with ratios of width to depth ranging from 0.5:1 to 3.4:1 (Howard-Hines 1994:19).

The type of rock used by Native American groups historically to line earth ovens is dependent on local availability but, with few exceptions, there is a preference for large, flat rocks (Basehart 1960:31; Castetter et al. 1938:28; Castetter and Opler 1936:36; Opler 1965:357). Limestone is prevalent in the present project area, and was used to line the intact earth oven at the Lost Midden site.

Tunnell and Madrid (1990:154) report that limestone, when used, lasts approximately four firings before breaking up to a point where it is no longer useful as a heating element. Others have proposed an even shorter period of usefulness for fire cracked rock in general (Dering

1999:665). Regardless, the breakdown of rock used for heating earth ovens has resulted in high archeological visibility of earth oven debris, if not earth ovens themselves, across the landscape. It is possible that this has resulted in overestimates of population size and the degree of sedentism among the inhabitants of sites with these burned rock features (Dering 1999:671). Nonetheless, the prevalence of burned rock middens and other debris associated with earth ovens, as previously noted, suggests that the use of earth ovens peaked during the Late Archaic in the Lower Pecos and along the eastern edge of the adjacent Edwards Plateau, while not reaching a peak across the remainder of the Edwards Plateau until the Late Prehistoric period (Black and Dering 2001).

Unlike the early earth ovens at the Wilsen-Leonard site, succulents such as lechuguilla (*Agave lechuguilla*), sotol (*Dasylirion texanum*) and prickly pear (*Opuntia*) appear to be the primary food sources that were roasted in earth ovens in the Lower Pecos during the Archaic and Late Prehistoric periods. Some archeologists have suggested that these particular plants were a dietary mainstay of the region's residents (cf. Brown 1991; Shafer 1988; Sobolik 1991; Turpin 1995a), while others believe that these desert succulents probably served as famine food during periods of seasonal stress (Dering 1999).

3.2 Cultural History of the Lower Pecos

3.2.1 Paleoindian Tradition

The Paleoindian Tradition, the earliest defined cultural tradition in North America, extends from approximately 12,000 to 8,800 B.P. (years before present [B.P.] is utilized throughout this report, using 2010 as the present date) in the Lower Pecos (Turpin and Davis 1993:5; Table 3.2). This tradition is divided into Early and Late Paleoindian stages based on projectile point forms. Early Paleoindian artifact assemblages (11,900-9,800 B.P.) include fluted style projectile points, while Late Paleoindian (9,400-8,800 B.P.) assemblages include unfluted lanceolate points, typically with collateral flaking and basal/shoulder grinding.

Further subdivision of the Paleoindian Tradition into the Clovis complex (ca. 10,000-12,000 B.P.), Folsom complex (ca. 9,400-10,000 B.P.), and the Plano/Cody complexes (c.a. 8,000-9,400 B.P.) has been accomplished based on functional and stylistic differences in the tool kits of these groups (Miller and Kenmotsu 2004:212-213). These differences in artifact traits were probably functional, reflecting changing hunting and settlement adaptations (Miller and Kenmotsu 2004:212-213). On a local level, several phases have been proposed for the Paleoindian Tradition in the Lower Pecos (cf. Hester 1989b; Shafer 1986; Turpin 1985, 1991), including the Aurora (14,500 – 11,900 B.P.), Bonfire (10,700 – 9,800 B.P.) and Oriente (9,400 – 8,800 B.P.) phases. The early Aurora phase, however, is based on minimal evidence and is largely hypothetical at this time (Turpin 1985:6-7). These phases, as well as most of those designated by Turpin (1985) and others (cf. Bement 1986) for the following cultural traditions, were subsequently designated as subperiods (Bement 1989; Turpin 1995a).

Although there is increasing faunal evidence that suggests that these early inhabitants of the New World were probably subsistence generalists (Brown and Anthony 2000:81; Collins

Table 3.2. Summary of Cultural Periods at Seminole Canyon State Park and Historic Site.

Cultural Tradition/ Period	Cultural Subperiod or Tribe	Dates (Years Before Present)	Diagnostic Artifacts	Settlement/Subsistence Patterns
Historic	Jumanos Cibolos Apaches Comanches Kiowas	420-present in the Lower Pecos	European trade goods and metal arrow points	This period was marked by increased raiding by the Apaches, followed by the Comanches and Kiowas.
Protohistoric	Infierno	450-250	Stemmed arrow points, end scrapers, and plain bone-tempered pottery (no European trade goods are found on Infierno sites)	Preference for high promontories, usually overlooking springs or other water sources. Residential features are characterized by paired stones that were presumably pole supports for brush- or hide-covered structures.
Late Prehistoric	Toyah	710-660	Perdiz arrow points, beveled knives, end scrapers, drills made on flakes, and bone-tempered pottery that was sometimes decorated with a red-ochre slip or simple incised decorations.	The Toyah phase is only sparsely represented in the Lower Pecos, and is thought to be strongly linked to the return of bison herds into the Southern Plains.
	Flecha	1,320-450	Scallorn, Perdiz, Livermore, and Toyah arrow points	There was a cultural continuum between Archaic and Late Prehistoric occupations. Only those aspects of sedentary existence which enhanced an already entrenched and successful nomadic hunting-gathering adaptation were incorporated, including adoption of bow and arrow technology.
Transitional Archaic		2,300-1,300	Ensor, Figueroa, Frio, and Paisano dart points	This interval basically mirrors the Late Archaic Blue Hills Phase, but includes additional distinctive point styles.
Late Archaic	Blue Hills	2,300-1,300	Ensor, Frio, and Fairland dart points	Settlement patterns during this time shifted from an emphasis on rockshelters to open terrace campsites. Houses may be represented by circular or semicircular stone features that served as supports for a framework of branches that were covered with hides or grasses to form wickiups.
	Flanders	2,300-?	Marcos and Shumla dart points	
	Cibola	3,150-2,300	Montell, Castroville, Marshall, and Shumla dart points	
Middle Archaic	San Felipe	4,100-3,200	Langtry, Val Verde, and Almagre dart points	There was a growing dependence on the gathering of plant materials and a diminished reliance on the hunting of large game animals. A highly mobile settlement pattern was probably still preferred, but there may have been a trend toward decreasing group mobility. Site sizes and distributions suggest a gradual increase in populations, which may have resulted in more restricted territorial ranges.
	Eagle Nest	5,500-4,100	Pandale dart points	

Cultural Tradition/ Period	Cultural Subperiod or Tribe	Dates (Years Before Present)	Diagnostic Artifacts	Settlement/Subsistence Patterns
Early Archaic	Viejo	8,900-5,500	Baker, Bandy, Bell, and Early Triangular	The period reflects a gradual transition from the somewhat specialized subsistence strategy of the Paleoindian Tradition to a more generalized subsistence strategy. Small, mobile bands continued to move about within poorly defined territories.
Late Paleoindian	Oriente	9,400-8,800	Angostura and Golondrina points	Nomadic bands that camped in areas with good water and lithic resources. They were subsistence generalists, but were still somewhat dependant on Pleistocene megafauna.
Early Paleoindian	Bonfire	10,700-9,800	Folsom and Plainview points Clovis spear points	
	Aurora	14,500-11,900	None	This phase is based on minimal evidence and is largely hypothetical at this time.

1995:381; Sollberger and Hester 1972:326; Stanford 1991), Paleoindians were at least somewhat dependent upon hunting the large game animals, now extinct, of the last ice age (Dibble and Lorraine 1968; Frison 1978; Judge 1973; Suhm, et al. 1954:16; Weir 1976:120). These people traveled in small nomadic bands, camping in areas where permanent water sources attracted game and good lithic materials could be procured for the manufacture of tools (Mallouf 2000:6).

3.1.1 Archaic Tradition

The previous Oriente subperiod is somewhat transitional between the Paleoindian and Archaic Traditions, but the Archaic Tradition is generally considered to have begun 8,800 years ago and continued for approximately 7,500 years in the Lower Pecos. The Archaic Tradition has been divided into the Early (8,800-5,500 B.P.), Middle (5,500-3,200 B.P.) and Late (3,200-1,300 B.P.) Archaic periods in the region based on gradual changes in settlement patterns, population sizes and technology. In addition to Early,

Middle and Late Archaic periods, a Transitional Archaic period has been proposed by some researchers in west Texas to identify the lengthy period of gradual change between the Late Archaic and Late Prehistoric periods. Some have also dubbed this late period during the Archaic Tradition as the Terminal Archaic. The term 'Transitional Archaic' is used in this report, and a date range of 2,300-1,300 B.P. is used to represent this period (after Hester and Turner 2011). Several Archaic subperiods, discussed below, have also been defined for the Lower Pecos.

In general, the Archaic Tradition is one in which specialized technologies were utilized in more diverse environmental settings than the previous Paleoindian Tradition (Jennings 1974; Willey and Phillips 1958:107). This is reflected in the variety of projectile point styles and other tool types produced during this period, and the distribution of Archaic sites across the landscape (cf. Story 1985; Weir 1976). The survival of Archaic groups depended on the seasonal or fortuitous abundance of potential food sources across a wide range of microenvironments (Mallouf 1985:115; Marmaduke and Whitsett 1975). There was a growing dependence on the gathering of plant materials and a diminished reliance on the hunting of large game animals (cf. Fulton 2000:7; Prewitt 1981:74). A highly mobile settlement pattern was probably still preferred among Archaic inhabitants, but there may have been a trend toward decreasing group mobility (Charles 1994:34). Site sizes and distributions during this time suggest a gradual increase in Archaic populations, which may have resulted in more restricted territorial ranges (Mallouf 1985:115; Wulfkuhle 1993:4-5). Furthermore, the burials that were recovered from Seminole Sink (Turpin 1985) suggest that the Archaic inhabitants of sites within Seminole Canyon, Presa Canyon and the surrounding area had territorial ranges that perhaps centered on the diverse resources of these canyon systems.

The Early Archaic period, identified by Bifurcated Stem, Early Barbed, Uvalde, Gower-like, Nolan, Pandale, Baker and Bandy projectile points (Marmaduke and Whitsett 1975:78; Turpin and Davis 1993:28), marks the first appearance of basketry (Andrews and Adovasio 1980), cordage and sandals (Shafer and Bryant 1977:63), and painted pebbles (Parsons 1965:16) in the Lower Pecos. The period reflects a gradual, rather blurred transition from the somewhat specialized subsistence strategy of the Paleoindian Tradition to a more generalized subsistence strategy. Small, mobile bands continued to move about within poorly defined territories during this time (Carpenter et al. 1996:56). The Viejo subperiod (8,900–5,500 B.P.) has been named for this period in the Lower Pecos (Turpin 1985:8). At least one site at Seminole Canyon State Park and Historic Site, Black Cave, has an archeological component that dates to the Early Archaic Viejo subperiod. Three radiocarbon dates obtained from remnant hearths at Black Cave range in age from about 7,660-6,370 years B.P. (Turpin 1982:73).

The Middle and Late Archaic periods are well represented at Seminole Canyon State Park and Historic Site. Fate Bell Shelter, Fate Bell Annex, Panther Cave, Black Cave and several other sites on the property include Middle Archaic/Late Archaic-age Lower Pecos River style pictographs. Identified by monumental, multicolored images, including static and imposing anthropomorphic figures (generally assigned the label of 'shaman' figures by many area researchers and rock imagery enthusiasts), these paintings have been previously assigned a general age of 4,500–3,000 years B.P. Radiocarbon dates obtained from nineteen pigment samples taken from Lower Pecos River style figures at 41VV75 have produced dates ranging from 2750 to 4200 years B.P. (Chaffee et al. 1994; Ilger et al. 1995, 1996; Pace et al. 2000; Russ et al. 1990, 1992), suggesting that this pictograph style may be 250-300 years more recent than expected. Nonetheless, these images still date to the Middle Archaic/Late Archaic time period.

Bold Line Geometric-style pictographs, though much less prevalent than Lower Pecos River style images, are considered by some researchers to also have originated during the Middle Archaic period (cf. Davis et al. 2000:395); however, others consider the abstract figures that are representative of this style to be much more recent in age. Turpin (1986; Turpin and Davis 1993:9) considers Bold Line Geometric figures to date to the Late Prehistoric (1,000–400 years ago). Presently, no radiocarbon dates exist for this pictograph style (Rowe 2003:83).

Based primarily on differences in projectile point forms, and other more subtle differences in the archeological record, an Eagle Nest subperiod (5,500–4,100 B.P.) and San Felipe subperiod (4,100–3,200 B.P.) have been defined for the Middle Archaic period (Turpin and Davis 1993:20, 23). Pandale points are found on sites attributable to the Eagle Nest subperiod, while Langtry, Val Verde, Arledge, and Almagre dart points characterize the San Felipe subperiod. Lower Pecos River style pictographs may have been introduced during the San Felipe subperiod (Turpin 1985:9).

Late Archaic sites in the Lower Pecos include Blue Hills subperiod (2,360–1,360 B.P.), Flanders subperiod (2,300-?), and Cibola subperiod (3,150–2,300 B.P.) occupations (Turpin and Davis 1993:5, 20). The warm, drier conditions that existed prior to the Late Archaic period temporarily gave way to more mesic conditions early in the Late Archaic, during the Cibola subperiod. Economic and technological changes evident in the archeological record, as well as changes in the site settlement patterns during this time from an emphasis on rockshelters to open terrace campsites, may have been the result of these environmental changes or the impact of outside cultural groups. Cultural groups from the Central Texas region appear to have moved into the Lower Pecos, as evidenced by the presence of Central Texas style projectile points, in pursuit of bison herds and other large game that were attracted to the area by improved grazing opportunities. There is some minimal evidence of violent deaths during the Late Archaic, and the practice of ritually scraping or flaking the pigment from select Middle Archaic Lower Pecos Style anthropomorphic or zoomorphic pictographs, presumably by the creators of these images, dramatically decreases following the Middle Archaic period (Roberts 2005). The Cibola subperiod is identified by the presence of Montell, Marshall, and Castroville dart points (Turpin 2004:272).

Following the Cibola subperiod, drier conditions returned to the Lower Pecos. Exploitation strategies during the Flanders and Blue Hills subperiods reflected a growing reliance on desert plants, similar to the strategies utilized during the Early and Middle Archaic periods. The Flanders subperiod is characterized by Shumla and Marcos dart points (Turpin 1982:25, 1985:9), and by Serpentine style petroglyphs. Ensor and Frio dart points are found in Blue Hills cultural components (Turpin 2004:274). The fiber industry appears to have become somewhat more elaborate during the Blue Hills subperiod as indicated by the appearance of ornate painted mats in mortuary contexts (Turpin 2004:274). Houses during this period may be represented by circular or semicircular stone features that served as supports for a framework of branches that were covered with hides or grasses to form wickiups (Cliff et al. 2003:22). Examples of such stone features are present at Seminole Canyon, above the rockshelters at 41VV75 and 41VV76. The dart point assemblage recovered during the excavation of 41VV1991, as well as some of the radiocarbon dates obtained for the site, indicate that the Lost Midden site was initially occupied during the Blue Hills subperiod.

Rock imagery produced during the Late Archaic period in the Lower Pecos includes Red Linear pictographs, characterized by miniature, red stick figures engaged in animated group activities. Turpin (1984, 1990, 1995a) posited that these pictographs were painted as early as 2,500 – 2,000 years ago, and were diagnostic of the Late Archaic period based on the depiction of bison hunts; *Bison antiquus* and *Bison occidentalis* went extinct during the

Paleoindian period, and based on our present knowledge of archeology in the Trans-Pecos the American bison (*Bos bison*) appears not to have been present in this region until the Late Archaic, possibly following reestablished grasslands into the area during the Cibola subperiod (Alexander 1970:6; Dibble and Lorrain 1968; Turpin 1985:9). Recently, Middle Archaic Lower Pecos River style pictographs have been found superimposed on examples of Red Linear figures, suggesting that the Red Linear style may extend even earlier than 2,500 years ago (Boyd 2010). Based on the present assemblage of radiocarbon dates for the Lower Pecos River pictograph style, the superimposition of this style on Red Linear figures would extend the latter style back to at least 2750 years B.P. However, radiocarbon dates for one of the Red Linear bison images at 41VV162A and a deer image of the same style at 41VV75 produced dates of 1280 ± 150 years B.P. and 1280 ± 80 years B.P. respectively (Ilger, et al. 1994; Rowe 2003:83-88), suggesting that Red Linear pictographs were painted for an extended period of time during the Late Archaic period.

Technological innovations such as the bow and arrow are used to mark the beginning of the Late Prehistoric Tradition in the region, but the change from a Late Archaic to Late Prehistoric way of life was actually very gradual. As mentioned, some researchers use the term Transitional Archaic to identify this period of gradual change (cf. Katz and Katz 1974; P. Katz 1978; Mallouf 1985:28, 34). While Turpin and Davis (1993:5) do not identify a Transitional Archaic period in their chronology of the Lower Pecos, Hester (1989b:61) considers Ensor, Figueroa, Frio, and Paisano points as diagnostic of the Transitional Archaic period in the area.

3.1.2 Late Prehistoric Tradition

The Late Prehistoric Tradition extended from approximately 1010 to 420 B.P. in the Lower Pecos. As noted, this cultural tradition is generally characterized by the innovation of the bow and arrow across all of west Texas, as well as the manufacture of pottery, and the development of agriculture and the establishment of villages in parts of the region that were conducive to agricultural practices (Ing and Smith-Savage 1996:27; Sanchez 1999:36). These areas included the western Trans-Pecos, La Junta de los Rios in the vicinity of present-day Presidio, Texas, and various small sections of land throughout the region (Beene 1994:26), but apparently not the Lower Pecos. Though minimal amounts of pottery have recently been discovered in the Lower Pecos, evidence of cultigens and village sites are absent from the archeological record in this area. In the absence of these traits, the Late Prehistoric period in this region may have been marked, in part, by a shift from the previous Red Linear pictograph style to the Red Monochrome style. Archeological evidence suggests a time span of about 1350 - 650 years B.P. for the Red Monochrome style (Rowe 2003:83). The one radiocarbon age estimate that exists for this pictograph style assigns an age of 1125 years B.P. (Ilger et al. 1994). As previously discussed, the Bold Line Geometric pictograph style may also date to the Late Prehistoric period (Turpin 1986; 1993:9).

In many ways, the Late Prehistoric Tradition remained similar to the preceding Archaic Tradition. As discussed by Mallouf (1985:150), "only those aspects of sedentary existence which enhanced an already entrenched and successful nomadic hunting-gathering adaptation were actually incorporated." This cultural continuum between Archaic and Late Prehistoric occupations in the Trans-Pecos is reflected in the artifact assemblages recovered from rockshelters in the region. Shared artifact types include basketry, matting, sandals, rabbit sticks, rabbit fur robes, cordage, netting and various other items (Sanchez 1999:36).

In addition to the Blue Hills subperiod of the Late Archaic period, evidence from the Lost Midden site indicates that the site continued to be utilized during the Flecha subperiod (1320 – 450 B.P.) of the Late Prehistoric Tradition. The Flecha subperiod is characterized by the presence of Scallorn, Perdiz, Livermore, or Toyah arrow points. Despite the acquisition of bow and arrow technology by these people, they continued to adhere in many ways to the lifeways of the previous Late Archaic period. Archeological evidence indicates that during the Flecha subperiod groups reoccupied the campsites of Late Archaic inhabitants, built nearly identical wickiup house forms as the previous period, and occasionally re-used Archaic-period earth ovens. Also, in the Lower Pecos and on the Edwards Plateau, it is likely that these groups continued a long Archaic tradition of using natural sinkholes as burial places, although the first formal cemeteries came into use during this same time in Central Texas. Based on observations by the primary author of private collections recovered from archeological sites in the Lower Pecos, there are at least two occurrences of Scallorn points being embedded in human skeletal remains from the region, indicating a continuation of the violence that was suggested for the previous Late Archaic period. This violence may have been the result of territorial disputes or population pressures. It appears that the Flecha subperiod came to an end sometime in the fourteenth century, or at least the evidence of the culture diminishes or changes by that time.

The Toyah horizon of the Late Prehistoric Tradition emerged about 710 to 660 years ago, but is only sparsely represented in the Lower Pecos. It is better known on the adjacent Edwards Plateau and Balcones Canyonlands (Black and Dial 2005). The appearance and spread of Toyah culture is thought to be strongly linked to the return of bison herds into the Southern Plains (Black 1986; Johnson 1994). Bison bones, which are largely absent from sites dating to the seven centuries immediately preceding Toyah, are present in most Toyah sites. In addition to hunting bison, as well as other game, plant roasting continued much as it had in previous periods. Toyah assemblages include Perdiz arrow points, flake knives, beveled knives, small end scrapers, perforators made on flakes, marine shell, and mussel shell (Dering 2002:3.9). Bone-tempered pottery has also been recovered from some Toyah sites, including recent discoveries at Amistad National Recreation Area (Joseph Labadie, personal communication November 10, 2008). This pottery, which was sometimes decorated with a red-ochre slip or simple incised decorations, was mostly utilitarian and included ollas or simple bowls. Evidence of the Toyah culture discontinues by about 400 years ago (Dering 2002:3.9).

3.1.4 Protohistoric Period

Identified by Turpin (2004:276-277) as a Late Prehistoric phase, the Infierno phase is perhaps more specifically attributed to the Protohistoric period in the Lower Pecos (Black and Dering 2001). Estimated to date to approximately 450 to 250 years ago, the Infierno phase is identifed by stemmed arrow points, end scrapers, beveled knives, and plain, poorly fired, bone- or calcite-tempered pottery (Black and Dering 2001; Turpin 2004:276-277;

Turpin and Robinson 1998). Despite the estimated age range for the Infierno phase, no European artifacts have been recovered from any single component Infierno sites (Turpin 2004:277).

Sites attributable to the Infierno people are found on high promontories and are marked by circular stone alignments (i.e. tipi or wickiup rings) that are thought to have been pole supports for brush- or hide-covered structures (Turpin 2004:276-277). The number of such circular alignments has ranged from as many as 120 features on a site to a single feature. Rock cairns, possibly representing burials, are also known to occur on some Infierno sites. The Infierno artifact assemblage is comparable to the aforementioned Toyah horizon and, like the Toyah horizon, may represent an influx of outsiders from the Plains that were in pursuit of bison herds. It is believed that bison were lured back to the region during an extended interval of wetter conditions in Protohistoric and early Historic times, when grasslands again flourished in the Lower Pecos (Turpin 1987). Alternatively, the Infierno phase may simply represent a slight geographical or temporal variation of the Toyah culture in the Lower Pecos, based on the presence of bone-tempered pottery, scrapers, beveled knives, and arrow points on both Toyah and Infierno sites (Black and Dering 2001; Mehalchick and Boyd 1999:155). However, Perdiz points specifically have not been recovered from Infierno phase sites, and stone circle alignments have not been identified on Toyah sites (Dering 2002:3.9).

3.1.5 Historic Period

Prior to the Pueblo Revolt of 1680-1690, the Lower Pecos was the homeland or part of the homeland of as many as 31 different bands of Native Americans (Kenmotsu and Wade 2002). However, following the Revolt, the distribution of Native American tribes across this region changed considerably, largely due to the movement of the Lipan and Mescalero Apache into the area, followed by Comanche and Kiowa groups from the north (Kenmotsu and Wade 2002). These tribes would continue to have an impact on the region well into the nineteenth century.

The arrival of Europeans to the Lower Pecos also forever changed the geography of the region. Spanish explorers Cabeza de Vaca and Francisco Vasques de Coronado passed through the Trans-Pecos at various times in the first half of the sixteenth century, but the first Europeans to arrive in the Lower Pecos were members of Gaspar Castaño de Sosa's *entrada* in 1590 (Schroeder and Matson 1965). The expedition traveled from Montclova, Mexico up the Rio Grande to the Pecos River, continuing up the Pecos River to the Pecos Pueblo in northern New Mexico.

Subsequent forays into the Trans-Pecos by the Spanish were most often in pursuit of marauding bands of Indians rather than colonizing expeditions. As early as 1667, the Spanish considered plans for defending the Trans-Pecos frontier from Indian attacks (Simmons, et al. 1989). Missions were established across the region, supported by presidios and occasional offensive campaigns. Mexico continued to garrison the region after they gained their independence from Spain in 1821 (Wooster 1994:2-3). Despite these efforts, however, there was little success at stopping Indian attacks. Instead, Comanche and Apache attacks across the region increased as the United States government started removing eastern tribes to reservations in the west (Wooster 1994:3).

In 1836, the Republic of Texas won its independence from Mexico, and in 1845 the Republic of Texas became the 28th state in the Union. Following the Mexican War of 1846-1848, Mexico formally ceded its Trans-Pecos land holdings to the United States (Wooster 1994:3-4). It was not until this time that the region was thoroughly explored or mapped. A road was soon established leading northward from San Felipe Springs (Del Rio), along the Devils River, westward to the Pecos River and on to El Paso (Turpin and Davis 1993:6). This paved the way for the establishment of the San Antonio-San Diego mail route in 1853 (Austerman 1985).

Spurred on by the discovery of gold in California in 1849, travelers from the east crossed through west Texas on their way to the Pacific Coast. During this time, the Apache and Comanche continued their attacks on gold seekers and homesteaders alike, and Kickapoos made occasional forays northward from Mexico (Turpin and Davis 1993:6). As a result, the United States Army constructed a string of forts across the region, including Fort Clark, Fort Lancaster, Fort Stockton, Fort Davis and Fort Bliss (Charles 1994:37). Constructed in 1853, Fort Clark was situated directly on the Comanche Trace. In a further attempt to put a stop to Indian raids in the area, Camp Hudson was built in 1857 near Bakers Crossing, a major ford of the Devils River (Turpin and Davis 1993:6). Although several notable battles were fought in the region, including a skirmish along Devils River between the Second Cavalry and Comanches in 1857 (Fehrenbach 1983:426-427), the system of forts did ultimately have the desired affect. Reports of Indian attacks declined through the late 1800s.

In 1881, the tracks of the Southern Pacific Railroad reached west Texas, allowing goods and people to be more easily transported into and out of the area. Distant markets were suddenly more accessible, providing incentive for ranchers to establish operations in the region. Historic pictographs and graffiti, as well as other Historic cultural material, much of which is

attributable to those who constructed and supported the Southern Pacific railroad through the area in the late 19th century, are present at Seminole Canyon State Park and Historic Site. Some rock paintings on the property, such as those at Vaquero Shelter (41VV77), reflect the early Spanish presence in the region.

CHAPTER 4: RESULTS OF PRELIMINARY INVESTIGATIONS AT 41VV1991

4.1 Preliminary Field Investigations and Analysis

As discussed in Chapter 1 of this report, on September 25, 2007 the primary author conducted a series of shovel tests (n=9) at five meter (16.4 feet) intervals in cardinal directions from the backhoe excavation at the Lost Midden site to try to determine the size of this previously unidentified site. These shovel tests measured approximately 35 centimeters (13.8 inches) in diameter, and were excavated to bedrock, or other impassable rock (Figure 4.1). The resulting matrix was screened through ¼-inch hardware cloth. Cultural material resulting from the shovel testing was limited to thermally altered limestone rocks, approximately fist-sized, in one of the shovel tests south of the original backhoe excavation. These items were noted, but not collected. A representative sample of artifacts, however, was recovered from the surface of the site area, within the footprint of the proposed RV dump station project (Tables 4.1-4.3).

On September 26, 2007, Jack Johnson, then with Seminole Canyon State Park and Historic Site, prepared profile plans of the walls of the backhoe excavation (Figures 4.2-4.3), and on October 6, 2007, 14 volunteers, including archeologists Joe Labadie, Amistad National Recreation Area, Elton Prewitt, Shumla School, and Jack Johnson, screened over 50 percent of the backdirt that originated from the backhoe excavation through ¼-inch hardware cloth. Among the artifacts recovered were endscrapers, a bifacial cutting tool, utilized flakes, and chipped stone debitage and debris. Fragments of Tampico pearlymussel (*Cyrtonaias tampicoensis*) shell fragments, as well as the shells of two species of land snails—*Rabdotus dealbatus* and *Polygyra texasiana*—were also recovered (Tables 4.1-4.3). Also during this time, other possible burned rock was observed on the ground surface west of the backhoe pit, suggesting that the site area was perhaps larger than originally estimated, despite the results of the previous shovel testing.

As a result, between November 4 and 5, 2007, the Cultural Resources Coordinator, park staff, and other volunteers, excavated a series of 29 mechanical auger tests across the known site area and beyond (Figure 4.1). Transects were established in alignment with the existing backhoe pit and another backfilled trench associated with the project, resulting in a generally east-west trending baseline transect and several north-south trending transects, along which the auger tests were excavated. North-south and east-west coordinates were assigned to the auger tests as identifiers, with the datum designated as N0/W0, depending on where the auger tests were located along the transect (Figure 4.1). Auger tests were placed at 4-meter (13 feet) intervals. The site datum was located in GPS zone 14R, 276124.74mE, 3287830.79mN, approximately one meter (3.28 feet) west-northwest of the edge of the existing paved park

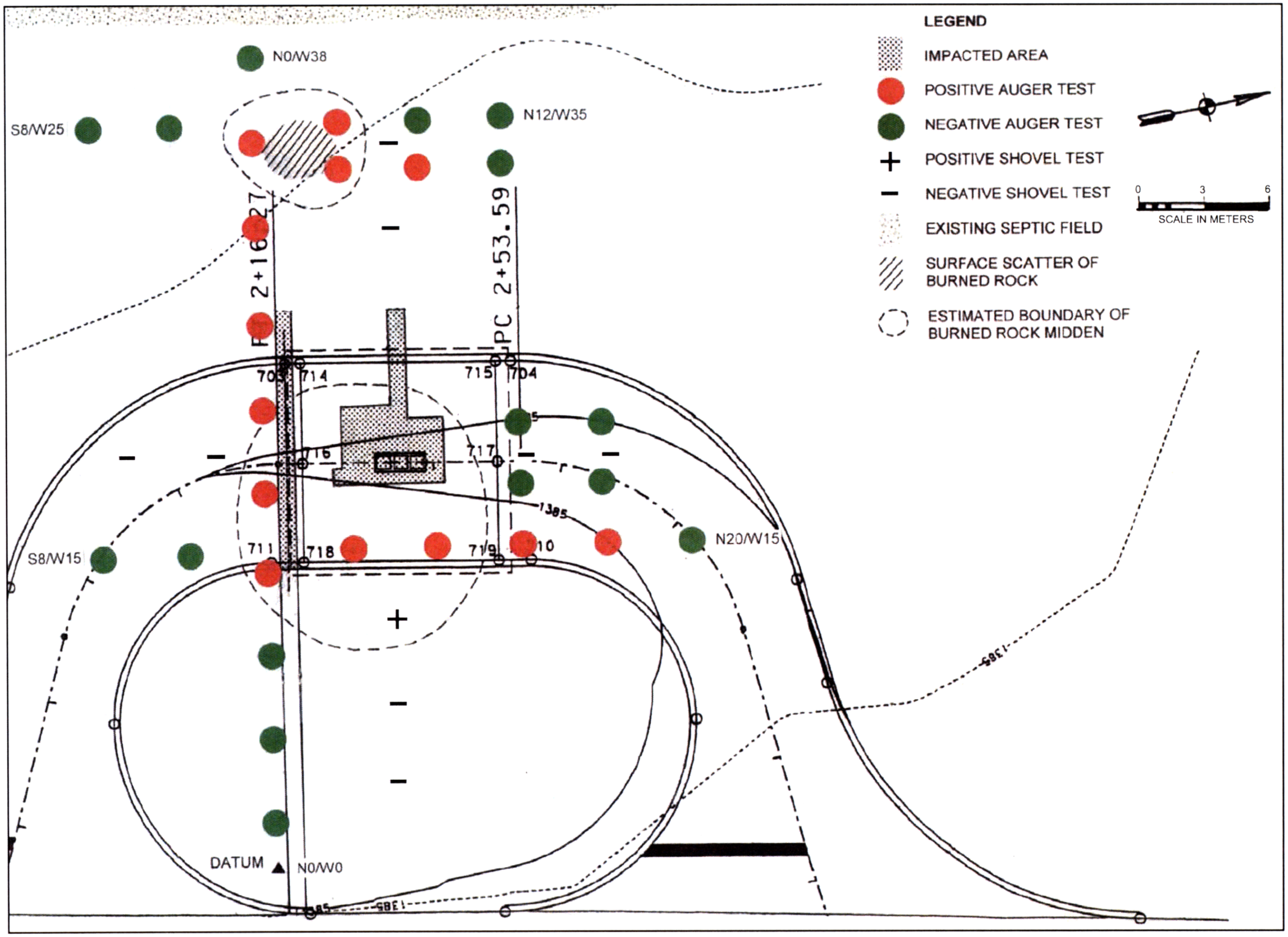

Figure 4.1. Locations of shovel tests and mechanical auger tests at the Lost Midden site (41VV1991), Seminole Canyon State Park and Historic Site.

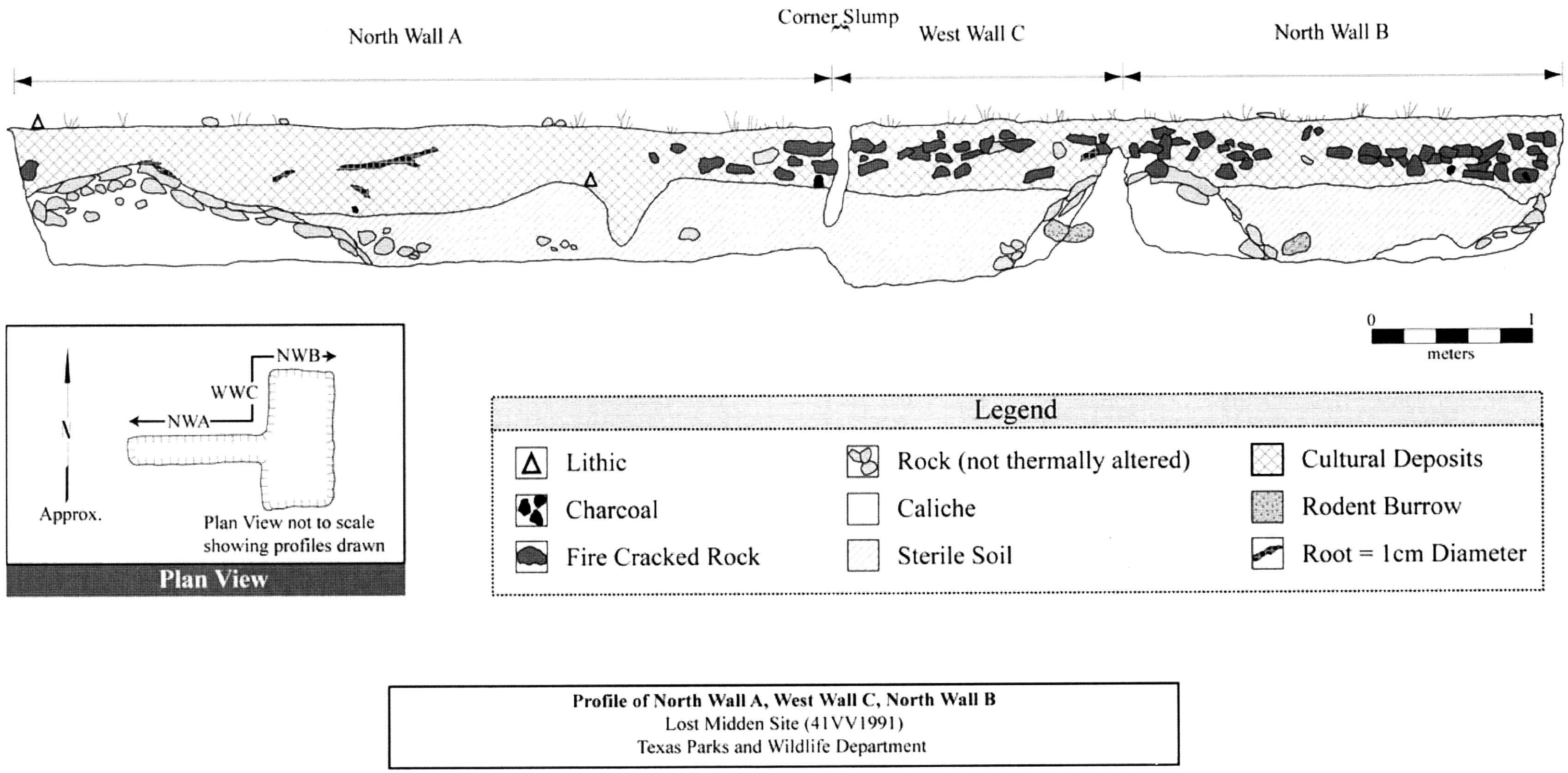

Figure 4.2. North wall profile of original backhoe excavation at 41VV1991, Seminole Canyon State Park and Historic Site.

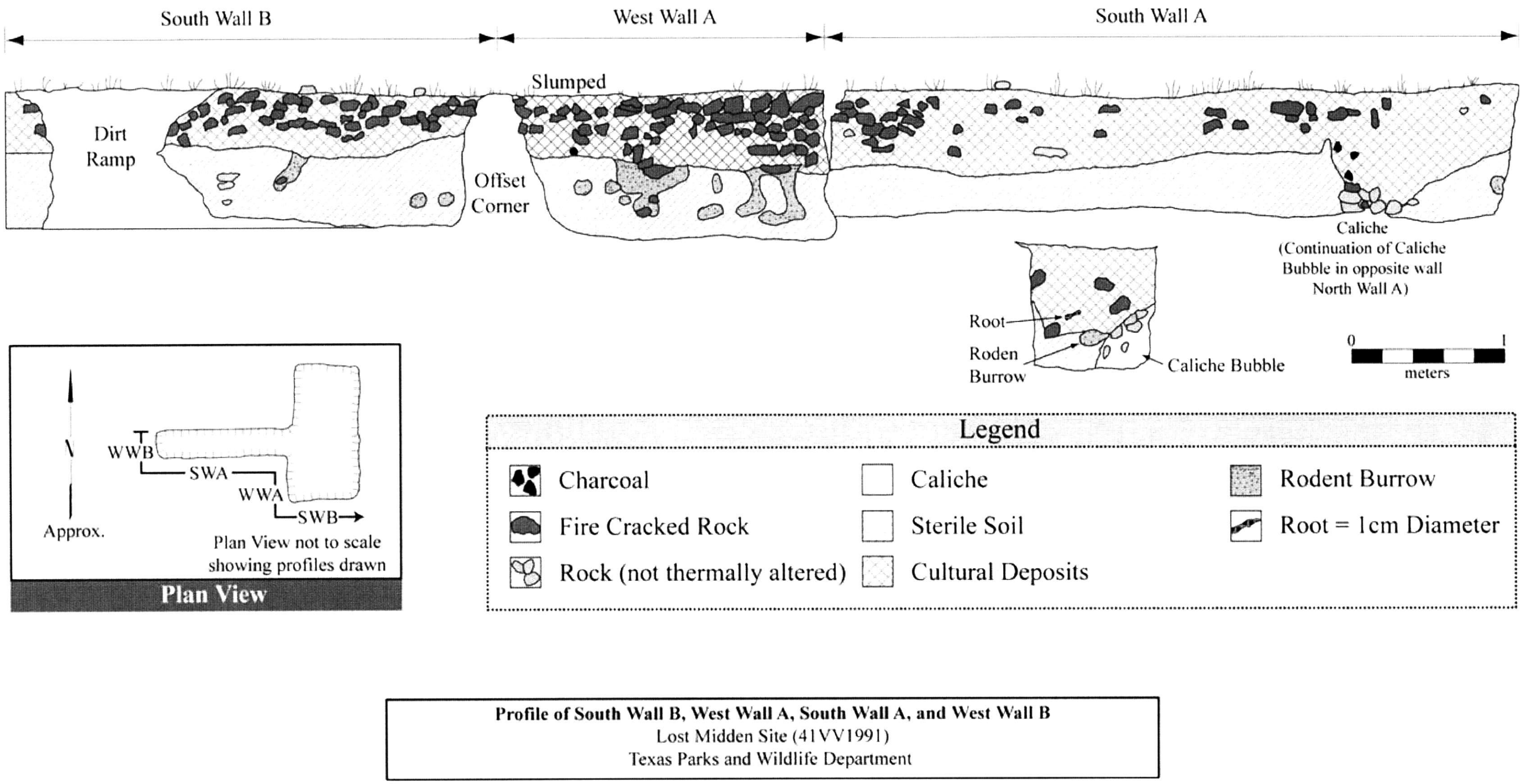

Figure 4.3. South wall profile of original backhoe excavation at 41VV1991, Seminole Canyon State Park and Historic Site.

road, west of the Visitor Center parking area. The site datum location was marked with a large survey nail and two pin flags. The auger, which was tractor-mounted, was approximately 23 centimeters (nine inches) in diameter. All auger tests were excavated to bedrock or other impenetrable rock, and the matrix screened through ¼-inch hardware cloth.

Thirteen of the auger tests produced positive results, revealing additional chipped stone debitage and burned rock (Tables 4.1-4.3). The cultural material was recovered from depths ranging from the current ground surface to 80 centimeters (31.5 inches) below ground surface, but was more often found within the upper 50 centimeters (19.7 inches) of the auger tests. The maximum depth of bedrock on the site was 1.10 meters (3.6 feet) in the vicinity of the backhoe pit, but got abruptly and considerably more shallow as auger tests were placed further away from the backhoe pit in all directions, further indicating along with the profiles of the backhoe pit that the site or a large portion of it was situated within a natural basin of some kind.

As noted in Chapter 1 of this report, a second burned rock midden (Feature 2) was identified during the mechanical auger testing west of the original midden (Feature 1). Based on the results of the auger testing, it was determined that 41VV1991 had a maximum north-south dimension of approximately 15 meters (50 feet) by a maximum east-west dimension of about 26 meters (85 feet), encompassing an area of 0.04 hectare (0.10 acre). Within the site area, Feature 1, the larger of the burned rock middens, was estimated to be approximately 12 meters (40 feet) in diameter. The other burned rock midden, located west of Feature 1, was somewhat smaller, measuring an estimated six meters (20 feet) east-west by eight meters (25 feet) north-south. These two features were situated about two meters (6.7 feet) apart at their closest points.

4.1.1 Artifact Assemblage

The preliminary investigations of the Lost Midden site suggested that the overall artifact density on the site was relatively sparse. Nonetheless, a total of 477 items were recovered during the combined preliminary field efforts at 41VV1991, including 76 chipped stone artifacts, 355 floral and faunal specimens, and 46 other items, some of which may not have been culturally utilized. With the exception of cores, the chipped stone artifacts represented the entire bifacial reduction sequence, indicating that tool manufacturing, as well as food processing activities were conducted on the site. Lithic tools recovered during the initial assessment of the Lost Midden site included six utilized flakes, three scrapers, and one Late Prehistoric Perdiz arrow point. Other items of interest included possible pieces of daub, which could potentially indicate the presence of residential features or perhaps lined pits in the area. The items recovered during the field investigations at the Lost Midden site are summarized in the tables below:

4.1.1.1 Temporally Diagnostic Artifacts

As noted in Table 4.1, one Late Prehistoric Perdiz arrow point was recovered during the preliminary investigation of 41VV1991 (Figure 4.4). With the exception of a very small

Table 4.1. Chipped Stone Artifacts Recovered from the Lost Midden Site (41VV1991) During the Preliminary Site Assessment

Provenience	Artifact Type	Artifact Count	Material Type	Other Observations
General Surface	Angular debris	1	Edwards chert	Light brown cortex evident; thermally altered
General surface	Early stage biface fragment	1	Edwards chert	Light brown cortex
General surface	Late stage biface	1	Edwards chert	Thermally altered
General surface	Utilized biface manufacturing flake	1	Edwards chert	Evidence of use-wear along inverse of 1 lateral edge and obverse of opposite lateral edge; apparent use as a scraping implement and possibly as a burin; thermally altered
General surface	Utilized interior thinning flake	1	Probable Edwards chert	Use-wear/retouch along 2 lateral edges; appears to have been used for scraping although similar items are commonly referred to as sotol knives
General Surface	Angular debris/thumbnail scraper	1	Probable Edwards chert	Steep retouch is evident along center of one lateral edge; light brown cortex evident
General Surface	End scraper	1	Unknown silicified material	Medium gray in color
Backdirt from original backhoe excavation	Arrow point	1	Unknown chert	Late Prehistoric Perdiz arrow point, produced from light gray chert
Backdirt from original backhoe excavation	Unifacial scraper fragment	1	Probable Edwards chert	Steep retouch apparent on the intact portion of 1 edge
Backdirt from original backhoe excavation	Utilized biface fragment	2	Edwards chert	Use-wear evident along one partial lateral edge on both pieces; both probably used for scraping, one is spokeshave-like
Backdirt from original backhoe excavation	Utilized flake fragment	1	Edwards chert	Use-wear evident along 1 lateral edge; thermally altered
Backdirt from original backhoe excavation	Utilized biface manufacturing flake	1	Possible rhyolite of unknown type	Maroon with lighter inclusions; evidence of retouch/use-wear along both lateral edges; probably used as a scraping implement

Provenience	Artifact Type	Artifact Count	Material Type	Other Observations
Backdirt from original backhoe excavation	Angular debris	10	8 pieces produced from Edwards chert; 1 produced from a medium to dark gray banded chert of unknown type; final item is made from an unknown light brown, coarse-grained, silicified material	3 pieces have been thermally altered
Backdirt from original backhoe excavation	Chips	11	10 pieces probably fit within the range of Edwards chert, 1 piece is an unknown coarse-grained material (off-white)	2 pieces may have been thermally altered
Backdirt from original backhoe excavation	Primary decortication flake	1	Unknown coarse-grained material	Pale brown with off-white cortex
Backdirt from original backhoe excavation	Secondary decortication flake	7	6 are produced from Edwards chert, the seventh is an unknown coarse-grained material (light brown)	Off-white, light gray, light brown, and maroon cortex colors; 2 pieces have been thermally altered
Backdirt from original backhoe excavation	Biface manufacturing flake	12	10 appear to be produced from Edwards chert, 1 is a black chert of unknown type, and the final item is produced from a coarse-grained banded gray/brown material of unknown type (chalcedony?)	3 of the flakes appear to have been thermally altered
Backdirt from original backhoe excavation	Interior thinning flakes	3	1 produced from unknown rhyolite (dark gray, coarse-grained), 1 produced from unknown light gray, coarse-grained material, and 1 manufactured from Edwards chert	Edwards chert item appears to have been thermally altered
Backdirt from original backhoe excavation	Biface thinning flake	4	Edwards chert	

Provenience	Artifact Type	Artifact Count	Material Type	Other Observations
Auger Test N0/W14	Secondary decortication flakes	2	Both items are probably produced from unknown rhyolites	1 item is maroon in color, while the other is a medium gray; both items are coarse-grained
Auger Test N0/W18	Angular debris	1	Edwards chert	
Auger Test N0/W18	Secondary decortication flake	1	Probable Edwards chert	Light brown cortex; material is more coarse than is typical for Edwards chert, but probably represents outer layer of Edwards chert
Auger Test N0/W18	Interior thinning flake	1	Edwards chert	
Auger Test N0/W18	Biface manufacturing flake	2	Edwards chert	
Auger Test N0/W22	Secondary decortication flake	1	Edwards chert	Off-white cortex
Auger Test N0/W22	Biface manufacturing flake	1	Unknown chert	Possible Edwards chert, but material has unfamiliar dark inclusions
Auger Test N0/W22	Biface thinning flake	1	Edwards chert	
Auger Test N0/W26	Chip	1	Probable Edwards chert	
Auger Test N0/W30	Angular debris	1	Probable Edwards chert	
Auger Test N4/W35	Secondary decortication flake	1	Edwards chert	Light brown cortex
Auger Test N12/W15	Chip	1	Edwards chert	
Auger Test N12/W15	Interior thinning flake	1	Edwards chert	

Table 4.2. Floral and Faunal Items Recovered from the Lost Midden Site (41VV1991) During the Preliminary Site Assessment

Provenience	Artifact Type	Item Count	Other Observations
Backdirt from original backhoe excavation	Tampico pearlymussel (*Cyrtonaias tampicoensis*) shell fragments	11	Small, unmodified fragments; items were discarded following analysis
Backdirt from original backhoe excavation	Charcoal	2	Wood species unidentified

Provenience	Artifact Type	Item Count	Other Observations
Backdirt from original backhoe excavation	*Polygyra texasiana* snail shells	166	No evidence of having been cooked or otherwise modified
Backdirt from original backhoe excavation	*Rabdotus dealbatus* snail shells	173	A majority of these shells have irregular holes in them, possibly caused by carnivorous *Euglandia rosea* snails; no evidence of having been cooked or otherwise modified
Auger Test N0/W18	Tampico pearlymussel (*Cyrtonaias tampicoensis*) shell fragments	2	Small, unmodified fragments; items were discarded following analysis
Auger Test N0/W18	*Rabdotus dealbatus* snail shell	1	No evidence of having been cooked or otherwise modified

Table 4.3. Other Items Recovered from the Lost Midden Site (41VV1991) During the Preliminary Site Assessment

Provenience	Artifact Type	Artifact Count	Material Type	Other Observations
Backdirt from original backhoe excavation	Fragment of pale yellow ochre	1	Part of fragment appears to be limestone	Cultural modification of the item is uncertain
Backdirt from original backhoe excavation	White, chalky mineral fragments	3	Unknown	Cultural modification or use of these items is uncertain
Backdirt from original backhoe excavation	Water-worn pebbles	2	One item may be jasper, the other possibly petrified wood	Cultural use of these items is uncertain
Backdirt from original backhoe excavation	Iron concretions	7	N/A	Cultural use of these items is uncertain
Backdirt from original backhoe excavation	Fossils of unknown type(s)	2	N/A	Cultural use of this item is uncertain
Backdirt from original backhoe excavation	Possible fossil coral fragments	3	N/A	Cultural use of these items is uncertain
Backdirt from original backhoe excavation	Possible burned clay lumps	10	N/A	Cultural use of these items is uncertain
Backdirt from original backhoe excavation	Possible burned daub	6	N/A	Darker gray/black compared to the light gray possible burned clay lumps noted above
Backdirt from original backhoe excavation	Possible unburned daub	4	N/A	Striations were evident on one piece

Provenience	Artifact Type	Artifact Count	Material Type	Other Observations
Backdirt from original backhoe excavation	Possible unburned daub or caliche	8	N/A	No evidence of striations or other impressions

fragment off the distal end, this specimen is complete. The point was produced from a fine-grained light gray chert that does not appear to have been thermally altered. The triangular blade edges are deeply concave and lightly serrated. The barbs flare outward. The length of this specimen is 29.4 millimeters (mm); maximum width is 22.9 mm; maximum thickness is 2.1 mm; stem length is 12.3 mm; maximum stem width is 4.2 mm; neck width is 4.2 mm; weight is less than 0.1 grams (g). This point type, which is found throughout most of Texas and Louisiana, dates to the Late Prehistoric period, between approximately 810 and 410 years ago (Johnson and Goode 1994:41; Turner and Hester 1999:227).

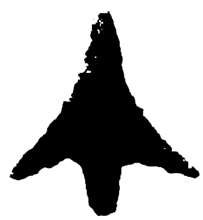

Figure 4.4. Perdiz point recovered from backhoe fill near Feature 1. Shown actual size.

4.2 Conclusions and Recommendations Resulting from Preliminary Assessment of 41VV1991

As a result of the preliminary field investigations at 41VV1991, the site was found to include at least two burned rock middens and associated artifacts. The two burned rock middens, which include a small midden on the western edge of the site and a much larger midden to the east, are situated within about two meters (6.7 feet) of each other at their nearest points. The associated artifact deposits appeared to be sparse. Mechanical auger testing indicated that the site had a maximum north-south dimension of approximately 15 meters (50 feet) by a maximum east-west dimension of about 26 meters (85 feet), encompassing approximately 0.04 hectare (0.10 acre).

The site is situated in an upland setting overlooking the western edge of Seminole Canyon. While much of this upland area has little to no soil deposition, the original backhoe pit and subsequent auger tests indicated that the larger of the two burned rock middens at 41VV1991 was located within a soil-filled basin. It has been suggested that this pocket of soil may have resulted when a former upland *tinaja* or partially collapsed sinkhole was filled with soil, through aeolian or alluvial deposition (Ed Hajic, personal communication October 22, 2009). The smaller burned rock midden at 41VV1991 is situated on shallower bedrock and some burned rocks from this feature were partially exposed on the ground surface, just outside the present RV dump station project area.

Temporally diagnostic artifacts recovered from the Lost Midden site during these early stage investigations were limited to one Late Prehistoric Perdiz arrow point attributable to a Flecha subperiod occupation of the site. Also in support of a Late Prehistoric timeframe for the site, more specifically Flecha or Infierno phase occupations, was a general paucity of artifacts on the site and the relative abundance of endscrapers recovered during the preliminary assessment. When encountered, Flecha and Infierno sites generally produce a paucity of cultural material, most of which is recovered from within cultural features. Areas between features are often nearly void of artifacts on these sites. Endscrapers are one of four diagnostic artifact classes that typify these sites in the Lower Pecos region. Flecha and Infierno sites, but especially Infierno sites, when encountered, tend to be found in upland settings such as the one upon which 41VV1991 is situated. Sites of this type and age are relatively rare in the Lower Pecos.

Given that damage to this previously unrecorded site was done and that the site was to be further damaged by the additional work still required for the completion of the RV dump station, and possibly by the future expansion of an adjacent septic field, the Texas Parks and Wildlife Department recommended further mitigation of the site following the preliminary assessment. As will be discussed in subsequent chapters of this report, the additional work included the exposure of the two burned rock middens that were identified during the preliminary site investigations, the excavation of a total of 19 one meter by one meter (3.3 feet by 3.3 feet) test units within these features, and geomorphological and paleobotanical analyses. The research design and technical methods for the excavation of 41VV1991, which were reviewed and approved by the Texas Historical Commission prior to the excavation being initiated, are included in the next two chapters.

CHAPTER 5: RESEARCH DESIGN FOR THE EXCAVATION OF 41VV1991

As discussed in Chapter 1, preliminary investigations of 41VV1991 were conducted on several different occasions between the time of its accidental discovery in September 2007 and November 2007. These investigations included surface investigations, shovel testing and mechanical auger testing. Following these preliminary investigations, a Scope of Work was prepared for subsequent large-scale excavation of the site, which was reviewed and approved by the Texas Historical Commission prior to the excavation. This work was accomplished between March and November 2008, under Antiquities Permit No. 4862. The excavation was completed by members of the TPWD Cultural Resources Program, the staff of Seminole Canyon State Park and Historic Site, and a number of volunteers. The research design that guided the excavation of 41VV1991 is summarized below, while the research techniques are discussed in the following chapter.

5.1 Objectives

The primary objective of this project was to gather sufficient data to characterize the physical condition of 41VV1991 and to determine the significance of the site within the regional history, allowing a statement of significance of this site to be provided to the Texas Historical Commission for review and comment. To accomplish this objective, the present research design is intended to define the project, relate archival and field work to particular contexts, and to provide for the integration of this information.

Data gathered during this investigation was also used specifically to address six critical research questions about burned rock middens posed by Black et al. (1997) in their burned rock midden study *Hot Rock Cooking on the Greater Edwards Plateau: Four Burned Rock Midden Sites in West Central* Texas. These questions, as they pertain to the Lost Midden site, are:

1) When did the burned rock middens at this site accumulate?
2) How did these middens form?
3) What foods were processed/cooked in these middens?
4) How did the middens function within the context of the site?
5) How can we explain the midden to midden variation that appears to exist between the two middens at the present site?
6) Why did these middens form where they did on the landscape?

5.2 Methodology

5.2.1 Systems Approach

This investigation was undertaken using a "Systems Approach" (Clark 1968; Flannery 1968). Using this approach, the effect of humans upon the environment and *vice versa* forms the basis for understanding physical as well as cultural change over time on the landscape. As discussed by Butzer (1982:5), the ultimate goal of archeologists is to determine the interrelationship between culture and environment, emphasizing archeological research "directed toward a fuller understanding of the human ecology of prehistoric communities" (Butzer 1964:vii, 5).

Archeological sites are the result of human activities that took place within a constantly changing physical and cultural environment. The surviving record of these varied activities is only a small remnant of the entire picture; however, it is these remnants which archeologist must fully analyze in an attempt to understand the past as completely as possible. As discussed by Gibbon (1989:72-73):

> Since material culture was once an integral part of functioning cultural systems and is 'mirrored' in the archeological record, archeological materials have in principal the capacity to inform on all aspects of past cultural systems. Given their multidimensional origins, the information content of artifacts and assemblages is not exhausted by the reconstruction of norms. Although the archeological record may be patterned, its contents have no single meaning and are therefore a source of information about many features of past cultural systems and processes.

The cultural evolutionary and ecological theoretical orientation assumes that human activities are directly affected by the environment and that those activities can be traced, more or less, through time (Steward 1955). As researchers of past human activity, we define a natural environment and a cultural environment. Both environments in combination affected a given population at any given point in time.

Layers of systems having local, regional and even broader manifestations further enrich the systems model. By viewing external factors in relation to local events, our understanding and appreciation of the local level increases. This gives researchers a larger context within which to analyze past lifeways.

5.2.2 Contexts and Systems Theory

Historic contexts and related property types are a useful means for applying the systems approach to cultural resource investigations. "Theme, place, and time are the basic elements that define historic contexts." (USDI 16:7). These variables are obviously part of the natural and cultural environment as well.

The development of appropriate contexts provides a valuable tool for understanding the importance and evolution of a project area and for evaluating the significance of particular properties and sites.

5.2.3 Research Considerations

Within the aforementioned theoretical framework, there are three considerations which guide our present research. The first consideration is the natural context of cultural deposits. It is assumed that the conditions for the preservation of archeological information are determined first and foremost by geological changes in the landscape and the process of soil development (pedogenesis). Since archeological sites are incorporated within landforms by natural site formation processes, they can be viewed in much the same manner as one would view geologic deposits with respect to erosion and deposition. Therefore, the relative location of sites and the conditions of site preservation can be estimated by systematically testing given areas in relation to their landforms. This approach is also useful for recognizing historic alluvium, made land, Ap horizons (plow zones), and other disturbances that may have affected the area under investigation. While this approach enjoys generally good success in predicting where archeological sites are likely to be located on the landscape, there are occasions when the model fails, the accidental discovery of 41VV1991 being a good case in point. Buried upland sites, such as the Lost Midden site, have been thought to be relatively uncommon in west Texas.

The second consideration is the applicability of previous research. It is assumed that the cultural sequence previously defined by archeologists for the Lower Pecos region of Texas is applicable to the present project. Given the quantity, and quality, of the archeological research that has been conducted in the region, including the Seminole Canyon area, there is no reason to believe that the cultural sequence presently defined for the region is not applicable to the Lost Midden site.

The third consideration is the type of site reflected in the present study. We expect that this site, like other burned rock midden sites, represents the remnants of a generalized hunting and gathering mode of production. However, the precise mode of production may vary according to the effects of tradition, the cultural value and application of labor, historical circumstances, political considerations and environmental constraints.

CHAPTER 6: TECHNICAL METHODS

6.1 Pre-Field Stage

A growing body of data exists for burned rock midden sites in Texas, including sites in the Lower Pecos, Edwards Plateau, and Big Bend regions of the state. A review of these data, as well as interviews with area archeologists, including Elton Prewitt, Shumla School; Jack Johnson, Amistad National Recreation Area; Joe Labadie, formerly with the Amistad National Recreation Area, now retired; Phil Dering, Shumla Archeobotanical Services, Comstock and others, was beneficial in helping place 41VV1991 within the broader prehistoric context of the Lower Pecos region and within the context of other burned rock midden sites. The resulting information was incorporated into the appropriate sections of this report.

The pre-field stage of this project included inspection of archeological site records, cultural resource management reports and other pertinent publications on file at the General Land Office, Austin; the Texas Archeological Research Laboratory, Austin; the Texas Historical Commission, Austin; the Texas Parks and Wildlife Department Archeology Laboratory, Austin; the TPWD Region 1 Cultural Resource Coordinator's Office, Fort Davis; and the Center for Big Bend Studies, Sul Ross State University, Alpine. These archives were used to compile the following summary of previous archeological investigations in and near Seminole Canyon State Park and Historic Site.

6.1.1 Evaluation of Historic Plats, Aerial Photographs and Other Archival Documents: Establishing a Land Use History for the Project Area

As noted in Chapter 1, prior to the present project, the area in the vicinity of 41VV1991 had been previously impacted to some extent by several developments that have been undertaken since the park property was acquired by the TPWD in 1973. These developments include the placement of a nearby septic field, sewer line, fiber optic line, park road, and parking area. The present project area was also apparently previously bladed so that it could be used to accommodate overflow parking during the dedication of Bill Worrell's shaman-like sculpture 'Maker of Peace', erected at the park in 1994. Archeological surveys conducted in advance of these projects, and the subsequent excavations related to the construction of these facilities, did not reveal any archeological deposits in the vicinity of the Lost Midden site.

Historically, there have been other impacts to the broader area that is now Seminole Canyon State Park and Historic Site. In the early 1880s, the Southern Pacific Railroad, operating through a subsidiary, the Galveston, Harrisburg, and San Antonio Railway Company, built a railroad grade through what is now the state park. The railroad was constructed primarily by manual labor and the thousands of men who constructed the railway stayed in camps, at least one of which was within the current boundaries of the park (41VV540; Turpin 1995b). Other facilities, including a former saloon (41VV544), served the camp occupants. Railroad era graffiti is present at various rockshelters and overhangs in the area, including 41VV72, 41VV73, and 41VV226. One of the rockshelters, Running Horse Shelter (41VV226), is said to have been used to store the explosives needed for the construction of the railroad grade (Briggs 1974:37; Patterson 1980:13). Perhaps of greatest impact to the landscape, fill dirt and rocks in the area were used to construct the railroad grade, segments of which can still be seen today. The section of railroad grade that runs through the park property was abandoned by the Southern Pacific in 1891 (Turpin 1995b:9), when the present railroad alignment was constructed further north.

Apart from the railroad construction, the primary use of the area from the late 1800s until the property was purchased by the TPWD was ranching. The first operation was cattle ranching, which later gave way to sheep and goat ranching. The main ranch headquarters from this early ranching heritage is within the park. This headquarters complex was also where most of the livestock was kept in the early days of the ranch. There are also reports of wild cattle and horses in the area from this time.

In the 1920s, US Highway 90 was built. It was rerouted in 1983 and took in a small portion of state land for construction of the bridge across Seminole Canyon.

While livestock could certainly have had an impact on the vegetation, and perhaps on the rate of erosion in the area of 41VV1991, they are unlikely to have had an impact on the buried archeological deposits at the site. Likewise, the railroad and highway construction in the area of Seminole Canyon State Park and Historic Site do not appear to have had any direct impact on the Lost Midden site.

6.2 Field Stage

Fieldwork for the intensive excavation of the Lost Midden site was conducted between April 29 and November 16, 2008. The field techniques utilized during this stage of the project were designed to determine the variation in artifact types and density, stratigraphic integrity and differentiation, depth and extent of preservation of cultural deposits and the extent of natural or artificial site disturbances. This information is crucial for determining the significance and research potential of a site (Glassow 1977:419).

Cultural materials recovered from 41VV1991 were subsequently analyzed in an effort to understand subsistence strategies and other patterns of behavior by the former inhabitants of the site.

6.2.1 Removal of Overburden, and Site Mapping

Most of the soil that mantled the large burned rock midden at 41VV1991 (Feature 1) was removed by heavy equipment prior to the midden being impacted by the backhoe excavation, as part of the preparation for constructing the proposed RV dump station. As a result, little overburden remained atop the remainder of this feature, and only a thin layer of soil appeared to be present across the rest of the site in general. The remaining soil that mantled the site was removed by hand, through troweling and occasional shovel skimming, to fully expose the cultural features and any additional living surface that might be present. Because the cultural features and most artifacts associated with this site were situated below this upper layer of soil, and because the soil was being removed by troweling and shovel skimming, the overlying soil was not screened during this stage of the project. When encountered, artifacts were retained for analysis and curation, and their provenience recorded.

Also, during this early stage of excavation at 41VV1991, the remaining loose soil within the original backhoe excavation was removed, exposing the bedrock floor of the large natural basin within which much of the Lost Midden site is situated.

Upon removing this soil and exposing the cultural features at 41PS1991, the floorplan of the site was thoroughly documented through conventional digital photography and low altitude aerial digital photography (i.e. kite photography and blimp photography; Figure 6.1). A base map of the site was also completed, using a total data station and stadia rod with metric readings, and Surfer PC software (Figure 6.2). Test units, discussed below, were subsequently placed within the fully revealed features and other areas of the site to be tested.

Horizontal and vertical mapping controls for the test unit excavations were established at the Lost Midden site with reference to the benchmark datum, a survey nail with washer established along the west-northwest side of the park entrance road, across from the Visitor Center parking area, by the Texas Department of Transportation (TxDOT). The benchmark datum was further located in GPS zone 14R, 276131.48mE, 3287658.70mN. The absolute elevation of the benchmark datum was 420.08 meters (1,378.21 feet) above mean sea level. As previously noted, the site datum was located in GPS zone 14R, 276124.74mE, 3287830.79mN, and was designated as the N0/W0 coordinate point of a site grid oriented along a generally east-west trending baseline transect with several north-south trending transects. The elevation of the site datum was 419.93 meters (1.377.72 feet) above mean sea level. Excavation units were oriented relative to this grid and the original backhoe excavation. Grid markers consisted of survey nails and pin flags placed at 5-meter (16 feet) intervals along the grid; these were left in place until all excavation work was completed. Transit readings were taken to produce a site map showing the topography, extent of the cultural features, and locations of the test unit excavations at 41VV1991. Site plan views were produced by taping from staked grid points.

6.2.2 Test Unit Excavations

The present project utilized 1 meter by 1 meter (3.3 feet by 3.3 feet) test units to further investigate the two burned rock middens at the Lost Midden site. A total of 14 test units were excavated within the larger of the burned rock middens at 41VV1991 (identified as Feature 1); the midden that was damaged by the backhoe excavation. Seven test units were placed in the southeastern portion of the feature, two test units in the northwestern area of the midden, and four test units in the southwestern area of Feature 1 (Figures 6.2-6.3).

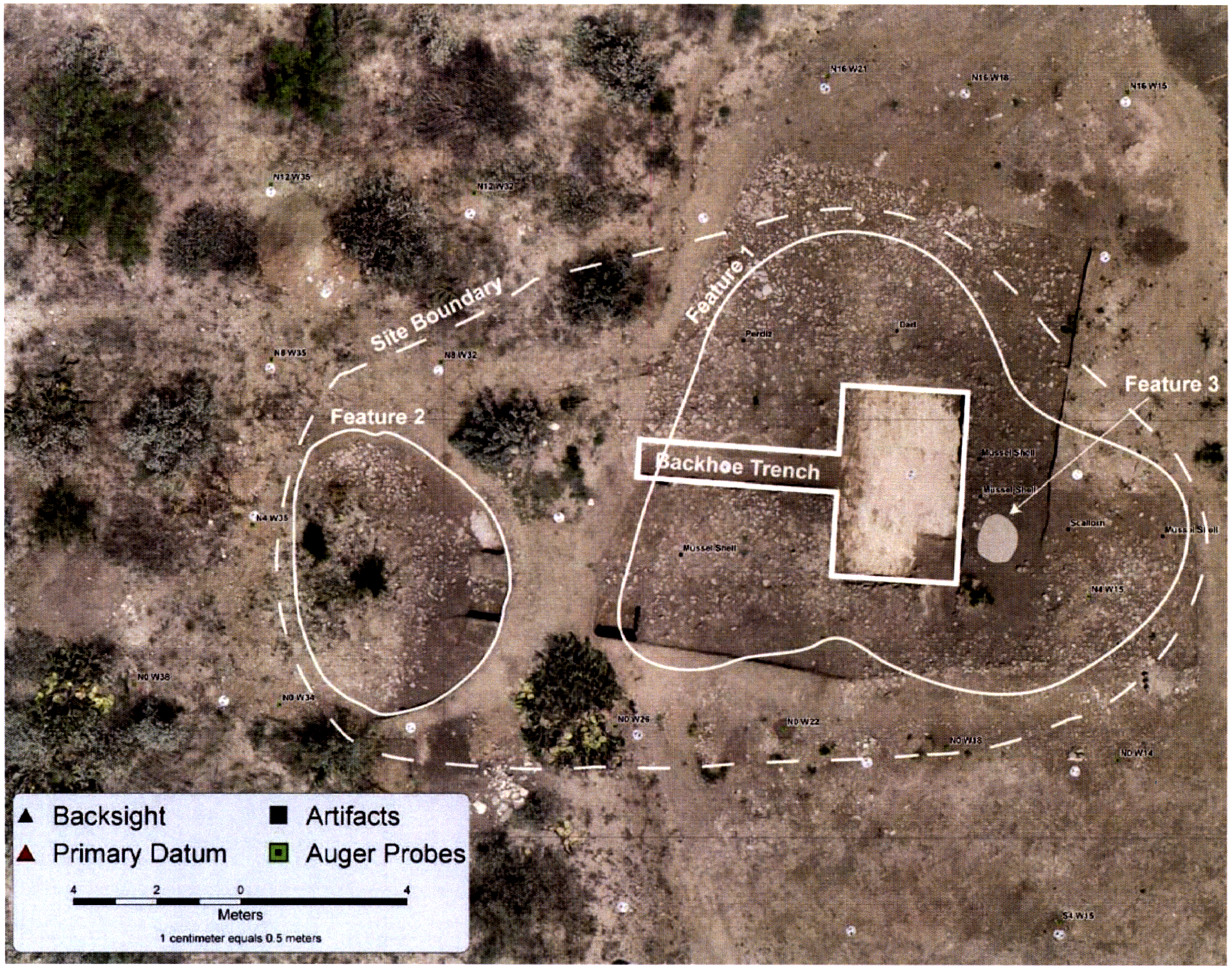

Figure 6.1. Aerial view of Lost Midden site following the removal of overburden from Features 1 and 2. Photograph is oriented approximately north-south.

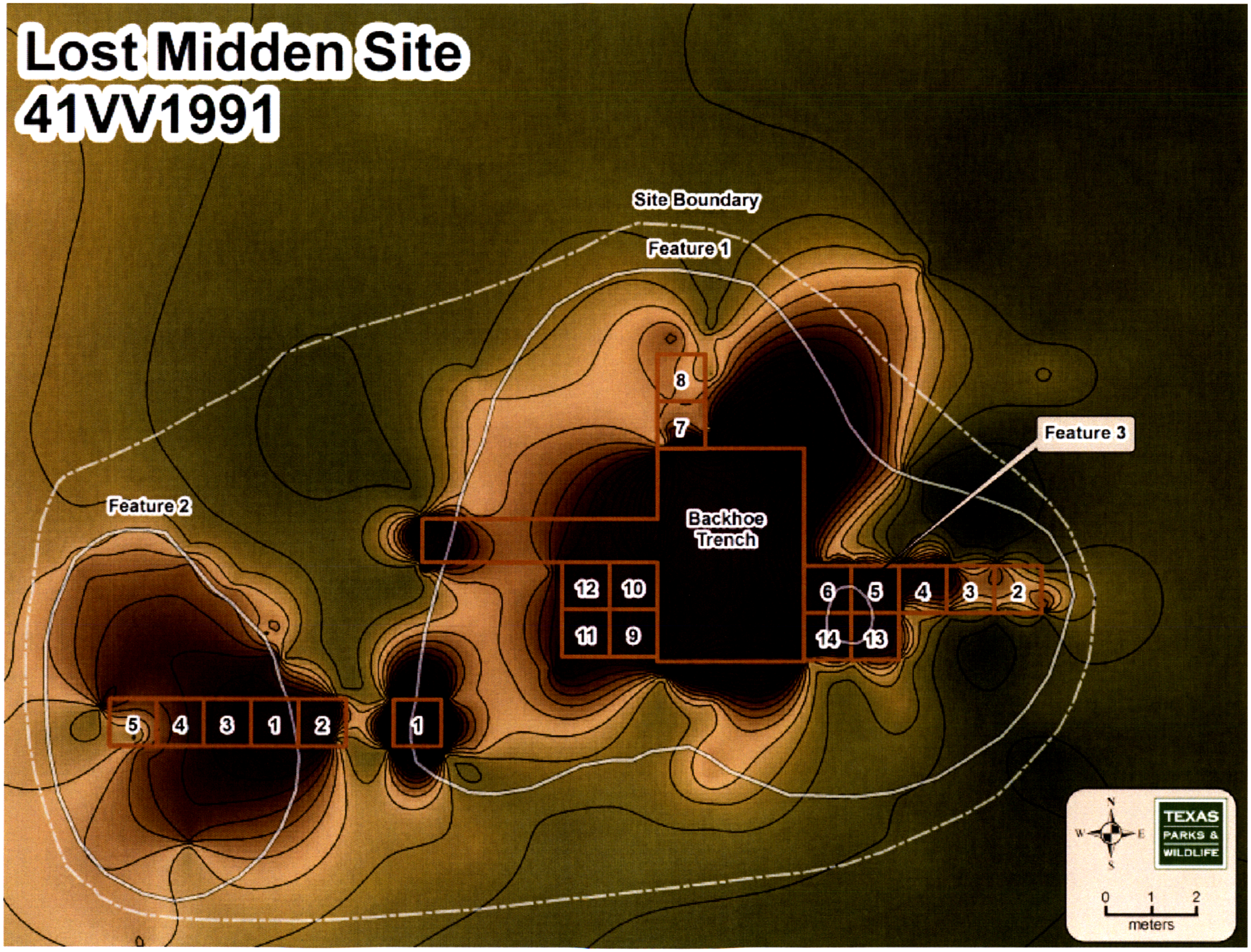

Figure 6.2. Contour map of the Lost Midden Site, Seminole Canyon State Park and Historic Site.

This distribution of test units within Feature 1 provided a good cross-section of this feature, and exposed an intact roasting pit (Feature 3) in the southeastern part of midden.

A total of five test units were placed along a single transect within the smaller of the two burned rock middens, designated Feature 2. This transect of test units extended from near the center of this feature, across the eastern edge of the midden (Figures 6.1-6.2, 6.4).

Additional test excavations included three 50 centimeter by 50 centimeter (1.6 feet by 1.6 feet) test units that were placed along a line where a future pipeline will connect the RV dump station with an existing septic field.

All test unit excavations were achieved through a combination of shovel skimming and troweling, and were accomplished using 10-centimeter arbitrary levels. All units were excavated to bedrock or culturally sterile soil, which was generally 50 to 60 centimeters (19.7 to 23.6 inches) below the present ground surface. Several soil samples were collected for flotation or geomorphological analyses, but all other soil matrix was screened through ¼-inch mesh hardware cloth, and the recovered material kept for analysis.

At the base of each excavation level, the test unit floor and wall profiles were cleaned to identify any possible features or other cultural phenomena. Scaled maps, profile illustrations, and digital photographs were used to document noteworthy disturbances or cultural features within each test unit. Data pertaining to each excavation level was recorded on standardized field forms. Finally, each excavation unit was assigned a sequential number within Feature 1 and Feature 2 and placed on a base map of 41VV1991.

One intact roasting pit feature, Feature 3, was encountered during the excavation of test units within the larger of the two burned rock middens at 41VV1991. Once exposed, this feature was drawn in plan view, photographed and eventually bisected. The resulting profile was drawn and photographed. Data pertaining to the excavation of the roasting pit was recorded on standardized field forms. In the process of excavating Feature 3, which had an obvious abundance of organic material, three flotation samples were recovered from two different levels of the feature. All other matrix was screened through ¼-inch mesh hardware cloth, and the recovered material kept for analysis. This feature was entirely excavated.

Occasionally, significant amounts of charcoal were recognized *in situ* during the excavation that was not within soil being collected for flotation purposes. In these instances, the charcoal was plotted on level forms and elevation noted, removed from the surrounding soil matrix and was wrapped in aluminum foil for subsequent identification and possible radiocarbon dating.

Excavations at 41VV1991 included the use of volunteers, when possible. Among these volunteers was Joe Labadie, former site archeologist at Amistad National Recreation Area, now retired; Jack Johnson, former staff person at Seminole Canyon State Park and Historic Site, now the site archeologist at Amistad National Recreation Area; and, Elton Prewitt,

Figure 6.3. Excavation of test units within Feature 1 of 41VV1991.

Figure 6.4. Excavation activities within Feature 2, 41VV1991.

Shumla School, Comstock, Texas. Other volunteers included park volunteers and members of the Texas Archeological Society. In addition to the authors of this report, other members of the TPWD Cultural Resources Program were also involved in the excavation of the Lost Midden site.

A total of 19.75 square meters (212.59 square feet) of soil was excavated from 41VV1991 during the excavation of test units at the site. The depth of the test units was variable due to differences in the depth of cultural deposits, soil stratigraphy and the unevenness of the underlying bedrock, but a maximum estimate of approximately 6.39 m^3 (225.66 ft^3) of soil was excavated from within the largest of the burned rock middens (Feature 1), including the interior roasting pit (Feature 3). A maximum estimate of approximately 2.12 m^3 (74.87 ft^3) of soil was removed from the second burned rock midden (Feature 2) at the site during testing. An additional 0.11 m^3 (3.88 ft^3) of soil was excavated during testing of the proposed pipeline corridor that will eventually link the new RV dump station, when completed, with an existing septic field.

6.3 Post-Field Stage

6.3.1 Artifact Processing

The processing of artifacts from the Lost Midden site consisted of washing the items and separating them by general artifact type, by provenience. The artifacts were subsequently catalogued and numbered with lot numbers in accordance with the curation standards and procedures established by the Council of Texas Archeologists, and adhered to by the TPWD Archeology Laboratory. The TPWD curation facility is an Accredited Archeological Repository (discussed in more detail in Section 6.4.3 of this chapter).

6.3.2 Artifact Analyses

As discussed by James Deetz (1965:2):

> Artifacts are the material products of culturally patterned behavior. The patterning manifest in the attributes which characterize any series of similar objects exists because the behavior which produced these objects is patterned. Repeated series of nearly identical operations by one person, or a group of persons, produces objects marked by a high degree of similarity. The patterning of behavior which produces standardization in artifacts is largely conditioned by the culture of the makers of those objects.

The present analyses were designed to identify patterns within the artifact assemblage, thus providing a tool for interpreting the behavior of the inhabitants of the Lost Midden site.

6.3.2.1 Lithic Analysis

A total of 500 lithic artifacts were analyzed during the present project, including items recovered during the preliminary investigations of the Lost Midden site. This analysis also included selected specimens recovered from secondary contexts (i.e. backhoe dirt piles). Two of the items were ground stone artifacts, the remainder were chipped stone specimens.

In order to correlate attributes of a lithic assemblage with human behavior, the factors associated with the reduction of raw materials to their final forms must be considered (Henry 1973; Sellars 1989). These technological and functional factors were considered in the analysis of the present assemblage. A technological analysis was designed with the goal of providing information about the reduction strategy utilized to produce blanks or "potential tools" (Bradley 1979). The probable functions of lithic tools recovered during the present project were established through use of published and unpublished use-wear studies (cf. Hayden, ed. 1977; Odell 1981, 1982: Shen 1995). In addition, because function is the major controlling factor of a tool's final form (Henry 1977:231), the morphology of the artifact itself may suggest a specific activity.

Lithic materials were sorted into gross preliminary categories of tools, debitage (flakes produced during the lithic reduction process), chips (medial and distal flake fragments), and angular debris (lithic debris that lacks clear flake features). As part of the technological analysis, various metric, qualitative and quantitative attributes were observed and recorded for each of the artifacts. Qualitative observations were made under natural light, while metric attributes were measured in millimeters with the aid of Mitutoyo 550 Series digital calipers. The attributes chosen for study were selected for their usefulness in identifying reduction strategies, and to reveal the most pertinent information with regard to the initial processes of lithic tools. Lithic tools were identified and described individually, following a morphological typology that has proven useful in past analyses of lithic tools (cf. Benn 1987; Roberts and Henning 1994).

Thermal alteration of chipped stone materials was identified on the basis of diagnostic attributes that heat treatment produces (cf. Anderson 1979; Mandeville 1973; Olausson and Larsson 1982). Fire cracked rock was identified and described following the definitions provided by Benn (1986). The context from which the fire cracked rock was recovered, raw material type, and relative degree of utilization were considerations in the identification of this artifact type.

In addition to the methods outlined above, lithic materials were identified by raw material type, when possible. Raw material types were identified through macroscopic and low-power microscopic analysis of the recovered lithics. Attempts were made to identify and consult any raw lithic material type collections that might include samples from the study area, but no such collections could be found during the present investigation. However, Edwards chert, a primary lithic material type utilized by the inhabitants of the Lost Midden site, was identified through comparisons with raw material sources at Devil's Sinkhole State Natural Area, Edwards County, Texas. Sources of similar lithic material are also known to occur at Kickapoo Cavern State Park, Kinney and Edwards counties, Devils River State Natural Area, Val Verde County, and at least at five lithic procurement sites at Seminole Canyon State Park and Historic Site itself. In addition, comparisons were also made with Pleistocene fluviatile gravels collected from the present study area.

6.3.2.1.1 Lithic Glossary

The following terms are used in the present lithic analyses, and are provided here to make these analyses more useful to other researchers (from Austin 1986; Benn 1987:340-344; Harrison 1985:45-49, 52-54; Sellars and Ambrosino 1990:103; Tomka et al. 2001).

Detachment Techniques

Pressure Flaking. The manual pressure technique consists of holding the incipient tool on a pad or cushion of leather or some other suitable material in one hand or on a stationary anvil on a horizontal or slightly oblique plane and applying the distal edge of the pressure flaking tool, held in the opposite hand, to an edge of the incipient tool and pressing off a flake. Induction of mechanical force, in the form of pressure exerted simultaneously in an upward direction, away from the incipient tool, and inward, toward the incipient tool. The flaking tool may be a length of bone, antler, hard wood, or stone.

Hard-Hammer Percussion. Refers to the use of a hammerstone as a percussor. Hammerstones are of various sizes and weights depending upon what is required of them. Flakes detached by hard-hammer percussion are relatively thick and large with high platform angles, large protrusive bulbs of percussion, and a cone of percussion. Flakes are produced by holding the core in one hand on a horizontal or slightly oblique plane; a sustained blow is struck on the outer edge of the core platform with the sub-round end of a hammerstone held in the opposite hand, inducing the detachment of a flake from the underside of the core.

Soft-Hammer Percussion. The core is positioned as in hard-hammer percussion but it is struck with the convex distal edge of a rounded length of bone, antler, hard wood, or stone softer than the core material. This technique produces a thin flake with a low striking platform, a subtle bulb of percussion, no cone of percussion, and a lip-like protrusion on the ventral edge of the platform. The point of impact is located on the dorsal edge of the platform. Flakes produced by soft-hammer percussion are much thinner at their proximal ends than those produced by hard-hammer percussion.

Striking Platform Types

Unfaceted Platform. Often includes a flat, concave, or convex surface resulting from a previous flake scar that may or may not have been associated with preparing the platform. Unfaceted platforms include the crushed platforms and corticated platforms noted in the present analysis.

Faceted Platform. Platform with multiple, more or less parallel, flake scars at a right angle to the width of the platform surface.

Flake Production

Core. Stone greater than 50 millimeters (1.97 inches) in diameter with one or more striking platforms, cortex removal, and evidence of primary flake production from at least one shaped flaking face.

Core Fragment. Broken fragment with one or more platforms or some other evidence of flake production.

Debitage. Flakes produced during the lithic reduction process.

Primary Decortication Flake. Decortication flake with the entire obverse surface covered with cortex. As a result of the detachment process, cortex may not be present in a small area of the obverse surface immediately beneath the striking platform.

Secondary Decortication Flake. Decortication flake with both flake scars and cortex on the obverse surface. This type of flake is usually detached with hard hammer percussion.

Interior Thinning Flake. Flake with no cortex on the obverse surface and often with a high platform angle. This type of flake is usually detached by hard hammer percussion.

Biface Manufacturing Flake. These flakes may be primary, secondary, and tertiary debitage that were removed by hard hammerstone or billet, and exhibit longitudinal curvature and moderate to prominent dorsal flake scar ridges. The flake scars are indicative of sequential flake removals and removals from opposite biface edges. Striking platforms are typically single facet or are multifaceted, with one or two facets being most common (Tomka et al. 2001).

Biface Thinning Flake. Tertiary thinning flakes removed by soft hammerstone or billet, and exhibit a moderate to high number of dorsal flake removal scars, low flake scar ridges, and moderate to slight longitudinal curvature. Striking platforms are multifaceted and ground, with some lipping on the ventral edge of the striking platform (Tomka et al. 2001).

Biface Resharpening Flake. Small flakes (<20 mm) exhibiting multiple shallow dorsal flake scars and slight to moderate longitudinal curvature. These flakes exhibit very small striking platforms that show use-related polish and rounding. The striking platforms of resharpening flakes are typically unifacial and very small (Tomka et al. 2001).

Notching Flake. Small flakes (ca. 5-15 mm) removed by pressure flaking to create notches along the basal and lateral margins of a biface. Notching flakes exhibit a characteristic recessed, U-shaped platform. The dorsal surfaces of these flakes typically exhibit deep, semi-circular scallops produced by prior sequential removals of notching flakes (Austin 1986).

Complete Flake. A flake that retains a striking platform and a feathered and/or hinged termination.

Proximal Flake. A flake fragment that retains a striking platform but lacks feathered or hinged distal ends.

Chips. Medial and distal flake fragments.

Angular Debris. Lithic debris that lacks clear flake features.

Potlid. A concave-convex or plano-convex fragment of stone. Potlids never have a ringcrack or any other feature relating to the input of external force. They often have a central protruberance which indicates an internal initiation to the fracture. Potlids are the result of differential expansion of heated rock.

Blade. Flakes that are twice as long as they are wide, exhibit parallel sides, and one or more parallel dorsal ridges. The striking platforms of these flakes are typically corticate and/or single faceted; however, striking platforms with two or more facets are also common (Tomka et al. 2001).

Platform/Core Preparation Flake. These flakes can range from small (<10 mm) to large (>40 mm), depending on the stage of reduction when they were removed and/or the size of the parent specimen. Shapes range from blade-like to somewhat rounded to half moon-shaped, depending on the parent core. Flakes removed during blade core preparation usually have single facet platforms, while platform preparation flakes removed from bifacially flaked cores may have single facet or multifaceted platforms (Tomka et al. 2001).

Uniface Manufacturing/Resharpening Flake. Flakes are small to medium-sized with single facet platforms, and often exhibit slight longitudinal curvature adjacent to the distal end. In general, the dorsal surfaces of uniface manufacturing/resharpening flakes retain a series of parallel flake scars and shorter step-fractured flake scars resulting from manufacture activity and from attempts to resharpen the working edge. Uniface resharpening flakes can be identified by the presence and nature of usewear on the platform; rounded, polished, and sometimes striated platform facets indicate resharpening of tools that have been used (Tomka et al. 2001).

Uniface Rejuvenation Flake. These flakes are a product of three uniface rejuvenation methods, each producing distinctive flakes (Shafer 1970). The first method removes a worn or heavily step-fractured and deeply undercut working edge by using a striking platform located on or near a lateral side of the uniface to remove a burin like flake that retains the flat ventral surface of the uniface on one face and the working edge on the opposite. The platform of these flakes is multifaceted, while the flake is relatively narrow and retains a strong dorsal ridge formed by the intersection of the ventral surface of the uniface and the working edge of the tool. The second method uses the ventral surface of the uniface as a platform to remove small segments of the worn working edge. These flakes typically exhibit single-faceted striking platforms, multiple step-fractured flake scars on the dorsal surface, longitudinal curvature immediately adjacent to the distal end, and dorsal ridge running perpendicular to the long axis of the flake. These flakes are identical to uniface manufacturing flakes but retain evidence of use wear. The third method uses the working edge as the striking platform to remove flakes from the ventral surface of the uniface. These flakes have multifaceted striking platforms that retain part of the working edge of the uniface. The flakes often terminate in hinge fractures (Tomka et al. 2001).

Chipped Stone Tools

Utilized Flake. Flake of any type which has evidence of use as a tool but has not been recognizably modified to perform a specific task.

Retouched Flake. Any flake which has undergone edge modification (usually by pressure flaking) to create a specific tool type or resharpen a dull edge.

Uniface. Only one face of the chipped stone artifact has been entirely or partially shaped by flaking. The flaking was produced by percussion or pressure from one direction.

Biface. A round, oval, triangular, or rectangular form with a regular cross-section that has been shaped by primary flaking on both faces of the cutting edge.

Projectile Point. Bifacial or unifacial tool which is longitudinally symmetrical. The proximal end has been prepared for hafting and the distal end is pointed. Surfaces and edges have been shaped by initial edging, primary and secondary flaking, and/or tertiary flaking.

Burin. A pointed tool with a transverse (chisel) edge made by the removal of one or more flakes.

Graver. A small tool with a sharp tip that was used to engrave bone, stone, wood or other materials.

Knife. A tool that was flaked to form one or more elongate cutting edges. Occasionally, these tools are 'backed', or purposely dulled to prevent cutting the fingers; the opposite edge has evidence of use-wear, indicating a working edge.

Sotol Knife. Unifacial tools made on large secondary flakes that apparently were used to sever agave leaves from the heart of the agave plant. These tools are commonly found in association with agave roasting pits across the American Southwest.

Scraper. Bifacial or unifacial tool which generally has a blunt, convex, steep-angled working edge that has indication of use as a hide scraper (i.e., edge rounding, polish, etc.).

End scraper. Bifacial or unifacial tool which has convex, steep-angled retouch along distal edge.

Side scraper. Bifacial or unifacial tool which has convex, steep-angled retouch along lateral edge(s).

Spokeshave. A tool, usually a uniface, that has at least one retouched lunate notch in one edge. Generally thought to have been used to shape and smooth wooden rods and shafts.

6.3.2.2 *Faunal Analysis*

A total of 1,401 faunal items, consisting entirely of mollusk shells or shell fragments, were recovered from the Lost Midden site. These mollusks included mussels and land snails.

<u>Mussel Shells</u>

Mussel shells recovered from the Lost Midden site were identified by Dr. Artie L. Metcalf, University of Texas – El Paso, and Tim Roberts. Per practices utilized by Dr. Robert E. Warren, Illinois State Museum, Springfield, 'identifiable' mussel shells were defined as specimens that retained the beak or umbo portion of the shell in the vicinity of the pseudocardinal tooth (cf. Burch 1975; Parmalee 1967). As reported by Warren (Ahler et al. 1997:61), this approach minimizes the possibility that fragmented specimens would be counted more than once. Those specimens that were lacking the beak or umbo portion of the shell were considered unidentifiable. All identifiable specimens were counted and weighed by provenience.

<u>Snail Shells</u>

Snail shells recovered during the present project were identified by this author based on comparisons with those documented from other archeological sites in Texas (cf. Brown 2002), as well as websites on the subject (cf. Johnson 2006; Nordsieck 2009). Shell color and surface structure are of the greatest importance in the identification of snails, but shell size, the number of whorls, and the form of the aperture also help identify the species (Nordsieck 2009). In an effort to avoid counting a specimen more than once, specimens less than approximately two-thirds complete were considered unidentifiable and not counted. All identifiable specimens were counted and weighed as a group by provenience.

6.3.2.3 *Macrobotanical Analysis*

A total of three flotation samples, all of which were recovered from the intact roasting pit (Feature 3) at the Lost Midden site, were submitted to the Center for Big Bend Studies, Sul Ross State University, Alpine, in June 2009 for processing. These samples, after being measured with graduating measuring pitchers, were processed in a machine-assisted flotation device. The heavy fraction was captured with window screen, while the light fraction was collected with very fine nylon cloth bags. The resulting light and heavy fractions were submitted to Macrobotanical Analysis, Manchaca, Texas, for analysis.

During the processing of the flotation samples, light fractions were caught in such fine nylon bags that some sediment remained in the light fractions. As a result, the light fractions were placed in coarser nylon bags (openings 0.33 mm) at the Macrobotanical Analysis laboratory, and gently rinsed and dried in the shade. Floral materials were removed from heavy fractions and added to the light fractions prior to analysis. All carbonized plant material larger than 2 mm was removed from the heavy fraction, and the remainder was scanned for non-wood plant remains. For the three flotation samples, an average of 33 percent (by weight) of plant material larger than 0.2 mm was recovered from the heavy fraction.

Once the heavy fraction plant material had been added, flotation light fractions were sorted according to standard methods (Pearsall 2000). Each flotation light fraction was weighed on an electronic balance with a sensitivity of 0.01 g before being size-sorted through a stack of geologic mesh with openings of 2 mm, 1.4 mm, and 0.71 mm. Materials in the > 2 mm size fraction were completely sorted, and all carbonized botanical remains were counted, weighed, recorded, and labeled. All materials in the > 2 mm size fraction other than carbonized and semi-carbonized plants were referred to as "contamination" on laboratory forms. At Lost Midden these materials usually consisted of rootlets, stems, and gastropods. Materials that fell through the 2 mm mesh, referred to as "residue," were examined carefully under a stereoscopic microscope at 7 to 45 X magnification for carbonized botanical remains other than wood charcoal. These plant parts, which at Lost Midden consisted only of indeterminable starchy fragments, were removed from residue. All plant material removed from the residue was counted, weighed, and labeled. The presence of fresh seeds in the residue was also recorded on laboratory forms, but these materials were not removed from residue.

For each flotation sample, twenty wood charcoal fragments were selected for identification at random from those larger than 2 mm. Fragments were snapped to reveal a transverse section and examined under a stereoscopic microscope at 28 to 180 X magnification. When necessary, tangential or radial sections were examined for ray seriation, presence of spiral thickenings, types and sizes of intervessel pitting, and other minute characteristics that can only be seen at the higher magnifications of this range (Hoadley 1990).

Carbon samples were identified and analyzed like the flotation samples, except that only a 2 mm mesh was used. Because at least some of the material was designated for radiometric analysis, extra care was taken to ensure that samples were not contaminated in the laboratory. The analyst wore vinyl gloves whenever working with the samples and, as always, clean glassware was used. Contact with paper products was avoided.

Seeds, fruits, and woody tissue are not always sufficient, by themselves, to allow identification of the plant from which they came to the species level. Botanical materials from Lost Midden were identified to the lowest possible taxonomic level by comparison to materials in the comparative collection of Macrobotanical Analysis and through the use of standard reference works and databases (e.g., Davis 1993; Hoadley 1990; InsideWood 2004; Martin and Barkley, 1961; Musil 1963; Panshin and de Zeeuw 1980). An article by Willis Bell and Carl King (1944) and descriptive comments by Scooter Cheatham and colleagues (1995) provided additional aid for the identification of sotol and agave. Plant samples from the Seminole Canyon State Park and Historic Site were provided by Mark Lockwood, Texas Parks and Wildlife Conservation Biologist for west Texas, and Randy Rosales, Park Superintendent of Seminole Canyon State Park and Historic Site. Some taxa were identified to species through positive identification or elimination of other possible members of the genus. Most commonly botanical materials, whether carbonized or not, were identified to the genus. Botanical nomenclature and common names follow the PLANTS national database (USDA, NCRS 2009) except in the cases where the common name in local use differs significantly from the common name given in the database.

6.3.2.4 Radiocarbon Dating

When significant amounts of charcoal were recognized *in situ* at the Lost Midden site, the material was removed from the surrounding soil matrix with a trowel and placed within an aluminum foil envelope or medicine vial. Additional charcoal samples were recovered during the screening process or when the flotation samples were processed. Using an indelible marker, the foil envelopes or medicine vials were labeled as charcoal samples, and the appropriate provenience information, date, excavator's name(s), and circumstances in which the charcoal sample was collected were placed on the container. The foil envelope or medicine vial was then sealed within a strong plastic zip-lock bag, and the bag labeled with the same aforementioned information.

A total of eight charcoal samples, including two from Feature 1 (Beta-262708, Beta-262709), two from Feature 2 (Beta-262710, Beta-262711), and four from Feature 3 (Beta-262712, Beta-262713, Beta-262714, Beta-262715), were submitted to Beta Analytic Inc, Miami, Florida, for C-14 dating. All of the submitted charcoal samples were small and required accelerator-mass-spectrometer (AMS) techniques for dating. While AMS dating is more costly than standard radiocarbon dating, it does have potential advantages. Small discrete samples that are submitted for AMS dating are more likely to represent a single cultural event, as opposed to larger charcoal samples that may include pieces of charcoal from multiple burning episodes (Black and Creel 1997:272).

As reported by Beta Analytic Inc. (2009; Appendix B), the submitted charcoal samples were subjected to an "acid/alkali/acid" pretreatment to eliminate secondary carbon components. During the acid/alkali/acid pretreatment, the samples were first gently crushed and dispersed in deionized water. They were then given hot HCl acid washes to eliminate carbonates and alkali washes (NaOH) to remove secondary organic acids. The alkali washes were followed by a final rinse to neutralize the solution prior to drying. Chemical concentrations, temperatures, exposure times, and number of repetitions, were applied accordingly with the uniqueness of the sample. Each chemical solution was neutralized prior to the application of the next. During these serial rinses, mechanical contaminants such as associated sediments and rootlets were eliminated. This type of pretreatment is considered a "full pretreatment" (Beta Analytic Inc. 2009).

Accelerator-mass-spectrometer results are derived from reduction of sample carbon to graphite (100 percent Carbon), along with standards and backgrounds, followed by C-14 measurement and calculation in an accelerator-mass-spectrometer located at one of six collaborating research facilities, who return the results to Beta Analytic Inc. for verification, isotopic fractionation correction, calendar calibration, and reporting. The "Conventional C-14 Age" is the result after applying C-13/C-12 corrections to the measured age and is the most appropriate radiocarbon age (Beta Analytic Inc. 2009). Along with the resulting radiocarbon dates, Beta Analytic Inc. also reported the individual analysis method, delivery basis, material, and type of chemical pretreatment used for each charcoal sample (Appendix B).

6.3.3 Curation Procedures

All cultural materials, and archival documentation produced during the present project, were cataloged and curated in accordance with Title 13, Part 2, Chapter 29 of the Texas Administrative Code, relating to management and care of archeological collections, and the Council of Texas Archeologists' (1985) Guidelines for Curation Standards and Procedures. These items are curated at the Texas Parks and Wildlife Department's Archeology Laboratory, accredited by the Texas Historical Commission.

CHAPTER 7: RESULTS OF EXCAVATIONS AT 41VV1991

7.1 Geomorphological Investigation

After completing preliminary testing (i.e. shovel testing and mechanical auger testing) at the Lost Midden site, and before initiating the larger scale excavations at the site as outlined in Chapter 6, project geomorphologist Ed Hajic, Santa Fe, New Mexico, visited the site. Mr. Hajic examined the exposed stratigraphic profiles within the original backhoe excavation, and collected several soil samples as well as samples of the area rock. He also gathered charcoal samples for possible radiocarbon dating when adequate amounts of charcoal were available within the profiles.

As discussed in Chapter 2 of this report, the Lost Midden site is situated almost entirely within a large sediment-filled basin of carbonate bedrock, which may represent a partially collapsed sinkhole or perhaps a *tinaja*. Within the basin, the sediment sequence consists of two soil horizons that extend to a maximum depth of approximately 1.2 meters (3.9 feet; Figure 7.1). The lower increment consists of dark brown granular to fine gravel silty clay to heavy loam. Sand is abundant, and ranges from fine to very coarse. Not all sand, however, consists of siliciclastic material. In some samples, sand-size grains appear to be rounded aggregates of silty clay. The upper increment consists of very dark brown to dark brown granular to very fine gravel silt loam to loam that more or less coincides with the prehistoric component of the Lost Midden site. Sand content is similar to the lower unit. Angular cobble gravel of the local bedrock is common, sometimes appearing as stone lines in profile in association with cultural deposits and features. The sediment within the basin accumulated as a combination of eolian and local colluvial depositional episodes (Ed Hajic, personal communication October 22, 2009).

The contact between the two sediment units at 41VV1991 is clear to abrupt, and somewhat masked by soil formation and likely cultural activities. In general, the soil exhibits a moderately expressed A1 – A2 – 2Bw1 – 2Bw2 – 2BC – R profile. The soil has granular to subangular blocky structure and a friable consistency. It is unleached, and there is a paucity of whole snail shells. A modest amount of charcoal is dispersed throughout the upper increment; only a few fragments were encountered in the lower increment beneath the cultural deposits (Ed Hajic, personal communication October 22, 2009).

As will be further discussed in the Feature 1 section of this chapter, one of the charcoal samples collected by Mr. Hajic from the lower reaches of the cultural deposits within Feature 1 produced a radiocarbon date of A.D. 650 to 780 (see Appendix B).

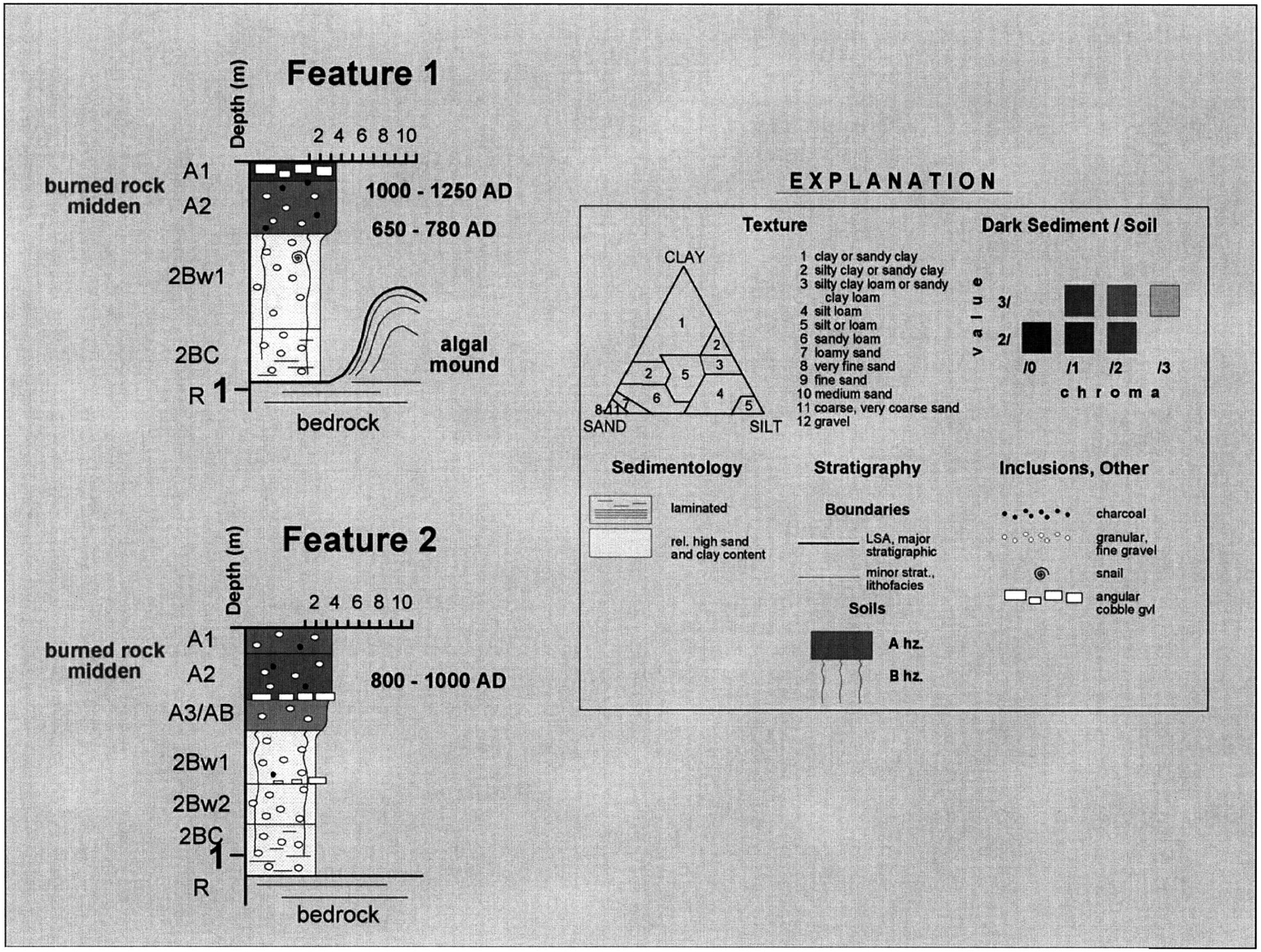

Figure 7.1. Graphic sediment logs for 41VV1991, prepared by project geomorphologist Ed Hajic.

7.2 Feature Analysis

Investigations at the Lost Midden site, including the test unit excavations, revealed a total of three cultural features. These features included the two previously noted burned rock middens and an intact roasting pit (Feature 3) discovered within Feature 1. Descriptions of these features, including the artifact assemblage recovered from each feature, are detailed below.

7.2.1 Feature 1

As has been discussed throughout this report, Feature 1 is the large burned rock midden that was discovered by accident during backhoe excavations for a proposed recreational vehicle dump station. Evidence of this feature, including an abundance of approximately fist-sized angular limestone rocks, charcoal staining, and occasional chipped stone artifacts, was readily apparent in the soil profiles of the backhoe excavation (Figures 1.3-1.4, 4.2-4.3). The full margins of this feature were subsequently exposed during the removal of remaining overburden by hand, through troweling and shovel skimming (Figures 2.2, 6.1).

Fourteen test units were excavated within Feature 1. The placement of these test units was determined, in part, by the remaining intact areas of Feature 1, the nature of these areas in relationship to the overall burned rock midden, the abundance of cultural material in these areas, evidence of other possible cultural features, and the geomorphological setting. One test unit (Test Unit 1) was placed along the southwestern edge of the feature; seven test units (Test Units 2-6 and 13-14) were placed in the southeastern portion of the feature, including an obvious area of dark staining; two test units (Test Units 7-8) in the northwestern area of the midden; and four test units (Test Units 9-12) in the southwestern area of the feature (Figures 6.1-6.2). This distribution of test units provided a good cross-section of Feature 1, and resulted in the discovery of an intact roasting pit (Feature 3) in the southeastern part of midden.

As noted in Chapter 6, test unit excavations were achieved through a combination of occasional shovel skimming and troweling, and were accomplished using 10-centimeter arbitrary levels. All units were excavated to bedrock or at least 20 centimeters (7.9 inches) into culturally sterile soil.

Feature 1 is situated within a 1.2-meter (3.9 feet) deep soil-filled natural basin, possibility representing a partially collapsed sinkhole or *tinaja*. The sediment sequence within the basin consists of two increments, the lowest consisting of dark brown granular to fine gravel silty clay to heavy loam, and the upper increment consisting of very dark brown to dark brown granular to very fine gravel silt loam to loam that coincides with the Feature 1 deposits. Sand is abundant in both soil increments, and ranges from fine to very coarse. Angular cobble gravel of the local bedrock is common in the uppermost increment, sometimes appearing as stone lines in profile in association with cultural deposits. The sediment was deposited through eolian and local colluvial actions (Ed Hajic, personal communication October 22, 2009).

7.2.1.1 Feature Attributes

Feature 1 is amorphous in shape, and has a maximum north-south dimension of 10 meters (32.8 feet) by 12.5 meters (41.0 feet) east-west. The maximum depth of this feature is approximately 57 centimeters (22.4 inches) below the present ground surface, but the base of the feature is uneven. The average depth of Feature 1 is approximately 45 centimeters (17.7 inches) below the surface. The area of Feature 1 immediately surrounding Feature 3, an intact earth oven, is reminiscent of a singular ring midden. However, the large, amorphous nature of the broader Feature 1, suggests that it actually represents remnants of multiple ring middens or crescent middens. The radiocarbon dates for this feature, summarized below (also see Appendix B), also seem to support the likelihood that Feature 1 consists of multiple middens that were utilized beginning at the very end of the Blue Hills subperiod of the Terminal or Transitional Archaic (2360 – 1360 B.P.) and extending throughout much of the Late Prehistoric Flecha subperiod (1380 – 510 B.P.). But, if Feature 1 does actually represent multiple burned rock middens, it was not readily apparent within the extensive stratigraphic profiles of the original backhoe excavation or the test unit excavations.

Table 7.1. Radiocarbon Dates for Feature 1.

TPWD Sample #	Beta Analytic Sample #	Test Unit	Excavation Level	Two Sigma Calibrated Result
41VV1991-01	Beta-262708	4	40-50 cmbs	940 - 780 B.P.
41VV1991-02	Beta-262709	6	30-40 cmbs	920 - 700 B.P.
08 tpw-smn secA 0.26	Beta-250376	Original backhoe excavation	43 cmbs	1300 - 1170 B.P.

7.2.1.2 Material Assemblage

Lithic Analysis

The objectives of the chipped stone artifact analysis were to identify the tools to functional or morphological categories, and to use the debitage sample to reconstruct raw material acquisition and manufacturing activities. Procurement practices were examined by identifying raw material sources among the chipped stone artifacts, particularly those that retain cortex. Raw material color and quality were also taken into consideration to determine raw material sources. Chert nodules from local, upland sources from the study area have a rough calcium carbonate cortex and are moderate to coarse grained tan cherts exhibiting a visible crystalline structure and a grainy texture. The chert nodules from nonlocal, riverine sources (e.g. Quaternary terraces and Rio Grande secondary deposits) have a lightly to highly polished cortex of calcium carbonate and/or chert and/or tend to be fine-grained agates, cherts, and jaspers lacking visible crystalline structure. The indeterminate specimens could not be confidently attributed to local, upland or nonlocal, riverine sources based on cortex, color, and/or quality of the raw material. The high percentage of indeterminate and nonlocal materials resulted from a conservative approach to raw material identification, and the actual percentage of local raw material (i.e. Salmon Peak Formation chert) may be considerably higher.

The chipped stone artifacts recovered during block excavations of the Lost Midden site includes 53 tools and tool fragments, 3 cores, and 366 pieces of debitage. The largest sample was obtained from the Feature 1 excavations (n = 309, 84 percent), while the remainder of the assemblage was obtained from Feature 2 (n = 52, 14 percent) and Feature 3 (n = 4, 1 percent).

Chipped Stone Tools

All of the chipped stone tools and cores (n=56, 13 percent of total number chipped stone artifacts) recovered during block excavations of 41VV1991 were collected from Feature 1. Specifically, these artifacts include 5 dart points and fragments, 5 arrow points, 8 knives, 11 scrapers, 2 spokeshaves, 1 graver, 1 burin flake, 5 miscellaneous bifaces, 4 miscellaneous unifaces, 10 utilized flakes, and 3 cores.

Dart Points. Five dart points and dart point fragments were recovered from Feature 1 during the block excavations at the Lost Midden site (Figure 7.2). All five specimens are broken but two retain features sufficient for type identification, while three specimens are untypable. The typable specimens include one Darl and one Ensor point. The dart points are described in alphabetical order; metric attributes for all projectile points are presented in Table 7.2.

A single Darl point fragment, nearly complete, has a long and slender triangular blade that is beveled along one lateral edge. The point lacks both barbs, while the distal tip is missing. The distal break is indeterminate but the remaining distal end is burinated. The specimen also exhibits a slightly expanding and concave stem. The point is made of fine-grained chert from an indeterminate source. Darl points date to the Late Archaic period. Based on recent findings, the dates for these points appear to range between about 1810 and 1360 B.P. (Texas Beyond History 2010; Turner and Hester 1999:101).

One Ensor proximal dart point fragment was recovered from Feature 1. The blade is generally triangular in shape but the blade margins are slightly convex. The distal tip is missing but the break type is indeterminate. The shoulders are weak, while the side-notches are shallow and wide. The specimen also exhibits a broad stem and a straight base. The point is made of fine-grained chert from an indeterminate source. Ensor points date to the Blue Hills subperiod, between 2360 and 1410 BP (Turpin 2004:274).

Three untypable dart point fragments were recovered and consist of one proximal, one distal, and one blank fragment. The proximal fragment appears to have been made on a flake. The blade has been heavily resharpened but retains a triangular blade shape, which is beveled along the remaining lateral blade edge. The point fragment lacks both barbs and the distal tip is missing, likely due to a use-related break. The specimen retains a beveled, slightly expanding, and concave stem. The distal fragment is thin and appears to be a finished specimen that exhibits a use-related break. The blank fragment is missing the distal end and it was abandoned before a stem was formed. Dart points are generally dated to the Archaic period, between approximately 9,000 and 1,400 years ago (Johnson and Goode 1994:5).

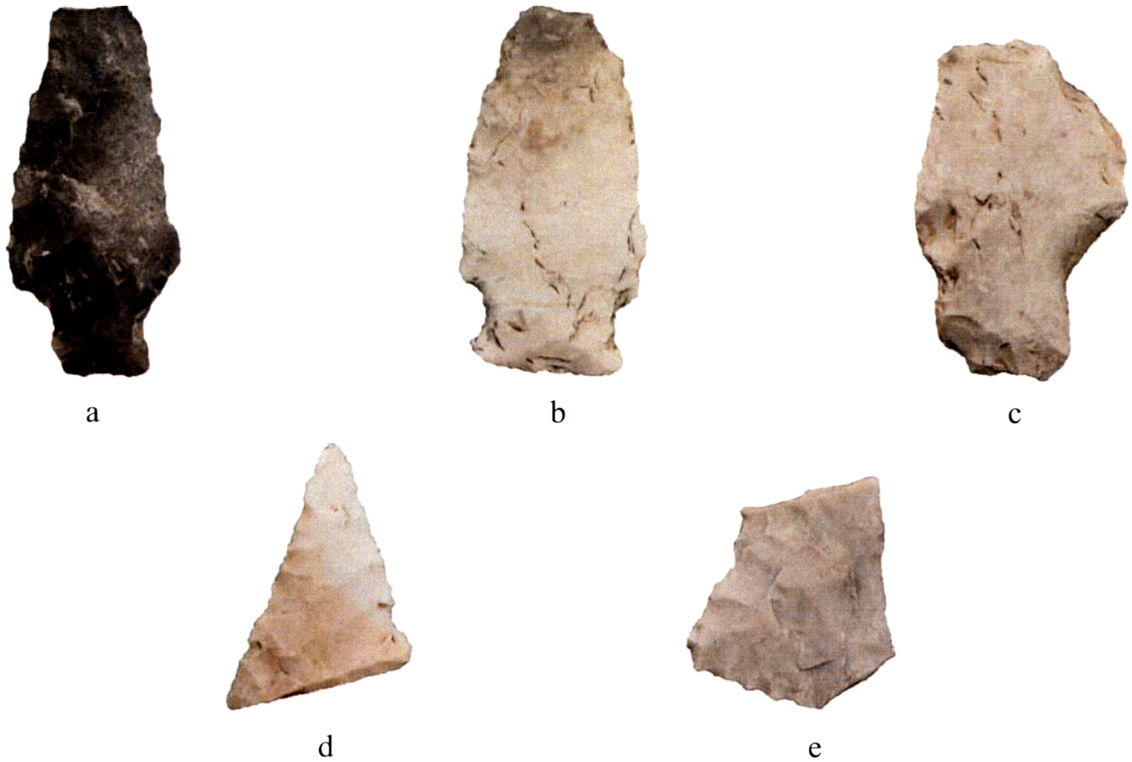

Figure 7.2. Dart points recovered from Feature 1 excavations: (a) Darl; (b) Ensor; (c-e) untyped dart points. Shown actual size.

Table 7.2. Measurements (mm) of Projectile Points Recovered from Test Unit Excavations at 41VV1991.

Type	Length	Haft Length	Blade Width	Neck Width	Base Width	Base Depth	Thicknes s
Dart Points							
Darl	-	4	20	10	11	-1	6
Ensor	-	4	19	13	16	0	5
Untyped	-	5	22	13	14	0	6
Untyped	-	-	-	-	-	-	3
Untyped	-	-	-	-	-	-	4
Arrow points							
Perdiz	23	-	20	4	-	-	3
Sabinal	-	2	22	4	7	0	4
Sabinal	-	-	-	-	-	-	3
Scallorn	25	4	16	6	7	-	3
Untyped	-	-	-	-	-	-	4

Arrow Points. Five arrow points were collected during block excavations at 41VV1991. One arrow point is complete, two are distal fragments, one is a proximal fragment, and one is a medial fragment (Figure 7.3). Four of the specimens have been identified to type, while one specimen is untypable. The arrow points are described in alphabetical order; metric attributes for the projectile points are presented in Table 7.2.

One distal Perdiz point fragment was collected from Feature 1. The specimen exhibits concave blade margins that are slightly serrated. The barbs are exaggerated to aberrant and flare outward from the specimen long axis. The one remaining corner notch is wide and deep. The stem is absent on this specimen. The point is made of fine grained tan chert from an indeterminate source. This point type, which is found throughout most of Texas and Louisiana, dates to the Late Prehistoric period, between approximately 810 and 410 years ago (Johnson and Goode 1994:41; Turner and Hester 1999:227).

One Sabinal proximal fragment and one lateral fragment were recovered from block excavations in Feature 1. The proximal fragment exhibits blade margins that are recurved and slightly serrated, while the barbs are downsloped and flare outward from the specimen long axis. Deep and narrow basal notches define the bulbous stem. The specimen is made of fine-grained chert from a non-local source. The lateral Sabinal fragment retains most of both blade margins and one intact barb. The lateral blade edge retaining the barb is recurved and slightly serrated while the remaining barb is downsloped and flares outward from the specimen long axis. The specimen is made of fine-grained chert from an indeterminate source. Sabinal points date to the Late Prehistoric period between 890 and 760 B.P. (Turner and Hester 1999:229).

A fragmentary Scallorn arrow point was recovered from excavations in Feature 1. The specimen has a thin, triangular blade but is missing the distal tip and base due to use-related breaks. The barbs have been reworked, while the corner notches are wide and relatively deep. The point is made of fine-grained chert from an indeterminate source. Scallorn points date to the Late Prehistoric period, between about 1,410 and 710 years ago (Johnson and Goode 1994:40-41; Turner and Hester 1999:230).

One arrow point medial fragment was recovered from Feature 1 excavations. The specimen was likely a finished or a near finished specimen as it retains one barb fragment and evidence of a second barb and a base. The break surfaces indicate the specimen was broken during use. The specimen is made of fine-grained chert from an indeterminate source. Arrow points generally date to the Late Prehistoric period, which dates between about 1,410 and 410 B.P. in the Lower Pecos (Johnson and Goode 1994:39-41).

Knives. Eight knives and knife fragments were recovered from the Feature 1 excavations. The knife specimens include two complete, one near complete, one proximal fragment, one distal fragment, two indeterminate fragments, and one unifacial Sotol knife. One complete specimen is a triangular formal bifacial knife that is 57 mm long, 31 mm wide, and 10 mm thick. The lateral edges are acute and retain evidence of resharpening and exhibit rounded flake scar ridges and polish consistent with use-wear that extends along 47 mm of one lateral edge of the 57 mm long blade; the sharpened lateral edges are also beveled. The specimen is made of a fine-grained chert from a local source. The second complete specimen is a

a b c d e

Figure 7.3. Arrow points recovered from Feature 1 excavations: (a) Perdiz; (b-c) Sabinal; (d) Scallorn; (e) untyped arrow point. Shown actual size.

triangular unifacial knife made on a tertiary flake. The lateral edges are acute and retain evidence of resharpening and use-wear along the entire length of one lateral edge. The specimen is 42 mm long, 25 mm wide, and 5 mm thick, and is made of a fine-grained chert from an indeterminate source.

The near complete specimen appears to have been a dart point in its original form but was subsequently used as a knife. The specimen is roughly triangular in shape but the distal tip is missing, due to what appears to be an impact fracture. The proximal end is also missing, due to a use-related break. The specimen retains evidence of use wear along both lateral edges but lacks evidence of being resharpened. The tool is 47 mm long, 25 mm wide, and 6 mm thick, and is made of fine-grained chert from an indeterminate source.

The proximal knife fragment is made on a tertiary flake. Both lateral edges are acute and retain evidence of resharpening and use-wear, while the proximal end of the tool is missing due to a use-related break. The specimen is 32 mm long, 30 mm wide, and 8 mm thick, and is made of a fine-grained chert from a local upland source.

The distal knife fragment is made on a tertiary flake. Its lateral edges and distal end are acute and exhibit rounded flake scar ridges and polish consistent with use-wear. The ventral surface exhibits two flake scars along one lateral edge that are likely associated with the use-wear break responsible for the missing proximal end. Additionally, the ventral surface at the dorsal end exhibits evidence of resharpening. The dorsal surface also exhibits evidence of resharpening along both remaining lateral edges and the distal end. The knife is 32 mm long, 32 mm wide, and 9 mm thick, and is made of a fine-grained chert from an indeterminate source.

One indeterminate knife fragment retains two acute lateral edges that exhibit evidence of resharpening and rounded flake scar ridges and polish. The knife fragment was subjected to heat as several pot-lid scars are evident on both faces of the specimen. The fragment measures 47 mm long, 31 mm wide, and 10 mm thick; the tool is made of a fine-grained chert from an indeterminate source. The second indeterminate specimen retains one acute edge that retains evidence of resharpening and exhibits rounded flake scar ridges and polish. The fragment measures 26 mm long, 23 mm wide, and 11 mm thick; it is made of a fine-grained chert from an indeterminate source.

One unifacial Sotol knife was surface collected from the Feature 1 area (Figure 7.4). The knife is oval in shape and is made on a large flake lacking dorsal cortex. Both lateral edges are acute and exhibit rounded flake scar ridges and polish. The ventral surface exhibits no noticeable retouch while the dorsal surface exhibits microfractures along both lateral edges while one lateral edge exhibits flake removals consistent with repeated episodes of retouch. The knife measures 81 mm long, 42 mm wide, and 9 mm thick, and is made of a fine-grained chert from an indeterminate source.

Figure 7.4. Sotol knife recovered from the surface of Feature 1. Shown actual size.

Scrapers. Eleven scraper fragments were recovered from Feature 1. The specimens include one complete side scraper, three side scraper fragments, one end scraper fragment, and seven indeterminate specimens. The one complete side scraper is made on a secondary flake. One lateral edge exhibits a steep working edge that has been reworked and retains uniform and consistent microfractures along its entire length. The steep working edge appears to have been produced by the reworking of a break face, while the opposite lateral edge is a break face. The scraper is 44 mm long, 31 mm wide, and 15 mm thick. The dorsal surface retains a minor amount of rough cortex; the material is a fine-grained chert from a local, upland source. Of the three side scraper fragments, one is a medial fragment made on a secondary flake. One lateral edge exhibits a steep working edge that has been reworked and retains uniform and consistent microfractures along its entire length. The steep working edge appears to have been produced by the reworking of a break face. The scraper is 51 mm long, 34 mm wide, and 8 mm thick. Most of the dorsal surface of the scraper is covered with rough cortex; the material is a fine-grained chert from a local upland source. A second side scraper fragment is a unifacial scraper that is made on a large flake that exhibits a break face at the distal end. Both lateral edges and ends exhibit microfractures consistent with use-wear. One lateral edge and the proximal end exhibit steeply retouched edges, while the remaining lateral edge and the distal end are unmodified but exhibit microfractures along their entire length. The scraper fragment is 67 mm long, 48 mm wide, and 13 mm thick. The dorsal surface of the scraper retains a small patch of water worn cortex; the material is a fine-grained chert from a riverine, non-local source. The third side scraper fragment is made on a tertiary flake that is missing most of one lateral edge and the distal end. The intact lateral edge has been reworked and retains uniform and microfractures along its entire length. The tool measures 69 mm long, 34 mm wide, and 8 mm thick, and is made of a fine-grained chert from an indeterminate source.

The end-scraper fragment is made on a decorticate flake. Both ends of the flake exhibit micro-fractures along their entire length, consistent with use-wear, while the lateral edges exhibit no use-wear. The tool is 48 mm long, 31 mm wide, and 11 mm thick, and is made of a fine-grained chert from an indeterminate source.

Six indeterminate scraper fragments were recovered from the Feature 1 excavations. One indeterminate scraper fragment is made on a flake and exhibits use-wear and evidence of reworking along one edge. The scraper is 40 mm long, 18 mm wide, and 8 mm thick, and is made of a fine-grained chert from an indeterminate source. A second scraper fragment is made on a decorticate flake. Two edges exhibit evidence of resharpening and microfractures consistent with use-wear. The specimen is 22 mm long, 32 mm wide, and 9 mm thick, and is made of a fine-grained chert from an indeterminate source. Four of the six indeterminate specimens are small and retain one steep working edge that has been reworked and retains uniform and consistent microfractures along its entire length. The specimens are made on flakes and are made of fine-grained material from an indeterminate source. One specimen is burned and measures 20 mm long, 21 mm wide, and 5 mm thick. The second specimen measures 31 mm long, 22 mm wide, and 9 mm thick. A third specimen 21 mm long, 7 mm wide, and 6 mm thick, while the fourth specimen is 22 mm long, 11 mm wide, and 3 mm thick.

Spokeshaves. Two spokeshaves were collected from the Feature 1 excavations. One specimen is made on a unifacially worked tertiary flake that exhibits a concave cutting and/or scraping edge along one of its lateral edges. The tool measures 28 mm long, 25 mm wide, and 7 mm thick, while the concave working edge measures 3 mm deep and 19 mm wide. It is made of a coarse-grained material from an upland and local source. The second specimen is made on a unifacially worked secondary flake. The tool exhibits one concave cutting and/or scraping edge, while the opposite edge exhibits microfractures consistent with use-wear. The tool measures 25 mm long, 42 mm wide, and 12 mm thick, while the concave working edge measures 3 mm deep and 13 mm wide. It is made of a fine-grained material, and the dorsal surface of the tool retains a patch of rough cortex indicating the raw material is from a local upland source.

Graver. A graver was recovered from the Feature 1 excavations. The graver is made on a tertiary flake that has been unifacially worked. The specimen is a compound tool combining a graver tip with two utilized lateral edges; the graver tip and lateral edges exhibit evidence of minimal retouched. The tool is 32 mm long, 31 mm wide, and 9 mm thick, and is made of fine-grained chert from an indeterminate source.

Burin. One burin spall was recovered from the Feature 1 excavations. The specimen is a secondary burin spall which was removed after removal of the primary burin spall. The specimen is trapezoidal in cross-section and retains the primary burin facet. It appears to have been removed from a unifacially worked parent piece. The burin measures 40 mm long, 8 mm wide, and 8 mm thick, and is made of a fine-grained chert from an indeterminate source.

Miscellaneous Bifaces. Five miscellaneous biface fragments that could not be placed in functional categories were collected from the surface and/or recovered from Feature 1 excavations. One specimen is a nearly complete specimen while the remaining three are fragmentary specimens that exhibit indeterminate bifacial edges. The nearly complete specimen has a biconvex cross section and represents a piece that was discarded due to manufacturing problems preventing the piece from reaching a functional state; the specimen is 32 mm long, 35 mm wide, and 10 mm thick, and is made from a fine-grained chert from a local upland source. The four fragmentary specimens are biconvex and have indeterminate use-break morphologies. Two of the specimens are made of fine-grained chert from indeterminate sources, one specimen is made of a fine-grained chert from a non-local source, while the fourth specimen is made of a coarse-grained chert from a local upland source. One specimen is 31 mm long, 26 mm wide, and 11 mm thick, the second is 28 mm long, 41 mm wide, and 13 mm thick, the third specimen is 21 mm long, 23 mm wide, and 5 mm thick, while the fourth specimen is 30 mm long, 28 mm wide, and 4 mm thick.

Miscellaneous Unifaces. Four miscellaneous uniface fragments were recovered from the Feature 1 excavations. The specimens consist of two proximal fragments, one distal fragment, and one medial fragment. One proximal fragment is made on a tertiary flake, and measures 34 mm long, 31 mm wide, and 11 mm thick. One lateral edge retains evidence on the dorsal surface of use related microfractures and reworking; the specimen exhibits a use-related break. The specimen retains a river-worn corticate platform and is made of a fine-grained chert of an indeterminate source. The second proximal fragment is made on a tertiary flake, and measures 12 mm long, 21 mm wide, and 5 mm thick. Both lateral edges retain evidence on the dorsal surface of use-related microfractures consistent with use-wear; the specimen also exhibits a use-related break. The tool is made of a fine-grained chert from an indeterminate source.

The distal fragment is made on a tertiary flake, and is 33 mm long, 37 mm wide, and 11 mm thick. One lateral edge has been intentionally modified and reworked while the remaining edges exhibit use-related microfractures; the tool exhibits a use-related break. The specimen is made of a fine-grained chert from a local source. The medial fragment is made on a secondary flake, and is 42 mm long, 11 mm wide, and 3 mm thick. The remaining lateral edge has been intentionally modified and exhibits use-related microfractures; it exhibits a use-related break. The specimen is made of a fine-grained chert with a patch of coarse cortex indicative of a local upland source.

Utilized Flakes. Ten utilized flakes were recovered from the Feature 1 excavations. The ten utilized flake specimens consist of two complete specimen, three proximal fragments, two distal fragment, and three lateral edge fragments. The tools have not been modified but do exhibit microfractures due to use-wear. One complete specimen is made on a tertiary flake that retains a corticate platform of water-worn cortex. The specimen exhibits use-wear along both lateral edges. It is 31 mm long, 16 mm wide, and 5 mm thick, and is made of a fine grained chert from a non-local source. The second complete specimen is made on a secondary flake that retains a small patch of dorsal cortex and a corticate platform of water-worn cortex. The tool exhibits use-wear along one lateral edge. It is 32 mm long, 19 mm wide, and 5 mm thick, and is made of a fine-grained chert from a non-local source.

One proximal fragment is made on a secondary flake that retains dorsal cortex and a corticate platform of water-worn cortex. The specimen exhibits use-wear along the terminal edge and exhibits an indeterminate break along one lateral edge. The tool measures 44 mm thick, 45 mm wide, and 14 mm thick, and is made of a fine-grained chert from a non-local source. The second proximal fragment retains a corticate platform of rough, upland cortex. The specimen retains use-wear along both lateral edges and the distal end is missing due to a use-related break. It is 37 mm long, 42 mm wide, and 7 mm thick, and is made of a fine-grained chert from a non-local source. The third proximal fragment exhibits use-wear along both lateral edges and the distal end is missing due to a post-depositional break. The tool is 32 mm long, 31 mm wide, and 15 mm thick, and is made of a fine-grained chert from a local source.

One distal flake fragment exhibits use-wear along one lateral edge; the specimen is made on a secondary flake exhibiting water-worn cortex. It is 33 mm long, 40 mm wide, and 7 mm thick, and is made of a fine-grained chert from a non-local source. The second distal fragment is made on a tertiary flake and exhibits use-wear along both lateral edges and the terminal edge. The proximal end is missing due to a use-related break. The tool is 34 mm long, 29 mm wide, and 5 mm thick, and is made of a fine-grained chert from a local source.

One lateral edge fragment is made on a tertiary flake and exhibits use-wear along the lateral edge. The fragment is 36 mm long, 12 mm wide, and 4 mm thick, and is made of a fine-grained chert from an indeterminate source. The second lateral edge fragment exhibits use-wear along one lateral edge; it is made on a tertiary flake that exhibits pot-lid fractures. The tool is 37 mm long, 16 mm wide, and 6 mm thick, and is made of a fine-grained chert from a local source. The third lateral edge fragment is made on a tertiary flake and exhibits use-wear along one lateral edge. The tool measures 25 mm long, 12 mm wide, and 4 mm thick, and is made of a fine-grained chert from an indeterminate source.

Cores. Two complete cores and one core fragment were recovered from the Feature 1 excavations. The two complete specimens are multi-directional, amorphous cores while the core fragment is unifacial and amorphous. One complete specimen is a multi-directional, amorphous core that retains evidence of four flake removals and platform preparation. The core is 73 mm long, 64 mm wide, and 50 mm thick, and is made of a non-local fine-grained quartzite that retains river-worn cortex. The second specimen is a multi-directional, amorphous core that retains evidence of six flake removals and platform preparation. The core is 47 mm long, 51 mm long, and 53 mm wide, and is made of a non-local coarse-grained chert that retains river-worn cortex. The core fragment is unifacial and amorphous, and exhibits three flake removals. The core is 35 mm long, 32 mm wide, and 12 mm thick; it retains river-worn cortex and is made of a fine-grained chert from an indeterminate source.

Chipped Stone Debitage

A total of 366 pieces of chipped stone debitage were recovered from the Lost Midden site during block excavations (Table 7.3). The largest sample of these artifacts (n = 309, 84 percent) originated from Feature 1.

The objectives of the debitage analysis were to assess raw material acquisition and manufacture processes. Five lithic procurement sites are recorded within the state park boundary – 41VV219, 41VV393, 41VV405, 41VV406, and 41VV417. The materials from 41VV393, 41VV406, and 41VV417 are derived from the Salmon Peak Limestone formation, while the materials from 41VV219 and 41VV405 are derived from Quaternary Pleistocene fluviatile gravel deposits. Additional lithic procurement sites are known in the surrounding area.

The majority of the raw material represented in the chipped stone debitage and debris from 41VV1991 is fine-grained chert, which is available in upland outcrops of the Salmon Peak Limestone formation and in Quaternary terrace deposits (Fisher 1977). However, the raw materials derived from upland procurement sites 41VV393, 41VV406, and 41VV417 are moderate to coarse grained tan chert exhibiting a visible crystalline structure and a grainy texture. The raw materials derived from the Quaternary Pleistocene fluviatile gravel deposits tend to be fine-grained agates, cherts, and jaspers lacking visible crystalline structure.

Of the pieces of fine-grained chert debitage that retain cortex, most retain areas of polished cortex indicative of riverine sources, while a minority retain rough cortex indicative of upland sources. Other lithic raw materials are represented by coarse-grained chert. Of the five pieces of coarse-grained chert debitage from the site that retain cortex, three (60 percent) retain rough cortex indicative of an upland source, while two specimens (40 percent) retain areas of polished cortex indicating its origin from a riverine source.

Half of the debitage sample consists of complete flakes, with lesser numbers of proximal flakes and chips, and a small amount of angular debris. Dorsal cortex is absent on 83 percent of the flakes and chips in the present assemblage. Cortex covers less than half of the dorsal surface of 11 percent, while cortex covers more than half of the dorsal surface of 3 percent of the sample. Cortex covers the entire dorsal surface of only 2 percent of the overall sample.

Over half of the complete flakes in this assemblage measure between 11 and 20 mm in maximum dimension, while 33 percent are slightly larger, measuring between 21 and 30 mm in maximum dimension. The remaining complete flakes are either very small (1 to 10 mm) or larger (31 to 40 mm, 6 percent) to fairly large, with maximum dimensions between 41 and 50 mm, and greater than 61 mm.

Analysis of the platforms on complete and proximal flake fragments indicates that most of the observable platforms are single faceted platforms. Flake platforms exhibiting two facets make up 4 percent of the overall sample, while flake platforms exhibiting three or more facets make up 21 percent of the overall sample. Crushed platforms account for 19 percent, and corticate platforms make up 15 percent of the overall sample.

Table 7.3. Selected Chipped Stone Debitage Attributes from the Complete Assemblage.

Debitage Type								Dorsal Cortex						Platform Facets*									
Complete Flakes		Proximal Flakes		Chips		Angular Debris		Primary		Secondary		Tertiary		Corticate		1		2		3+		Crushed	
#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
181	50	67	18	102	28	16	4	8	2	57	16	301	82	38	15	101	41	11	4	52	21	46	19

* Excludes chips and angular debris

Table 7.4. Debitage Types from the Complete Assemblage.

Biface Manufacturing		Biface Thinning		Notching		Biface Resharpening		Platform/Core Preparation		Blade		Uniface Manufacturing /Resharpening		Uniface Rejuvenation		Indeter-minate	
#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
171	47	38	10	1	<1	11	4	22	6	–	–	6	2	–	–	117	32

The breakdown of debitage by flake types (Table 7.4) indicates that specimens associated with biface manufacture and biface thinning are the most common categories represented; while, biface resharpening flakes represent a small part of the collection.

Specimens derived from platform/core preparation also comprise a small part of the collection, as do uniface manufacturing/resharpening and notching flakes.

Ground Stone Analysis

Two ground stone fragments were recovered from the Feature 1 excavations. The two fragments are small, indeterminate fragments and exhibit definite use-wear polish. One ground stone fragment is made of red rhyolite and exhibits a highly polished surface; the specimen is 32 mm long, 7 mm wide, and 8 mm thick. The remaining fragment is made of black rhyolite and exhibits a small area of polish; the specimen is 14 mm long, 11 mm wide, and 3 mm thick. The materials for these artifacts were likely obtained from secondary deposits in Rio Grande gravel bars.

Faunal Analysis

Snail Shells

The shells and shell fragments of two species of land snails were recovered from Feature 1 during the excavation of 41VV1991. These species are *Rabdotus dealbatus* and *Polygyra texasiana*. A total of 505 specimens were identified as *Rabdotus dealbatus*, while 429 specimens were categorized as *Polygyra texasiana* (Table 7.5). Irregular-shaped holes were evident in 75 of the *Rabdotus dealbatus* shells, including very small specimens. None of the snail shells showed any evidence of having been burned or otherwise modified for consumption or other use by the inhabitants of the Lost Midden site.

Mussel Shells

The shells and shell fragments of one species of mussel were recovered from Feature 1 during the excavation stage of the mitigation at 41VV1991. A total of 38 specimens, including both complete and partial shells, were identified as Tampico pearlymussel (*Cyrtonaias tampicoensis*). One of the shells, recovered from level 3 of Test Unit 14 in Feature 1, showed evidence of having been burned. This was in close proximity, but outside of, Feature 3, the intact roasting pit.

Table 7.5. Snail Shells Recovered from Feature 1.

Provenience			Snail Species/Count		Hole Present/Count	
Feature	**Test Unit**	**Level**	***Rabdotus dealbatus***	***Polygyra texasiana***	**Yes**	**No**
1	2	1	16		0	16
1	2	1		6	0	6
1	2	2	5		0	5

Provenience			Snail Species/Count		Hole Present/Count	
Feature	Test Unit	Level	*Rabdotus dealbatus*	*Polygyra texasiana*	Yes	No
1	2	2		5	0	5
1	3	1	17		3	14
1	3	1		8	0	8
1	3	2	8		0	8
1	3	2		13	0	13
1	3	3	8		0	8
1	3	3		3	0	3
1	4	1	8		3	5
1	4	2	3		1	2
1	4	3	30		4	26
1	4	3		10	0	10
1	4	4	8		0	8
1	4	4		26	0	26
1	4	5	24		3	21
1	4	5		23	0	23
1	4	6	8		4	4
1	5	1	5		1	4
1	5	2	2		0	2
1	5	3	23		3	20
1	5	3		22	0	22
1	5	4	41		0	41
1	5	4		44	0	44
1	5	5	6		0	6
1	5	5		3	0	3
1	5	6	11		3	8
1	5	6		3	0	3
1	6	1	12		3	9
1	6	1		18	0	18
1	6	2	18		5	13
1	6	2		19	0	19
1	6	3	10		2	8
1	6	3		11	0	11
1	6	4	21		6	15
1	6	4		7	0	7
1	6	5	4		2	2
1	6	5		1	0	1
1	7	2	2		1	1
1	7	3	1		0	1
1	7	3		1	0	1
1	8	1	1		0	1
1	8	1		2	0	2
1	8	2		2	0	2
1	9	1	8		2	6
1	9	1		18	0	18
1	9	2	9		1	8
1	9	2		14	0	14
1	9	3	18		4	14
1	9	3		19	0	19
1	9	4	2		0	2
1	9	4		1	0	1

Provenience			Snail Species/Count		Hole Present/Count	
Feature	**Test Unit**	**Level**	***Rabdotus dealbatus***	***Polygyra texasiana***	**Yes**	**No**
1	10	1	2		1	1
1	10	2	5		3	2
1	10	2		4	0	4
1	10	3	14		3	11
1	10	3		6	0	6
1	10	4	6		1	5
1	11	1	3		0	3
1	11	1		1	0	1
1	11	2	12		1	11
1	11	2		18	0	18
1	11	3	34		6	28
1	11	3		23	0	23
1	11	4	16		6	10
1	11	4		5	0	5
1	12	2	2		0	2
1	12	2		1	0	1
1	12	3	4		1	3
1	12	3		1	0	1
1	12	4	4		0	4
1	12	4		6	0	6
1	13	1	5		0	5
1	13	1		4	0	4
1	13	2	14		0	14
1	13	2		10	0	10
1	13	3	8		0	8
1	13	3		14	0	14
1	13	4	4		1	3
1	13	4		1	0	1
1	13	5	1		0	1
1	13	5		2	0	2
1	14	1	7		2	5
1	14	1		12	0	12
1	14	2	6		0	6
1	14	2		21	0	21
1	14	3	17		0	17
1	14	3		17	0	17
1	14	4	12		0	12
1	14	4		4	0	4
Feature 1 Totals			**505**	**429**	**75**	**859**

Macrofloral Analysis

Collection Samples

Charcoal

Charred wood or leaf bases were collected from three different proveniences within Feature 1 during the test unit excavations of 41VV1991 (Table 7.6). In addition, the project geomorphologist recovered a charcoal sample from one of the walls of the original backhoe excavation, which was also within Feature 1 (Table 7.6). These samples were packaged in foil and/or in tissue and plastic vials, and were submitted for identification following completion of the excavation. As shown in the table below, at least 17 species of plants are represented by the macrofloral samples from Feature 1.

Table 7.6. Carbon Sample Identifications from Feature 1.

Provenience	Plant Type	Common Name	Botanical Name
Original backhoe excavation (43 cmbs)	Wood charcoal	Mesquite	*Prosopis* spp.
Feature 1, TU 4, Level 5	Wood charcoal	Acacia	*Acacia* spp.
	Wood charcoal	Unknown	*Colubrina* spp.
	Wood charcoal	Condalia	*Condalia* spp.
Feature 1, TU 6, Level 4	Wood charcoal	Condalia	*Condalia* spp.
	Wood charcoal	Mesquite	*Prosopis* spp.
	Wood charcoal	Bumelia	*Sideroxylon lanuginosum*
	Wood charcoal	Cenizo	*Leucophyllum* spp.
	Leaf base	Sotol	*Dasylirion texanum*
	Wood charcoal	White group oak	*Quercus* subg. *Quercus*
	Wood charcoal	Elbowbush	*Forestiera* spp.
	Wood charcoal	Legume family	Fabaceae
	Wood charcoal	Unknown	Undeterminable hardwood residue
Feature 1, TU 9, Level 4	Wood charcoal	Mesquite	*Prosopis* spp.
	Wood charcoal	Plateau live oak	*Quercus fusiformis*
	Wood charcoal	Condalia	*Condalia* spp.
	Wood charcoal	Unknown	Indeterminable hardwood
	Wood charcoal	Agarito	*Mahonia trifoliolata*
	Wood charcoal	Verbena family	Verbenaceae
	Wood charcoal	White group oak	*Quercus* subg. *Quercus*
	Leaf base	Unknown	Indeterminable
	Wood charcoal	Acacia	*Acacia* spp.
	Wood charcoal	Baccharis	*Baccharis neglecta*
	Wood charcoal	Mimosa	Mimosa sp.

7.2.2 Feature 2

Feature 2 is a somewhat smaller burned rock midden that was discovered during the mechanical auger testing that followed the accidental discovery of Feature 1. Several angular limestone rocks, approximately fist-sized, were encountered in three of the auger tests. One of the auger tests, at N4/W35, also produced a secondary decortication flake produced from probable Edwards chert. At the time of the auger testing, it was also recognized that some smaller gray rocks on the ground surface of this area were apparently associated with this feature. The boundaries of this feature were subsequently exposed during the removal of the overlying soil by hand, through troweling or shovel skimming.

Five test units were excavated within Feature 2 (Test Units 1-5). The test units were placed in such a way as to create a contiguous east-west trench across the feature (Figures 6.1-6.2, 7.5). This distribution of test units provided a good cross-section of Feature 2, revealing that the feature was situated on a slight slope adjacent to the natural basin within which Feature 1 is located. The test unit excavations further revealed that there was no central pit associated with Feature 2. In fact, no pits were identified anywhere within the test unit excavations at Feature 2; but, it is possible that a pit was/is located somewhere within the natural basin, adjacent to this midden.

Again, test unit excavations were achieved through a combination of occasional shovel skimming and troweling, and were accomplished using 10-centimeter arbitrary levels. All units were excavated to bedrock or at least 20 centimeters (7.9 inches) into culturally sterile soil. The sediment sequence is similar to that reported for Feature 1.

7.2.2.1 Feature Attributes

Feature 2 is a smaller and somewhat more conical or dome-shaped burned rock midden in comparison to Feature 1. This feature is situated on the southwestern edge of the basin. As noted, much of this midden appears to be located just outside the basin, upon gently east-sloping bedrock. There is little actual accumulation of burned rock at the summit of the landform, and no evidence of a pit in the center of the feature or elsewhere in the immediate vicinity. This feature measures 7 meters (23 feet) north-south by 6.5 meters (21.3 feet) east-west, and has an estimated maximum depth of approximately 30 centimeters (11.8 inches) in the eastern one-half of the feature. Midden deposits thin as one moves from east to west across the feature. Radiocarbon dates for Feature 2 indicate that this feature dates to the Flecha subperiod of the Late Prehistoric Tradition (Table 7.7; also see Appendix B).

7.2.1.2 Material Assemblage

Lithic Analysis

<u>Chipped Stone Debitage</u>

No chipped stone tools were recovered from Feature 2 during excavations of that feature, but 52 pieces of chipped stone debitage (14 percent of the total chipped stone assemblage recovered during the excavations) were collected from this feature during this stage of the project (Table 7.3). The nature of this assemblage is similar to that already discussed under Feature 1.

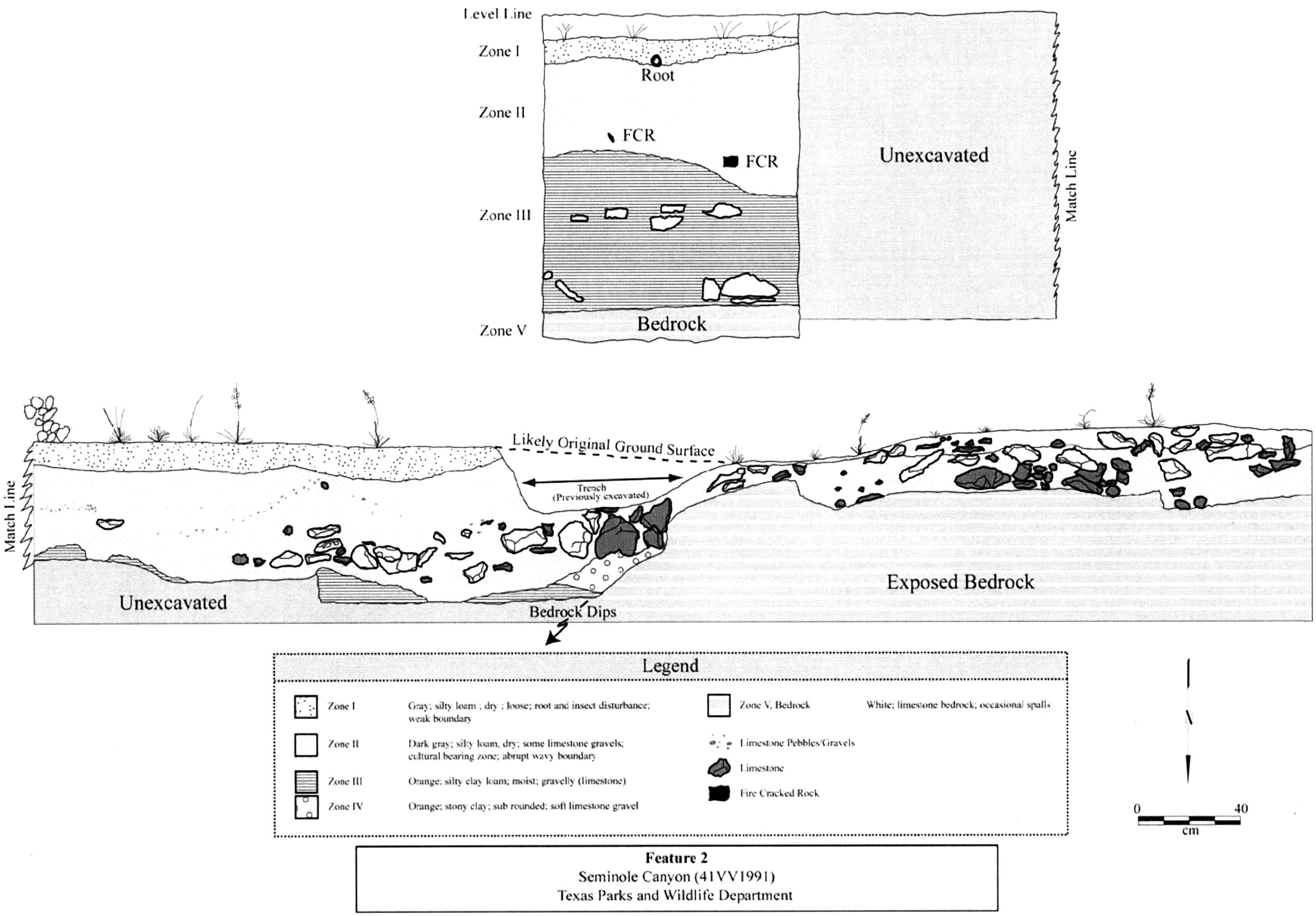

Figure 7.5. South profile of Feature 2 excavation trench.

Table 7.7. Radiocarbon Dates for Feature 2.

TPWD Sample #	Beta Analytic Sample #	Test Unit	Excavation Level	Two Sigma Calibrated Result
41VV1991-03	Beta-262710	1	40-50 cmbs	1170 - 960 B.P.
41VV1991-04	Beta-262711	2	40-50 cmbs	1060 - 920 B.P.

Faunal Analysis

Snail Shells

Similar to Feature 1, numerous specimens of *Rabdotus dealbatus* and *Polygyra texasiana* were recovered from Feature 2 (Table 7.8). Sixty-one specimens were identified as *Rabdotus dealbatus*, and 53 specimens were categorized as *Polygyra texasiana*. Irregular-shaped holes were evident in nine of the *Rabdotus dealbatus* shells. None of the snail shells from this feature showed any evidence of having been burned or otherwise modified for consumption or other use by the inhabitants of 41VV1991.

Table 7.8. Snail Shells Recovered from Feature 2.

Provenience			Snail Species/Count		Hole Present/Count	
Feature	Test Unit	Level	*Rabdotus dealbatus*	*Polygyra texasiana*	Yes	No
2	1	4	1		0	1
2	1	4		5	0	5
2	1	5	1		0	1
2	1	5		3	0	3
2	2	1	2		0	2
2	2	1		2	0	2
2	2	2	2		0	2
2	2	2		2	0	2
2	2	3	8		1	7
2	2	3		13	0	13
2	2	4	8		1	7
2	2	5	14		4	10
2	2	5		8	0	8
2	2	6	2		0	2
2	3	2	3		1	2
2	3	3	4		0	4
2	3	3		3	0	3
2	4	1	2		0	2
2	4	1		2	0	2
2	4	2	2		1	1
2	4	3	6		1	5
2	4	3		14	0	14
2	5	1	6		0	6
2	5	1		1	0	1

Provenience			Snail Species/Count		Hole Present/Count	
Feature	**Test Unit**	**Level**	***Rabdotus dealbatus***	***Polygyra texasiana***	**Yes**	**No**
Feature 2 Totals			**61**	**53**	**9**	**105**

Mussel Shells

A total of six shells and shell fragments of Tampico pearlymussel (*Cyrtonaias tampicoensis*) were recovered from the test unit excavations within Feature 2. None of these specimens showed any evidence of having been burned or otherwise modified for consumption or other use by the inhabitants of the Lost Midden site.

Macrofloral Analysis

Collection Samples

Charcoal

Fragments of wood charcoal or burned cactus pads were collected from five different proveniences within Feature 2 during the test unit excavations of 41VV1991 (Table 7.9). These samples were packaged in foil and/or in tissue and plastic vials, and were submitted for identification following completion of the excavation. As shown in Table 7.9, at least 7 species of plants are represented by the macrofloral materials recovered from Feature 2.

Table 7.9. Carbon Sample Identifications from Feature 2.

Provenience	**Plant Type**	**Common Name**	**Botanical Name**
Feature 2, TU 1, Level 3	Internode (pad)	Prickly pear	*Opuntia* spp.
Feature 2, TU 1, Level 5	Wood charcoal	Condalia	*Condalia* spp.
	Wood charcoal	Mesquite	*Prosopis* spp.
Feature 2, TU 2, Level 5	Wood charcoal	Condalia	*Condalia* spp.
	Wood charcoal	White group oak	*Quercus* subg. *Quercus*
	Wood charcoal	Colubrina	*Colubrina* spp.
	Internode (pad)	Prickly pear	*Opuntia* spp.
Feature 2, TU 3, Level 4	Wood charcoal	Acacia	*Acacia* spp.
Feature 2, TU 5, Level 2	Wood charcoal	Lotebush	*Ziziphus obtusifolia*

7.2.3 Feature 3

Feature 3, an intact rock-lined roasting pit, was first recognized in Unit 6 (Level 5; 40 -50 cm below line level [BLL]) in the Feature 1 area of 41VV1991 as a semi-circular arrangement of semi-vertical tabular limestone fire-cracked rock (FCR). In Unit 6, the exposed portion of Feature 3 measured approximately 51 cm N/S by 52 cm E/W. Excavation continued in the adjacent unit, Unit 5, located immediately to the east; Feature 3 was contacted in this unit in Level 6 (50-60 cm BLL). In Unit 5, Feature 3 was also recognized by the semi-circular arrangement of semi-vertical tabular limestone FCR. In Unit 5, the exposed portion of Feature 3 measured approximately 50 cm N/S by 54 cm E/W. Excavation of Units 5 and 6 revealed what appeared to be half of a semi-circular arrangement of semi-vertical tabular limestone FCR (Figure 7.6). Interior areas of the feature in Units 5 and 6 may have been removed before the feature was recognized; however, some of the interior FCR and feature matrix remained.

Excavation in Units 5 and 6 stopped once Feature 3 was partially exposed, and excavation expanded into Units 13 and 14, south of Units 5 and 6 (Figure 7.6). Excavation proceeded in Units 13 and 14 with the removal of upper levels and with the anticipation that Feature 3 would be encountered in the lower levels of these two units. Feature 3 was eventually contacted in Units 13 and 14 in Level 5 (40-50 cm BLL). Feature 3 in these units also appeared as a semi-circular arrangement of semi-vertical tabular limestone FCR; interior areas of the feature were left unexposed. In Unit 13, the exposed area of Feature 3 measured 88 cm N/S by 58 cm E/W, while in Unit 14, the feature measured 88 cm N/S by 61 cm E/W. Once the Feature 3 boundary was identified, excavation in Units 13 and 14 was halted and the plan view of the feature was drawn and photographed.

Excavation of Feature 3 continued simultaneously in Units 13 and 14 with trowels. In Unit 13, Feature 3 Matrix Samples 1 and 2 were collected from the upper elevations of the feature (Table 7.10); Charcoal Sample 1 was also collected from upper elevations in Unit 13 (Table 7.11). The feature matrix that was not collected as a matrix sample was screened through ¼" mesh; artifacts and charcoal were collected and bagged. Once the feature fill from Unit 13 was excavated, the exposed FCR was left in place until the entire feature was exposed, drawn and photographed. Excavation of Unit 14 followed the same protocol established for Unit 13, except no matrix samples were collected. Feature fill was excavated with trowels and screened through ¼" mesh; artifacts and charcoal were collected and bagged. The exposed portions of the feature in Units 13 and 14 suggested that the feature was an oval rock-lined roasting pit, or earth oven.

Once the feature matrix from Units 13 and 14 was excavated and screened leaving the southern portion of Feature 3 exposed, excavation again focused on Units 5 and 6. In Units 5 and 6, the remaining matrix located outside of Feature 3 was excavated down to the light brown (7.5YR 6/3) subsoil and to an elevation of 75 cm BLL; this matrix was also screened through ¼" mesh for artifacts, but no artifacts were recovered. Once this was completed, the removal of Feature 3 continued in Units 5 and 6. The same protocol

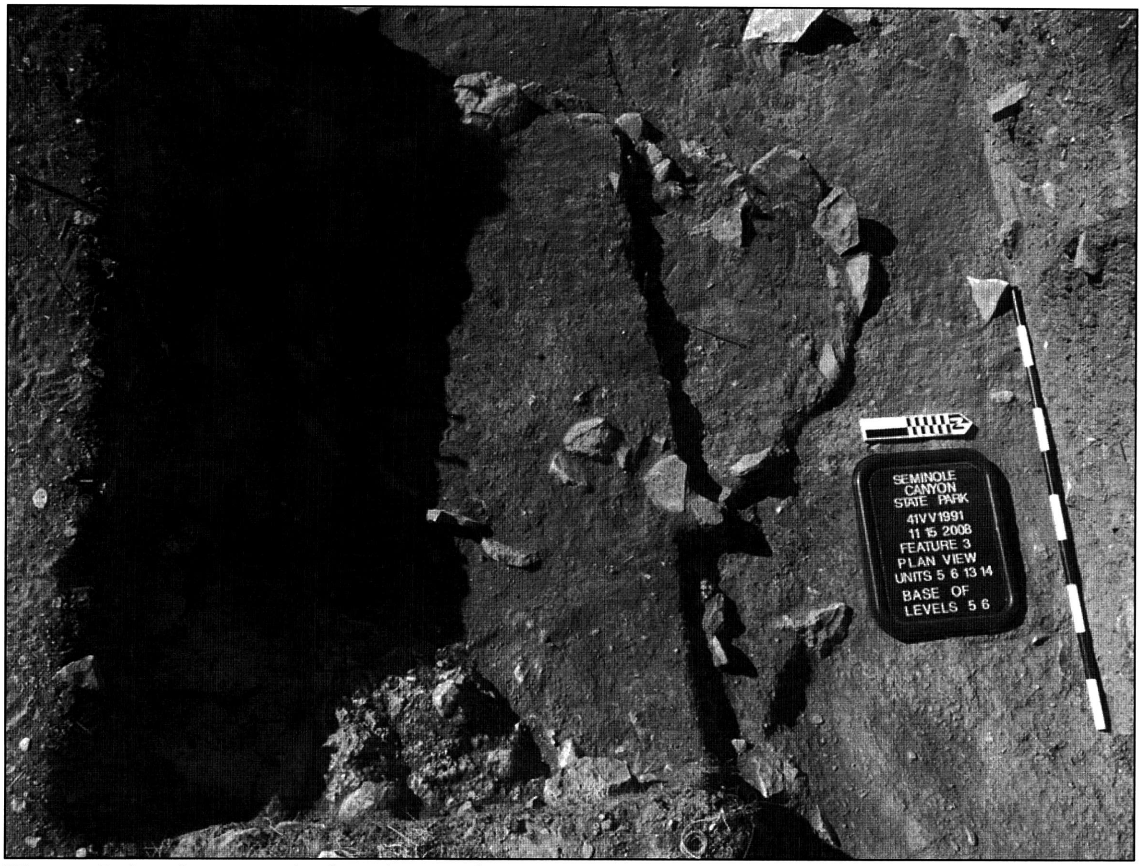

Figure 7.6. Photograph showing early exposure of tabular limestone around Feature 3.

Table 7.10. Feature 3 matrix samples.

Matrix Sample #	Liters	Unit	Elevation (cm BLL)
1	9	13	52 - 58
2	14	13	58 - 68
3	6	13	77 - 79

Table 7.11. Feature 3 charcoal samples.

Charcoal sample #	Unit	Elevation (cm BLL)	# Pieces (>5 mm)	Weight (g)	Notes
1	13	58	3	.51	SE quadrant
2	6	72	4	2.13	NE quadrant
3	6	66	8	1.10	NE quadrant
4	6	72	9	2.1	NE quadrant
5	13	72	3	.92	SE quadrant
6	14	72	2	2.25	SW quadrant
7	14	69	2	.61	Profile

Charcoal sample #	Unit	Elevation (cm BLL)	# Pieces (>5 mm)	Weight (g)	Notes
8	13	72	17	3.93	SE quadrant
9	13	71	8	5.14	SE quadrant

established for Units 13 and 14 was followed; feature fill was excavated and screened through ¼" mesh and artifacts and charcoal were collected and bagged.

Feature matrix samples were not collected from Units 5 and 6, although Charcoal Sample 3 was collected from Unit 6 (66 cm BLL). Additional plan view drawings were completed and feature photographs were taken once the feature was completely exposed (Figures 7.7-7.9). The next step involved the recording of FCR elevations (Table 7.12) followed by the removal of feature FCR from Units 5 and 6. All removed feature FCR was counted and weighed (Table 7.13). Elevations were recorded at various points located immediately below the lowest FCR located near the bottom of the feature. Once the feature FCR was removed, the remaining matrix was excavated to match the 75 cm BLL floor level of Units 5 and 6 to expose the light brown subsoil; however, a small portion of the feature that had not been noted before remained intact at the bottom of the level, as indicated by the presence of gray sediments and a few FCR fragments in the subsoil. Removal of the northern half of the feature (i.e. Units 5 and 6) provided a profile view of the southern half of Feature 3 that was documented in a measured drawing (Figure 7.9).

Once the feature profile was drawn and photographed, the removal of Feature 3 in Units 13 and 14 moved forward. Elevations were taken at points believed to represent the highest and lowest parts of Feature 3; low points were identified upon the removal of FCR located at the base of Feature 3. Matrix Sample 3 was collected from the bottom of Feature 3 in Unit 13 (Table 7.10). Charcoal Samples 2 and 4 – 9 were collected from the lower levels of Feature 3, where increased amounts of charcoal were observed at the interface of the gray feature matrix and the light brown subsoil. Fire cracked rock was removed from Units 13 and 14 and the remaining feature matrix was screened through ¼" screen; artifacts and charcoal were collected and bagged. Once all the FCR was removed, counted, and weighed from Units 13 and 14 the remaining feature matrix was excavated, in an effort to expose the original basin dug into the subsoil. In Units 13 and 14, the original basin appears to have measured ca. 1.3 meters in diameter (Figure 7.9); however, measurements in Units 5 and 6 were not available, due to the prior excavation of these units into the subsoil. Once the feature matrix was removed exposing the original basin in the light brown subsoil, final feature photographs were taken.

7.2.3.1 Feature Attributes

Feature 3 is a concentration of fire cracked limestone rocks that represents a rock-lined roasting pit located in Units 5, 6, 13, and 14 in the Feature 1 area of the Lost Midden site. Oval in shape, Feature 3 measures 1.4 m north-south by 1.04 m east-west (Figure 7.9). All boundaries were well defined and were delineated by semi-vertical alignments of burned tabular limestone measuring ≤24 cm, while the interior of the feature was composed of both

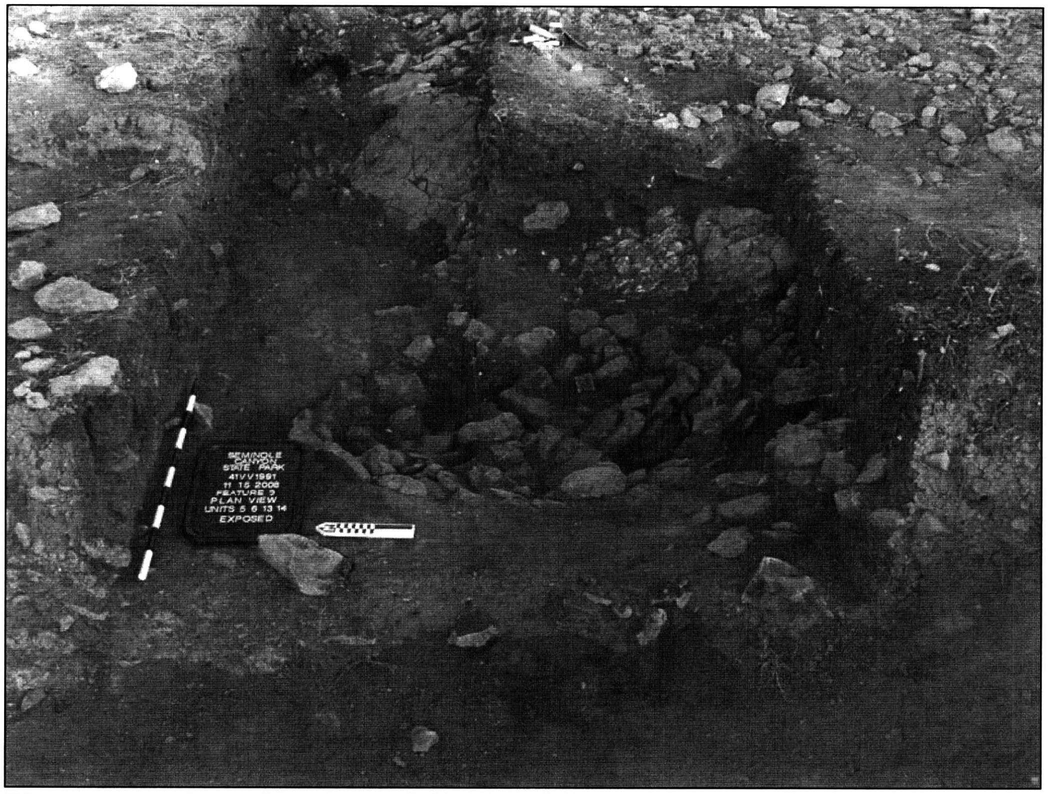

Figure 7.7. View of Feature 3 following full exposure of the Feature.

Figure 7.8. Plan view of Feature 3 following full exposure of the Feature. Edge of original backhoe trench is visible on the left.

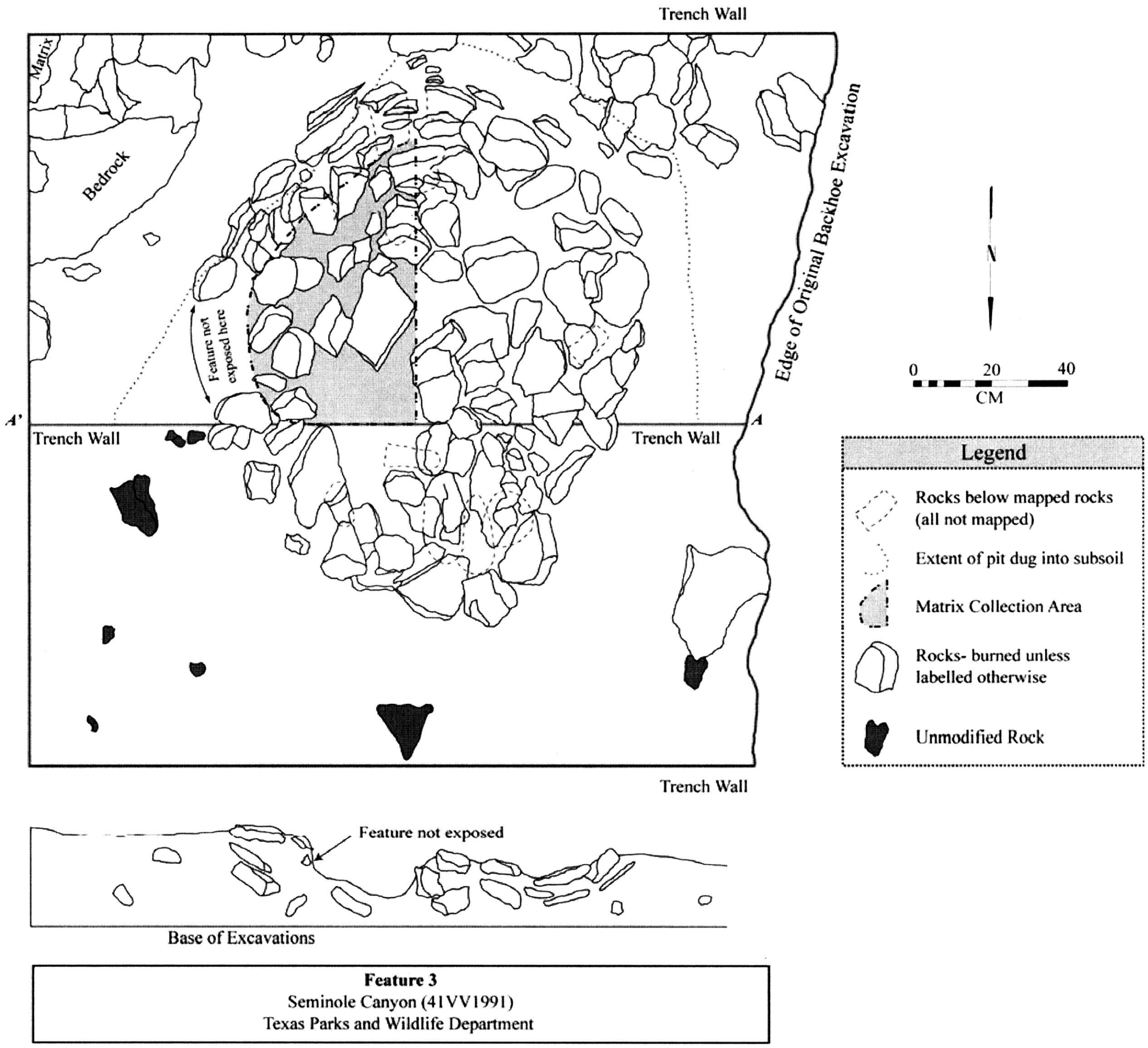

Figure 7.9. Plan view and profile of Feature 3.

Table 7.12. Feature 3 elevations by unit.

Unit	Highest (cm BLL)	Lowest (cm BLL)
5	52	74
6	50	74
13	48	75
14	48	72

Table 7.13. Feature 3 FCR counts.

Unit	FCR#	Weight (lbs.)	Weight (kg)	Maximum Dimensions[1]
5	14	11	4.9	≤17 cm
6	30	50	22.6	≤24 cm
13	68	108	48.9	-
14	119	62	28.1	-
total	*231*	*231*	*104.5*	-

[1]FCR maximum dimensions not recorded for all units

tabular and nodular limestone rocks measuring ≤24 cm. Basin shaped, its cross section is approximately 16 cm thick along its edges and approximately 24 cm thick near the center of the basin.

The upper portion of Feature 3 originated in the gray matrix observed across the site, while the basin appears to have been partially dug into the orange subsoil. Limestone bedrock underlies the feature; excavations suggest a dip or downward trend in the bedrock toward the northwest. In Unit 13, bedrock was contacted at ca. 30 cm BLL, while bedrock is visible in the dump station trench adjacent to Unit 5 at ca. 85 cm BLL. Feature elevations indicate that the highest point of the feature was located in the southeast quadrant (48 cm BLL) and dips slightly to the northwest (52 cm BLL; see Table 7.12). Feature 3 likely followed the natural contour or dip in the limestone bedrock/caliche located beneath it.

Feature 3 and Feature 1 (burned rock midden) functioned together as an earth oven and associated FCR discard area, respectively. Feature 3, the carefully arranged oval rock-lined roasting pit represents the heated elements that cooked the food items. The high density of FCR in this feature is probably the result of the central pit not being "cleaned out" after its last roasting episode, or perhaps left intact in anticipation of future use. Fire cracked rocks in the vicinity of Feature 1 represent the refuse from repeated use of Feature 3 and other possibly undiscovered rock-lined baking pits.

No temporally diagnostic artifacts were recovered from Feature 3, but four radiocarbon dates for this feature all date to the Flecha subperiod of the Late Prehistoric Tradition (Table 7.14).

Table 7.14. Radiocarbon Dates for Feature 3.

TPWD Sample #	Beta Analytic Sample #	Test Unit	Excavation Level	Two Sigma Calibrated Result
41VV1991-05	Beta-262712	6	72 cm bll	910 - 850 B.P./ 830 - 690 B.P.
41VV1991-06	Beta-262713	13	72 cm bll	930 - 740 B.P.
41VV1991-07	Beta-262714	14	71 cm bll	920 - 720 B.P.
41VV1991-08	Beta-262715	15	58 cm bll	910 - 850 B.P./ 830 - 690 B.P.

7.2.3.2 Material Assemblage

Artifact recovery at Feature 3 was actually highest in the levels immediately above the feature, while artifact recovery from feature matrix was low. Charcoal flecking was observed throughout the feature matrix but increased near the bottom of the feature at the interface of the gray feature matrix and the orange subsoil. Materials recovered from Feature 3 are summarized below:

Lithic Analysis

Fire-Cracked Rock

A total of 231 fire cracked rocks (104.5 kg.) were associated with Feature 3; unburned limestone rocks were counted and weighed in Units 5 and 6 (n = 9; <7lbs.) but were not counted or weighed in Units 13 and 14. All burned rock was discarded in the field.

Chipped Stone Debitage

No chipped stone tools were identified from Feature 3, and only 4 pieces of chipped stone debitage were recovered from this feature (Table 7.15). Chipped stone artifacts from Feature 3 accounted for approximately 1 percent of the total chipped stone assemblage recovered during the excavations of the Lost Midden site.

Faunal Analysis

Mussel Shells

Four Tampico pearlymussel (*Cyrtonaias tampicoensis*) shells and shell fragments were recovered from within Feature 3 during the present excavation. Like the specimens recovered from Feature 2 and most recovered from Feature 1, none of the mussel shell from Feature 3 showed any evidence of having been burned or otherwise modified for consumption or other use by the inhabitants of 41VV1991.

Table 7.15. Feature 3 artifacts

Unit	Level	Other Provenience	Recovery	Notes
5	7		2 mussel shell fragments	outside Feature 3
5		Feature 3 matrix	1 flake, charcoal	
6	6		snails, charcoal	outside Feature 3
6		Feature 3 matrix	1 flake, charcoal	
13		Feature 3 matrix	snails, charcoal	
14		Feature 3 matrix	2 flakes, snails, charcoal	

Macrofloral Analysis

Collection Samples

Charcoal

Nine charcoal samples were collected from Feature 3; locations and elevations are mapped on the plan view map in Figure 7.9, and summarized in Table 7.16. Charcoal samples collected from Feature 3 (excluding samples collected from the screen) were packaged in foil and/or in tissue and plastic vials. Additional charcoal fragments were collected from the feature matrix screened through the ¼-inch mesh; these samples were collected as general provenience specimens.

Matrix/flotation

Three feature matrix/flotation samples were collected from Unit 13 in the southeastern quadrant of Feature 3. Samples 1 and 2 were collected from the upper elevations of the feature, while Sample 3 was collected from near the base of the feature. The Feature 3 sediment is classified as a silty clay loam; Munsell color values were not recorded for the feature matrix or sediments adjacent to the feature. Samples were collected with trowels and scoops, placed in nylon sample bags, and labeled with corresponding provenience data. Sample locations are mapped on the plan view map in Figure 7.9 and provenience data is summarized in Table 7.16.

Analysis Results

As shown in Table 7.14, the charred wood and leaf samples recovered from Feature 3 represent at least 12 different species of plants. Unlike the Feature 1 and Feature 2 burned rock middens, the macrofloral material collected from the Feature 3 earth oven included the Agave family (Agavaceae).

Table 7.16. Carbon Sample Identifications from Feature 3.

Provenience	Plant Type	Common Name	Botanical Name
Feature 3, TU 5	Wood charcoal	Acacia	*Acacia* spp.
	Wood charcoal	Condalia	*Condalia* spp.
Feature 3, TU 6	Wood charcoal	Mesquite	*Prosopis* spp.
	Wood charcoal	Condalia	*Condalia* spp.
	Wood charcoal	Unknown	Indeterminable hardwood
	Wood charcoal	Colubrina	*Colubrina* spp.
Feature 3, TU 6, 66 cm bll	Wood charcoal	Acacia	*Acacia* spp.
	Wood charcoal	White group oak	*Quercus* subg. *Quercus*
Feature 3, TU 6, 69 cm bll	Wood charcoal	Acacia	*Acacia* spp.
Feature 3, TU 6, 72 cm bll	Wood charcoal	Condalia	*Condalia* spp.
	Wood charcoal	Legume family	Fabaceae
	Wood charcoal	Colubrina	*Colubrina* spp.
	Wood charcoal	White group oak	*Quercus* subg. *Quercus*
Feature 3, TU 13	Wood charcoal	Condalia	*Condalia* spp.
	Wood charcoal	Lotebush	*Ziziphus obtusifolia*
	Wood charcoal	Mimosa	*Mimosa* spp.
	Wood charcoal	Unknown	Indeterminable hardwood
	Wood charcoal	Colubrina	*Colubrina* spp.
	Wood charcoal	White oak group	*Quercus* subg. *Quercus*
	Wood charcoal	Legume family	Fabaceae
Feature 3, TU 13, 72 cm bll	Wood charcoal	Acacia	*Acacia* spp.
	Wood charcoal	Unknown	Indeterminable hardwood
	Wood charcoal	Condalia	*Condalia* spp.
	Wood charcoal	Colubrina	*Colubrina* spp.
	Wood charcoal	Mesquite	*Prosopis* spp.
Feature 3, TU 14	Wood charcoal	Plateau live oak	*Quercus fusiformis*
	Wood charcoal	Condalia	*Condalia* spp.
	Wood charcoal	Legume family	Fabaceae
	Wood charcoal	Agarito	*Mahonia trifoliolata*
	Wood charcoal	Unknown	Indeterminable hardwood
	Wood charcoal	Lotebush	*Ziziphus obtusifolia*
	Wood charcoal	Mesquite	*Prosopis* spp.
	Wood charcoal	Mimosa	*Mimosa* spp.
	Leaf base	Agave family	Agavaceae
Feature 3, TU 14, 71 cm bll	Wood charcoal	Condalia	*Condalia* spp.
	Wood charcoal	Oak	*Quercus* spp.
	Wood charcoal	Mesquite	*Prosopis* spp.
Feature 3, TU 14, 72 cm bll	Wood charcoal	Condalia	*Condalia* spp.
Feature 3, TU 15, 58 cm bll	Wood charcoal	Condalia	*Condalia* spp.
	Wood charcoal	Colubrina	*Colubrina* spp.

7.3 Cultural Material Summary

7.3.1 Lithic Artifacts

Chipped Stone

The analyses of chipped stone artifacts from the Lost Midden Site were intended to obtain information on culture history, raw material procurement, and lithic reduction activities. The dates associated with the typed projectile points are subject to error due to the possibility of curation and reuse of older tools by later groups. The typed projectile points indicate use of the site from as early as 2210 B.P. (Ensor dart point) to as late as 710 B.P. (Scallorn arrow point). However, radiocarbon dates from the Lost Midden site have narrowed the age of the site to 1360 – 860 B.P., the very end of the Blue Hills subperiod of the Terminal or Transitional Archaic and the Flecha subperiod of the Late Prehistoric Tradition.

The unmodified debitage sample represents behaviors related to lithic technology at 41VV1991. Although a large part of the debitage sample is decorticate and most of it falls into the 11 to 20 mm size range, the collection is not diagnostic of late stage reduction and the production of finished tools. Rather, given the large quantity of biface manufacture flakes (n = 171, 47 percent) and the small number of biface thinning flakes (n = 38, 10 percent), the characteristics of the collection is indicative of blank and preform manufacture. Given the ready availability of local chert resources from erosional exposures on the Lower Cretaceous Salmon Peak Limestone and Quaternary Pleistocene fluviatile gravel deposits in the uplands, and from gravel bars once found in the Rio Grande, it is likely that biface manufacture probably began with naturally occurring chert nodules. However, given the large percentage of decorticate debitage, it is possible that some of the very early stages of lithic reduction occurred on or near the source locales rather than at the site.

Procurement practices were further examined by identifying raw material sources among the chipped stone artifacts, particularly those that retain cortex. Of the chipped stone tools and cores (n = 56), 16 (29 percent) are identified to local sources, 11 (20 percent) are made of nonlocal materials, and 29 (52 percent) are made from materials from indeterminate sources. It is highly probable that some of the material identified as nonlocal is chert from local members of the Edwards Formation, exposed in many areas across the Edwards Plateau. However, the high percentage of indeterminate materials resulted from a conservative approach to raw material identification, and the actual percentage of local raw material may be considerably higher.

Of the 56 chipped stone tools and cores, cortex was present on only 13 (23 percent): 6 scrapers, 2 utilized flakes, 1 spokeshave, 1 miscellaneous biface, and 3 cores. Within this limited sample, 6 (46 percent of the artifacts with cortex) have highly polished cortex indicative of riverine gravels, while 5 (39 percent) have the rough cortex that is indicative of upland sources. The cortex on the remaining 2 specimens could not be identified confidently to upland or riverine sources. The remaining 43 tools, including all of the projectile points, retain no cortex. The 65 pieces of corticate debitage show a similar pattern; most (n = 36, 55 percent) are made of materials from riverine lithic sources, while fewer (n = 18, 28 percent) are made of materials from upland sources. Although suitable raw materials were locally available in the uplands, this small sample of chipped stone artifacts indicates a preferential use of riverine sources of chippable stone.

Ground Stone

Two ground stone fragments, both from Feature 1, were recovered during the present excavations. The two fragments are small, indeterminate fragments and exhibit definite use-wear polish. Both specimens were produced from rhyolite, which was probably available as secondary deposits in Rio Grande gravel bars. Little can be said about activities on the site related to these artifacts.

7.3.2 Faunal Material

Faunal material recovered from the Lost Midden site consisted entirely of the shells and shell fragments of two species of land snails, including *Rabdotus dealbatus* and *Polygyra texasiana*, and Tampico pearlymussel (*Cyrtonaias tampicoensis*). All three of these species are still found in the area today, suggesting that the environment in the Seminole Canyon area 860 to 1,360 years ago was much the same as it is today. Based on the findings during the present project, it appears that the snails were incidental on the site. There is no evidence that the snails were utilized by the human occupants at 41VV1991.

Most of the mussel shells and shell fragments at the Lost Midden site also showed no obvious evidence of having been utilized. However, the nearest source of this riverine species of mussel to 41VV1991 is the Pecos River, located approximately three miles west of the site. This suggests that these mussels were intentionally sought out and brought back to the site by the inhabitants of the Lost Midden site. One of the shells, recovered in close proximity to Feature 3, did show evidence of having been burned. It appears likely that mussels were part of the diet of site occupants at 41VV1991.

7.3.3 Macrofloral Material

Because few intact roasting pits have been discovered and excavated in the Lower Pecos region, the floral recovery and subsequent analysis at the Lost Midden site was focused primarily on Feature 3 during this investigation. As a result, most of the present macrofloral results are directly associated with Feature 3. However, charcoal samples from Features 1 and 2 were also identified prior to being submitted for radiocarbon dating. The floral analysis identified the remains of sotol (*Dasylirion*) from Features 1 and 3 and agave, most likely lechuguilla (*Agave lechuguilla*), from Feature 3. Carbonized prickly pear pads were recovered from Feature 2. These findings indicate that sotol and lechuguilla were being processed on the site. Prickly pear (*Opuntia*) pads may have also been processed as a food source, or they may have been used in the roasting process to protect the food contents from being burned by the underlying hot rocks and coals, and from the overlying cap of soil, while also providing moisture for the foods being cooked. A wide variety woody plant sources were gathered to fuel the fire(s) in the earth oven at 41VV1991, including condalia (*Condalia* spp.), acacia (*Acacia* spp.), members of white group oak (*Quercus* subg. *Quercus*), colubrina (*Colubrina* spp.), mesquite (*Prosopis* spp.), lotebush (*Ziziphus obtusifolia*), members of the legume family (*Fabaceae*), plateau live oak (*Quercus fusiformis*), elbowbush (*Forestiera* spp.), bumelia (*Sideroxylon lanuginosum*), acacia/mesquite (*Acacia/Prosopis* spp.), agarito (*Mahonia trifoliolata*), mimosa (*Mimosa* spp.), unspecified oak (*Quercus* spp.), members of the verbena family (*Verbenaceae*), baccharis (*Baccharis neglecta*), bumelia (*Sideroxylon lanuginosum*), cenizo (*Leucophyllum* spp.), stickpea (*Calliandra* spp.), sumac (*Rhus* spp.), and other unidentifiable species. Oak would have been gathered from within area canyons, while the other species would have been available on the uplands.

As reported by Leslie Bush (2009; Appendix A), many of the woody plants recovered from the Lost Midden site have uses other than fuel sources, although they are probably less likely in the context of burned rock middens. Several of the trees and bushes from which wood was recovered, including oaks, elbowbush, condalia, lotebush, mesquite, agarito, and sumac, provide edible fruits (Tull 1987). Agarito roots and branches also make a brilliant yellow dye. Bumelia and one species of condalia, *C. hookeri*, have fruits that can be used to make a blue dye (Tull 1987). The young pads of prickly pear and the ripe fruits are edible raw; the fruits can also be used to make a red dye. Sotol and lechuguilla were both used for fibers (McGregor 1992:19). None of these uses would have necessarily required the construction and use of roasting pits.

Because the smaller burned rock midden on the site, Feature 2, dates to the same general time period as Features 1 and 3 and is located within a few steps of these features, it seems likely that this midden would probably have been used to cook the same types of food as these other features. As noted, evidence of charred prickly pear pads was recovered from Feature 2. Prickly pear was used as a food source by Native Americans in the Lower Pecos, but was also commonly used to protect the food contents in roasting pits and to provide moisture to those contents (Black and Dering 2001).

The complete macrofloral analysis report is attached in Appendix A of this report.

CHAPTER 8: CONCLUSIONS AND SITE RECOMMENDATIONS

As noted in Chapter 1 of this report, the focus of the excavation of 41VV1991 was the recovery of data that was sufficient to address six critical research questions about burned rock middens posed by Black, et al. (1997) in their burned rock midden study *Hot Rock Cooking on the Greater Edwards Plateau: Four Burned Rock Midden Sites in West Central* Texas. These questions, as they pertain to the Lost Midden site, are:

7) When did the burned rock middens at this site accumulate?
8) How did these middens form?
9) What foods were processed and cooked in these middens?
10) How did the middens function within the context of the site?
11) How can we explain the midden to midden variation that appears to exist between the two middens at the present site?
12) Why did these middens form where they did on the landscape?

These research questions are addressed in the following sections. In addition, site recommendations for the remaining portion of the Lost Midden site are presented in the 'Management Summary' section of this chapter.

8.1 Chronology

A total of 11 temporally diagnostic artifacts, all of which were projectile points, were recovered from the Lost Midden site during the present investigations. These artifacts included both dart points and arrow points, possibly ranging in age from the Blue Hills subperiod of the Terminal or Transitional Archaic (2360 – 1360 B.P.) to the Late Prehistoric Flecha subperiod (1380 – 510 B.P.). All of the projectile points were recovered from Feature 1 or backdirt associated with Feature 1, which was the larger, dispersed burned rock midden at 41VV1991 (Feature 1 represents the remnants of at least one ring midden, and perhaps multiple ring middens or crescent-shaped middens). The period of use of this feature was refined through the radiocarbon dating of seven charcoal samples submitted by the Principal Investigator, including four samples from the intact roasting pit (Feature 3) discovered within Feature 1. The other samples were taken from various levels within the cultural layer of Feature 1. These radiocarbon dates indicated that Feature 1 and the associated Feature 3 were utilized between 1010 and 760 B.P., during the Late Prehistoric Flecha subperiod. However, a separate radiocarbon sample from Feature 1 that was submitted by the project geomorphologist, collected low in the profile of Feature 1 cultural deposits, produced an earlier date of 1300 to 1170 B.P. Nonetheless, this date range also falls within the Flecha subperiod, albeit the earlier part of the subperiod. The date range for Feature 1 fits well with the generally held belief that ring middens became common in the region from the latter part of the Late Archaic period, after 2310 B.P. (Hester 1989a).

The radiocarbon dates from Feature 1 and Feature 3 suggest that little or no mixing of cultural components has occurred within these features. Instead, it is possible that the two identifiable earlier dart points recovered from the site, including one Darl point and one Ensor point, were curated from elsewhere and brought onto the site (as discussed in the following paragraph, Feature 2 also appears to date to the Flecha subperiod), or that the age range of these points extends more towards the Late Prehistoric Tradition than once thought (cf. Turner and Hester 1999:101, 114). Such was recently suggested as a result of excavations at the J. B. White site in Milam County, Texas (Gadus, et al. 2006). The deepest levels of the J. B. White site, which were dated to about 1360 B.P., produced several Darl points as well as Scallorn arrow points. The occurrence of these points together in this intact context likely represents the transition from use of the atlatl and dart to the bow and arrow, a scenario which also appears probable at the Lost Midden site.

As noted, no temporally diagnostic artifacts were recovered from Feature 2, the smaller, somewhat more conical burned rock midden at 41VV1991. True dome-shaped middens have generally been considered earlier than ring or crescent-shaped middens in the Lower Pecos, dating to the Middle Archaic period or earlier (Cliff, et al. 2003:37). However, two charcoal samples recovered from Feature 2 produced radiocarbon dates ranging between 1210 and 1010 B.P. Again, this date range falls within the Late Prehistoric Flecha subperiod.

Analysis of the floral remains recovered from the Lost Midden site indicated that the occupants of this site made use of plant resources from both the uplands and within the canyons. In addition, there is at least some minimal evidence that 41VV1991 was utilized during the spring and perhaps early summer, suggesting the possibility that the occupants of the site may have inhabited area rockshelters during cold weather months. Though no association can be determined with certainty between the occupants of the Lost Midden site and the nearby Fate Bell Shelter (41VV74) and Fate Bell Annex (41VV73), there are possible Late Prehistoric pictographs at both of these rockshelters that could fall within the Flecha subperiod. Among the rock imagery at Fate Bell Shelter are Red Linear style images (although recent evidence suggests that at least some figures painted in this style could date back to at least the Middle Archaic period), while Red Monochrome style paintings have been noted at Fate Bell Annex. A probable Late Prehistoric shield-bearer figure is also present at Fate Bell Annex.

8.2 Site and Feature Formation Processes

As a result of the radiocarbon dates at the Lost Midden site, it appears that the initial occupation of the site occurred approximately 1,300 to 1,170 years ago in the area of Feature 1. As noted in the previous section, Feature 1 is the larger, more dispersed burned rock midden on the site. Amorphous in shape, this midden has a maximum north-south dimension of 10 meters (32.8 feet) by 12.5 meters (41.0 feet) east-west. The maximum depth of Feature 1 is approximately 57 centimeters (22.4 inches) below the present ground surface, but averages approximately 45 centimeters (17.7 inches) below the surface. Because of the large, amorphous nature of Feature 1, it is possible that it actually represents remnants of more than one ring midden or crescent midden. Certainly, the area surrounding Feature 3, an intact earth oven, is reminiscent of a ring midden, and adheres to Black and Creel's (1997:285) view that all burned rock middens are "center-focused accumulations." If Feature 1 does actually represent multiple burned rock middens, it was not obvious within the extensive stratigraphic profiles of the original backhoe excavation or the subsequent test unit excavations. Also, the radiocarbon dates for Feature 1 seem very consistent for having multiple middens, unless the middens were utilized simultaneously or within a relatively brief period of time.

Feature 1 is situated within a 1.2-meter (3.9 feet) deep soil-filled natural basin, possibility resulting from a partially collapsed sinkhole. As previously discussed in this report, the sediment sequence within the basin consists of two increments. The lower increment consists of dark brown granular to fine gravel silty clay to heavy loam. Sand is abundant, and ranges from fine to very coarse. The upper increment consists of very dark brown to dark brown granular to very fine gravel silt loam to loam that coincides more or less with the archeological deposits at the Lost Midden site. Sand content is similar to the lower unit. Angular cobble gravel of the local bedrock is common, sometimes appearing as stone lines in profile in association with cultural deposits. The sediment within the basin accumulated as a combination of eolian and local colluvial depositional episodes (Ed Hajic, personal communication October 22, 2009).

Because the base of burned rock midden deposits at Feature 1 first occur approximately 45 centimeters (17.7 inches) below the present ground surface, it appears that the natural basin at 41VV1991 was perhaps not entirely filled with soil by the time of the initial occupation of the site. As a result, the location may have retained moisture, perhaps even some standing water, following storms (Today, the nearest permanent source of water is Seminole Watering Hole, a spring located about 370 meters [1,214 feet] northeast of the Lost Midden site.). The presence of soil and prolonged moisture may have provided an environmental niche where vegetation differed in abundance, foliage, or possibly even diversity compared to the surrounding area. Such characteristics could have provided a visual clue even during drier times of the year to the presence of deeper soils in the area, a beneficial component for the construction of earth ovens. As will be discussed in detail under 'Site Patterning', the depression may have also provided some degree of protection from prevailing spring and summer winds.

Following the initial occupation of 41VV1991, use of the site appears to have moved to or expanded to the perimeter of the basin area between 1,210 and 1,010 years ago. Feature 2, a smaller, somewhat more conical or dome-shaped burned rock midden in appearance, is situated on the southwestern edge of the basin. In fact, much of this midden appears to be located just outside the basin, upon gently east-sloping bedrock. There is little actual accumulation of burned rock at the summit of the landform, and no evidence of a pit in the center of the feature or elsewhere in the immediate vicinity of Feature 2. This feature measures 7 meters (23 feet) north-south by 6.5 meters (21.3 feet) east-west, and has an estimated maximum depth of approximately 30 centimeters (11.8 inches) in the eastern one-half of the feature. Midden deposits thin as one moves from east to west across the feature.

The final occupation of the Lost Midden site appears to have been again within Feature 1, and dates between 1,010 and 760 years ago. Feature 3, an intact rock-lined roasting pit in the southeast portion of Feature 1, also dates to this occupation. The upper portion of the roasting pit originated in the gray matrix observed across this area of the site, and had similar soil characteristics as the surrounding matrix; as a result, the exact boundaries of this portion of the feature were difficult to determine during the excavation. However, the lower portion of the pit was very obvious; it was partially excavated into the subsoil and lined with both tabular and nodular limestone rocks. Limestone bedrock underlies Feature 3; excavations suggest a dip or downward trend in the bedrock toward the northwest. The plan view of this feature is oval-shaped, and measures 1.4 meters (4.6 feet) north-south by 1.04 meters (3.4 feet) east-west. In profile, the roasting pit is basin-shaped and the readily identifiable portion of the feature—the rock-lined basin—is 24 centimeters (9.4 inches) in thickness. One scatter of burned rock in the southeast part of Feature 1, adjacent to Feature 3, appears to include burned rocks that are generally smaller than those from the remainder of Feature 1 and could represent a distinct cleaning episode of fragmented rock from Feature 3. At the time of its discovery, Feature 3 had not been cleaned of the rocks from its final use as a roasting pit. Perhaps the rocks were left in place in anticipation by the site inhabitants of returning and re-using the roasting pit, or possibly this could have been the result of the inhabitants having to quickly abandon the site. Because of the large amorphous nature of Feature 1, and the prevalence of dark gray midden soil across the remnants of this feature, it is likely that additional roasting pits were associated with this burned rock midden. If so, they may have been located within the area of the recent backhoe excavation.

Most artifacts recovered from 41VV1991 were found on or within the cultural features on the site. Only sparse amounts of artifacts were recovered from the surrounding area. This could be the result of tasks being focused within or immediately adjacent to the burned rock middens, but the paucity of material outside the middens could also be the result of soil being gathered from these areas to cap the earth ovens, and then discarded more immediately adjacent to the roasting pits when the roasting process was completed. However, one might anticipate more of a mixing of radiocarbon dates as a result of such a process than what occurred at the Lost Midden site.

8.3 Feature Variation and Function

Because of the relative scarcity of intact earth ovens in the archeological record of the Lower Pecos region, the floral recovery and subsequent analysis at 41VV1991 was focused primarily on Feature 3 during the present investigation. As a result, most of the present data regarding feature function is most directly applicable to Feature 3 and the surrounding burned rock midden (Feature 1). The floral analysis identified the remains of sotol (*Dasylirion*) from Features 1 and 3 and agave, most likely lechuguilla (*Agave lechuguilla*), from Feature 3. Carbonized prickly pear pads were recovered from Feature

2. These findings indicate that sotol and lechuguilla were being processed on the site. Prickly pear (*Opuntia*) pads were probably used in the roasting process to protect the food contents from being burned by the underlying hot rocks and coals, and from the overlying cap of soil, while also providing moisture for the foods being cooked. A wide variety of woody plant sources were gathered to fuel the fire(s) in the earth oven, including condalia (*Condalia* spp.), acacia (*Acacia* spp.), members of white group oak (*Quercus* subg. *Quercus*), colubrina (*Colubrina* spp.), mesquite (*Prosopis* spp.), lotebush (*Ziziphus obtusifolia*), members of the legume family (*Fabaceae*), plateau live oak (*Quercus fusiformis*), elbowbush (*Forestiera* spp.), bumelia (*Sideroxylon lanuginosum*), acacia/mesquite (*Acacia/Prosopis* spp.), agarito (*Mahonia trifoliolata*), mimosa (*Mimosa* spp.), unspecified oak (*Quercus* spp.), members of the verbena family (*Verbenaceae*), baccharis (*Baccharis neglecta*), bumelia (*Sideroxylon lanuginosum*), cenizo (*Leucophyllum* spp.), stickpea (*Calliandra* spp.), sumac (*Rhus* spp.), and other unidentifiable species. Oak would have been gathered from within the adjacent canyons, while the other species would have been available on the surrounding uplands.

As reported by Leslie Bush (2009; Appendix A), many of the woody plants recovered from the Lost Midden site have uses other than fuel sources, although they are probably less likely in the context of burned rock middens. Several of the trees and bushes from which wood was recovered, including oaks, elbowbush, condalia, lotebush, mesquite, agarito, and sumac, provide edible fruits (Tull 1987). Agarito roots and branches also make a brilliant yellow dye. Bumelia and one species of condalia, *C. hookeri*, have fruits that can be used to make a blue dye (Tull 1987). The young pads of prickly pear and the ripe fruits are edible raw; the fruits can also be used to make a red dye. Sotol and lechuguilla were both used for fibers (McGregor 1992:19). None of these uses would have necessarily required the construction and use of roasting pits.

Conspicuously absent from the woody plants represented at the Lost Midden site is Texas mountain laurel, a plant that is not uncommon in the Seminole Canyon area today and would have presumably been available to the Late Prehistoric inhabitants of 41VV1991. It has been suggested by some that the cytisine (the alkaloid in Texas mountain laurel) content of this particular wood might make the smoke harmful if inhaled or might impart a bad flavor to food being cooked over such wood. But, recent experiments by Leslie Bush, Macrobotanical Analysis, Manchaca, Texas, did not find that the smoke produced by Texas mountain laurel was especially unpleasant or that it affected the taste of food cooked with the wood. Two other characteristics of this wood may contribute to its absence at the Lost Midden site, however. First, Texas mountain laurel branches do not readily die and drop from the tree, as the branches of oak and many other trees do. So there would rarely be any dry Texas mountain laurel wood available for collection unless a whole tree had died. Second, the wood generates an abundance of sparks when burned, which would be uncomfortable for people nearby, and would increase the risk of spreading the fire unintentionally (Leslie Bush, personal communication October 20, 2010).

Because the smaller burned rock midden on the site, Feature 2, dates to the same general time period as Features 1 and 3 and is located within a few steps of these features, it seems likely that this midden would probably have been used to cook the same types of food as these other features. As noted, evidence of charred prickly pear pads was recovered from Feature 2; prickly pear pads were commonly used to protect the food contents in roasting pits and to provide moisture to those contents. Feature 2 does have the appearance of being somewhat more conical in shape than Feature 1, but there is no evidence to suggest that this is the result of a difference in the function of the feature.

Several Tampico pearlymussel (*Cyrtonaias tampicoensis*) shells or shell fragments were recovered from among the two burned rock middens and the roasting pit at 41VV1991 during the present investigation, and have been reported from a number of other sites at Seminole Canyon State Park and Historic Site that include burned rock middens or burned rock scatters (i.e. possible remnants of burned rock middens). This riverine mollusk is still present today in the local waterways, but the closest source to 41VV1991 is the Pecos River, three miles west of the site. It is apparent that a concerted effort was made to bring these mussels to the site and to other sites in the area. Nonetheless, modification to these mussel shells as a result of food preparation, cooking, or other uses was limited to evidence of burning on only one shell recovered from Feature 1. It is unknown whether the shell was burned intentionally as a result of cooking, or whether it was incidental. If intentional, it seems likely that additional mussel shell specimens would show evidence of burning. It is possible that the mussels were eaten raw, or were perhaps boiled, and that these processes left little or no evidence of modification on the shells.

Likewise, no cultural modification was evident among the *Rabdotus dealbatus* and *Polygyra texasiana* snail shells recovered during the present investigation. Again, perhaps the snails were boiled and this process did not result in recognizable modification to the shells. But, there were no concentrations of snail shells on the site, and many of the shells had holes in them that are the likely result of natural predation.

Regardless of whether mussels or snails were consumed by the inhabitants of the Lost Midden site, it does not appear that roasting was the technique by which they would have been prepared. The features at 41VV1991 appear to have been limited to the roasting of the vegetal sources previously noted. This is consistent with the general notion among regional archeologists that burned rock middens represent specialized plant-processing areas (cf. Shafer 1981; Hester 1989b; Black and Ellis 1997:7).

8.3.1 Artifact Function(s)

Based on the lithic assemblage recovered from 41VV1991, other activities conducted on the site in addition to the actual roasting of foodstuffs included the preparation of sotol or lechuguilla for cooking; seed processing; chipped stone blank and perform manufacture; possible hide processing; and woodworking. Although five dart points and six arrow points or point fragments were recovered from the site, the absence of animal bones at the Lost Midden site suggests that hunting and meat processing were probably not conducted at 41VV1991.

Plant processing is reflected in the assemblage of eight knives or knife fragments recovered from the site, including a specimen typically identified as a Sotol knife. At least some of the 14 utilized flakes from 41VV1991 may have also been used for the processing of plant foods. Two groundstone fragments are more specifically attributable to seed processing at the Lost Midden site.

Hide processing may be indicated by the presence of several endscrapers and sidescrapers, as well as utilized flakes that appear to have been used for scraping. A graver, one burin, and at least one multi-functional utilized flake that functioned as a scraper and burin may have also been used for working hides.

The recovery of three spokeshaves from the Lost Midden site suggests that at least some woodworking, such as the shaping of dart and arrow shafts, occurred at 41VV1991.

Although a large part of the chipped stone debitage sample collected from the Lost Midden site is decorticate and most of it falls into the 11 to 20 millimeter size range, the collection is not diagnostic of late stage reduction and the production of finished stone tools. Instead, given the large percentage of biface manufacture flakes (47 percent) and the small percentage of biface thinning flakes (10 percent) in the present chipped stone assemblage, the debitage from the site is generally more indicative of blank and preform manufacture. Given the ready availability of local chert resources from erosional exposures on the Lower Cretaceous Salmon Peak Limestone and Quaternary Pleistocene fluviatile gravel deposits in the uplands of the area, and from gravel bars once found in the Rio Grande, it is likely that biface manufacture probably began with naturally occurring chert nodules. However, given the large percentage of decorticate debitage, it is possible that some of the very early stages of lithic reduction occurred on or near the source locales rather than at the Lost Midden site.

8.4 Site Patterning

The placement of the Lost Midden site on the landscape appears to have been dictated, at least in part, by the presence of extensive soil deposits and perhaps seasonal water and a greater abundance of potential fuel sources resulting from the natural basin at the site location. In addition, at the beginning of the present investigation, the former park manager at Seminole Canyon State Park and Historic Site indicated that he believed similar open sites were present on the uplands above several of the major rockshelters in Seminole and Presa Canyons; if so, this would suggest that the location of 41VV1991 and other burned rock midden sites in the area were influenced by their proximity to the large rockshelters that were inhabited. But, a subsequent review of the archeological site forms for the area and other archival documents, including a report documenting the results of a 100 percent archeological survey of the park (Turpin 1982), did not support the observations of the former park manager. While the present project did not include any archeological survey of other areas in the park that overlook major rockshelters, it does not appear based on available documentation that the location of the burned rock midden sites in the area, in general, were dictated by their proximity to these shelters.

The placement of Feature 3 adjacent to the southeast wall of the natural basin at 41VV1991 may offer a clue as to intrasite patterning, as well as possible seasonality at the site. The location of Feature 3 would have been optimal for sheltering it (more specifically, it would have protected the users of the roasting pit from blowing ash and embers.) from the prevailing southeasterly winds that occur between April and October in the Lower Pecos. The apparent absence of hearth features at the Lost Midden site may further support a warm weather use of the site. Historically, many Native American groups harvested "female" lechuguilla and sotol plants as they begin to send up flower stalk, from late spring through midsummer (usually in May and June); this is when the plants contained the most water and sugar-converting enzymes (Brown 1991:105; Cheatham, et al. 1995:143-144). However, while it is suggested that 41VV1991 was perhaps utilized during the late spring or early summer, a warm weather use of the site is not certain. The inhabitants of the Lost Midden site could have gathered succulents at any time of the year if food was scarce, such as has been documented for the Mescalero Apache (Basehart 1960:10).

Although no general site distribution pattern was recognized between the major rockshelters at Seminole Canyon State Park and Historic Site and open burned rock midden sites such as 41VV1991, it is possible that the present site could have functioned as a 'summer kitchen' of sorts for inhabitants of the nearby Fate Bell Shelter or Fate Bell Annex, keeping the heat generated by the roasting process out of the otherwise cool rockshelters.

8.5 Management Recommendations for 41VV1991

8.5.1 Construction Recommendations

The present report details the testing and data recovery excavations that were conducted by the Texas Parks and Wildlife Department and volunteers following the accidental discovery of a burned rock midden site, 41VV1991, during backhoe excavations for a proposed RV dump station at Seminole Canyon State Park and Historic Site. The dump station was needed to facilitate the anticipated increase in camping use resulting from a campground extension that was/is also being constructed within the park, and to serve as a back-up to the other aging RV dump station in the park.

Prior to selecting the present location for the RV dump station, several other possible locations in the park were examined. However, the other locations were dismissed because of cultural resource concerns or the proximity of these locations to the edge of Seminole Canyon. As discussed within the report, a pedestrian survey of the present location did not identify any cultural resource concerns. In addition, the location is near an existing septic field, and is convenient for use by campers as they are exiting the park. Unfortunately, site 41VV1991 was discovered in the process of constructing the dump station, and work on the facility was stopped. Nonetheless, the need for the RV dump station still exists, and there are still the same concerns regarding the other previously proposed locations for the dump station. As a result, the present archeological testing and data recovery investigation was designed with the goals of mitigating the damage that was done to the Lost Midden site, and to recover sufficient data to allow the construction of the proposed RV dump station, including placement of a pipeline connecting the dump station to the existing septic field, to proceed in the present location.

These efforts focused on the original proposed footprint of the RV dump station and pull-through, as well as the area between the original footprint and the existing septic field to the west of the project area. This included testing of the proposed corridor within which a pipeline will be placed that will connect the dump station with the existing septic field. The data recovery within the proposed footprint of the RV dump station and pull-through included the removal of the soil overlaying Feature 1, and the excavation of 14 1 x 1 meter (3.3 x 3.3 feet) test units within this feature. The test unit excavations within Feature 1 represent a sample of approximately 14 percent of the total area of the feature, which is estimated to have been about 99 square meters (1,065.6 square feet) prior to the backhoe excavation that damaged this feature. The area of damage caused by the backhoe excavation is estimated to be approximately 24 square meters, or about 24 percent of the total Feature 1 area. As a result, approximately 62 percent of the feature, or 61 square meters, appears to remain intact. The single earth oven (Feature 3) that was identified within Feature 1 was 100 percent excavated during the present investigation.

The necessary pit for the proposed dump station was entirely excavated by the TxDOT contractor prior to the discovery of the Lost Midden site, and the subsequent shutting down of the project. As a result, minimal new subsurface excavations would be required to complete the proposed construction project. The soil that was placed back within the backhoe excavation following the present field investigation would need to be removed, but new subsurface impact would be limited to the trench needed to connect the location of the RV dump station with the existing septic field. Subsurface testing (N=2 shovel tests, and 3 50 x 50 cm test units) within the proposed approximately 13.1-meter (43 feet) long trench location did not reveal any archeological deposits. With the exception of the Feature 2 location, artifacts in areas adjacent to the proposed trench were very sparse.

The proposed pull-through will be surfaced, which has the potential to impact future radiocarbon dates from this site. However, nine such dates were recovered from the Lost Midden site during the present investigation. These dates all clustered within the Late Prehistoric Flecha subperiod, minimizing the need for additional radiocarbon dates from this site in the future.

Feature 2 is located outside of the originally proposed footprint of the RV dump station; however, there was subsequent consideration given to expanding the existing septic field toward the east, between the existing field and the dump station. Similar to Feature 1, data recovery within Feature 2 included the removal of the soil overlaying this feature. In addition, 5 1 x 1 meter (3.3 x 3.3 feet) test units were excavated. The test unit excavations within Feature 2 represent a sample of approximately 14 percent of the total area of the feature, which is estimated to be about 36 square meters (387.5 square feet). As a result, approximately 86 percent of the feature, or 31 square meters (333.7 square feet), appears to remain intact. Though sparse, some artifacts are evident in the area adjacent to Feature 2.

Based on these findings, it is recommended that the proposed RV dump station and pipeline connecting it with the existing septic field be allowed to proceed in there presently proposed locations. But, it is further recommended that the existing septic field not be expanded to the east, towards the dump station location. Instead, if it is deemed necessary to expand the capacity of the current facility, it is suggested that a mounded system be considered. Or, following the necessary pedestrian survey and shovel testing, with negative results, the existing septic field could potentially be expanded to the west or south. However, preliminary observations of these areas suggest that there is extensive bedrock in both areas, and may prevent the use of a buried septic system.

All excavations associated with this investigation were lined with black plastic and have been back-filled with culturally sterile soil.

8.5.2 Interpretive Recommendations

Outreach efforts implemented during the course of this investigation included the publication of a professional quality tri-fold interpretive brochure by the Texas Parks and Wildlife Department on prehistoric earth oven technology and the preliminary findings at the Lost Midden site. This brochure, which was and still is available to park visitors or other interested parties, summarizes the findings at 41VV1991 about the time that the excavations were 50 percent complete, places the site within the cultural framework of the area, and provides interpretation on the function of the site. The brochure was completed at this early stage due to the almost daily presence of a number of curious park visitors to the archeological site.

Following the fieldwork at the site, a model of an earth oven, with the interior of the oven exposed, was constructed by Lake Amistad archeologist Jack Johnson and park staff near the Visitor's Center at Seminole Canyon State Park and Historic Site. This reconstructed feature provides another tool for park staff to explain prehistoric earth oven technology to interested visitors. Interpretive signage is currently being planned for placement near the earth oven model.

With the completion of the excavation at 41VV1991, and the summary of results from this work, new information is now available to update segments of the aforementioned tri-fold interpretive brochure that focus on the Lost Midden site.

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APPENDIX A:

Lost Midden Site (41VV1991) Macrobotanical Results

By Leslie Bush, Macrobotanical Analysis,
Manchaca, Texas

MACROFLORA
FROM
LOST MIDDEN (41VV1991),
A BURNED ROCK MIDDEN SITE IN
SEMINOLE CANYON STATE PARK AND
HISTORIC SITE
VAL VERDE COUNTY, TEXAS

September 4, 2009

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Three flotation samples and 22 carbon samples were submitted for identification and analysis from the Lost Midden site (41VV1991). Lost Midden is a buried, upland burned rock midden site located within Seminole Canyon State Park and Historic Site, a park located in the Lower Pecos region of Texas, west of Del Rio. The site consists of two burned rock middens, a roasting pit, and associated artifacts. No radiocarbon dates are available at the time of this writing, but the frequency of end scrapers suggests that most occupation dates to the Late Prehistoric. The earliest diagnostic artifact recovered on the site was a Darl point, suggesting that site use occurred within the last 1,500 years.

Environmental Setting

Modern climatic conditions have been in place in the Lower Pecos since 2,000 BP, when a millennium-long mesic period ended (Van Devender 1977). Modern vegetation patterns can thus be used, with caution, to understand the vegetation present when Lost Midden was occupied. Seminole Canyon is located near the convergence of three major physiographic zones, the Edwards Plateau, the South Texas Brush Country and the Trans-Pecos (Diamond et al. 1987). Its diverse flora includes plants characteristic of all three regions (Labas 1989). The Edwards Plateau is a savannah area characterized by grasses and forbs interspersed with mottes comprised mainly of oaks, hackberry, and juniper. As its name implies, the South Texas Brush Country includes dense, thorny shrubs such as condalia, acacias, and prickly pear. Grasslands are also important ecosystems in South Texas. Trans-Pecos landscapes include both mountain and desert, with desert shrubs such as creosote, lechuguilla, yucca, and cholla characterizing the eastern Trans-Pecos. Flat, upland areas in the Lower Pecos such as that near Lost Midden support floral associations most like the South Texas Brush Country (Labas 1989).

Seminole Canyon receives an average of 45 cm (17.7") annual precipitation, with most rainfall in late spring and early fall (Labas 1989:7). Soils are rocky and alkaline, overlying limestone (Labas 1989:7). The nearest water is a spring about 370 meters northeast of the site.

Methods

Flotation samples from Lost Midden were processed at the Center for Big Bend Studies, Sul Ross State University, Alpine, in June 2009 in a machine-assisted flotation device with window-screen bottom mesh. Light fractions were caught in such fine nylon bags that much sediment remained in the light fractions. They were placed in coarser nylon bags (openings 0.33 mm) at the Macrobotanical Analysis laboratory and gently rinsed and dried in the shade. Floral materials were removed from heavy fractions by the author and added to the light fractions prior to analysis. All carbonized plant material larger than 2 mm was removed from the heavy fraction, and the remainder was scanned for non-wood plant remains. For the three samples, an average of 33 percent (by weight) of plant material larger than > 2 mm was recovered from the heavy fraction.

Once the heavy fraction plant material had been added, flotation light fractions were sorted according to standard methods (Pearsall 2000). Each flotation light fraction was weighed on an electronic balance with a sensitivity of 0.01 g before being size-sorted through a stack of geologic mesh with openings of 2 mm, 1.4 mm, and 0.71 mm. Materials in the > 2 mm size fraction were completely sorted, and all carbonized botanical remains were counted, weighed, recorded, and labeled. All materials in the >2 mm size fraction other than carbonized and semi-carbonized plants are referred to as "contamination" on laboratory forms. At Lost Midden these materials usually consisted of rootlets, stems, and gastropods. Materials that fell through the 2 mm mesh, referred to as "residue", were examined carefully under a stereoscopic microscope at 7-45 X magnification for carbonized botanical remains other than wood charcoal. These plant parts, which at Lost Midden consisted only of indeterminable starchy fragments, were removed from residue. All plant material removed from the residue was counted, weighed, and labeled. The presence of fresh seeds in the residue was also recorded on laboratory forms, but these materials were not removed from residue.

For each flotation sample, twenty wood charcoal fragments were selected for identification at random from those larger than 2 mm. Fragments were snapped to reveal a transverse section and examined under a stereoscopic microscope at 28-180 X magnification. When necessary, tangential or radial sections were examined for ray seriation, presence of spiral thickenings, types and sizes of interveseel pitting, and other minute characteristics that can only be seen at the higher magnifications of this range (Hoadley 1990).

Carbon samples were identified and analyzed like the flotation samples, except that only a 2 mm mesh was used. Because at least some of the material was designated for radiometric analysis, extra care was taken to ensure that samples were not contaminated in the laboratory. The analyst wore vinyl gloves whenever working with the samples and, as always, clean glassware was used. Contact with paper products was avoided.

Seeds, fruits, and woody tissue are not always sufficient, by themselves, to allow identification of the plant from which they came to the species level. Botanical materials from Lost Midden were identified to the lowest possible taxonomic level by comparison to materials in the author's comparative collection and through the use of standard reference works and databases (e.g. Davis 1993; Hoadley 1990; InsideWood 2004; Martin and Barkley 1961; Musil 1963; Panshin and de Zeeuw 1980). An article by Willis Bell and Carl King (1944) and descriptive comments by Scooter Cheatham and colleagues (1995) provided additional aid for the identification of sotol and agave. Mark Lockwood, the Natural Resources Coordinator for the Texas Parks and Wildlife Department in west Texas, and Randy Rosales, Superintendent of Seminole Canyon State Park and Historic Site, generously sent plant samples from the park. Some taxa were identified to species through positive identification or elimination of other possible members of the genus. Most commonly botanical materials, whether carbonized or not, were identified to the genus. Botanical nomenclature and common names follow the PLANTS national database (USDA, NCRS 2009) except in the cases where the common name in local use differs significantly from the common name given in the database.

Results

In all, three flotation samples representing 28.85 cubic deciliters of soil matrix from Feature 3 were examined. Table 1 shows macrobotanical remains recovered by flotation count and weight, respectively.

Uncarbonized plant remains

Although survival of ancient, uncarbonized plant material is common in caves and rock shelters in the Lower Pecos, it is less likely on an open-air site such as Lost Midden. All uncarbonized taxa from Lost Midden except two cacti are weedy plants that quickly colonize disturbed areas such as that near the picnic ground and parking lot where Lost Midden is located. Cactus seeds would also be expected in the park. For these reasons, fresh seeds at Lost Midden are interpreted as modern seed rain that has worked its way into the soil. Some incompletely carbonized elbowbush wood was identified in a carbon sample from Feature 1 (see Table 1). This material is included here among the archeological remains, although it could also be the result of a more recent fire.

Carbonized plant remains

Wood charcoal. As shown in Figure 1, condalia makes up more than one-third (38 percent) of wood charcoal identified from all sources at Lost Midden. Oaks (17 percent), acacias (13 percent), colubrine (9 percent), mesquite (9 percent), and lotebush (5 percent) are well represented, and the total species list comprises an impressive twenty-one taxa. The expectation of floral diversity at Seminole Canyon is well-met in this assemblage. Although characteristic Edwards Plateau species are present, most woody taxa reflect a South Texas Brush Country environment, as expected in an upland area near the lower Pecos River. Woody plants such as Texas mountain laurel and kidneywood that are present at Seminole Canyon today but not identified in the archeological wood assemblage may be represented in the general "legume" category.

Wood charcoal recovered from Lost Midden is believed to represent fuel wood associated with the roasting pit and burned rock middens that make up the site. Archeological theories known variously as the "firewood indifference hypothesis" or the "Principal of Least Effort" predict that firewood should reflect in a relatively straightforward manner the local environment at the time of occupation (Asch and Asch 1986; Shackelton and Prins 1992). Several factors may cause the archeological record of wood charcoal to differ from the local vegetation: Self-pruning trees may be over-represented archeologically, and species intended for other uses may be under-represented archeologically (Asch and Asch 1986; Dufraisse 2008). In addition, ethnohistorical sources indicate that Native Americans were well aware of the burning properties of different woods and exploited them accordingly (e.g., Gilmore 1933:139; Zigmond 1981:57). Nonetheless, the broad assumption of firewood indifference is followed here except when archeological evidence indicates otherwise.

The frequency of condalia in the wood charcoal assemblage at Lost Midden is probably higher than it was in the ancient landscape, although it is found today in upland locations at Seminole Canyon. Condalia (*C. viridis*) was presnt in 5 of 22 transects investigated by Zachary Labas (1989). All five were upland transects, including Tract 10, which is the nearest samples tract to the Lost Midden site. In the five tracts in which it was present, condalia made up a maximum of 3.4 percent of relative cover. Condalia wood is heavy and makes an excellent fuel (Simpson 1999). White group oaks and live oaks, the second most common group of wood at Lost Midden, along with acacia, are similarly heavy and prized for their coaling qualities. Both woods are likely over-represented at Lost Midden in relation to their abundance on the landscape because of deliberate selection for their qualities as fuel wood.

Food plants. In addition to wood, three other plant parts were identified at Lost Midden. Sotol was identified from Features 1 and 3, and a species of agave was identified from Feature 3. The agave is most likely lechuguilla, since *Agave lechuguilla* is the only species of agave found in Seminole Canyon (Labas 1989). Cheatham and colleagues describe lechuguilla's spines and characterize it as "appallingly common" in Trans-Pecos Texas (Cheatham et al. 1995:138). Ethnographic and archeological evidence indicates that burned rock middens were used to cook geophytes (leaf bases of lechuguilla and sotol) for long periods, usually about two days (Ebeling 1986:470-471; Shafer 1986:118). Moist plant material such as green grasses and prickly pear pads were packed around the food plants to help seal in moisture during the cooking process. Carbonized prickly pear pad fragments were recovered from Feature 2 at Lost Midden. Thus, macrobotanical remains from Lost Midden indicates cooking of sotol and lechuguilla and use of prickly pear pads for insulation in cooking features. It is possible that grass was also used and its more delicate leaves disintegrated in the rocky soil, leaving only the tougher prickly pear fragments to be recovered by archeologists. Sotol, lechuguilla and prickly pear are the three staple plants available year-round in the Lower Pecos (Shafer 1986:118), so it is not surprising they constitute the non-woody plants recovered from Lost Midden.

Other plant uses. Most likely, the plants identified at Lost Midden were either the remains of food cooked in the roasting pit(s) or fuel for the cooking fires. However, many of the plants recovered have other uses, even if these are less likely in the context of a burned rock midden. Several of the trees from which wood was recovered supply edible fruits. These include oaks (acorn), elbowbush, condalia, lotebush, mesquite, agarito, and sumac (Tull 1987). Agarito roots and branches make a brilliant yellow dye. Bumelia and one species of condalia, *C. hookeri*, have fruits that can be used to make a blue dye, a color rare in nature (Tull 1987). The young pads of prickly pear are edible raw, as are the ripe fruits (which also make a red dye). Sotol is a vitally important fiber plant, and lechguilla was also occasionally used for fiber (McGregor 1992:19).

Summary

Flotation samples and carbon samples from Lost Midden yielded a wide range of wood charcoal types that were used as fuel for cooking fires. The wood charcoal reflects the trees and shrubs that would have been immediately available in the upland setting of the

Lost Midden site. The preponderance of less common but particularly good fuel woods such as condalia and oak indicate deliberate selection of particular plants for fuel. Sotol and lechuguilla remains provide evidence of the food plants cooked at Lost Midden. Prickly pear pads were used to cover the sotol and lechuguilla hearts, providing moisture and keeping the food clean during the cooking process.

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Table 1: Carbon Samples from Lost Midden (41VV1991)

Context	Plant type	Common Name	Botanical Name	Count	Weight (g)
Feature 1, TU Level 5	[redacted]	[redacted]	[redacted]	[redacted]	0.14
	[redacted]	[redacted]	[redacted]	[redacted]	0.01
	[redacted]	[redacted]	[redacted]	[redacted]	0.34
Feature 1, Unit Level 4 30-40 cm	[redacted]	[redacted]	[redacted]	[redacted]	1.05
	[redacted]	[redacted]	[redacted]	[redacted]	0.94
	[redacted]	[redacted]	[redacted]	[redacted]	0.25
	[redacted]	[redacted]	[redacted]	[redacted]	0.18
	[redacted]	[redacted]	[redacted]	[redacted]	0.28
	[redacted]	[redacted]	[redacted]	[redacted]	0.06
	[redacted]	[redacted]	[redacted]	[redacted]	0.06
	[redacted]	[redacted]	[redacted]	[redacted]	0.16 not fu carbonized
	[redacted]	[redacted]	[redacted]	[redacted]	0.03
	[redacted]	[redacted]	[redacted]	[redacted]	0.20
Feature 1, TU Level 4 30-40 cm	[redacted]	[redacted]	[redacted]	[redacted]	0.75
	[redacted]	[redacted]	[redacted]	[redacted]	0.23
	[redacted]	[redacted]	[redacted]	[redacted]	0.45
	[redacted]	[redacted]	[redacted]	[redacted]	0.60 not fu carbonized
	[redacted]	[redacted]	[redacted]	[redacted]	0.03
	[redacted]	[redacted]	[redacted]	[redacted]	0.04
	[redacted]	[redacted]	[redacted]	[redacted]	0.15
	[redacted]	[redacted]	[redacted]	[redacted]	0.06
	[redacted]	[redacted]	[redacted]	[redacted]	0.09
	[redacted]	[redacted]	[redacted]	[redacted]	0.08
	[redacted]	[redacted]	[redacted]	[redacted]	0.06
	[redacted]	[redacted]	[redacted]	[redacted]	1.30
Feature 2, TU Level 2 10-20 cm	[redacted]	[redacted]	[redacted]	[redacted]	0.27
	[redacted]	[redacted]	[redacted]	[redacted]	0.12
Feature 2, TU Level 4	[redacted]	[redacted]	[redacted]	[redacted]	0.07
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Feature 2, TU Level 5 40-50 cm	[redacted]	[redacted]	[redacted]	[redacted]	0.21
	[redacted]	[redacted]	[redacted]	[redacted]	0.14
	[redacted]	[redacted]	[redacted]	[redacted]	0.74
Feature 2, TU Level 3	[redacted]	[redacted]	[redacted]	[redacted]	0.09
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Context	Plant type	Common Name	Botanical Name	Count	Weight (g)
Feature 2, TU Level 5	[redacted]				
	[redacted]				
	[redacted]				
Feature 3, Level 6 cm bll	[redacted]				
	[redacted]				
	[redacted]				7.75
Feature 3, TU 6, cm bll	[redacted]				
	[redacted]				76.10
Feature 3, TU 6, cm bll	[redacted]				1.52
	[redacted]				0.06
	[redacted]				0.01
	[redacted]				0.01
	[redacted]				4.81
Feature 3, TU 6, cm bll	[redacted]				0.36
	[redacted]				5.27
Feature 3, TU 5	[redacted]				0.14
	[redacted]				0.16
Feature 3, TU general unit	[redacted]				3.05
Feature 3, TU general unit	[redacted]				2.03
	[redacted]				0.22
	[redacted]				0.04
	[redacted]				0.11
	[redacted]				0.28
	[redacted]				0.04
	[redacted]				0.03
Feature 3, TU Level 5 58 cm	[redacted]				0.42
	[redacted]				0.02
	[redacted]				1.02
Feature 3, TU general unit	[redacted]				0.16
	[redacted]				0.23
	[redacted]				0.09
	[redacted]				0.06
	[redacted]				0.10
Feature 3, TU general unit	Wood charcoal	Plateau live oak	*Quercus fusiformis*	2	0.48

Context	Plant type	Common Name	Botanical Name	Count	Weight (g)
Feature 3, TU general unit	[redacted]	[redacted]	[redacted]	[redacted]	1.96
					0.07
					0.05
					0.35
					0.11
					0.22
					0.14
					0.14
Feature 3, TU 14, cm	[redacted]	[redacted]	[redacted]	[redacted]	2.19
					4.19
Feature 3, TU 14, cm	[redacted]	[redacted]	[redacted]	[redacted]	2.30
					0.20
					0.86
					4.23
Feature 3, TU 13, cm	[redacted]	[redacted]	[redacted]	[redacted]	0.41
					0.40
					2.11
Feature 3, TU 13, cm	[redacted]	[redacted]	[redacted]	[redacted]	2.05
					0.39
					0.27
					0.20
					0.46
			Residue		3.93

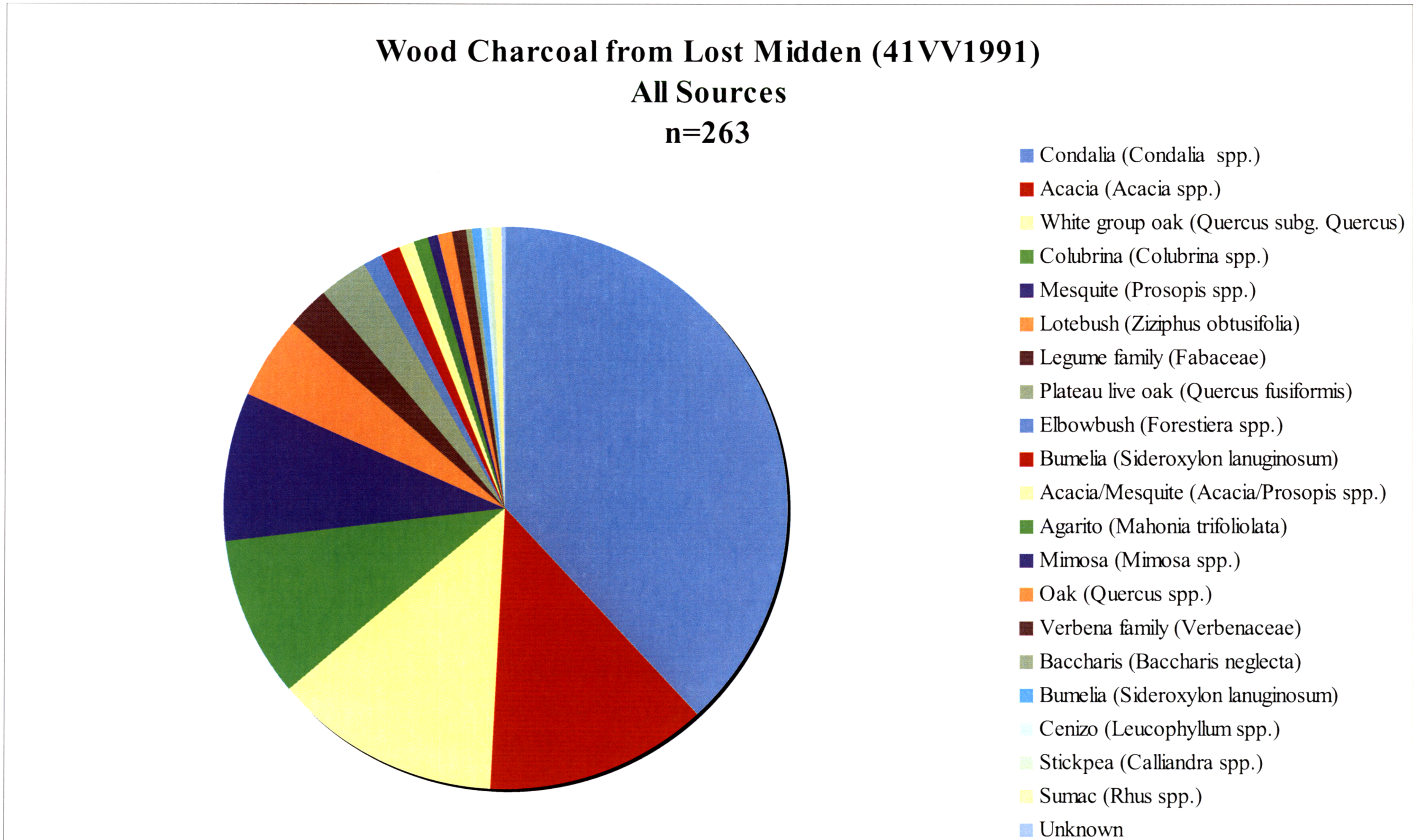

Figure 1. Frequency of Wood Charcoal at 41VV1991, by Count.

APPENDIX B:

Lost Midden Site (41VV1991) Radiocarbon Dates

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Darden Hood
President

Ronald Hatfield
Christopher Patrick
Deputy Directors

August 25, 2009

Mr. Tim Roberts
Texas Parks and Wildlife
P.O. Box 1807
Fort Davis, TX 79734
USA

RE: Radiocarbon Dating Results For Samples 41VV1991-01, 41VV1991-02, 41VV1991-03, 41VV1991-04, 41VV1991-05, 41VV1991-06, 41VV1991-07, 41VV1991-08

Dear Tim:

Enclosed are the radiocarbon dating results for eight samples recently sent to us. They each provided plenty of carbon for accurate measurements and all the analyses proceeded normally. As usual, the method of analysis is listed on the report with the results and calibration data is provided where applicable.

As always, no students or intern researchers who would necessarily be distracted with other obligations and priorities were used in the analyses. We analyzed them with the combined attention of our entire professional staff.

If you have specific questions about the analyses, please contact us. We are always available to answer your questions.

The cost of analysis was previously invoiced. As always, if you have any questions or would like to discuss the results, don't hesitate to contact me.

Sincerely,

Darden Hood

Digital signature on file

BETA

BETA ANALYTIC INC.

DR. M.A. TAMERS and MR. D.G. HOOD

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MIAMI, FLORIDA, USA 33155
PH: 305-667-5167 FAX:305-663-0964
beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Mr. Tim Roberts — Report Date: 8/25/2009

Texas Parks and Wildlife — Material Received: 8/6/2009

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 262708	960 +/- 40 BP	-25.2 o/oo	960 +/- 40 BP

SAMPLE : 41VV1991-01
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 1010 to 1170 (Cal BP 940 to 780)

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 262709	860 +/- 40 BP	-23.6 o/oo	880 +/- 40 BP

SAMPLE : 41VV1991-02
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 1040 to 1240 (Cal BP 920 to 700)

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 262710	1120 +/- 40 BP	-23.4 o/oo	1150 +/- 40 BP

SAMPLE : 41VV1991-03
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 780 to 980 (Cal BP 1170 to 960)

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 262711	1070 +/- 40 BP	-25.2 o/oo	1070 +/- 40 BP

SAMPLE : 41VV1991-04
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 890 to 1030 (Cal BP 1060 to 920)

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 262712	810 +/- 40 BP	-22.2 o/oo	860 +/- 40 BP

SAMPLE : 41VV1991-05
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 1040 to 1100 (Cal BP 910 to 850) AND Cal AD 1120 to 1260 (Cal BP 830 to 690)

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

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beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Mr. Tim Roberts

Report Date: 8/25/2009

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 262713	930 +/- 40 BP	-24.8 o/oo	930 +/- 40 BP

SAMPLE : 41VV1991-06
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 1020 to 1210 (Cal BP 930 to 740)

Beta - 262714	890 +/- 40 BP	-25.0 o/oo	890 +/- 40 BP

SAMPLE : 41VV1991-07
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 1030 to 1230 (Cal BP 920 to 720)

Beta - 262715	820 +/- 40 BP	-22.5 o/oo	860 +/- 40 BP

SAMPLE : 41VV1991-08
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 1040 to 1100 (Cal BP 910 to 850) AND Cal AD 1120 to 1260 (Cal BP 830 to 690)

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-25.2:lab. mult=1)

Laboratory number: **Beta-262708**

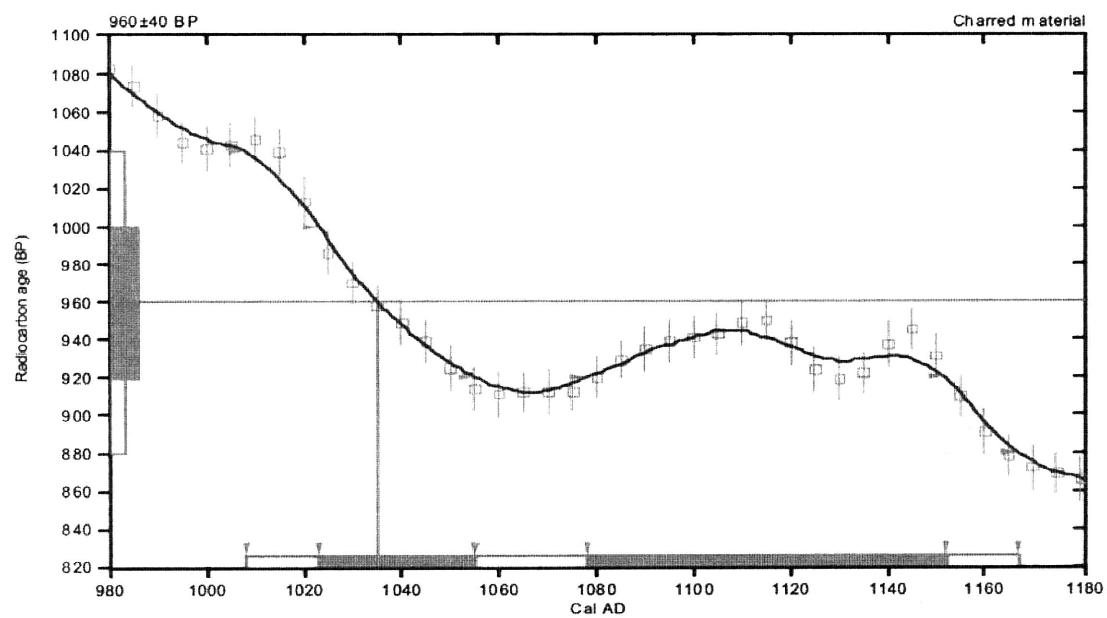
Conventional radiocarbon age: **960±40 BP**

2 Sigma calibrated result: **Cal AD 1010 to 1170 (Cal BP 940 to 780)**
(95% probability)

Intercept data

Intercept of radiocarbon age with calibration curve: Cal AD 1040 (Cal BP 920)

1 Sigma calibrated results: Cal AD 1020 to 1060 (Cal BP 930 to 900) and
(68% probability) Cal AD 1080 to 1150 (Cal BP 870 to 800)



References:
Database used
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Calibration Database
INTCAL04 Radiocarbon Age Calibration
IntCal04: Calibration Issue of Radiocarbon (Volume 46, nr 3, 2004).
Mathematics
A Simplified Approach to Calibrating C14 Dates
Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-23.6:lab. mult=1)

Laboratory number: **Beta-262709**

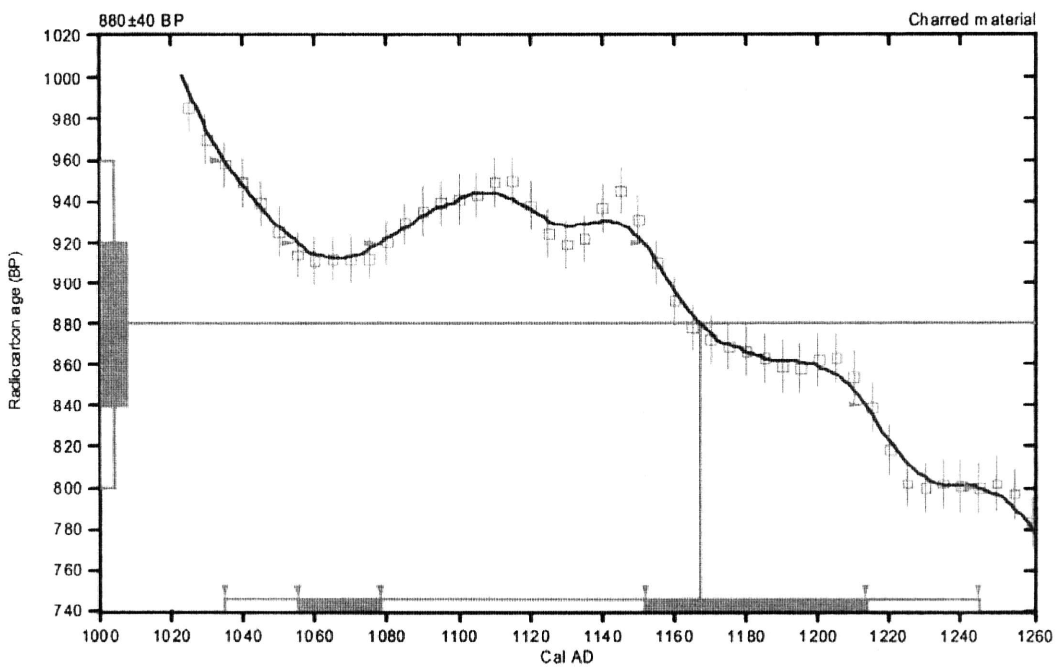
Conventional radiocarbon age: **880±40 BP**

2 Sigma calibrated result: (95% probability) **Cal AD 1040 to 1240 (Cal BP 920 to 700)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal AD 1170 (Cal BP 780)

1 Sigma calibrated results: (68% probability) Cal AD 1060 to 1080 (Cal BP 900 to 870) and Cal AD 1150 to 1210 (Cal BP 800 to 740)



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Database used

INTCAL04

Calibration Database

INTCAL04 Radiocarbon Age Calibration

IntCal04: Calibration Issue of Radiocarbon (Volume 46, nr 3, 2004).

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-23.4:lab. mult=1)

Laboratory number: **Beta-262710**

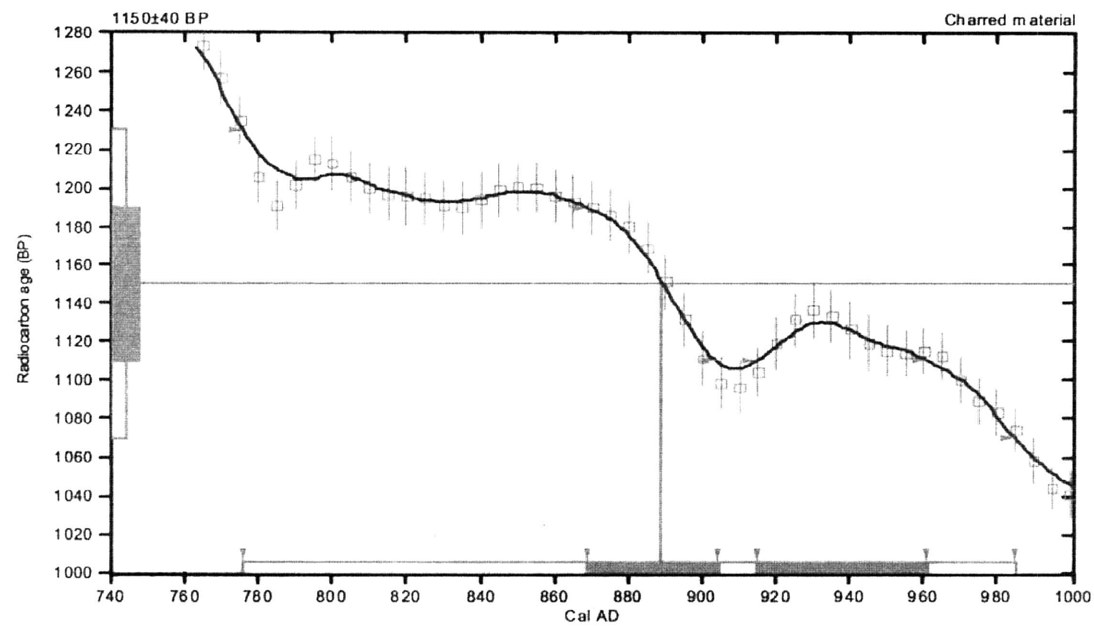
Conventional radiocarbon age: **1150±40 BP**

2 Sigma calibrated result: **Cal AD 780 to 980 (Cal BP 1170 to 960)**
(95% probability)

Intercept data

Intercept of radiocarbon age with calibration curve: Cal AD 890 (Cal BP 1060)

1 Sigma calibrated results: Cal AD 870 to 900 (Cal BP 1080 to 1050) and
(68% probability) Cal AD 920 to 960 (Cal BP 1040 to 990)



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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-25.2:lab. mult=1)

Laboratory number: **Beta-262711**

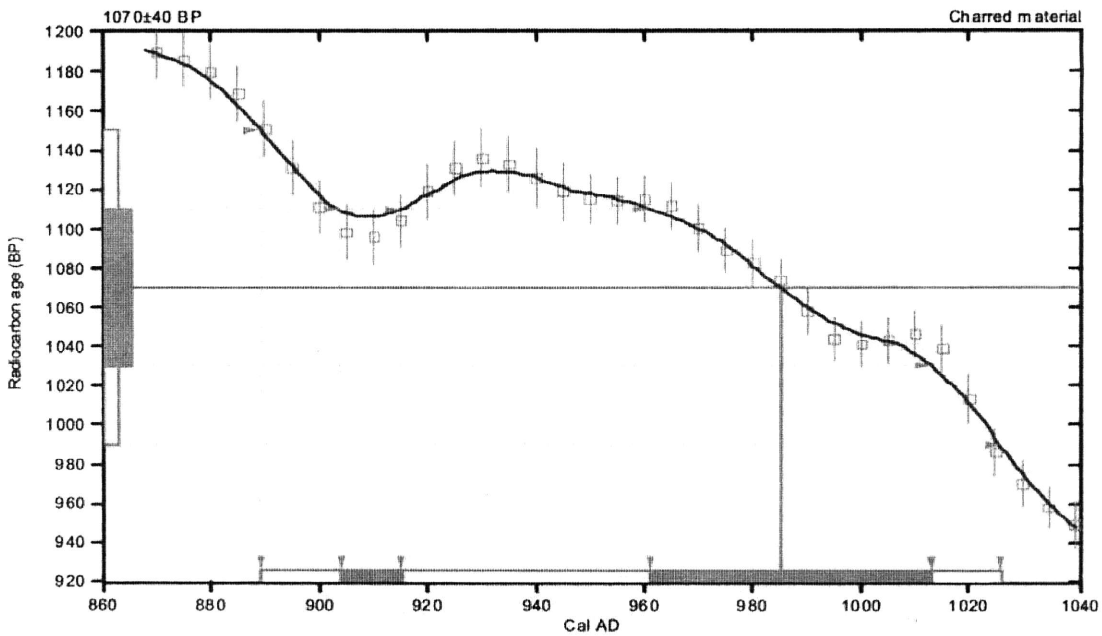
Conventional radiocarbon age: **1070±40 BP**

2 Sigma calibrated result: (95% probability) **Cal AD 890 to 1030 (Cal BP 1060 to 920)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal AD 980 (Cal BP 960)

1 Sigma calibrated results: (68% probability) Cal AD 900 to 920 (Cal BP 1050 to 1040) and Cal AD 960 to 1010 (Cal BP 990 to 940)



References:

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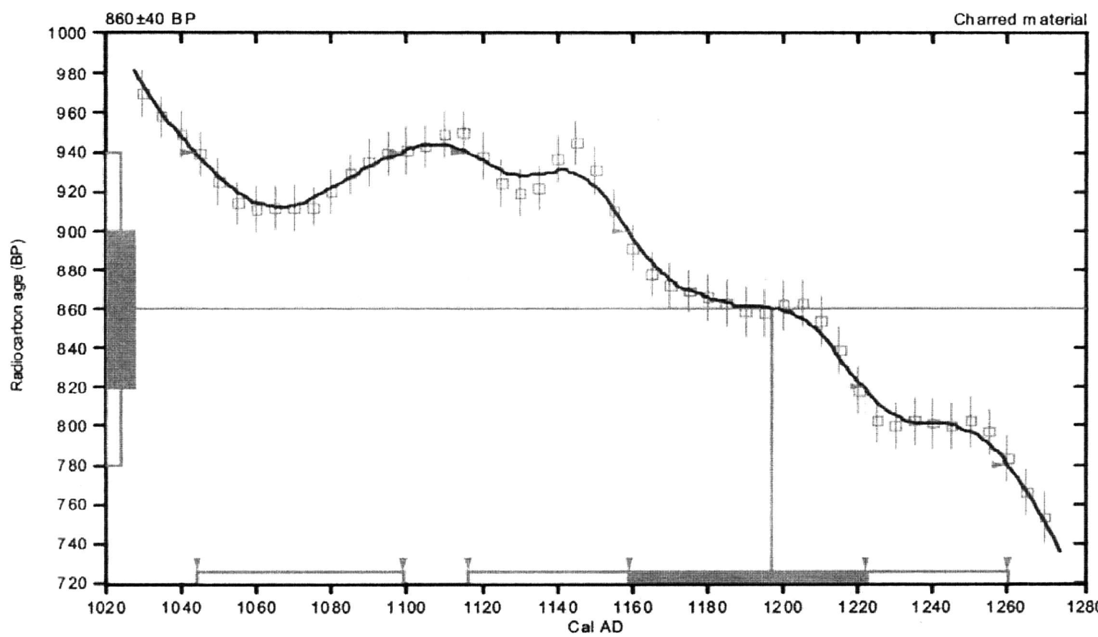
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-22.2:lab. mult=1)

Laboratory number:	**Beta-262712**
Conventional radiocarbon age:	**860±40 BP**
2 Sigma calibrated results: (95% probability)	**Cal AD 1040 to 1100 (Cal BP 910 to 850) and Cal AD 1120 to 1260 (Cal BP 830 to 690)**

Intercept data

Intercept of radiocarbon age with calibration curve:	Cal AD 1200 (Cal BP 750)
1 Sigma calibrated result: (68% probability)	Cal AD 1160 to 1220 (Cal BP 790 to 730)



References:

Database used

INTCAL04

Calibration Database

INTCAL04 Radiocarbon Age Calibration

IntCal04: Calibration Issue of Radiocarbon (Volume 46, nr 3, 2004).

Mathematics

A Simplified Approach to Calibrating C14 Dates

Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-24.8:lab. mult=1)

Laboratory number: **Beta-262713**

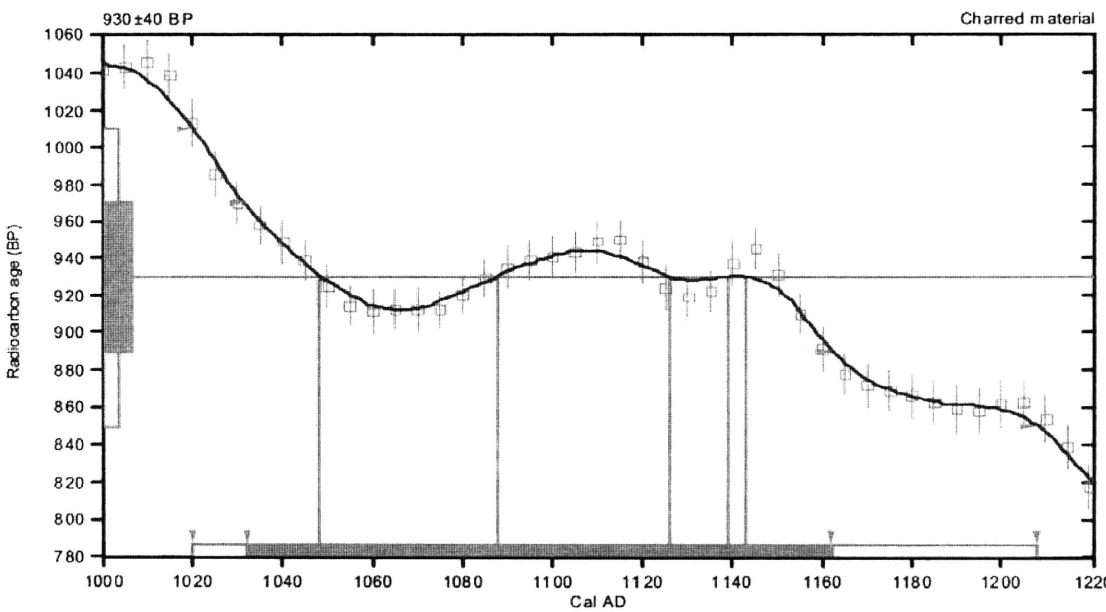
Conventional radiocarbon age: **930±40 BP**

2 Sigma calibrated result: **Cal AD 1020 to 1210 (Cal BP 930 to 740)**
(95% probability)

Intercept data

Intercepts of radiocarbon age
with calibration curve: Cal AD 1050 (Cal BP 900) and
Cal AD 1090 (Cal BP 860) and
Cal AD 1130 (Cal BP 820) and
Cal AD 1140 (Cal BP 810) and
Cal AD 1140 (Cal BP 810)

1 Sigma calibrated result: Cal AD 1030 to 1160 (Cal BP 920 to 790)
(68% probability)



References:

Database used
INTCAL04
Calibration Database
INTCAL04 Radiocarbon Age Calibration
IntCal04: Calibration Issue of Radiocarbon (Volume 46, nr 3, 2004).
Mathematics
A Simplified Approach to Calibrating C14 Dates
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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-25:lab. mult=1)

Laboratory number: **Beta-262714**

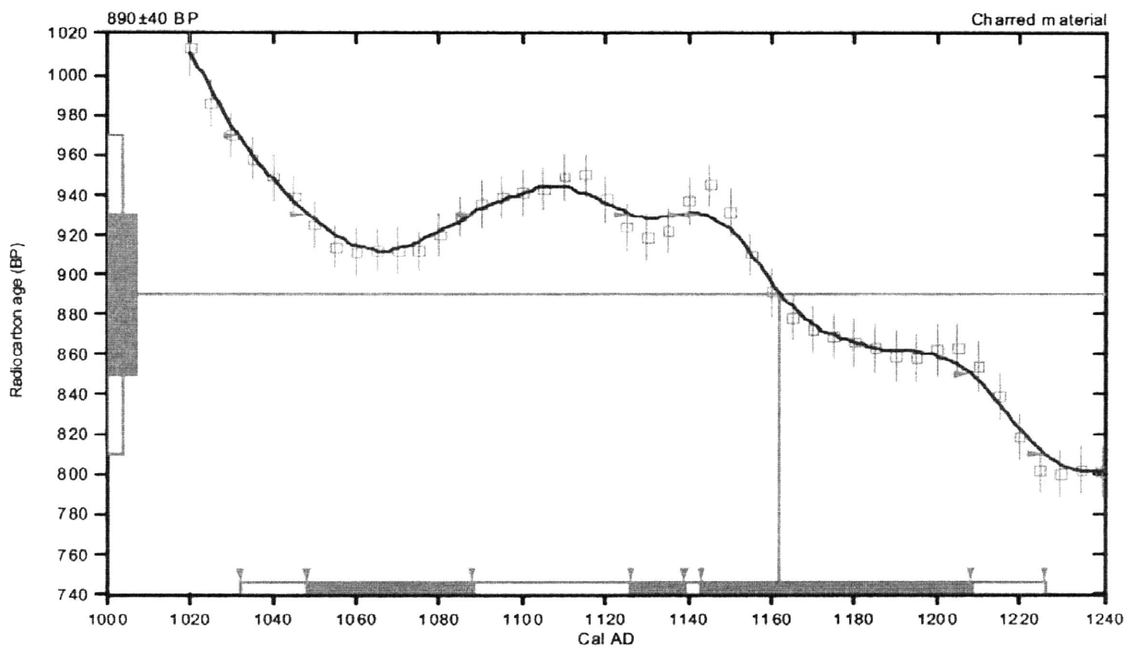
Conventional radiocarbon age: **890±40 BP**

2 Sigma calibrated result: **Cal AD 1030 to 1230 (Cal BP 920 to 720)**
(95% probability)

Intercept data

Intercept of radiocarbon age with calibration curve: Cal AD 1160 (Cal BP 790)

1 Sigma calibrated results: Cal AD 1050 to 1090 (Cal BP 900 to 860) and
(68% probability) Cal AD 1130 to 1140 (Cal BP 820 to 810) and
Cal AD 1140 to 1210 (Cal BP 810 to 740)



References:

Database used
INTCAL04
Calibration Database
INTCAL04 Radiocarbon Age Calibration
IntCal04: Calibration Issue of Radiocarbon (Volume 46, nr 3, 2004).
Mathematics
A Simplified Approach to Calibrating C14 Dates
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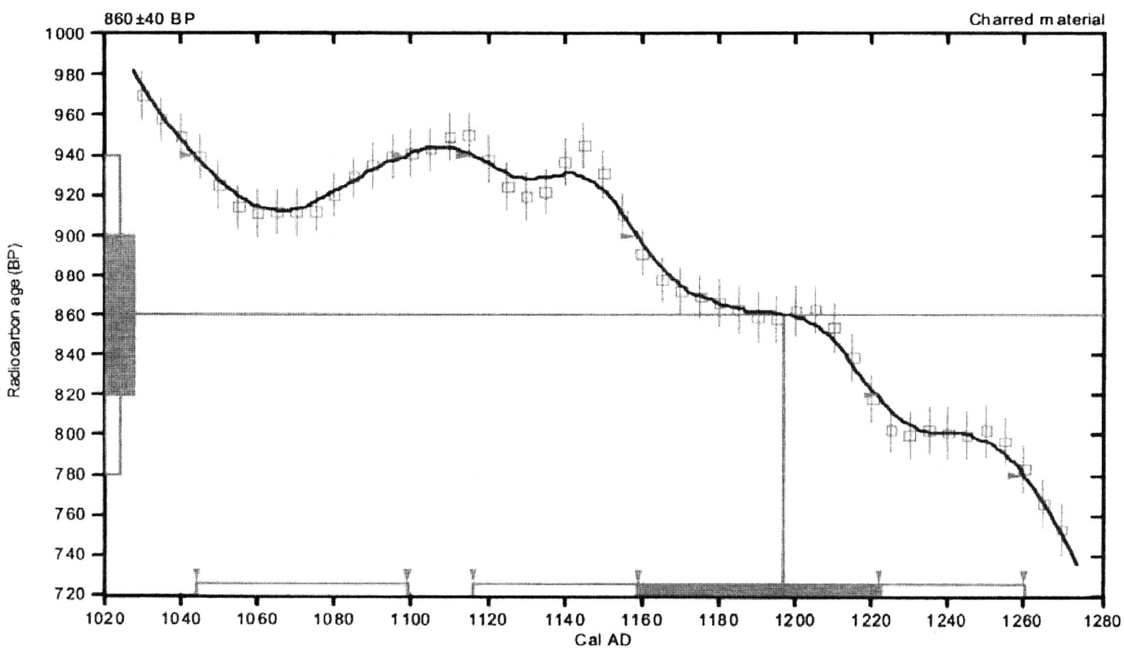
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-22.5:lab. mult=1)

Laboratory number:	**Beta-262715**
Conventional radiocarbon age:	**860±40 BP**
2 Sigma calibrated results: (95% probability)	**Cal AD 1040 to 1100 (Cal BP 910 to 850) and Cal AD 1120 to 1260 (Cal BP 830 to 690)**

Intercept data

Intercept of radiocarbon age with calibration curve:	Cal AD 1200 (Cal BP 750)
1 Sigma calibrated result: (68% probability)	Cal AD 1160 to 1220 (Cal BP 790 to 730)



References:

Database used

INTCAL04

Calibration Database

INTCAL04 Radiocarbon Age Calibration

IntCal04: Calibration Issue of Radiocarbon (Volume 46, nr 3, 2004).

Mathematics

A Simplified Approach to Calibrating C14 Dates

Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

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Mr. Darden Hood
President

Mr. Ronald Hatfield
Mr. Christopher Patrick
Deputy Directors

The Radiocarbon Laboratory Accredited to ISO-17025 Testing Standards (PJLA Accreditation #59423)

Final Report

The final report package includes the final date report, a statement outlining our analytical procedures, a glossary of pretreatment terms, calendar calibration information, billing documents (containing balance/credit information and the number of samples submitted within the yearly discount period), and peripheral items to use with future submittals. The final report includes the individual analysis method, the delivery basis, the material type and the individual pretreatments applied. The final report has been sent by mail and e-mail (where available).

Pretreatment

Pretreatment methods are reported along with each result. All necessary chemical and mechanical pretreatments of the submitted material were applied at the laboratory to isolate the carbon, which may best represent the time event of interest. When interpreting the results, it is important to consider the pretreatments. Some samples cannot be fully pretreated, making their ^{14}C ages more subjective than samples, which can be fully pretreated. Some materials receive no pretreatments. Please look at the pretreatment indicated for each sample and read the pretreatment glossary to understand the implications.

Analysis

Materials measured by the radiometric technique were analyzed by synthesizing sample carbon to benzene (92% C), measuring for ^{14}C content in one of 53 scintillation spectrometers, and then calculating for radiocarbon age. If the Extended Counting Service was used, the ^{14}C content was measured for a greatly extended period of time. AMS results were derived from reduction of sample carbon to graphite (100 %C), along with standards and backgrounds. The graphite was then detected for ^{14}C content in one of 9 accelerator-mass-spectrometers (AMS).

The Radiocarbon Age and Calendar Calibration

The "Conventional ^{14}C Age (*)" is the result after applying $^{13}C/^{12}C$ corrections to the measured age and is the most appropriate radiocarbon age. If an "*" is attached to this date, it means the $^{13}C/^{12}C$ was estimated rather than measured (The ratio is an option for radiometric analysis, but included on all AMS analyses.) Ages are reported with the units "BP" (Before Present). "Present" is defined as AD 1950 for the purposes of radiocarbon dating.

Results for samples containing more ^{14}C than the modern reference standard are reported as "percent modern carbon" (pMC). These results indicate the material was respiring carbon after the advent of thermo-nuclear weapons testing and is less than ~ 50 years old.

Applicable calendar calibrations are included for materials between about 100 and 19,000 BP. If calibrations are not included with a report, those results were too young, too old, or inappropriate for calibration. Please read the enclosed page discussing calibration.

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Calendar Calibration at Beta Analytic

Calibrations of radiocarbon age determinations are applied to convert BP results to calendar years. The short-term difference between the two is caused by fluctuations in the heliomagnetic modulation of the galactic cosmic radiation and, recently, large scale burning of fossil fuels and nuclear devices testing. Geomagnetic variations are the probable cause of longer-term differences.

The parameters used for the corrections have been obtained through precise analyses of hundreds of samples taken from known-age tree rings of oak, sequoia, and fir up to about 10,000 BP. Calibration using tree-rings to about 12,000 BP is still being researched and provides somewhat less precise correlation. Beyond that, up to about 20,000 BP, correlation using a modeled curve determined from U/Th measurements on corals is used. This data is still highly subjective. Calibrations are provided up to about 19,000 years BP using the most recent calibration data available.

The Pretoria Calibration Procedure (Radiocarbon, Vol 35, No.1, 1993, pg 317) program has been chosen for these calendar calibrations. It uses splines through the tree-ring data as calibration curves, which eliminates a large part of the statistical scatter of the actual data points. The spline calibration allows adjustment of the average curve by a quantified closeness-of-fit parameter to the measured data points. A single spline is used for the precise correlation data available back to 9900 BP for terrestrial samples and about 6900 BP for marine samples. Beyond that, splines are taken on the error limits of the correlation curve to account for the lack of precision in the data points.

In describing our calibration curves, the solid bars represent one sigma statistics (68% probability) and the hollow bars represent two sigma statistics (95% probability). Marine carbonate samples that have been corrected for $^{13}C/^{12}C$, have also been corrected for both global and local geographic reservoir effects (as published in Radiocarbon, Volume 35, Number 1, 1993) prior to the calibration. Marine carbonates that have not been corrected for $^{13}C/^{12}C$ are adjusted by an assumed value of 0 %0 in addition to the reservoir corrections. Reservoir corrections for fresh water carbonates are usually unknown and are generally not accounted for in those calibrations. In the absence of measured $^{13}C/^{12}C$ ratios, a typical value of -5 %0 is assumed for freshwater carbonates.

(Caveat: the correlation curve for organic materials assume that the material dated was living for exactly ten years (e.g. a collection of 10 individual tree rings taken from the outer portion of a tree that was cut down to produce the sample in the feature dated). For other materials, the maximum and minimum calibrated age ranges given by the computer program are uncertain. The possibility of an "old wood effect" must also be considered, as well as the potential inclusion of younger or older material in matrix samples. Since these factors are in determinant error in most cases, these calendar calibration results should be used only for illustrative purposes. In the case of carbonates, reservoir correction is theoretical and the local variations are real, highly variable and dependent on provenience. Since imprecision in the correlation data beyond 10,000 years is high, calibrations in this range are likely to change in the future with refinement in the correlation curve. The age ranges and especially the intercept ages generated by the program must be considered as approximations.)

PRETREATMENT GLOSSARY
Standard Pretreatment Protocols at Beta Analytic

Unless otherwise requested by a submitter or discussed in a final date report, the following procedures apply to pretreatment of samples submitted for analysis. This glossary defines the pretreatment methods applied to each result listed on the date report form (e.g. you will see the designation "acid/alkali/acid" listed along with the result for a charcoal sample receiving such pretreatment).

Pretreatment of submitted materials is required to eliminate secondary carbon components. These components, if not eliminated, could result in a radiocarbon date, which is too young or too old. Pretreatment does not ensure that the radiocarbon date will represent the time event of interest. This is determined by the sample integrity. Effects such as the old wood effect, burned intrusive roots, bioturbation, secondary deposition, secondary biogenic activity incorporating recent carbon (bacteria) and the analysis of multiple components of differing age are just some examples of potential problems. The pretreatment philosophy is to reduce the sample to a single component, where possible, to minimize the added subjectivity associated with these types of problems. If you suspect your sample requires special pretreatment considerations be sure to tell the laboratory prior to analysis.

"acid/alkali/acid"

The sample was first gently crushed/dispersed in deionized water. It was then given hot HCl acid washes to eliminate carbonates and alkali washes (NaOH) to remove secondary organic acids. The alkali washes were followed by a final acid rinse to neutralize the solution prior to drying. Chemical concentrations, temperatures, exposure times, and number of repetitions, were applied accordingly with the uniqueness of the sample. Each chemical solution was neutralized prior to application of the next. During these serial rinses, mechanical contaminants such as associated sediments and rootlets were eliminated. This type of pretreatment is considered a "full pretreatment". On occasion the report will list the pretreatment as "acid/alkali/acid - insolubles" to specify which fraction of the sample was analyzed. This is done on occasion with sediments (See "acid/alkali/acid - solubles"

Typically applied to: charcoal, wood, some peats, some sediments, and textiles "acid/alkali/acid - solubles"

On occasion the alkali soluble fraction will be analyzed. This is a special case where soil conditions imply
That the soluble fraction will provide a more accurate date. It is also used on some occasions to verify the present/absence or degree of contamination present from secondary organic acids. The sample was first pretreated with acid to remove any carbonates and to weaken organic bonds. After the alkali washes (as discussed above) are used, the solution containing the alkali soluble fraction is isolated/filtered and combined with acid. The soluble fraction, which precipitates, is rinsed and dried prior to combustion.

"acid/alkali/acid/cellulose extraction"

Following full acid/alkali/acid pretreatments, the sample is bathed in (sodium chlorite) $NaClO_2$ under very controlled conditions (Ph = 3, temperature = 70 degrees C). This eliminates all components except wood cellulose. It is useful for woods that are either very old or highly contaminated.

Applied to: wood

"acid washes"

Surface area was increased as much a possible. Solid chunks were crushed, fibrous materials were shredded, and sediments were dispersed. Acid (HCl) was applied repeatedly to ensure the absence of carbonates. Chemical concentrations, temperatures, exposure times, and number of repetitions, were applied accordingly with the uniqueness of each sample. The sample was not be subjected to alkali washes to ensure the absence of secondary organic acids for intentional reasons. The most common reason is that the primary carbon is soluble in the alkali. Dating results reflect the total organic content of the analyzed material. Their accuracy depends on the researcher's ability to subjectively eliminate potential contaminants based on contextual facts.

Typically applied to: organic sediments, some peats, small wood or charcoal, special cases

PRETREATMENT GLOSSARY
Standard Pretreatment Protocols at Beta Analytic
(Continued)

"collagen extraction: with alkali or collagen extraction: without alkali

The material was first tested for friability ("softness"). Very soft bone material is an indication of the potential absence of the collagen fraction (basal bone protein acting as a "reinforcing agent" within the crystalline apatite structure). It was then washed in de-ionized water, the surface scraped free of the outer most layers and then gently crushed. Dilute, cold HCl acid was repeatedly applied and replenished until the mineral fraction (bone apatite) was eliminated. The collagen was then dissected and inspected for rootlets. Any rootlets present were also removed when replenishing the acid solutions. "With alkali" refers to additional pretreatment with sodium hydroxide (NaOH) to ensure the absence of secondary organic acids. "Without alkali" refers to the NaOH step being skipped due to poor preservation conditions, which could result in removal of all available organics if performed.

Typically applied to: bones

"acid etch"

The calcareous material was first washed in de-ionized water, removing associated organic sediments and debris (where present). The material was then crushed/dispersed and repeatedly subjected to HCl etches to eliminate secondary carbonate components. In the case of thick shells, the surfaces were physically abraded prior to etching down to a hard, primary core remained. In the case of porous carbonate nodules and caliches, very long exposure times were applied to allow infiltration of the acid. Acid exposure times, concentrations, and number of repetitions, were applied accordingly with the uniqueness of the sample.

Typically applied to: shells, caliches, and calcareous nodules

"neutralized"

Carbonates precipitated from ground water are usually submitted in an alkaline condition (ammonium Hydroxide or sodium hydroxide solution). Typically this solution is neutralized in the original sample container, using deionized water. If larger volume dilution was required, the precipitate and solution were transferred to a sealed separatory flask and rinsed to neutrality. Exposure to atmosphere was minimal.

Typically applied to: Strontium carbonate, Barium carbonate
(i.e. precipitated ground water samples)

"carbonate precipitation"

Dissolved carbon dioxide and carbonate species are precipitated from submitted water by complexing them as ammonium carbonate. Strontium chloride is added to the ammonium carbonate solution and strontium carbonate is precipitated for the analysis. The result is representative of the dissolved inorganic carbon within the water. Results are reported as "water DIC".

Applied to: water

"solvent extraction"

The sample was subjected to a series of solvent baths typically consisting of benzene, toluene, hexane, pentane, and/or acetone. This is usually performed prior to acid/alkali/acid pretreatments.

Applied to: textiles, prevalent or suspected cases of pitch/tar contamination, conserved materials.

"none"

No laboratory pretreatments were applied. Special requests and pre-laboratory pretreatment usually accounts for this.

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BETA ANALYTIC INC.

DR. M.A. TAMERS and MR. D.G. HOOD

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REPORT OF RADIOCARBON DATING ANALYSES

Dr. Edwin R. Hajic

Report Date: 11/7/2008

Material Received: 10/13/2008

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 250376	1260 +/- 40 BP	-22.7 o/oo	1300 +/- 40 BP

SAMPLE : 08 tpw-smn secA 0.26
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 650 to 780 (Cal BP 1300 to 1170)

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

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