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Blanton & Associates, Inc.
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Prepared for

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Principal Investigator, David L. Sherman

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ABSTRACT

Between October 2012 and July 2013, Atkins conducted National Register of Historic Places (NRHP) eligibility testing at historic sites 41BP585 and 41BP594 and prehistoric site 41BP595, located within the Three Oaks Mine in Bastrop County, Texas, which is owned and operated by Luminant. Impacts to all three sites are anticipated as a result of planned mine development. This work was conducted under the direction of Principal Investigator David L. Sherman. This report of investigations was written at Atkins and is being finalized by Blanton & Associates, with David L. Sherman remaining as the Principal Investigator.

This work demonstrated that significant archeological deposits that may contribute to the overall NRHP eligibility statuses of the two historic sites are absent at both sites. Standing architecture at 41BP594, however, has previously been determined to be eligible for listing on the NRHP (Martin 2001). Archival research conducted as part of the current investigation into the histories of the historic sites remains inconclusive with respect to the identity of their 1870s and earlier occupants.

Testing at prehistoric site 41BP595 indicated it resulted from multiple occupational episodes during the period from the late Paleoindian to the Late Prehistoric. Shovel testing and mechanical trenching revealed the presence of an expansive buried anthrogenic A soil horizon, or midden, replete with preserved subsistence remains. Mechanical trenching also exposed a variety of burned rock cooking facilities partially surrounding the midden area. Radiocarbon assays of burned nut shells recovered from feature contexts, along with the assemblage of diagnostic lithic artifacts, suggest the site was most intensively occupied from the Late Archaic to the early Late Prehistoric. A suite of special studies was conducted on burned rock samples recovered from four of the better-preserved burned rock features. These studies, which include residue, starch, and phytolith analysis, suggest that the burned rock features were used in part to process tubers/roots and grass seeds for subsistence. Macrobotanical analysis of flotation samples recovered from feature contexts identified spent fuel remains including oak and hickory wood and subsistence remains including oak, hickory, black walnut, and acorn burned nut shells. A small amount of burned bulb, possibly representing wild onion, was also recovered through flotation. These findings suggest that significant archeological deposits important to understanding the Late Archaic to early Late Prehistoric period have been preserved at 41BP595.

Acknowledgments

The authors would like to thank Scott Mills, Marty Irwin, and James Birkhead at Luminant. Shelly Fischbeck was the Project Archeologist and field supervisor. The field crew included Karissa Basse, Mel Nichols, Haley Rush, Russ Shortes, Mike Smith, and Ray Tubby. David L. Sherman was the Principal Investigator and senior report author. Macrobotanical analysis was performed by Leslie Bush. Charles Frederick conducted the geomorphological investigation of the midden area at Site 41BP595. Linda Scott Cummings performed the residue analysis of burned rocks recovered from 41BP595. Kelley Russell was the architectural historian. Linda Ellis analyzed the assemblage of ground stone recovered from 41BP595. The historic artifacts recovered during the project were analyzed by Karissa Basse. Ardi Kalter served as the Laboratory Manager.

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INTRODUCTION

Between October 2012 and July 2013, Atkins conducted National Register of Historic Places (NRHP) eligibility testing at historic sites 41BP585 and 41BP594 and prehistoric site 41BP595, located within the Three Oaks Mine in Bastrop County, Texas (**Figures 1** and **2**), which is owned and operated by Luminant. Impacts to all three sites are anticipated as a result of planned mine development. This work was conducted under the direction of Principal Investigator David L. Sherman. This report of investigations was written at Atkins and is being finalized by Blanton & Associates (B&A), with David L. Sherman remaining as the Principal Investigator.

All three sites were subjected to an intensive program of shovel testing. Limited hand excavation was conducted on the two historic sites. In addition to shovel testing, the prehistoric site was sampled with mechanically excavated trenches and hand-excavated units. The standing architecture at 41BP594 has previously been determined to be eligible for inclusion to the NRHP (Martin 2001). Archival research conducted as part of the current investigation into the histories of the historic sites was inconclusive with respect to the identity of the occupants during the 1870s and earlier.

Shovel testing and hand excavation at 41BP585 and 41BP594 have shown that significant archeological deposits have not been preserved at either site. Testing has demonstrated that site 41BP585 lacks the data resources to warrant NRHP inclusion under any eligibility criteria. Consequently, no further investigation is warranted nor recommended. The standing architecture at 41BP594 has been determined to be eligible for NRHP inclusion under Criterion A, as part of a Rural Historic District (Penick 2001, Martin 2001). Additionally, the standing architecture may be eligible for NRHP inclusion under Criterion D for its potential to yield information about log building construction in Central Texas (Martin 2001). It is recommended that impact to the standing architecture at 41BP594 be avoided. If this is not feasible, it is recommended that a treatment plan be developed in consultation with the Texas Historical Commission (THC) to mitigate negative impact stemming from mine-related development.

Shovel testing at site 41BP595 revealed the presence of three sub-site areas and an expansive sub-surface anthrogenic A horizon. Mechanical and hand excavation within the sub-site areas exposed 33 cultural features, ranging from simple rock hearths to large burned rock cooking facilities. A fully representative sample of the features identified was sampled. Seventeen features were excavated by hand, three features were drawn but not excavated, and one feature was partially excavated. Feature 30 was sampled with two 50 by 50 centimeter (cm) units. The remaining eleven features were photographed after exposure and subsequently reburied. Testing at the prehistoric site (41BP595) indicate it resulted from multiple occupational episodes during the period extending from the late Paleoindian to the early Late Prehistoric. Radiocarbon assays of burned nut shells recovered from feature contexts along with the assemblage of diagnostic lithic artifacts suggest the site was most intensively utilized during the Late Archaic II to the Late Prehistoric Austin Phase.

A suite of special studies was conducted on burned rock samples recovered from four of the better preserved features. These studies, which include residue, starch, and phytolith analysis, suggest that the burned rock features were used in part to process tubers/roots and grass seeds for subsistence.

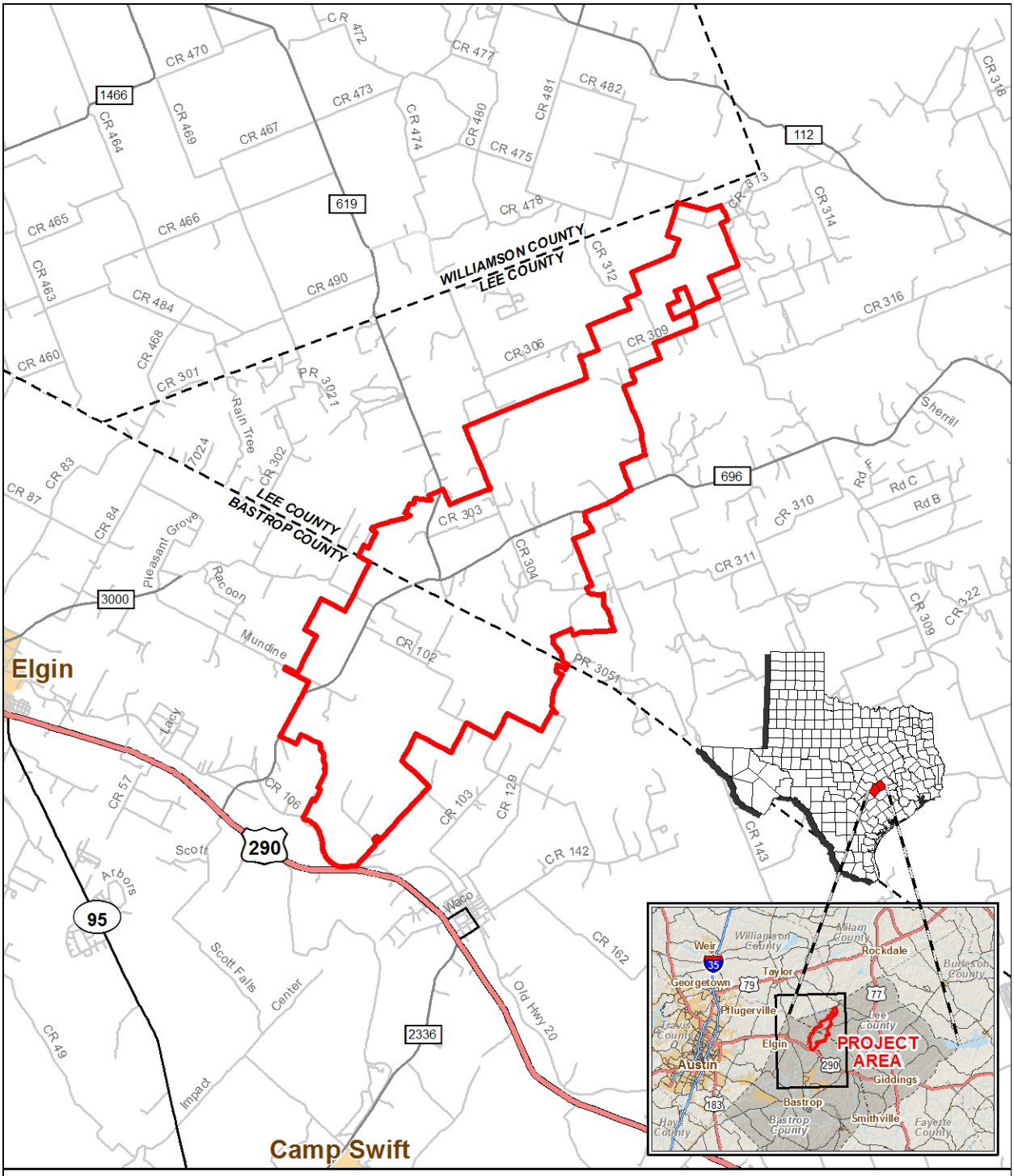

Figure 1
Location Map
Three Oaks Mine
Bastrop and Lee Counties, Texas

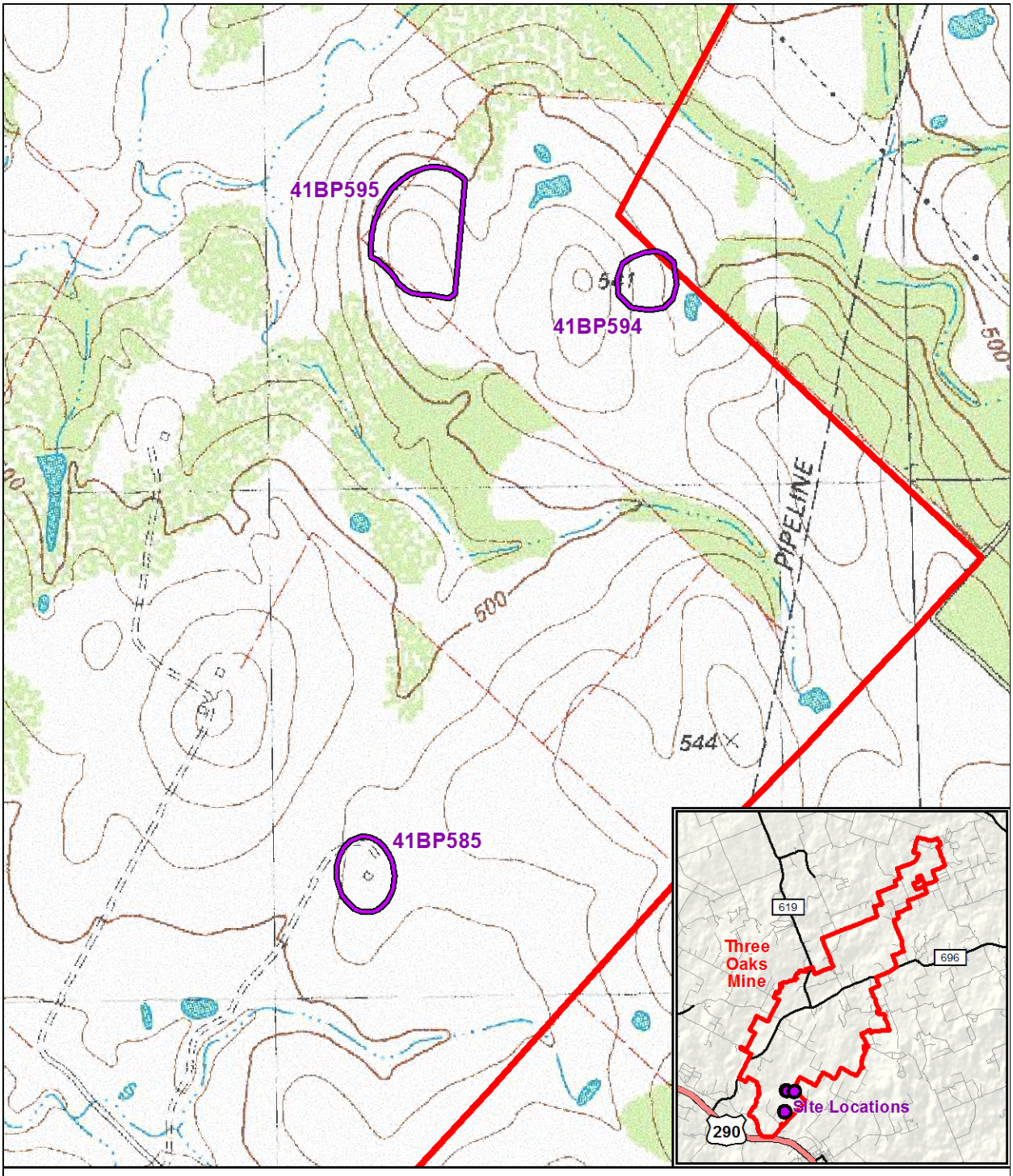

Figure 2
Topographic Setting of Sites
41BP585, 41BP594, and 41BP595
Three Oaks Mine
Bastrop and Lee Counties, Texas

Macrobotanical analysis of flotation samples recovered from feature contexts identified spent fuel remains including oak and hickory wood and subsistence remains including oak, hickory, black walnut, and acorn burned nut shells. A small amount of burned bulb, possibly representing wild onion, was also recovered through flotation.

This work demonstrated that significant cultural deposits, which are likely to yield information important to understanding the Late Archaic to early Late Prehistoric period in Bastrop County, and are eligible for NRHP inclusion under Criterion D, have been preserved on site 41BP595. It is recommended that impact to 41BP595 be avoided. If this is not feasible, it is recommended that anticipated mine-related adverse impacts to site 41BP595 are mitigated through data recovery investigations.

These investigations were performed in compliance with the Protection of Historic Properties regulations (36 CFR 800), which govern the Section 106 review process as established by the National Historic Preservation Act of 1966 (PL 89-665), as amended in 1974, 1976, 1980, and 1992; the National Environmental Policy Act of 1969 (PL 91-190, 83 Stat. 915, 42 USC 4231, 1970); the Office of Surface Mining Regulations, as superseded by the Coal Mining Regulations of the Texas Railroad Commission, 1981, as updated in 1989; other appropriate cultural resources legislation; and the guidelines set forth by the Council of Texas Archeologists and the Register of Professional Archaeologists.

Including this introduction, this report has eight sections and four appendices. Sections 2 and 3 describe the natural and cultural settings of the Three Oaks Mine. Section 4 includes the research design and methods used to test the three sites. The testing results for sites 41BP585, 41BP594, and 41BP595 are presented in Sections 5, 6, and 7 respectively. A summary of the results of these investigations along with site specific recommendations are contained in Section 8. **Appendix A** includes tables relevant to the Phytolith, Starch, and Organic Residue analysis described in Section 7. **Appendix B** includes the tables referenced in the Macrobotanical Analysis in Section 7. **Appendix C** contains the geoarcheological analysis data.

NATURAL SETTING

VEGETATION

The Three Oaks Mine is contained entirely within the Post Oak Savannah Vegetational Area, as defined by Gould (1975). The Post Oak Savannah region, dominated by climax prairie grasses and scattered oak trees, covers approximately 8.5 million acres within Texas and is bordered by the Pineywoods region to the east and the Blackland Prairie region to the west. Elevation ranges from approximately 300 to 800 feet above mean sea level (msl) within the Post Oak Savannah, and gently rolling to hilly topography is common (Lyndon B. Johnson School of Public Affairs [LBJ] 1978).

Historically, plant succession in the Post Oak Savannah was strongly influenced by natural wildfire, with frequent, low-intensity fires maintaining the savannah character of this plant community. Modern land use practices result in the suppression of natural fire and, in the absence of this control mechanism, woody invaders such as yaupon (*Ilex vomitoria*), eastern red cedar (*Juniperus virginiana*), and greenbrier (*Smilax* spp.) are able to develop deep understory and shrub layer thickets. Thickets of yaupon and eastern red cedar are common throughout the modern Post Oak Savannah, especially in areas not managed to preclude these species, and their presence can indicate a deterioration of this plant community (Hatch et al. 1990; Thomas 1975). Additionally, the lack of factors that previously maintained the savannah has also resulted in the development of much more dense woodlands throughout the region.

The two tree species that dominate the Post Oak Savannah Vegetational Area are post oak (*Quercus stellata*) and blackjack oak (*Quercus marilandica*), which occur in upland habitats and are commonly associated with winged elm (*Ulmus alata)*, cedar elm (*Ulmus crassifolia)*, black hickory (*Carya texana*), eastern red cedar, and sugar hackberry (*Celtis laevigata)*. The climax grasses associated with the Post Oak Savannah include little bluestem (*Schizachyrium scoparium*), Indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), silver bluestem (*Bothriochloa laguroides*), purpletop (*Tridens flavus*), tall dropseed (*Sporobolus asper* var. *asper*), and Texas wintergrass (*Nassella leucotricha*) (Hatch et al. 1990). However, much of the forests have been cleared for agricultural use since European settlement, and most acreage is in improved pastureland.

The modern-day practice of livestock grazing within the Post Oak Savannah has resulted in a shift of species composition from the climax herbaceous species such as those listed above toward introduced pasture grass species such as bermudagrass (*Cynodon dactylon*), dallisgrass (*Paspalum dilatatum*), and bahiagrass (*Paspalum notatum*). Native herbaceous species that remain in unimproved, yet disturbed, habitats often include buffalograss (*Buchloe dactyloides*), common curly mesquite (*Hilaria berlangeri*), threeawns (*Aristida* spp.), red lovegrass (*Eragrostis oxylepis*), broomsedge bluestem (*Andropogon virginicus*), splitbeard bluestem (*Andropogon ternarius*), smutgrass (*Sporobolus indicus*), yankeeweed (*Eupatorium compositifolium*), western ragweed (*Ambrosia psilostachya*), and silverleaf nightshade (*Solanum elaeagnifolium*).

CLIMATE

The climate of east-central Texas is humid and subtropical because of the flow of warm, moist air from the Gulf of Mexico. Summers are typically hot and humid, while winters are generally mild. However, sudden changes in temperature can occur during winter when cold, dry polar air masses replace warm, moist tropical air. During spring months, precipitation results from thunderstorms that are generally of high intensity and short duration. While these storms are most frequent in the spring, they can occur anytime during the year. Generalized, area-wide rainfall resulting from warm or stationary fronts lying across Texas is most common in winter months. The predominantly anti-cyclonic circulation over eastern Texas in the summer tends to exclude cold fronts from the area, resulting in a decrease in rainfall. The meteorological disturbances that produce precipitation within the region are highly variable. Average annual rainfall for Bastrop and Lee counties is approximately 35–40 inches (TWDB 2007). The monthly mean precipitation total is greatest in May and lowest in August.

BIOTIC PROVINCES

Blair (1950) delineated seven biotic provinces in Texas, based on the distribution of topographic features, climate, vegetation types, and terrestrial vertebrates, excluding birds. The mine area lies within the Texan Biotic Province. The Texan biotic province encompasses an area west to the Balcones Escarpment and east to the Austroriparian biotic province and is characterized by an intermingling of forest and grassland associations (Blair 1950). The Texan province has no endemic species of vertebrates, with a fauna consisting of a mixture of western grassland and eastern forest species (Blair 1950). The eastern boundary corresponds generally to the western limits of the pine/hardwood forests. It also contains numerous swamps and marshes, some of considerable extent (Dice 1943). According to Hubbs (1957), the distribution of freshwater fishes within the state generally correlates with the terrestrial-vertebrate province boundaries, although east-central Texas deviates to some extent from this general rule. The aquatic biotic communities are typical of the region as a whole.

GEOLOGY AND HYDROLOGY

The surface geology of the sites examined in this document is dominated by the Eocene-aged Calvert Bluff formation, of the Wilcox Group, which is "mostly mudstone with varying amounts of sandstone, lignite, ironstone concretions, and in the uppermost part locally glauconitic" (BEG 1974). This was the presumed source of the hematite/hematitic sandstone and sandstone recovered from prehistoric site 41BP595. The source for the raw materials identified as quartzite, silicified wood, and chert is, however, less certain. The ubiquity of these materials at 41BP595 suggests rather strongly that they were obtained on site or in very close proximity to the site. These materials could have been obtained from Quaternary high gravel deposits. Although no such deposits are depicted in the vicinity of the site on the Geologic Atlas of Texas, Austin Sheet (BEG 1974), such deposits are depicted several miles away. Expansive deposits of Quaternary high gravels are located about 12 miles to the southwest and west of the site near Willbarger and Cottonwood creeks. Additionally, a very small outcrop is located about 5 miles southwest from 41BP595, near the confluence of Yegua Creek and Paint Creek. Although no outcrops of Quaternary high gravels are mapped near Big Sandy Creek, the closest substantial creek to the site, the presence of such deposits within the

region underscores the possibility that additional smaller gravel deposits are present close by, and possibly on site, that were not large enough to be depicted on the Atlas (BEG 1974).

The Three Oaks Mine is located in the Colorado and Brazos river basins in east-central Texas. The Colorado River basin has a drainage area of 39,428 square miles (Texas Water Development Board [TWDB], 2007) and is bounded to the north and east by the Brazos River basin and to the west and south by the Guadalupe River basin. The Brazos River basin has a drainage area of 42,865 square miles (TWDB, 2007) and is bounded to the east by the Trinity River basin and to the south and west by the Colorado River basin. The Three Oaks Mine area is drained by tributaries of Middle Yegua Creek and Sandy Creek. Lake Summerville is an impoundment of the Yegua Creek system located immediately east of the mine area. Sandy Creek drains to the south and is a tributary of the Colorado River. All of the Big Sandy Creek watershed is located within the Colorado River watershed and is within Bastrop County.

CULTURAL SETTING

PREVIOUS INVESTIGATIONS

The earliest archeological investigations in the region were undertaken in the 1930s with reconnaissance surveys by the University of Texas and their later excavation and removal of two burials at site 41BP1 in 1953. However, the earliest, large-scale archeological survey in the region was conducted by the Texas Archeological Salvage Project of the University of Texas in 1961 for the proposed Somerville Reservoir in Lee, Burleson, and Washington counties. Thirty-nine sites were recorded, which were primarily prehistoric surface scatters in cultivated fields (Honea 1961). Soon after, the Texas Archeological Salvage Project completed the initial reconnaissance investigations for the Laneport (now Granger) Reservoir in eastern Williamson County (Shafer and Corbin 1965).

The first systematic controlled excavation in the region was Gilmore's (1969) work at the San Xavier Mission complex near the confluence of the San Gabriel River and Brushy Creek in northwestern Milam County. In 1973, the Texas Archeological Salvage Project conducted limited testing on three sites at Granger Reservoir (41WM118, 41WM133, and 41WM135) (Eddy 1973) and the Texas Archeological Survey tested 41WM230, the Loeve-Fox Site (Prewitt 1974; 1982). Sites 41WM133, 41WM135, and 41WM230 were deemed significant and warranted further excavation.

Beginning in 1976, several intensive archeological surveys took place in the region. The THC conducted an approximate 12,000-acre survey at the Sandow Mine in Lee and Milam counties south of Highway 79 and located 70 archeological sites, of which 37 were prehistoric, with a temporal range from the Middle Archaic through the Late Prehistoric period (Betancourt 1977). Two sites were tested but had little depth and were not recommended for additional work. Three prehistoric sites located during the survey were recommended for additional testing.

In the same year, Texas A&M University began intensive survey investigations at Granger Reservoir (Patterson and Moore 1976, Moore et al. 1978). Eighteen new sites were discovered and 47 previously recorded sites were reevaluated. Texas A&M also tested three sites, 41WM21, 41WM124, and 41WM133, all of which were recommended for further excavation (Moore 1976).

Data Recovery excavations pursuant to the construction of Granger Reservoir included those conducted by the Texas Archeological Survey of the University of Texas at Austin at the Loeve-Fox Site (41WM230) and the Loeve Site (41WM133) (Dibble and Prewitt 1982; Prewitt 1981), as well as at three sites (41WM130, 41WM284, and 41WM294) collectively known as the Hoxie Bridge Sites, excavated by Texas A&M University (Bond 1978).

At the Loeve-Fox Site (41WM230), discrete episodes of occupations extending from the Middle Archaic Round Rock Phase through the Late Prehistoric Toyah Phase were found. Numerous cultural features primarily representing cooking and warming hearths were uncovered, and a sequence of three occupations was recognized, with each episode displaying feature patterning indicative of a circular encampment similar to those documented for the Plains Indians. Features were often found within recognizable pits and thus could be more comfortably associated with artifactual debris. More limited excavations at the Loeve Site

(41WM133) yielded evidence of a discrete episode of camping during the early Archaic Circleville Phase (7000-8500 years B.P. [Before Present]). The patterning of features and debris suggests a hunting and gathering encampment that was situated on a gravel point bar.

Of the three sites excavated by Texas A&M University at the Granger Reservoir, only site 41WM130 contained in situ subsurface deposits. It yielded evidence of prehistoric occupation during the Late Archaic Twin Sisters Phase through the late Prehistoric Toyah Phase. Lithic reduction techniques used at the site were largely confined to working of cobbles into lanceolate-shaped bifaces and the production of blades from platform cores. While minor changes in lithic technology occurred through time at the site, and later Toyah occupations used ceramics and exploited bison, there was a general pattern of continuity in subsistence technology. Like the Loeve-Fox Site, discrete occupational evidence, in the form of well-preserved stone-lined fire pits was found at 41WM130. While functional interpretations regarding the use of these pits were largely conjectural, Bond (1978:233) suggested that the fire pits were not used to process a single food source but that the rock pavements found in the pits acted as a supportive grill for baking of a variety of foods.

Texas A&M University began archeological investigations at the Sandow Mine in 1976 with the initial survey of the Industrial Generating Company's lignite mining area near the headwaters of East Yegua Creek southeast of the Alcoa Aluminum Company complex (Hillier 1977). Six small prehistoric lithic scatters were recorded during this survey. One site, 41MM106, was recommended for testing, which was conducted in May of 1977, but the site had no discernible stratigraphy, and no further investigation was recommended (Weed 1977).

In 1977, Texas A&M University conducted a survey of the area of the Sandow Mine then known as the North Leases, located north of Highway 79 (Weed and Ippolito 1977). Nine prehistoric sites and seven historic sites were recorded. One prehistoric site, 41MM116, was tested and occupations with stratigraphic integrity more than a meter (m) in depth dating to the Archaic and Late Prehistoric periods were documented. Due to the paucity of artifacts and features, the testing investigation was considered adequate mitigation, and no further work was recommended (Weed and Whittaker 1980:73).

In 1978, Texas A&M University conducted NRHP testing at three prehistoric sites and three historic mining sites initially recorded by Bentancourt in 1977 (Ippolito and Childs 1978). The prehistoric sites were found to be stratigraphically compressed and exhibited few diagnostic artifacts. None of these sites met the requirements for inclusion to the NRHP.

The next major archeological survey investigation in the region was a 4,000-acre survey conducted at Camp Swift in Bastrop County in 1979 by the Texas Archeological Survey of the University of Texas. The survey recorded 42 prehistoric sites and 43 historic sites and tested eight prehistoric sites (Skelton and Freeman 1979).

In 1980, Texas A&M University conducted a survey within the Sandow Mine in Milam and Lee counties. Eight prehistoric sites and 24 historic sites were recorded. Four of the prehistoric sites, including 41LE57, 41LE59, 41LE60, and 41MM138 were recommended for further investigation (Rushmore et al. 1980).

In 1980, the Center for Archaeological Research of the University of Texas at San Antonio conducted a reconnaissance survey of eight tracts along the east side of FM 696 in northern Bastrop County and southern Lee County totaling about 1,900 acres planned for lignite mining by CPS Energy. This was the first large-scale survey investigation within the present Three Oaks Mine area. Nine sites, 41BP199-41BP206, and 41LE63 were recorded, including five prehistoric sites (41BP199, 41BP204, 41BP205, 41BP206, and 41LE63) and four historic sites (41BP200, 41BP201, 41BP202, and 41BP203). Sites 41BP204, 41BP205, and 41BP206 were recommended as potentially NRHP-eligible. However, all three sites were outside of the project area, along Big Sandy Creek west of FM 696. Historic site 41BP200 is the Morgan Chapel Cemetery, which is protected by state law. The remaining five sites were not thought to be NRHP-eligible (Kelly and Roemer 1981).

In 1983, the Center for Archaeological Research of the University of Texas at San Antonio conducted an intensive survey for CPS Energy of four of the eight tracts previously surveyed in 1980 (Kelley and Roemer 1981) and one new tract, totaling 712 acres. These survey areas are within the present Three Oaks Mine area. Seven sites were located or relocated (41BP200, 41BP203, 41BP264, 41BP265, 41LE73, 41LE74, and 41LE75). Sites 41BP200 (the Morgan Chapel Cemetery), 41BP203, 41LE74, and 41LE75 were historic sites, dating chiefly to the mid-to late 19th century. Sites 41BP264, 41BP265, and 41LE73 were prehistoric sites. Site 41BP264 was tested but found to be completely disturbed. None of the sites were recommended for further investigation. The Morgan Chapel Cemetery was mapped and documented and recommended for relocation prior to construction.

In 1981-1982, the Texas Archeological Survey surveyed the Lower Colorado River Authority's 1,200-acre Powell Bend mine in Bastrop County. The survey located 30 prehistoric and 22 historic sites (Kenmotsu et al. 1982). Four sites were tested, and data recovery investigations were conducted at sites 41BP191 (a large habitation site dating to the Late Archaic and Late Prehistoric periods) and 41BP192 (a large burned rock midden) (Bement 1984).

In 1983, Texas A&M University conducted additional survey investigations in the northern part of the Sandow Mine in Milam County, which conststed of five widely separate areas totaling approximately 2,000 acres. Fifty-one sites including 10 prehistoric sites and 41 historic sites were recorded. Three prehistoric sites and five historic sites were recommended as potentially NRHP-eligible (Carlson et al. 1983).

In 1984, the Center for Archaeological Research of the University of Texas at San Antonio conducted an intensive survey for CPS Energy of 985 acres of the CPS Butler lignite prospect in northern Bastrop County and southern Lee County, within the present Three Oaks Mine area. Fourteen archeological sites were identified during this project including two prehistoric sites (41BP271 and 41BP272), 11 historic sites (41BP202, 41BP272, 41BP274, 41BP275, 41BP276, 41BP277, 41BP278, 41LE86, 41LE87, 41LE88, and 41LE89), and one multicomponent site (41LE85). None of the sites were considered NRHP-eligible (Taylor 1987).

In 1985-1986, further investigations were conducted for a new permit area at the Sandow Mine in Milam and Lee counties by Espey, Huston & Associates with two surveys totaling 1,737 acres (James 1986; James

and Moore 1987). Six historic sites and five prehistoric sites were located, none of which warranted further investigation.

In 1985-1986, the Texas Archeological Survey conducted a 3,400-acre intensive survey along the Colorado River lowland zone in Bastrop County, funded by the Bastrop County Historical Commission and a National Register Thematic District Grant. Prior to this investigation, almost all previous large-scale surveys in the region were in upland areas. Thirty-nine sites were recorded dating to Paleoindian, Archaic, and Late Prehistoric periods. Test excavations were conducted at two sites: 41BP66, a Late Archaic and Late Prehistoric encampment, and 41BP279, where a Toyah phase Late Prehistoric component was identified. A Middle and Late Archaic cemetery, 41BP282, was also identified. The prehistoric findings contributed to construction of a prehistoric settlement system model for the Colorado River valley (Robinson 1987).

In the mid-1980s, highway widening projects prompted data recovery investigations at four important sites in the region. Two sites—41BP19, the Kennedy Bluffs Site, and 41BP280, the Bull Pen Site—were located on the Colorado River in Bastrop County. Site 41BU16 is located on the Brazos River in eastern Burleson County, and the Bessie Kruze Site (41WM13) is on Brushy Creek in southeastern Williamson County.

At the Kennedy Bluffs Site, cultural remains consisted of burned rock hearth features composed of quartzite, sandstone, chert, and petrified wood and lithic tools dating primarily to the Middle Archaic periods. Occupations were attributed to Central Texas groups, based on the presence of a large number of Pedernales- and Bulverde-like dart points as well as Clear Fork gouges, drills or perforators, and interestingly, a slab of graphite (Bement 1989; Bement et al. 1989).

Excavations at the Bull Pen Site (41BP280) produced materials from as early as the Early Archaic period, though the major occupations occurred during the Middle Archaic and produced evidence of use as a hunting and gathering encampment of small groups of people, probably on a seasonal round in a continuum that began by at least 3500 years B.P. and continued to the Late Prehistoric. The chipped stone artifact inventory at Bull Pen included Pedernales, Fairland/Ensor, Darl, and Scallorn projectile points. Subsistence evidence at the site was largely indirect, with grinding tools indicating plant food processing and numerous projectile point types demonstrating the importance of hunting (Ensor and Mueller-Wille 1988).

Excavations conducted by Texas A&M at 41BU16 yielded prehistoric burials dating to between 4000 B.P. and possibly as late as 450 B.P. Evidence in the form of four rock cooking hearths attested to the use of the site as an encampment as well. Projectile points found at the site were equally representative of those from both Central and Southeast Texas, while ceramics recovered were aligned with Southeast Texas. The authors questioned the applicability of either the Central Texas or Southeast Texas culture history/chronological models to the Post Oak Savannah of eastern Central Texas (Roemer and Carlson 1987).

The Bessie Kruze Site (41WM13) was excavated by the Texas Department of Transportation in 1988 and 1989 (Johnson 2000). The site occupied an ancient terrace along Brushy Creek composed of stratified alluvial deposits that were approximately 1.3 m to 1.4 m thick. The primary prehistoric deposits included a

cremation burial. Late Archaic I deposits containing Pedernales dart points comprised the bulk of the deposit, though later Late Archaic II wide corner-notched points also occurred.

In 1989, North American Consultants surveyed a new 1,370-acre area in the Sandow Mine in Milam and Lee counties (LaVardera and Keller 1989). Additionally, because the THC had redefined intensive survey requirements, an additional 1,780-acres including portions of several earlier surveys were resurveyed (Betancourt 1977; Hillier 1977; Rushmore et al. 1980; James and Moore 1987). Eighteen sites were located. Five of these sites, 41LE113, 41LE115, 41LE117, 41LE120, and 41MM277, were considered to be potentially NRHP-eligible due to high artifact density and deep, relatively intact cultural deposits, and were recommended for further investigation. Three previously recorded sites, 41LE57, 41LE59, and 41LE60 were tested, of which 41LE59 was considered to be NRHP-eligible.

In 1989, two multi-component sites along the Onion Creek valley in east-central Hays County, the Barton Site (41HY202) and the Mustang Branch Site (41HY209), were excavated by the Texas Archeological Research Laboratory (Ricklis and Collins 1994). Early and Late Archaic projectiles and burned rock features were associated with the Barton Site. At the Mustang Branch Site, a Late Archaic era burned rock midden was encountered. Two Late Prehistoric intervals, Austin and Toyah, were also documented (Ricklis and Collins 1994). In 1994, Espey, Huston & Associates conducted data recovery investigations at the Chesser Site (41LE59) at the Sandow Mine in Lee County. The site yielded cultural remains from the late Paleoindian through Late Prehistoric periods. Well-stratified cultural deposits about 1.3 m thick and intact features from the latter part of the Middle Archaic period through the Late Prehistoric periods were encountered during the excavation. The site generally represents numerous low-intensity occupations with the greatest degree of human activity during the Late Archaic II subperiod, dating from around 600 B.C. to A.D. 600 (Rogers and Kotter 1995).

Also in 1994, Espey, Huston & Associates conducted a cultural resources survey of 380 acres for Alcoa's Sandow Mine (Hageman 1994). The survey recorded two multicomponent prehistoric and historic archeological sites, 41MM304 and 41MM305. Neither site was recommended for further investigation.

In 1996, Espey, Huston & Associates conducted a 202-acre survey along Ham Branch south of Praesel at the Sandow Mine in Milam County. Six prehistoric sites (41MM310, 41MM311, 41MM312, 41MM314, 41MM315, and 41MM317) and three multicomponent prehistoric/historic sites (41MM309, 41MM313, 41MM316) were located. Three of the prehistoric sites, 41MM310, 41MM315, and 41MM317 were recommended as potentially NRHP-eligible and warranting further investigation (Tate and Bates 1996).

In 1997, Espey, Huston & Associates conducted a 2,420-acre survey west of Highway 77 between Rockdale and Lexington in Lee and Milam counties. Forty-six sites were located including 23 prehistoric sites, 16 historic sites, and seven multicomponent prehistoric/historic sites. Ten prehistoric sites (41LE134, 41LE144, 41LE149, 41LE154, 41LE157, 41LE166, 41LE175, 41LE176, 41LE17, and 41MM321) and one historic site (41LE145) were recommended as potentially NRHP-eligible and warranting further investigation (Tate et al. 1997).

During 1997-1998, Espey, Huston & Associates conducted a cultural resources survey of 430 acres within the I Area Expansion and 675 acres within the H Area Expansion at the Sandow Surface Mine in Lee,

Milam, and Williamson Counties, Texas. The 430-acre tract within the I Area Expansion is within the present Three Oaks Mine Area. Three previously recorded sites were revisited, and 25 new sites were recorded. Seven sites (41LE190, 41LE191, 41LE192, 41LE195, 41LE196, 41MM337, and 41WM926) within the I Area Expansion were recommended for testing (Rogers and Cruse 1998).Within the H Area Expansion, three sites (41LE180, 41LE182, and 41LE184) were recommended for testing to determine their NRHP status.

In 1999, Espey, Huston & Associates conducted data recovery investigations at the Walleye Creek Site (41LE57) at the Sandow Mine in Lee County. The site yielded cultural remains from the Late Archaic II subperiod, about 2,300 B.P., into the Late Prehistoric period, about 800 B.P. Although living surfaces were not definable in the sandy sediments, a number of intact hearths with organic remains provided insight into food utilization and preparation (Rogers 1999).

Also in 1999, Coastal Archaeological Research conducted NRHP testing investigations at site 41LE177 at the Sandow Mine in Lee County. The site was found to contain intact burned rock hearth features and lithic artifacts representing the Paleo-Indian, Early Archaic, Middle Archaic, and Late Prehistoric periods, all within unconsolidated sandy deposits. However, despite the presence of intact features, interpretation of cultural components at 41LE177 was considered tenuous due to the paucity of diagnostic artifacts and continuous admixture of older cultural material from upslope through colluvial deposition (Ricklis 2001).

Between 1990 and 2000, archeologists from the Center for Archaeological Research at the University of Texas at San Antonio revisited and evaluated the 169 sites then known on Camp Swift (Tomka and Crouch 1996). Based on the results of a subsequent survey, site 41BP138 (the Wine Cellar Site) was considered NRHP-eligible, 59 sites were considered potentially eligible and warranted further investigation, and 106 sites were considered not eligible for inclusion in the NRHP. Three cemeteries are protected by state law (Robinson et al. 2001).

Excavations at the Toyah Bluff site (41TV441), located above Onion Creek in Travis County, revealed over 20 features, including burned rock hearths and earth ovens, some of which retained vegetal remains (Karbula et al. 2001). Faunal remains were also present, but in relatively low numbers, representing bison, deer, dog, and turtle. Both the faunal and vegetal evidence suggest a significantly more diverse subsistence pattern for this period than often assumed, with bison probably supplementing rather than supplanting existing subsistence practices. Manos and metates, further signs of plant processing, were also found frequently in association with the burned rock features. While the earliest of the features at Toyah Bluff date to approximately A.D. 1200, at least one of the earth ovens has been dated by radiocarbon analysis to within the normal range of Toyah activity, between A.D. 1310 and 1480. Two Scallorn points, indicative of the Austin phase, were found near the earliest features. However, the majority of the diagnostic artifacts found at the site appear to belong to a typical Toyah assemblage and include beveled knives, blades, drills, end scrapers, and nine arrow points of the Perdiz type. Ceramics recovered from Toyah Bluff consisted of 39 small specimens, the majority of which were bone-tempered with sandy paste; due to similarities with sherds from nearby sites, these may suggest a widely produced local type (Karbula et al. 2001). Other ceramics from the site were characterized by sand and bone temper or by a very sandy paste. This latter

group may possibly reflect ties with eastern Texas or the Texas coast due to their similarities with the Goose Creek Plain type.

Between 1999 and 2001, an intensive survey of approximately 16,000-acres of the upland divide between the Brazos and Colorado rivers was conducted for Luminant's Three Oaks Mine (Turpin 2003). The survey located or relocated 78 prehistoric sites, 122 historic sites, and nine multi-component sites. The prehistoric sites are largely sparse lithic scatters in sandy matrix sediments. Sites with temporally diagnostic artifacts range in age from Middle Archaic to Late Prehistoric times. Ten sites (41LE224, 41LE227, 41LE245, 41LE259, 41LE289, 41LE300, 41LE302, 41LE310, 41LE311, and 41BP595) were initially recommended as being potentially NRHP-eligible. However, sites 41LE300 and 41LE310 were tested during the course of the investigation and were determined to be not eligible. The historic sites illustrate differing patterns of rural development and growth, but their archeological promise is low. Five standing structures sites (41LE306, 41BP202, 41BP275, 41BP557, and 41BP594) were recommended as NRHP-eligible.

In 2001-2003, the Center for Archaeological Studies of Texas State University conducted extensive shovel testing investigations at 58 sites identified by Robinson et al. (2001) as potentially eligible. After intensive shovel testing, 31 were described as having little or no integrity, and no further work was recommended. The remaining 27 sites were recommended as requiring additional investigation (Nickels et al. 2003; Nickels and Lehman 2004).

In the early 2000s, SWCA Environmental Consultants in Austin conducted an archeological survey of the 635-acre Hyatt Regency Lost Pines Resort area in eastern Bastrop County. A number of sites were identified, among them 41BP627, a Late Archaic II campsite that would later be designated the McKinney Roughs Site (Carpenter et al. 2006; Texas Beyond History [TBH] 2007). This well-stratified site lies on the banks of the Colorado River where nearly continual deposition of sediments during repeated periods of overbank flooding resulted in rapid burial of some of the site's three discrete prehistoric living surfaces, preserving them in place. The earliest and deepest of the three components dated to about 100 B.C. (2,100 years ago), and designated the Ensor I component after the style of dart point found in the zone. Small features of burned rock and living debris such as stone tools were found in this component. The second component dated to roughly A.D. 200 (1,800 years ago). The Ensor II component consisted of a living surface replete with burned rock cooking features, lithic debris from stone tool making, and food remains, predominately mussel shells. The third and most significant occupational surface is the Darl component. This occupational zone yielded two radiocarbon dates of about A.D. 1150 and A.D. 1100 (850-900 years ago). The Darl component comprised a well-preserved living surface with discrete burned rock features, charcoal, stone tools, and debitage, as well as abundant mussel shell, with little or no evidence of overprinting from later occupations at the site.

CULTURAL HISTORY

The Three Oaks Mine is located on the southeastern edge of the Central Texas Archeological Region of the Central and Southern Planning Region of Texas near its interface with the Prairie Savanna Archeological Region (Ellis et al. 1995; Mercado-Allinger et al. 1996; Prewitt 1981). Archeological assemblages in this zone often share internal similarities with both archeological regions; however, the breadth of these similarities expresses diachronic variation.

Over the last 60 years, the Central Texas Archeological Region has been the focus of intensive archeological investigations (see Collins 2004; Johnson and Goode 1994). As a result, a fairly detailed archeological sequence, based primarily on projectile point styles, has been developed for the area. Much of the data upon which this sequence is based comes from sites in the eastern Edwards Plateau and the Balcones Canyonlands; however, the evidence suggests a generalized fluidity of boundaries for the indigenous groups in the region, as the archeological record points to seasonal movement of some groups and interactions with groups living in East Central Texas and the South Texas Plains. For a comprehensive review of the significant archeological work done in this region, the reader is referred to Collins (1995; 2004), Fields 2004, and Johnson and Goode (1994).

In Central Texas, the most common types of sites are open camp sites (both shallow and deeply buried), situated on various topographic settings, rockshelters, and surface scatters. Site characteristics vary, but most sites are recognized by the accumulation of cultural debris. Some of the more conspicuous feature types are burned rock middens, burned rock hearths, lithic quarries and/or scatters, and pits. Prehistoric cemeteries have also been recorded in Bexar County (Givens 1968), Williamson County (Prewitt 1974), and Bell County (Watt 1936).

Sites along the east/southeastern margins of Central Texas are often deeply buried in the deep sandy soils of the Blackland Prairies or the Post Oak Savanna (Bond 1978, Brown 1986, Carpenter et al. 2006, Taylor 1987). For hunting and gathering peoples, the area would have provided rich food sources, including pecan and hickory trees (e.g. nuts), geophytes (e.g., roots, tubers, and bulbs), terrestrial fauna, and aquatic resources. Thus, not surprisingly, sites typically occur along the riparian corridors of rivers and streams where resources are concentrated.

In those portions of Central Texas that are east of the Balcones Escarpment, surface exposures of bedrock are generally less common and burned rock features are generally less common than in the remainder of the region. This apparent bias may be due, in part, to the lower visibility of burned rock features off of the escarpment in deeper sandy soils. However, where bedrock exposures and/or lag gravel deposits are present, burned rock features of varying sizes and densities are often found. Sizable burned rock features measuring 1-2 m across have been found in the broad sandy mantle of the Post Oak Savanna, many of which may be the remains of large cooking features (Black and Ellis 1997:4-5; Thoms and Ahr 1996).

Cultural developments in this region are classified by archeologists according to four primary chronological and developmental stages: Paleoindian, Archaic, Late Prehistoric, and Historic. These periods are defined primarily by changes in material culture over time, as evidenced through information and artifacts recovered from archeological sites.

Paleoindian Period (12,000-8800 B.P.)

Paleoindian sites and isolated artifacts have been found throughout Central Texas, as attested to by several stratified sites excavated in the region. Excavations of sites found along the eastern and southern margins of the region, such as the Pavo Real (Collins et al. 2003; Henderson and Goode 1991), Wilson Leonard (Collins 1998), Loeve-Fox and Tombstone Bluff (Prewitt 1982), and the Gault site (Collins 1998), have

enabled a fairly well-defined chronological sequence which indicates that people have been coming to Central Texas since the Paleoindian period, for at least 12,000 years (see also Bever and Meltzer 2007).

Collins (1995; 2004) divides the Paleoindian period into early and late subperiods. The early subperiod includes chipped stone artifact assemblages characterized by the fluted lanceolate Clovis and Folsom points (see Hester et al. 1985). These early assemblages yield archeological remains such as engraved stones, exotic lithic material such as obsidian, and ochre-stained artifacts (Collins et al. 1991). Data collected from sites such as the Kincaid Rockshelter in Uvalde County (Campbell et al. n.d.; Collins et al. 1989), the Saint Mary's Hall site in Bexar County (Hester 1978), the Gault Site in Bell County (Collins 1998; Black 2001), and the Chesser Site in Lee County (Rogers and Kotter 1995) provide evidence of a generalized hunting and gathering lifeway that provided a diverse diet of large and small animals coupled with an array of wild plants.

The transition from the early to the late Paleoindian subperiods is marked by the appearance of several unfluted projectile point styles whose technological and cultural significance remains uncertain. These early "Plainview-like" point styles fit within the typological range of the Southern Plains Plainview points. However, they lack the thinness and overall flaking technology seen on the Plainview type-site points (Collins 2004). The appearance of Dalton and San Patrice dart points during this transitional period also complicates the temporal and cultural sequence, as many of the deposits from which they were recovered lack integrity. Both point types have been recovered from sites in Bastrop and Grimes Counties along the margins of the Prairie Savanna region (Johnson 1989: Table 2; Rogers and Foster 1994:66). Three later nonfluted lanceolate point types, Wilson, Golondrina, and Saint Mary's Hall, are somewhat better defined and appear to post-date this earlier transitional group of points (Collins 2004). Interestingly, in some of the better documented sites, such as Wilson Leonard (Collins ed. 1998) and Horn Shelter No. 2 (Redder 1985), the artifact assemblages and organic remains associated with these later point styles are similar to those found in archaic assemblages. Thus, the available data led Collins (2004:116) to suggest that the entire late Paleoindian subperiod may be in many ways "an archeological intermediate or transitional era between the Early Paleoindian and the Archaic."

One line of evidence Collins (2004) points to is the temporal continuity of the Angostura dart point and its variants. This is also supported by data from relatively well-dated open campsites such as the Richard Beene site (Thoms and Mandel 1992, 2007) and Camp Pearl Wheat (41KR243) (Collins et al. 1990). Towards the end of the Paleoindian period, the archeological record exhibits clear evidence of diversification in subsistence patterns and adaptive strategies that mark the beginning of the complex chronological period referred to as the Archaic.

Archaic Period (8,800-1,250 B.P.)

The Archaic period subsumes two-thirds of the prehistory of Central Texas and is divided into three subperiods, Early (8500-6000 B.P.), Middle (6000-4000 B.P.), and Late (4000-1200 B.P.). Each of these subperiods is defined on the basis of distinctive adaptive, environmental, and technological (primarily projectile point styles) changes.

Johnson et al. (1962) first applied the term "Early Archaic" to early post-Paleoindian sites in Texas, though it had been used previously in eastern North America to denote the temporal period that followed the Paleoindian and was contemporaneous with the earlier post-glacial adaptations. The Early Archaic groups continued to exhibit many of the characteristics of the preceding Paleoindian groups; however, there is clear evidence of resource intensification that is supported by an increased prevalence of ground stone tools and the use of heated rocks. Although subsistence data is sparse for this early subperiod, there are indications that subsistence strategies diversified to include the hunting of a variety of medium and small game animals, including deer and rabbit, and the gathering of edible roots, nuts, and fruits (Fields 2004; Collins 2004). Site types include rock shelters, camp sites, lookout sites, and quarry sites that are usually located near a reliable water source, a large number of which are concentrated along the eastern and southern margins of the Edwards Plateau (Johnson and Goode 1994).

Most of the projectile points from this subperiod are well made and fall into three style intervals: Angostura (which exhibits characteristics typical of late Paleoindian technologies), the early split stem point styles, and the Martindale-Uvalde point styles. Clear Fork and Guadalupe tools (possibly specialized wood working tools) appear in the archeological record, as do grooved and notched stones (possibly net sinkers) (Collins 2004; Black and McGraw 1985).

The Middle Archaic subperiod can be subdivided into three projectile point style intervals: Bell-Andice-Calf Creek, Taylor, and Nolan-Travis. The first two style intervals with their thin-bladed, basically triangular forms, could serve equally well as knives or as the tips of lances, spears, or darts, and reflect a definite shift in lithic technology (Collins 2004). These bifacial forms are thought to have been added to the Archaic toolkit as part of specialized bison hunting weaponry that accompanied a more mesic climatic interval that saw a resurgence of bison in the region (Ricklis and Collins 1994; Johnson and Goode 1994).

During the Middle Archaic subperiod, the number, size, and distribution of sites increased, probably in response to increasing population density and changes in social organization (Prewitt 1981; Weir 1976). During this subperiod, large burned rock features became more common (e.g., the Barton Site in Hays County [Ricklis and Collins 1994]). Burned rock features have also been identified at sites situated on the marginal Prairie Savanna just east of the escarpment, such as the Bull Pen site (41BP20) (Ensor and Mueller-Wille 1988). The proliferation of these site types during the Middle Archaic is indicative of the increased reliance on plant resources and the development of a specialized plant processing economy used to cook xerophytes such as sotol (Collins 2004; Johnson and Goode 1994).

The later part of the Middle Archaic saw the onset of one of the most xeric climatic intervals ever experienced by the prehistoric inhabitants of Central Texas. Bison nearly disappear from the archeological record, and there are notable shifts in subsistence strategies and mobility patterns that would have required a shift in exploitation zones in order to accommodate the changing patterns of vegetative productivity as well as related shifts in faunal distribution (see Ellis et al. 1995). These shifts were accompanied by a number of technological changes that are exemplified in assemblages such as that found at the Wounded Eye Site (41KR107) and the Shep Site (41KR109), where both Taylor bifaces and Nolan and Travis projectile points were recovered from small burned rock middens (Luke 1980). These points, with their

comparatively thick, narrow blades, are morphologically distinct from their earlier predecessors (Collins 1995, 2004).

The beginning of the Late Archaic period saw a proliferation of new projectile point types (e.g., Bulverde and Pedernales), but there is a continuation of Middle Archaic subsistence strategies including the continued use of hot rock technology and their most archeologically recognizable by-product—the burned rock midden. Prewitt (1981) has suggested that this proliferation of projectile points may represent a return to the Early Archaic pattern of small, dispersed bands with wide-ranging territorial areas.

Johnson and Goode (1994) subdivide this late period into two subperiods. The Late Archaic I subperiod began with the appearance of Bulverde dart points and coincided with a hotter, dryer climate. The Bulverde dart point type was followed by the appearance of Pedernales points, which may have developed on the Edwards Plateau, where they are particularly abundant. Subsequent dart point types attributed to the Late Archaic I subperiod include Lange, Marshall, Montell, and Castroville. The Late Archaic I subperiod witnessed an increase in population. In easterly portions of Central Texas, burned rock middens reached their most abundant level, particularly during the time when Pedernales points were in vogue (Collins 2004). It was during this time that the first evidence of contacts between Central Texas peoples and the Texas coast peoples occurs in the archeological record, as evidenced by the recovery of a conch columella bead in association with a Marshall dart point at the Loeve-Fox Site (41WM230; Prewitt 1982).

Late Archaic II subperiod begins sometime between 3500 and 2500 B.P., and corresponded to a somewhat more mesic climate (Johnson and Goode 1994). Along the eastern edges of the Edwards Plateau, dependence on less abundant xeric vegetation waned and the usage of burned rock middens declined. Evidence of contacts between peoples living in the eastern part of Central Texas and the Texas coast increased. Among many sites where marine shell ornaments have been found are the Locke Farm Site (41CM25) in Comal County, the Pat Parker Site (41TV88) in Travis County, and the Loeve-Fox Site (Bond 1978). Trade of Edwards chert outward from Central Texas also occurred. Johnson and Goode (1994) believe that this evidence of cross-cultural contacts and trade in ceremonial items reflects religious movements that were occurring in the eastern United States.

The latter part of this period appears to be marked by an emphasis on the utilization of a wide variety of food resources, perhaps indicative of population or climatic stress at this time. Burned rock features are also relatively common. For example at the McKinney Roughs site(41BP627) located on the banks of the Colorado River in eastern Bastrop County, three discrete Archaic II living surfaces replete with burned rock cooking features, lithic debris from stone tool making, and food remains were uncovered (Carpenter et al. 2006; TBH 2007). Projectile points diagnostic of the latter part of the Late Archaic include Darl, Ensor, Frio, and Mahomet point types (Collins 1995, 2004; Carpenter et al. 2006). These point types tend to be somewhat smaller than those used during the Late Archaic I subperiod, which may reflect a greater reliance on deer and smaller mammals.

Late Prehistoric Period (1200–300 B.P.)

The basic Late Archaic hunting and gathering lifeways continued into the Late Prehistoric and, consequently, there is no clear division between the two periods. However, the Late Prehistoric period is

marked by several major technological advances. Sometime around 1200 B.P., smaller Scallorn arrow points make their appearance in Central Texas, indicating the introduction of the bow and arrow, although dart points still commonly co-occur with Scallorn points during the next 400 years. By about 800 B.P., the bow and arrow becomes the standard weapon and small, thin Perdiz arrow points become the hallmarks of the Late Prehistoric period. This shift is accompanied by the introduction of pottery, and an expanded stone tool assemblage that included long, thin bifaces, end scrapers, and prismatic blades, which is associated with a new influx of bison into the region. These material culture markers serve as somewhat arbitrary points of reference for the division of the Late Prehistoric into two subperiods (Collins 1995; 2004; Johnson and Goode 1994). The early subperiod corresponds to the Austin "phase" and the later subperiod corresponds to the Toyah "phase". These phases are defined on the basis of early work by Kelley (1947), Jelks (1953), and Suhm (1957).

In his 1947 description of the Lehmann Rockshelter, J. Charles Kelley first identified the Late Prehistoric period as the Central Texas Aspect. He divided this into the Austin and Toyah foci primarily on the basis of the presence of Scallorn or Perdiz points, respectively. Explorations at Blum Rockshelter (Jelks 1953), the Kyle Site (41HI1; Jelks 1962), Smith Rockshelter (41TV42; Suhm 1957), and the Oblate Site (41CM1; Johnson et al. 1962) in the 1950s and 1960s identified the Austin phase as stratigraphically predating the Toyah phase. Clear distinction between Austin and Toyah stratigraphy at Blum and Kyle allowed Jelks to define material culture assemblages unique to each phase. Those artifacts Jelks categorized into the Austin phase toolkit include Scallorn and Granbury arrow points, some dart points, Friday knives, and serrated flakes. He included Perdiz and Clifton arrow points, double-pointed and four-edge beveled knives, Covington knives, small flake drills, snub-nosed end scrapers, pottery, and bison bone as indicators of the Toyah phase (Jelks 1962).

Although pottery is more commonly associated with Toyah phase assemblages, ceramic assemblages in east-central Texas are technologically diverse and frequently contain sandy paste ceramics and Caddo ceramics (Rogers et al. 2013: 249, Table 25). Research indicates that an indigenous ceramic tradition with ties to the east/southeast existed in these areas by about A.D. 1200–1300 (Rogers 1995:114–116; Rogers et al. 2013).

Following Jelks' (1962) definitive work at the Kyle site, minor revisions have been made to his date ranges and assemblage definitions, and investigations since then have changed few of the original conceptions of the Late Prehistoric period. In his 1981 summary of Late Prehistoric sites in Central Texas, Prewitt established date ranges of A.D. 700 to 1300 for the Austin phase and A.D. 1300 to 1750 for the Toyah phase. Edwards arrow points have also been added to the list of arrow points in the Austin phase assemblage.

The change from dart points to arrow points is generally accepted as marking the advent of the Austin phase, when the prevalence of dart points gradually gives way to two technologically distinct arrow point styles, Scallorn and Edwards. While the bow and arrow would likely have increased a hunter's efficiency, there is little evidence that subsistence practices changed significantly in Central Texas during the Austin phase, as there is evidence from the western and southern Central Texas sites that burned rock middens continue throughout the Late Prehistoric period (Black et al. 1997). This period also seems to have been

accompanied by an increase in hostilities, as witnessed by a number of burials in which arrow points were the apparent cause of death (Prewitt 1982: Table 4; Rogers 2000).

Several excavations have shed additional light on the lifestyles of the Austin phase peoples. The Sheppard Site (41WM1010), near the junction of the Edwards Plateau and Blackland Prairie in Williamson County, yielded evidence of short-term encampments containing numerous stone-lined hearths and abundant faunal remains, including bison (Dixon et al. 2003). A preliminary report of recent excavations at the J. B. White Site (41MM341), along the Little River in Milam County, indicates that the site was visited by Austin phase peoples who left a considerable amount of subsistence refuse, and the site also contains evidence of an ephemeral Toyah occupation (Gadus et al. 2006).

The origins of the succeeding Toyah phase remain controversial, with the controversy centered on whether Toyah represents an intrusion or migration of people into the region, or the spread of a successful toolkit, composed of blade flake production (as opposed to the bifacial core reduction of the preceding Austin phase) of Perdiz arrow points, Harahey knives, large flake/blade end scrapers, beveled knives, flake perforators, and arrow-shaft abraders. The former concept is championed by Johnson (1994), though he feels it unlikely that Toyah culture *sensu lato* was originally possessed over its entire geographic range by one ethnic group. Johnson refers to a Classic Toyah culture, which included distinctive pottery. He views this culture as arriving in Central and South Texas with outlanders who were in pursuit of bison, which had made their appearance after several centuries of absence. Johnson's main argument against Toyah being an in situ development in Central Texas through the melding of tools and associated behaviors is that the Toyah phenomenon appears throughout much of its geographic sphere seemingly at the same time.

Bastrop County History

The first permanent European settlement in present-day Bastrop County was Fort Puesta del Colorado, located at the Colorado River crossing where the town of Bastrop now stands (Moore 1977). Little is known about the fort except that its purpose was to protect commerce on the El Camino Real, which ran from San Antonio to Nacogdoches (Moore 1977; Marks 2013). The Baron de Bastrop had planned a German community at the site; however, it was not until 1827 when Stephen F. Austin received a grant from the Mexican Government for the "Little Colony" that settlement truly began in the area. In 1831, Austin received a second grant, and together the land was known as the Mina Municipality by 1834, which comprised 16 present-day counties including the majority of Bastrop County. When Texas became a republic in 1836, the Mina Municipality was one of 23 original colonies in Texas. In 1837, the Congress of the Republic of Texas changed the county name to Bastrop to honor the baron, and the town of Mina was renamed Bastrop as well. The Congress also whittled away the boundaries of the large county to form other counties, including Travis County to the west, and by 1840 Bastrop County was close to its present shape (Marks 2013).

The majority of initial settlers to the county was from Austin's original colony and practiced small-scale farming in the southern portion of the county near the Colorado River and the nascent town of Bastrop. Change came in 1837, which marked the first year that African slaves were brought to the county by their owners, the majority of whom were emigrants from the southern states (Marks 2013 and Kesselus 1987). This also marked the beginning of the new cotton industry and plantation economy in the county. Bastrop

County was never a leader in cotton production; however, it was considered the most important cash crop for the county during the next 50 years (Marks 2013). Large plantations were soon established along the fertile land surrounding the Colorado River, and the population of both free white settlers and slave laborers steadily increased. In 1847, the white population of the county was recorded at 1,273, and the slave population at 527. By 1850 the total county population had jumped to 2,180, of which 919 were slaves. This trend continued and by 1860 white residents of the county numbered 4,415, and the slave population numbered 2,591. While most (71 percent) slaveholders operated small farms, the remaining 29 percent in 1860 were large plantation owners who held over 75 percent of the slave population (Kesselus 1987).

With an increasing population of both whites and enslaved peoples, agricultural production rose significantly as well. In 1858, 7,880 acres in the county were recorded as in use for agricultural purposes; two years later, the acreage had increased to over 38,000 acres. The bulk of this land was devoted to corn and cotton production. As expected, almost 75 percent of the population of the county resided in rural farming communities, and most were located in the southern two-thirds of the county (Kesselus 1987).

The homogeneity of the southern character of the county began to breakdown in the 1850s with an influx of German immigrants. Prior to this time, the vast majority of white residents were from the American South. The 1850 Census enumerated 159 native Germans who represented seven percent of the county population. Only one was recorded as a slaveholder, likely because the majority of Germans were philosophically opposed to the institution of slavery. By the early 1860s, native Germans and their American-born children accounted for over 20 percent of the county's population (Kesselus 1987).

Despite the fact that the county possessed a large slave population that supported a growing cotton economy, Bastrop County residents voted 352 to 335 against secession in 1861 (Marks 2013). This was due in part to the increasing German population, who aside from their opposition to slavery, many had left their homeland to escape war and military service (Marks 2013). However, the close vote meant that many residents were Confederate sympathizers, and the county supported the war effort by arming and equipping military companies (Marks 2013).

The Confederacy's defeat in the Civil War and the emancipation of slaves changed nearly every aspect of the political, social, and economic climate within Bastrop County. Integration of the large population of formerly enslaved peoples as full citizens gave rise to conflict in the county and the South in general. Ex-Confederates and former slaveholders allied themselves with the Democratic Party in an attempt to maintain much of the former antebellum status quo, while Unionists (mainly African Americans and Germans) sided with the Republican Party, which sought radical reform. At the end of the war, the free African American population comprised 40 percent, Germans comprised 15 percent, native born Whites made up 35 percent, and other ethnicities accounted for the remaining 10 percent of the county population (Kesselus 2011). Included in this population were planters (former slaveholders), many white small-farm owners, a few white businessmen, and laborers, who accounted for virtually the entire black population who were dependent on whites for work.

While the majority of newly emancipated African Americans remained on rural properties owned by whites, a number relocated to Bastrop and others became landowners (Kesselus 2011). The majority of these new

black landowners resided in freedmen's settlements, which were scattered, informal communities of black farmers and stockmen. The settlements were unincorporated communities usually formed around a church and school and situated in pockets of cheap, neglected land; however, some were situated near former large plantations. Several freedmen's communities were located in Bastrop County, many of which were located in the southern two-thirds of the county. Some of these settlements included Alum Creek, Cedar Creek, Craft's Prairie, and Pleasant Grove (Sitton and Conrad 2005).

The Freedmen's Bureau was active in the county from 1865 to 1870 and was charged with providing relief to, and defending the civil rights of, freed slaves. With the help and protection of the Freedmen's Bureau during the time of Reconstruction (1865-1874), African Americans began to enjoy some of the same rights as their white counterparts, such as voting, holding county and state offices, owning land, and being paid for their work. However, many whites were fearful of and angry over the African Americans' new-found freedom and rights, sparking legislation such as the 1866 Texas labor laws or "Black Codes" which heavily favored white landowners and essentially allowed harsh treatment of black laborers (Kesselus 2011). The majority of negative white reaction was unofficial and ranged from intimidation, to raids on black homes, to lynching. By 1874, with the withdrawal of Federal Soldiers and the Freedmen's Bureau and the end of Republican Control of the county, the advance of freedmen began to wane (Kesselus 2011). It was during this time that the Ku Klux Klan was very active in Bastrop County, which made daily life for African Americans difficult to dangerous, and some left the county altogether (Kesselus 2011).

By 1870 the county population topped 11,000, and it had 34 manufacturing establishments, which included multiple gins, sawmills, gristmills, and a wool factory in Bastrop. By the 1880s additional factories, including those that manufactured brooms, iron, bricks, and pottery, were established within the county. The first railroad in the county, the Houston and Texas Central Railway, was extended across the northern portion of the county in 1871 to connect Austin to Brenham. Prior to its construction, Bastrop was the county's sole populous town, and only small rural settlements dotted the county. However, with the railroad came small communities that formed around railroad stops. These included the towns of McDade, Paige, and Elgin (which was the most substantial). The railroad also lessened the distance needed to haul cotton, timber, corn, and other products of the county by wagon (Marks 2013).

In 1874, Lee County was established and incorporated the mostly German, northern portions of Bastrop County. Additional railroads were built through the county in the 1880s and 1890s, including the Taylor, Bastrop and Houston Railway through Smithville and Bastrop. The Missouri-Kansas-Texas Company (MKT) built a line through the southern part of the county in 1894, and the towns of Rosanky and Red Rock developed along the line (Texas Historic Records Survey 1941). The MKT moved its central shops to Smithville at this time, and the town doubled in size, becoming the largest in the county (Marks 2013). At the turn of the century, the county was still primarily agricultural with over 3,500 farms and a population of almost 27,000 residents. Change came to the county in 1913 with the discovery of oil and later years of testing and drilling at various sites. However, most locations like the one near Cedar Creek were described as productive but unspectacular, and the industry never took off like it did in other counties (Marks 2013). Lignite mining proved to be a much more lucrative industry within the county. In 1926 there were nine mining companies north of Bastrop, but by 1941 only two were producing coal (Texas Historic Records Survey 1941).

The 1920s also brought changes to the Bastrop County agriculture industry. Cotton, followed by corn, continued to be the biggest cash crops in the county. However, a farm depression that began in 1920 forced changes in land use and diversification in agriculture and increased cattle production. The Great Depression followed in the 1930s, and the number of farms in the county decreased from 3,325 in 1920 to 2,473 in 1940 and farm value dropped from $17 million to just over $7 million. Many residents reacted by leaving the county, and the population decreased from 26,649 in 1920 to 21,610 in 1940. A brief economic upswing to the county came during World War II. Cattle production increased and the economy of several communities improved with the establishment of Camp Swift, an army training facility in the north-central part of the county. The upsurge was short-lived, and many residents left the county during the war. Camp Swift was phased out, the coal mines were closed, and lumbering exhausted the remaining commercial timber.

Cotton cultivation was one-sixth its 1920 acreage at the end of the war. However, farmers had begun to successfully diversify, and sorghum, watermelons, peanuts, and pecans became staple cash crops of the county. By 1950, the emphasis on agriculture had shifted to beef-cattle raising, and more land was set aside for pasture. While agriculture diversified, manufacturing became more focused, most notably on brick and tile. Three plants were operating in Elgin by 1950.

The Three Oaks Permit Area

While the majority of Stephen F. Austin's colonizers and later settlers took up residency in the southern portion of Bastrop County near the Colorado River and its many tributaries, the northern portion of the county remained largely unpopulated until after the Civil War. The Three Oaks Permit Area and its surrounding vicinity were originally large land grants that were eventually divided into smaller parcels and developed and farmed by individual families. Unlike central and southern Bastrop County, very few large plantations were located in the region. Instead, the loosely organized agrarian communities formed around churches and schools that were built on land donated by local farmers. These settlements appear to be situated around churches and include Anglo, German, and later African American landowners.

During the previous intensive survey of the Three Oaks Permit Area in Lee and Bastrop Counties (Turpin 2003), 120 historic sites were identified and included cemeteries, schools, industrial facilities, and farmsteads. Included in this number were the locations of 105 dwellings; according to archival research conducted by Turpin, they appear to have been built between 1855 and 1946, and the majority represented the homes of post-Civil War southern emigrants to the region. Of the sites that represented dwellings, 26 were extant at the time of survey. Five historic sites were attributed to the 1850s and 1860s and include the W. W. Beatty family homestead (41BP630), the German immigrant family Bretners' homesite (41BP572), the homesite attributed to Peter Kellermeier at 41BP585, and three additional sites to the north in Lee County. Turpin points out that several recorded cemeteries within the survey area contained marked internments dating from the 1860s, which indicates that several communities or families were living in the area by that time (Turpin 2003).

Nine of the recorded house sites were attributed to the 1870s, and the first known burials within the Three Oaks—Goerlitz and Adina cemeteries—occurred during this time. In addition, the initial prospecting for the Mowatt Lignite Mine began during this decade. Three sites were recorded just across the county line in Lee

County and include a tenant house (41LE308), T. J. Walkers' homestead (41LE87), and J. C. Carter's home (41LE277), located near the community of Blue. Sites recorded in Bastrop County that are thought to date to the 1870s include historic scatters that represent the A. B. Davidson (41BP272) and the Felix McLemore (41BP550) homesteads. The extant Alf Shepard home (41BP202), which consists of a frame dwelling with a log house core, was also thought to date to the 1870s. Turpin also recorded the site of the Wright Parmer homestead (41BP582). Parmer is listed as a freedman in a deed when he purchased the property from A. C. Cooper in 1872, and members of his family remained in the area until 1916. Turpin attributes Parmer and his family as the only Black presence in the permit area in 1872; however, current research has revealed that Jeff Tinnen, also a freedman, purchased the adjacent property (which contains 41BP594) from Cooper that same day. He remained on the property until he conveyed it John Kellermeier in 1884 (Turpin 2003).

Turpin attributed a large wave of home construction in the 1880s partly to an increase in German immigration and the founding of Hudler's gin, which provided work for the surrounding community (including the Wright Parmer family). By the 1890s the Mowatt Lignite Mine was operating at a peak, and housing for many workers was constructed near the shaft. Rural building appears to have decreased in the early twentieth century, while industrial and educational building increased. Schools included the third incarnation of the Mount Pleasant School (41BP546) and the Mount Rose or Chocolate School (41BP602). During this time the Elgin Butler Brick Company (41BP602) moved its headquarters to the current location.

Other large industries within the county included lumber production, though it appears to have been centered near the town of Bastrop, where the large pine trees were situated. The beginning of the lumber industry in the county is marked as 1838 with the operation of the Bastrop Steam Mill Company. Bastrop quickly became the supply source of lumbered pine in Central Texas, including what was used to construct the first state Capital and the French Legation building.

Log Houses in Central Texas

The information in the following section was adapted from Terry G. Jordan's *Texas Log Building: A Folk Architecture* (Jordan 1978)

The vast majority of log houses in Texas were influenced by emigrants to Texas from the Lower South of the U.S. Gulf Coastal Plains and Upper South and not directly influenced by European immigrants, as most European immigrants hailed from areas of Europe where log construction was not the primary building technique. Exceptions to this pattern include areas of Medina County and Fredericksburg. Many emigrants to Texas during the early to mid-nineteenth century were by then mostly of mixed European ancestry and had absorbed log structure construction techniques that were derived from the Pennsylvania Dutch (immigrants from Sudetenland, Bohemia, Moravia, Silesia, and Slovakia). Additionally, African-Americans acquired log building techniques while enslaved, and thus log structures were also constructed by black Texans before and after the Civil War. Log structure construction in Texas was for the most part confined to North-Central, Central, and East Texas due to the diminishing size and frequency of trees in the west, north, and southernmost parts of Texas. In general, Central and North Texas were populated by emigrants from the Upper South, while emigrants from the Lower South settled mostly in East Texas. The confluence of these two areas was made up of a mixture of both populations. Though both groups acquired knowledge of log culture complex from the same source, over time, log structures differed between the two

groups. Other factors for varied development in Texas log architecture include the lumber type, climate, level of craftsmanship, and economic status.

In Central and North Texas, the predominant tree types used in log construction were oak and cedar, while the abundant pines of East Texas were used almost exclusively as building materials in that region of the state. Tree type and size also influenced room size of the buildings. On average, North and Central Texas houses were smaller than those located in East Texas, which used tall pines that afforded larger rooms. Climate and weather likely influenced the popularity of floor plan type. For instance, open passageway or "dogtrot" plans were more popular in hot and humid East Texas than in North Texas. Another variable was the builder's level of craftsmanship. While some buildings were constructed during communal "log rollings" by amateur laborers, the majority of log houses (and the majority that survive today) were constructed by professional or semi-professional carpenters working for hire. Some of these craftsmen during the antebellum years were black slaves who traveled with their owners as carpenters or were rented out by slaveowners during log house construction. Additionally, economic status was another factor that influenced architecture, especially house construction. A richer man's house presumably would be larger, of better construction, and more likely to be covered with siding sooner after construction than a poorer man's house.

Log dwellings can be divided into two types: cabins and houses. A log cabin was usually a small, windowless, first-generation dwelling, built by amateurs, with crudely notched logs with the bark left intact. Cabins had dirt floors and, if present, chimneys were made of mud and sticks. Most cabins were occupied for just a few years before being replaced or demoted to outbuilding status and used as a barn or smokehouse. The majority of slave dwellings were log cabins. In contrast, a log house was a second-generation dwelling usually built by a carpenter with carefully hewn timbers that were tightly chinked, had a window or two, wood flooring, and a more permanent chimney of stone or brick.

Though each log dwelling was unique, they shared many common construction attributes. Typically they were situated in a well-drained location near a road or path and faced south to allow the summer breeze to ventilate the structure. Documented log house floorplans in Texas include single-pen, double-pen, dogtrot, triple-pen and four-pen. Often the floorplan underwent alterations and became more elaborate through time and as family size increased. The single-pen log house is the most common form of the dwelling in the interior portions of Texas and was less common in East Texas. Single-pen log dwellings may suggest a lower socioeconomic status. The majority of single-pen log houses (like 41BP594) had a side-facing gable and a chimney centered in one of the gabled ends.

Central Texas log houses were usually supported on flat field stone piers, and less commonly on wood piers, and were low to the ground. In contrast, dwellings found in East Texas generally had tall foundations of brick or log, which elevated the structure higher off of the ground to increase ventilation and to deter termites. Sill logs, which rest directly on the foundation stones or piers, were more substantial than the logs used for the walls and were hewn on all sides resulting in a square beam. They were placed on the eave sides of the structure and bear the entire weight of the building. For structures with a planned wooden floor, sills were mortised on the top side, and floor joists or sleepers (which supported the floor boards) were lap-jointed into the sills. Two additional logs were then placed parallel to the sills and notched into the joists

below. Walls were raised by adding two more logs on parallel sides, each notched into the log below until the wall attained the desired height. At the top of the wall, two plate logs rested below the eaves to support the rafters; like sills, they were larger than wall logs.

Wall logs were prepared prior to placement. They were generally hewed (with an axe) on the two sides that form the wall; the top and bottom sides were left untouched so that the chinking material could have a rough surface to adhere to. Hewing suggests that the preparer was more skilled. Aside from displaying a finished surface, a hewn wall could more easily be made tight against the weather and allowed for cladding to rest against the surface at a later date. Once the wall was fully raised, openings were cut for doors, windows, and a fireplace gap. Once the sawing was complete, the openings were framed with rived boards to stabilize the cut boards.

The vast majority of log walls in Texas were erected such that individual logs did not rest against each other, and a gap or "chink" larger than an inch remained between two logs. Chinks provided room for subsequent warping of the logs after construction, as many dwellings were built with unseasoned wood; chinks also allowed for the natural taper of logs. This gap between logs was covered or filled with a variety of material, which can provide clues relevant to the origins of the builder. In the American Deep South, the chinks were often covered horizontally with rived "sealing boards" on the inside and occasionally on the outside. As such, this is the dominant type of chinking found in East Texas which was settled largely by emigrants from the Deep South. In contrast, chinking in North and Central Texas generally consisted of fillers, which was a more common chinking method used by settlers from the Upper South. Fillers included thin slats of wood and small flat rocks wedged into the chink. The filler was then daubed both inside and out to form a tight weatherproof wall. Daubing materials differed regionally, depending mainly upon locally available resources. In areas where limestone was prevalent, a lime mortar was usually employed, and often wood ashes and occasionally salt was added. Clay mixed with material such as animal hair, moss, or straw was used in areas without limestone. In the absence of both, mud was used to fill the gaps.

The key element in log construction is the corner notch, the corner joint where logs from perpendicular walls are attached to one another. Apart from the sills, the corners support the entire lateral and dead loads of the building and prevent horizontal slippage. The majority of notching was performed on the ground using an axe or saw, and the final exact fitting was performed once the log was in place on the wall. In Texas, eight distinct notch types are found, with four dominant styles (half-dovetail notch, "V" notch, saddle notch, and square notch) and four less common types (full dovetail notch, semi-lunate notch, double notch, and half notch). The most prevalent notching style (with a concentration in North and Central Texas) is the half dove-tail, which is splayed on the top of the tongue of the log and forms a strong, locked joint. The "V" notch is an inverted V-shaped joint that forms a locked joint and was prevalent in the interior central and northern portions of the state. The saddle notch is likely the oldest notch type and is found on logs that are left round and not hewn. It is formed by scooping out a saddle-shaped depression to form a locked joint. This notch was most common in East Texas and is the dominant notch found on twentieth century log homes. The square notch consists of just right angles and requires less skill to fashion. As the notch does not form a joint, pegs or nails must be used to secure the joint. This type of notch was the most common form in Texas and is found in Central-east and East Texas.

The full dovetail notch is fairly uncommon in Texas, though it is a joint of superior strength because both the top and bottom of the tongue of the log are splayed. The semi-lunate notch is almost always applied to half-round pine logs and found mostly in East Texas. It resembles a half of a saddle notch. The double notch is also fairly rare in Texas and is simply a saddle notch with a square-shaped saddle and forms a solidly locked joint. The half notch is the simplest of all forms because the builder had to remove only one square of wood from the bottom corners of each log. Like the square notch, pegging or nails are required to secure the half notch corner in place since it is an unlocked joint as well. This joint is rare in Texas, and many square-notched structures feature occasional half-notched joints to rectify minor misfits in the wall.

Regional and temporal differences can also be observed in flooring, roofing, and chimneys of log houses. Prior to access to milled lumber for flooring, log houses with flooring used puncheons, short, thick, rived boards that reached from one floor joist to the next; the length was determined by the spacing of the joists, usually about 2 feet. A step above was a hand-sawn plank floor. Access to milled lumber provided a more stable and aesthetically pleasing floor. Several types of log house roofs are found in Texas, including "ridgepole-and-purlin," "ridgepole-and-rafter," and the non-ridgepole roof. By far, the dominant roof construction method in Texas is characterized by the absence of a ridgepole. These roofs had lap-jointed or mortised hewn or pole rafters on opposite slopes, with long slats affixed to them for stability. Vertical studs provided additional support on the gabled end and usually formed a 45-degree pitch. Early roof material was generally in the form of rived clapboard and was usually later replaced by shakes or shingles. Log house chimneys were almost always situated exterior to the structure on a gabled end and were constructed from a variety of materials including stick, dirt, and masonry. Though masonry chimneys sometimes replaced an initial stick and dirt chimney, most often stone or brick chimneys were original to the house. They were normally built freestanding, about 6 inches from the wall to keep unwanted heat out of the house and lessen the fire danger. After the Civil War, the majority of log houses were constructed without chimneys in favor of wood burning, cast iron stoves. Additionally, a large number of existing chimneys were removed in older dwellings, and the chimney gap was boarded over.

Log houses could be enlarged by several means, and this usually occurred as a process that unfolded over time. Many log houses were built with a porch, or one was added later. The majority of porches were situated in the front of the house and were full length with a roof attached a foot or two below the eaves. Shed rooms (typically one-half to two-thirds the width of the pen) were added to the back of the house with the roof attached to the main roof at the eaves, forming a break in profile. They were generally of frame construction due to the difficultly of attaching a new log structure to an existing one and because they were usually built at a later time period when there was access to milled lumber.

RESEARCH DESIGN AND METHODS

NRHP testing at prehistoric site 41BP595 was undertaken following a research design (Sherman and Frederick 2013) previously submitted to the THC. Research at the two historic sites (41BP585 and 41BP594) sought first to determine if significant archeological deposits were preserved and if behaviorally meaningful patterns of discard could be discerned. This was accomplished through implementation of an intensive systematic program of shovel testing augmented by limited hand excavation in units. Additionally, archival research was undertaken to identify the historic occupants of the properties containing the two historic sites and to determine whether they were associated with significant events, themes, or patterns of historic development.

ARCHIVAL RESEARCH, SITES 41BP585 AND 41BP594

Prior to the present investigation, the standing structure at site 41BP594 was determined to be eligible for NRHP inclusion as part of a rural historic district (Penick 2001) and potentially under Criterion D (Martin 2001). The eligibility status of site 41BP585 remains undetermined (Martin 2002). Of particular interest to the THC was whether either site was occupied during the 1850s to the 1870s (Martin 2001).

To supplement the limited archival research that was conducted earlier for both properties (Turpin 2003), the current research effort involved detailed consultation of online Texas General Land Office records and chain of title research at the Bastrop County courthouse in Bastrop, Texas, including review of deed, probate, and other vital records.

After determining the general timeline for development and occupation of the properties, the historian supplemented the chain of title data with Ad Valorem tax research at the Texas State Library in Austin, with the aim to determine when the properties were occupied and how they were used. The historian also consulted the population census rolls, which provided information such as county of residence at the time of enumeration, race, family size, and occupation. Limited secondary source research was conducted to develop a brief historic background for development in the region and included The Handbook of Texas Online, Turpin (2003), and several books concerning the development and history of Bastrop County.

PREHISTORIC RESEARCH OBJECTIVES, SITE 41BP595

An intensive program of shovel testing at 41BP595 (Sherman and Frederick 2013) isolated three sub-site areas, referred to as areas 1, 2, and 3. This work also identified a buried, organically enriched soil deposit in the southern half of Area 2. Research at 41BP595 sought to address several important questions concerning the origins of these deposits such as: what types of resources were processed in each area? When did the sub-site areas arise? Are interpretable cultural features with preserved remains suitable for radiocarbon dating present? Can use ware analysis of the ground and chipped stone tool assemblages be used to determine the types of materials processed on site? What are the origins of the organically rich soil deposit located in the southern half of site Area 2 and how was it buried?

Cultural Affiliation

Prior to the present investigation, no temporally sensitive artifacts had been recovered from site 41BP595, and its cultural affiliation remained uncertain. An important goal of testing was to recover temporally sensitive artifacts and charred subsistence/spent fuel remains suitable for radiocarbon analysis. Testing yielded several temporally diagnostic projectile points that suggest the site was occupied repeatedly from the Late Paleoindian to the Late Prehistoric periods. Radiocarbon analysis was performed on eight burned nut shells recovered from feature contexts and returned dates ranging from 1110 B.C. to A.D. 1150. The site appears to have been most heavily utilized during the period extending from the Late Archaic II to the early part of the Late Prehistoric period or Austin Phase.

Settlement/Subsistence

The present investigation identified a wide range of cultural features on site, including large burned rock cooking facilities, small cooking surfaces, and disarticulated burned rock features. An expansive buried anthrogenic A soil horizon, first identified in shovel tests, was sampled with hand-excavated units and backhoe trenches. Flotation of soil samples taken from the buried anthrogenic soil, and from burned rock features, recovered spent fuel remains and burned subsistence remains.

The artifact assemblage recovered from 41BP595 expressed limited diversity. The assemblage of flaked lithic tools included 36 specimens representing five tool types: projectile point, biface, utilized flake, uniface, and scraper. The assemblage of ground stone tools was much larger and included 114 specimens. The ratio of chipped to ground stone tools was 0.32. These patterns suggest the site resulted from a limited range of activities that were more focused on grinding activities than cutting activities. Site 41BP595 is thought to have resulted from activities largely associated with subsistence processing. Based on the results of macrobotanical, starch, phytolith, and residue analysis, the burned rock features appear to have resulted in part from processing tubers, bulbs, and nuts.

Spatial Patterning

The distribution of cultural materials across the site suggests the presence of three sub-site areas. Additional investigation within each site area sought to evaluate the structure (the distribution of feature types, artifacts, and other cultural materials) of each area in order to place these within a chronological framework and assess their function. Radiocarbon dates returned from samples recovered from sub-site areas 1 and 2, coupled with the assemblage of temporally sensitive lithic artifacts recovered from these areas, indicate that each of the sub-site areas resulted from multiple occupational episodes widely separated in time.

The buried anthrogenic soil horizon was limited to a roughly 55 m east/west by 22 m north/south area limited to the southern half of sub-site area 2. Radiocarbon dates returned from samples recovered from the anthrogenic soil deposit suggest it arose during a period potentially extending from 800 B.C. to A.D. 1030. Three of the four radiocarbon dates returned from charcoal samples recovered from burned rock features were encompassed by this date range. The charcoal sample recovered from Feature 29, cluster 1, in contrast, returned a date that precedes this range by at least 200 years.

Geoarcheological Investigation

A geoarcheological investigation was undertaken to determine the origin and burial mechanism of the organic-rich deposit in Area 2. There are several possible scenarios that can explain this deposit: 1) an ancient gully fill; 2) gleyed sediment on top of the argillic horizon; 3) an ancient anthrogenic deposit (or midden); 4) historic burn/bulldozer push feature. Although other scenarios exist, these are considered the most likely at this time and are amenable to geoarcheological examination and testing. The results of this investigation suggest that the organic-rich soil deposit has ancient anthrogenic origins and was buried via Aeolian deposition.

Excavation Methods

Backhoe Trenching

Each sub-site area defined through shovel testing was sampled with a series of backhoe trenches excavated at approximate 20 m intervals. Four trenches were excavated within and around Area 1, 12 trenches were excavated within and around Area 2, and four trenches were excavated within and around Area 3. A total of 32 cultural features were exposed during trenching.

Hand Excavation

A representative sample, consisting of 17 of the 32 cultural features exposed with the aid of mechanical excavation, was sampled through hand excavation.

Special Studies

Based on the context of recovery, some of the burned rocks encountered in intact features might have been directly exposed to food during cooking. The six best candidates, those rocks that were considered to possess the highest probability of having been directly exposed to food during cooking based on their context of recovery, were subjected to special studies including phytolith, starch, and Fourier Transform Infrared Spectroscopy (FTIR) analyses, in an attempt to determine what was cooked with the thermally altered rock. The rocks chosen for this analysis had a flat upward facing surface and were exposed on the tops of features.

All of the samples that were chosen were recovered from intact, or largely intact, burned rock features. The rocks chosen for analysis were selected from the top layer of feature rocks. Rocks that had a flat up-facing surface when exposed were chosen, if present. Burned rocks from features 1, 15, 21, 23, and 29 (clusters 1 and 3) were submitted to Paleo Research Institute, Inc. for analysis. Phytolith analysis identified an environmental signature from the grasses that grew in all of the features post-abandonment. Phytolith analysis also indicated that seeds might have been processed in features 1 and 23, or fortuitously deteriorated in the features. Similarly, hackberry seed phytoliths were recovered from Cluster 3 in Feature 29, which could represent subsistence processing or a fortuitous inclusion. Starch analysis revealed the presence of globular eccentric starches and globular centric starches from either grass seeds or tubers that presumably resulted from subsistence processing. All three of the features that yielded starch also included

sub-angular to angular starches with eccentric hila that are consistent with processing roots/tubers. These three features also yielded *Sagittaria*-type root/tuber starches, which is indicative of cooking wapato tubers.

Radiocarbon Dating

Eight radiocarbon samples, recovered from feature contexts, were submitted to Beta Analytic for analysis. The calibrated two sigma data ranges returned from these samples suggest the features sampled on site arose during the period extending from 1110 B.C. to A.D. 1150.

Macrobotanical Analysis

A total of 30 soil samples retained from feature fill were submitted to Macrobotanical Analysis for flotation and identification of the recovered botanical remains. This effort recovered spent fuel remains (including oak and hickory charcoal) and subsistence remains (including charred hickory and walnut shells and a charred bulb fragment.

FIELD METHODS

Horizontal Control

A grid was established at each site using a 60-m tape and a hand-held sighting compass. The grids at historic sites 41BP585 and 41BP594 were oriented with the standing structure or structural remains. The grid at prehistoric site 41BP595 was aligned with magnetic north. The locations of each shovel test were acquired using a Trimble GeoXT GPS device that, with post-processing, is typically accurate to within 2 m.

At 41BP595 an alpha datum was established and all hand-excavated units, backhoe trenches, cultural features, as well as all back sites, were tied to it with a total station. A permanent site datum and a permanent back site were established, using galvanized steel spikes set into concrete, along the southwestern limits of the site and shot in with the total station. The positions of the permanent datum, the alpha datum, along with all of the back sites, were also acquired with the GPS device.

Shovel Testing

At prehistoric site 41BP595, 150 shovel tests were excavated in two phases. Initially, shovel tests were excavated at 20 m across the site to assess the clinal variation of cultural materials across the site and determine if culturally meaningful patterns of discard have been preserved on site, such as artifact high density and diversity areas and cultural features. During the second phase, shovel tests were excavated at 10-m grid intercepts within areas of high artifact density and around possible cultural features. Three sub-site areas were identified and are referred to as areas 1, 2, and 3. Historic sites 41BP585 and 41BP594 were shovel tested at 5-m grid intercepts in the immediate vicinity of standing architecture or structural remains and at 10-m intercepts in the site areas beyond the immediate vicinity of those remains.

Trenching

Twenty backhoe trenches were excavated at site 41BP595 in an effort to locate cultural features within sub-site areas 1, 2, and 3. This effort exposed 30 burned rock features (features 1-3, 5- 29, 32, and 33) and one

rock concentration (Feature 4) whose origins appear to be largely natural. The buried anthrogenic A soil horizon first identified during shovel testing was exposed in Trenches 1, 6, 7, and 8 and designated as Feature 30. A portion of one additional burned rock feature (Feature 31) was exposed in a hand-excavated unit (5) used to sample the deposits adjacent to Feature 29.

Once identified in a backhoe trench, the portion of each burned rock feature present within the trench was fully exposed in plan using hand tools (trowels and brushes). Once fully exposed, each feature was photographed and then tied to the site grid with the total station.

FEATURE AND UNIT EXCAVATION

A representative selection of the burned rock features identified on site (1, 2, 3, 5, 6, 15, 16, 19, 20, 21, 23, 25, 26, 27, 29, 31, and 32), along with the concentration of unburned rocks (Feature 4), was selected for sampling through hand excavation. The anthrogenic soil deposit or midden feature (30) was drawn in profile, as expressed in the walls of trenches 6, 7 and 8, and then sampled with two 50 cm x 50 cm units (units 1 and 2) that were excavated off of trenches 7 and 8. A total of 11 features (7, 8, 9, 10, 11, 12, 13, 14, 17, 18, and 28) were photographed and reburied but were not sampled. Three features (22, 24, and 33) were photographed, sketched, and reburied but not sampled.

The limits of all features that were sampled through hand excavation were first fully exposed and the feature rocks were pedestalled. In hand-excavated units used to sample features, the sediment removed from the features was screened separately from the rest of the level. All sediment removed from each feature was screened using ¼ inch mesh, with the exception of sediment retained for flotation. All artifacts recovered in the ¼ inch mesh were retained and bagged by feature. Thermally altered rock was categorized by raw material, weighed using a bucket scale, and discarded in the field. Thermally altered ground stone artifacts recovered in association with burned rock features were categorized by material, weighed, and retained.

Each of the burned rock features selected for hand excavation was drawn in plan. Complex features, and large features thought to represent intact cooking facilities were bisected along a line crossing near the feature's center, and then drawn and photographed in profile. Lines of bisection were established with wooden stakes connected by level string lines and tied to the site grid with the total station. Flotation samples were retained from all of the excavated features that appeared to represent intact cooking facilities (1, 5, 15, 19, 21, 23, 26, 27, 29, and 32). One flotation sample was retained from each 10-cm level excavated in units 1 and 2 where Feature 30, the anthrogenic soil horizon, was encountered.

In addition to the two 50 cm x 50 cm hand-excavated units used to sample Feature 30, six additional hand-excavated units, ranging in size from 50 cm x 50 cm to 1 m x 1.25 m, were used to sample the deposits adjacent to six features. All of the units excavated on site were excavated off of backhoe trenches; the odd unit size was employed as a matter of expediency. The larger units (those larger than 1 m x 50 cm) were initially established as 1 m x 1 m units parallel to and about 20 cm away from the trench walls. Once the unit walls were cut to the bottom of the first level, the unit was then extended to the trench. This method was utilized in order to reduce the risk of wall failure and to make it easier to maintain squared unit walls.

LABORATORY METHODS

All recovered cultural materials were returned to the Archeological Laboratory at Atkins for processing preparatory to analysis. Following analysis and washing, all cultural materials were returned to B&A. Nonorganic remains were washed, dried, and catalogued by provenience. Once this report of investigations is finalized, B&A intends to curate only temporally/culturally diagnostic artifacts. The Anthropology and Archaeology Laboratory (AAL) at Stephen F. Austin Unisversity in Nacogdoches, Texas, is expected to be the curation repository.

Prehistoric Materials

All lithic artifacts were classified as either tools or nontools as well as by raw material type and, where possible, origin. Nontools were categorized as debitage, fire-cracked rock, or ground stone. The assemblage of lithic debitage was subcategorized by morphology into complete flake, broken flake, flake fragment, and debris.

The assemblage of lithic tools was examined under low-power microscopy in order to identify patterns of use wear. Morphological characteristics of projectile points were used to assess manufacturing techniques and identify cultural affiliation when possible.

The recovery of animal bone can provide clues pertinent to prehistoric subsistence patterns, duration and season of occupation, utilization of bone material for tools or ornamentation, and animal population density. Analysis sought to provide taxonomic identification of all faunal remains to the species level, or the most specific taxon possible, based on limitations of specimen completeness. Minimum number of individuals (MNI) of all species identified was calculated. Using MNI, a number of useful data categories such as species-specific and total animal biomass can easily be derived. Other attributes of the bone assemblage such as age distribution of species, observed pathology, differential preservation of various skeletal parts, taphonomy, or butchering evidence were also identified and interpreted when possible.

Archeobotanical remains recovered through flotation can give clues to the diet of the prehistoric occupants as well as to the season, or seasons, of occupation. Flotation samples recovered from feature contexts were submitted to Archeobotanical Analysis for flotation and analysis.

Historic Materials

Historic artifacts were initially divided into nine broad material categories, with the exception of uncommon and/or composite artifacts. These categories include historic ceramic, glass, metal, brick, mortar, thermally altered rock, burned matrix, and miscellaneous historic materials. Additional attributes such as material type, surface treatment, decorative element, maker's mark, morphological characteristics, technological variables, form, color, size, and condition were evaluated.

The historic artifact assemblages recovered from sites 41BP585 and 41BP594 were organized into a functional classification system built upon ideas put forth by South (1977) for quantitative analyses. South's artifact group and class system was developed to study patterned cultural processes at eighteenth century British settlement sites. Several modifications were made to South's categories to encompass a wider

variety of material bi-products produced in part by industrial, commercial, and technological advances subsequent to the 1700s. Historic artifacts were categorized according to the following use contexts: activities, agricultural, architectural, arms, clothing, household, kitchen, personal, and unknown. The classes within each group are based on form and sometimes function. The use context categories in this analysis are assumed to reflect the majority of a site inhabitants' daily behavior utilizing items of material culture found in the archeological record. However, this classification system is intended only as a general tool; artifacts may have had multiple uses that would be associated with entirely different categories and/or functions (Beaudry et al. 1991).

SITE 41BP585 NRHP TESTING RESULTS

SETTING

Site 41BP585 is an historic homestead located on a gently sloping ridge at an approximate elevation of 510 feet (ft) above mean sea level (msl) and covers approximately 8,000 square meters (see **Figure 2**). A surface inspection conducted during the present investigation located a variety of structural remains that together indicated the location of a structure that is no longer extant (**Figure 3**). These remains include foundation piers and posts─roughly arranged in a rectangular pattern, three structural beams─roughly 5 m in length, as well as a cistern. A transmission line right-of-way crosses the site roughly north to south immediately to the west of the structural remains. Vegetation at the site consists primarily of mesquite and cacti. Two large oaks stand 15 m west of the location of the former structure. The soil at the site is Edge fine sandy loam, 2 to 5 percent slopes, eroded (USDA/NRCS 2013). These soils are typically deep, moderately well drained, and formed in residuum. Shovel testing revealed yellowish red clay at the ground surface across most of the site. Slightly deeper soil, consisting of a shallow (10-40 cm deep) yellowish brown compact sandy loam, was encountered within an area extending roughly 30 m east to west in shovel tests 15, 34, 35, and 36, just to the south of the location of the former structure. The origins of this slightly deeper deposit of sand are uncertain. The sand may represent a low dune. Ground surface visibility was very high across the site and often exceeded 80 percent.

PREVIOUS INVESTIGATIONS

Site 41BP585 was recorded during previous survey of the Three Oaks Mine (Turpin 2003). At that time, seven shovel tests were excavated to define the limits of the site, of which three contained cultural material including one crockery sherd, one bottle top, and one piece of colorless glass.

WORK PERFORMED

Shovel Testing

During the present investigation, a total of 129 shovel tests were excavated at site 41BP585, of which 71 yielded cultural materials (**Figure 3**). Initially, 41 shovel tests were excavated within a 30 m x 25 m area, roughly centered on the site area where structural remains were exposed on the ground surface, at 5-m grid intercepts. The remaining 88 shovel tests were excavated at 10-m grid intercepts surrounding the above 30 m x 25 m area where structural remains were observed.

Of the 41 shovel tests excavated at 5-m grid intercepts, 32 were culturally positive and yielded 429 glass shards, 490 metal artifacts, 18 ceramic sherds, 56 shingle fragments, ten fragments of faunal bone, 40 mortar fragments, one charcoal fragment, five brick fragments, one slate fragment, one burned conglomerate of metal and glass, and one fragment of burned soil. Two prehistoric artifacts, both lithic debitage, were also recovered. Shovel test 20, the third most productive shovel test excavated on site, exposed a layer of ash in Level 3. The ash deposit was designated as Feature 1.

Inset

Locator

Positive Shovel Test
Negative Shovel Test
Foundation Stone
Post
Well
Site Area
Permit Boundary

Beam
Corral
Unit 1
Unit 2

0 50
Feet

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Figure 3
41BP585 Site Plan

Luminant Three Oaks Mine
Bastrop and Lee Counties, Texas

Prepared By:	1 inch = 50 feet
Job No.:	Date: 9/11/2014

\\SVRGIS08\Storage\Projects\Luminant\ThreeOaks\MXD\Reports\ARCH\Fig3_Site41BP585_PlanMap.mxd

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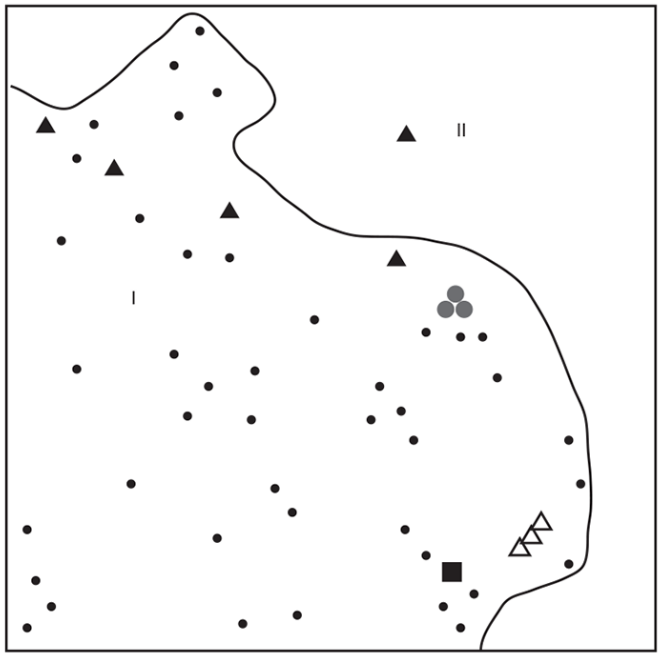
Of the 88 shovel tests excavated at 10-m intervals, 39 were culturally positive and yielded 585 glass shards, 75 metal artifacts, eight ceramic sherds, two brick fragments, two burned metal and glass conglomerates, one fragment of burned soil, and one fragment of charcoal. Four pieces of non-diagnostic lithic debitage were also recovered.

Glass shards were recovered in a slightly greater frequency from the shovel tests excavated at 10-m grid intercepts. An average of 15 glass shards was recovered from these shovel tests, while an average of 13.4 glass shards was recovered from the shovel tests excavated at 5-m grid intercepts in the immediate vicinity of the structural remains on site. The apparent concentration of glass shards in the area surrounding the immediate vicinity of the former structure reflects the yield from one shovel test (ST 90), which contained 478 shards of glass. Artifacts in all remaining categories, most notably metal, ceramic, and brick, were recovered in greater frequencies from the shovel tests excavated at 5-m grid intercepts.

Hand Excavation

Unit 1 and Feature 1

Unit 1 was excavated to sample Feature 1, first exposed in shovel test 20. Unit 1 was a 1 m x 1 m unit that encompassed shovel test 20 along its western edge. The unit was excavated to a depth of 54 cmbs, where the base of Feature 1 was encountered. Feature 1 was exposed in plan (**Figure 4**) at the base of Level 1, roughly as a quarter section of a circle with an uneven outline that encompassed about two thirds of the unit floor. The feature extended into the southern and western walls of the unit, and its horizontal limits were not fully exposed. The portion of the feature exposed in Unit 1 was bisected east to west along a line crossing the unit at its north/south midpoint. In profile the feature was shown to be a pit filled with domestic refuse with a distinct layer of ash (**Figure 5**). The pit extended into the clay subsoil and was positioned along the southern edge of the former structure. Based on the alignment of extant foundations piers, the pit feature would have been under the house floor.



Charcoal
Ceramic Sherd
Hematite
Milk Glass
Mortar

I Feature 1 fill, 10YR6/2 light brownish gray sandy clay loam with common charcoal and ash and some historic ceramic sherds, glass shards, and brick fragments

II E Horizon, 10YR3/6 dark yellowish brown fine sandy loam with rare glass shards and brick fragments.

N

0 20 40

CENTIMETER

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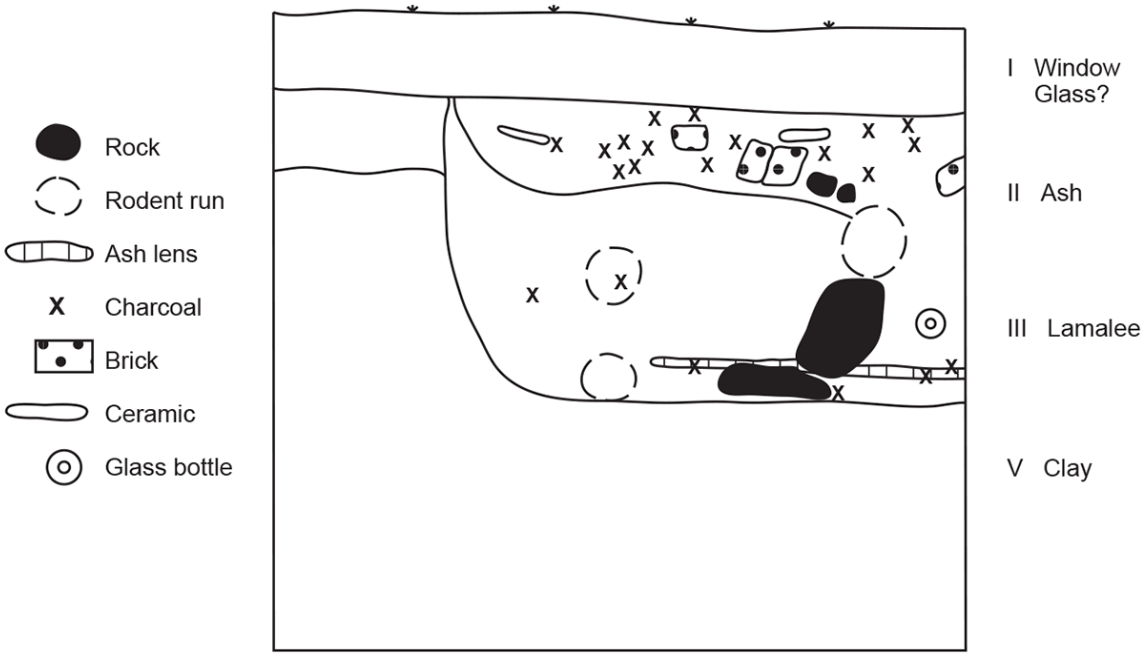
Figure 4

Site 41PB585
Feature 1 Plan



I A horizon, 10YR5/6 yellowish brown fine sandy loam, 0 – 12 cmbs.
II Feature 1 fill Zone I, 10YR6/2 light brownish gray, sandy clay loam with charcoal and ash, 10YR5/6 Yellowish brown sand, 12 – 22 cmbs.
III Feature 1 fill Zone II, 10YR4/6 dark yellowish brown fine sandy loam, with common coarse mottles of 10YR5/8 yellowish brown fine sandy loam and 10YR5/1 gray clay. 22 – 50 cmbs.
IV E horizon, 10YR3/6 dark yellowish brown fine sandy loam, 12 – 22 cmbs.
V Bt horizon, 7.5YR5/6 strong brown clay, 22+ cmbs.

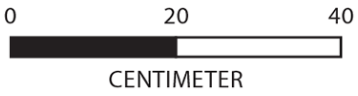


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Figure 5

Site 41BP585
Feature 1, Unit 1
South Wall Profile

Richard H. Kimmel (1993:102) notes that the functions of sub-floor pits are variable both in terms of original function and adaptive use. Such features often originated as borrow pits for hearth and chimney construction and were subsequently put to other uses such as root cellars or places to store valuables. Feature 1 may have served one or more of these functions. Kimmel notes that the placement of borrow pits within rather than outside of the foundation would eliminate an inconvenient hole in the yard.

The irregular outlines of Feature 1 and the absence of any evidence suggesting it might have been lined or finished suggests it likely originated as a borrow pit. The pit was filled in with domestic refuse, ash, and charcoal. Artifacts recovered from Feature 1 included 15 asphalt shingles, 29 brick fragments, 91 ceramic sherds, 133 faunal bone fragments, 1,585 pieces of glass, 707 metal artifacts, and 88 pieces of mortar. Only seven specimens (three glass, three ceramic, one faunal bone) exhibit signs of burning, indicating the ash and charcoal were secondarily deposited and do not represent in situ burning.

Unit 2

Unit 2 was a 1 m x 1 m unit located 15 m south of the former location of the structure, within the portion of the site with the deepest soils. Unit 2 was excavated to 47 cmbs. Artifacts recovered from Unit 2 included two brick fragments, two ceramic sherds, one faunal bone, 30 glass shards, 73 metal artifacts, three pieces of mortar, and one rubber fragment.

HISTORIC ARTIFACT ASSEMBLAGE ANALYSIS

Shovel testing and hand unit excavation at site 41BP585 yielded 4263 historic artifacts. Subsequent analyses indicated that these artifacts fit within nine functional groups. **Table 1** presents the functional groups and the total number of artifacts assigned to each group. The historic artifact assemblage is discussed within the framework of these artifact groups. When possible, contextual interpretations are made concerning how the material remains may have been used.

Table 1. Historic Artifact Functional Group Classification System at 41BP585

Artifact Group	Artifact	Examples	Count	Percentage
Activities	Musical Instrument Toy Tool	Harmonica Marble Axe, Chain	7	.16%
Agriculture	Animal Husbandry Fencing Hardware	Horse Tack Fence Staples, Fence Wire Fragment Scale Weight, Buckle, Hanger, Wire	311	7.3%
Architecture	Structural Material Construction Hardware Interior Finishing	Brick, Mortar, Window Glass, Asphalt Shingle Nail, Washer, Screw, Insulators, Miscellaneous Hardware	2345	55%
Arms	Ammunition	Cartridge Cases, Lead Projectiles	16	.38%
Clothing	Fastener Textile	Button Fabric	4	.01%
Household	Lighting	Chimney Lamp Glass, Lamp Parts	10	.24%

Table 1. Historic Artifact Functional Group Classification System at 41BP585

Artifact Group	Artifact	Examples	Count	Percentage
Kitchen	Indeterminate Ceramic Hollow Ware Ceramic Flat Ware Ceramic Glass Container	Storageware, Tableware Jug, Bowl, Pestle, Butter Churn, Lid Plate Vessel, Bottle, Jars, Jar Lid Liner, Unknown Vessel	1,178	27.63%
Personal	Tobacco Hygiene	Snuff Jar Hair Comb	8	.19%
Unknown	Unknown	Ferrous Metal Fragment, Burned Clay, Thermally Altered Rock, Slate, Plastic Fragments	384	9%
		Total	**4263**	

Activities (n=7; less than 1 percent)

The Activities Group includes items that may have been utilized by multiple occupants at the site during various pursuits. This group consists of a total of seven artifacts within three artifact classes, including musical instruments, toys, and tools. Activities-related artifacts include four harmonica plates, one marble, one axe head, and one chain fragment. No specimens within this group exhibited evidence of burning.

Musical Instruments

Harmonicas, also known as French harps or mouth organs consist of three basic parts: the comb, reed plates, and cover plates. Four copper alloy (likely brass) reed plates from a harmonica were recovered from the site. Harmonicas were introduced to America shortly after 1857 and rapidly became very popular. Although harmonicas are still popular today, the United States experienced a shortage of harmonicas during World War II due to limited supplies and rations.

Toys

The single toy recovered from the site is a glass marble. The marble type recovered was produced using an early machine method, which is indicated by a roughened end and a swirling pattern close to the surface of the marble. This technique is known as a transitional machine-made process, which generally dates from 1901 to 1926 (Randall 1971).

Tools

The historic tool assemblage includes two metal tools: a ferrous alloy axe head and a portion of a cast and linked ferrous alloy chain. Both items were likely utilized in a variety of contexts and activities; however, neither is temporally diagnostic.

SUMMARY OF ACTIVITIES GROUP ARTIFACTS

The artifacts assigned to the Activities Group are consistent with a domestic occupation dating from the nineteenth century and extending into the early twentieth century. The harmonica is associated with leisure-time activities, while tools recovered from the site imply a multitude of possible activities, which could have been undertaken at a rural farmstead.

Agriculture (n=311; 7 percent)

The Agriculture Group includes items pertaining to animal husbandry and farming. All artifacts within this category are comprised of ferrous alloy and were recovered in mostly incomplete forms. No specimens within this group exhibited evidence of burning.

Animal Husbandry

Objects relating to animal husbandry at site 41BP585 consist of three buckle fragments, one snaffle bit fragment, one harness buckle fragment, one horseshoe, 16 fence staples, and 262 fragments of fence wire. The snaffle bit fragment consists of a ring and a partial mouthpiece. Bits are pieces of horse tack used within the bridle. Harnesses allow a horse to pull various horse-drawn vehicles, such as wagons, carriages, or plows. Fence wire in conjunction with fence staples indicates the former presence of fencing. The predominant use for any type of fencing would have been for agricultural purposes, such as the containment of livestock.

Farming

Objects related to farming include 24 fragments of wire, one scale weight, and two hangers. Fragments of iron wire are assumed to reflect various agricultural activities including baling hay. Wire recovered from site 41BP585 was fragmentary and consisted of narrow gauges of rusted iron alloy. The two-pound scale weight is known as a hanging weight, which would have accompanied a balance beam scale and used to weigh cotton, tobacco, grain, meat, or other such items.

SUMMARY OF AGRICULTURE GROUP ARTIFACTS

While the Agriculture artifact assemblage is not temporally sensitive, the use contexts of the artifacts are consistent with a late-nineteenth to early-twentieth century farmstead occupation. The Agriculture artifacts, such as the horse bit, harness, fence staples, hanging weight, and wire, are congruent with materials and tools used in animal husbandry and farming activities during that time period.

Architecture (n=2345; 54 percent)

The Architecture Group includes structural materials, such as shingles, brick, mortar, and window glass; construction hardware, such as nails and washers; and interior finishing items, such as electric insulators and door handles. No specimens within this group exhibited evidence of burning.

Structural Materials

Asphalt Shingles

Asphalt shingles identified from the assemblage included 67 small fragments of an organic felt-backed shingle with reddish brown and off-white ceramic inclusions. These shingles date to before the 1970s and are likely historic in age.

Bricks

The 40 brick fragments recovered from site 41BP585 include handmade and machine-made varieties. Handmade brick fragments total 11 specimens (149.87 grams [g]) and range in color from reddish brown (n=5) to reddish yellow (n=5) to reddish gray (n=1). Machine-made brick fragments total 29 specimens (1,947.1 g), and range in color from dark reddish brown (n=2) to reddish brown (n=24) to white (n=3). No

surface treatments or evidence of burning was present on the brick specimens. While no maker's marks were observed, in Texas machine-made bricks generally began replacing hand-made bricks in construction around 1900 (Steinbomer 1982).

Mortar

Mortar recovered from the site consists of a soft, white, sandy paste. A total of 132 mortar fragments were recovered with a combined mass of 1,546.63 g. All recovered mortar was highly fragmented and displayed no evidence of burning.

Window Glass

Window glass belongs to the structural materials subcategory of the Architecture Group. A total of 1,687 flat glass shards were identified as window pane fragments. Aqua-tint shards (n=1,492) and colorless shards (n=195) were both recovered from site 41BP585. Recovery of flat glass less than 3.2 millimeters (mm) in width indicates that at least one structure at the site contained paned windows.

Construction Hardware

Nails

A total of 373 nail fragments were recovered and assigned to the Construction Hardware subcategory of the Architecture Group. The nail assemblage is comprised of fragmentary and heavily rusted specimens. Degradation of the nail assemblage precluded identification of any characteristics other than basic manufacturing techniques. Cut nails (n=65) are the least prevalent, while wire nails (n=288) represent over 80 percent of the nail assemblage. A total of 20 nails were of indeterminate manufacturing technique. A single type of nail head was identified from within the assemblage. Roofing nails with white metal caps meant to mushroom and seal the hammered nail hole comprised seven of the wire nails recovered. Although wire nails were introduced during the first quarter of the nineteenth century, they did not replace cut nails until the last decade of the nineteenth century (Adams 2003).

Miscellaneous

Brass washers (n=2), wood screws (n=4), iron staples (n=4), brass strapping fragments (n=16), ferrous alloy spring (n=1), and ferrous alloy ring (n=1) were recovered from the site, which are assumed to represent a portion of the architectural component. These items are not considered temporally diagnostic, and could date to either the historic or modern era.

Interior Finishing Items

Electric Insulators

Electric insulators are considered interior finishing items to varying types of structures. Two single-knob porcelain insulators were recovered from site 41BP585. Knob insulators were used for electrical wiring within buildings. Before 1935, only 2.3 percent of rural areas in Texas had access to electrification from a generating plant. However, the Emergency Relief Act of 1935 provided funding for electrification and by 1965 only 2 percent of Texas farms remained without electricity (Davis 2013). Therefore, it is likely that the electric insulators date from sometime after 1935.

Miscellaneous

Other items, which can be interpreted as finishing items within the Architecture Group, include iron brackets (n=4), mortise latch and lock (n=1), hinges (n=9), brass nozzles (n=1), and a ceramic Bennington-like brown-glazed doorknob (n=1). Many of these items could date to either the historic or modern period; however, it is likely that the doorknob dates to after the 1860s (Hall 2013).

SUMMARY OF ARCHITECTURE GROUP ARTIFACTS

Temporally diagnostic architectural remains at site 41BP585 provide production date ranges that span from 1790 to the present. The predominance of machine-made bricks produced after 1900 indicate significant building activities subsequent to the turn of the nineteenth century, with improvements, repairs, or additions into the first half of the twentieth century (Steinbomer 1982). Additionally, the majority of the nails recovered from the site are wire, suggesting construction activities were concentrated after circa 1900 (Edwards and Wells 1993). However, the presence of cut nails, handmade bricks, and items such as the Bennington-like doorknob suggest that domestic occupation began during the nineteenth century and may have occurred as early as 1860. The presence of insulators suggests the electrification of at least one structure at the site, which most likely occurred after 1935 but before 1965. Additionally, the presence of asphalt shingle fragments suggest that the site remained occupied into the first half of the twentieth century. In summary, the Architecture Group suggests building activities may have occurred prior to 1900 and as early as 1860, but the majority of materials date to the first half of the twentieth century.

Arms (n=16; less than 1 percent)

The Arms Group includes artifacts involved with the utilization and/or production of munitions. Artifacts assigned to the Arms Group include 11 cartridge cases and five projectiles. No specimens within this group exhibited evidence of burning.

Cartridge Cases

Cartridge cases recovered from site 41BP585 consist of rimfire (n=9) and centerfire (n=2) cases. The rimfire cases are all spent .22 caliber cartridges made of brass in regular (n=1), long or long rifle (n=6), and unknown (n=2) lengths. Rimfire .22 caliber cases have been in production since 1857; however, a head stamp of a diamond provides a date range of 1898 to 1935. This type of mark was used by the Western Cartridge Company founded in 1898, until its merger with the Winchester Repeating Arms Company in 1935 (Barnes 2000). Two "U" headstamps were in use from 1867 to 1962 by the Union Metallic Cartridge Company even after the Remington merger in 1911 according to Suydam (1979:327-329). In addition, a single "F" headstamp was identified as the mark of the Federal Cartridge Company from 1916 to present (Suydam 1979:323). A total of four cases exhibited a "SH" headstamp and a single case contained an unknown character, both of which have unidentified manufacturers and date ranges. The two centerfire cases are spent 12 gauge shotgun cartridges made of brass. The solid head cases exhibited a maker's mark associated with the Winchester Company and their line of New Rival shells from 1920 to 1929 (Stadt 1984:33).

Projectiles

The three projectiles recovered from the site include mushroomed, conical bullets of two sizes. A single 120 grain bullet and two 31 grain bullets are likely to be around .357 caliber and .22 caliber rounds,

respectively. These calibers were determined by weight. Both of these calibers are still in production today, and are therefore not temporally diagnostic.

SUMMARY OF ARMS GROUPS ARTIFACTS

While the Arms Group artifacts conceivably could have been produced during the period from 1857 to the present, the majority of the dated items represent production during the late nineteenth century to the 1930s. For this reason, the Arms Group assemblage is thought to represent discard primarily during the first half of the twentieth century.

Clothing (n=4, less than 1 percent)

Artifacts attributed to the Clothing Group include two fragments of the same button that were counted as one artifact and three fabric fragments, none of which exhibited evidence of burning.

Buttons

The two button specimens represent fragments of a single button and include a molded dark purple glass center and decoratively stamped copper alloy sheeting. The glass appears to be faceted and conical with a central perforation, which was presumably for a metallic drum. The brass sheeting encircles a portion of the exterior perimeter of the button, suggesting that the glass was decoratively rimmed. This type of button is known as a Victorian Jewel or glass mounted in metal. The size of the button is indeterminate due to its fragmentary nature, but it was likely larger than 25 Ligne (16 mm). Its decorative appearance suggests it was utilized on a woman's external garment.

SUMMARY OF CLOTHING GROUP ARTIFACTS

Artifacts attributed to the Clothing Group conceivably could date from the mid-nineteenth century through the early twentieth century. The single glass button (two fragments) was highly decorative and was a type popularly produced until around World War I. Although the textiles are likely more modern intrusions, the single button suggests discard during the late nineteenth to early twentieth century.

Household (n=10; less than 1 percent)

This group includes items that are commonly found within a domicile and were presumably utilized by multiple occupants at the site. Artifacts belonging to the Household Group are restricted to lighting items. No specimens within this group exhibited evidence of burning.

Lighting Items

Lighting items recovered from the site consist of glass chimney lamp fragments, brass oil lamp parts, and a single light bulb fragment. A total of six colorless chimney glass shards were recovered, one of which consists of a chimney base with a scalloped and beaded edge. All chimney lamp glass is presumably associated with kerosene lanterns, which required drafting in order to burn. Three portions of oil lamps were recovered and include a lamp collar and two burners. Kerosene lanterns were generally in use between 1860 and 1880 (Spillman 1983), a period consistent with the September 16, 1862 patent date stamped on both burners.

SUMMARY OF HOUSEHOLD GROUP ARTIFACTS

Few household items were recovered at site 41BP585. The presence of gas-burning lantern parts and light bulb fragments are consistent with a domestic occupation potentially beginning as early as 1862 and continuing into the twentieth century.

Kitchen (n=1,178; 27 percent)

The Kitchen Group includes subcategories of artifacts related to food preparation, storage, and consumption. These artifacts include ceramic vessel fragments, glass container fragments, and metal utensils. Sixteen specimens within this group exhibited evidence of burning.

Ceramics

A total of 125 ceramic sherds belonging to the Kitchen Group were recovered. Ware types recognized include ironstone (n=51), redware (n=2), and stoneware (n=72). These specimens represent vessels designed for use as tableware and storageware. Decoration is evident on 13 ceramic sherds; two sherds have maker's marks, and one sherd has a capacity mark. It is possible that the undecorated specimens belonged to blank portions of decorated vessels. Seven ceramic sherds exhibited evidence of burning.

Redware

Two sherds exhibiting a coarse red paste were recovered. Both are undecorated body sherds with an Albany-like slip on both the interior and exterior and could not be attributed to a particular vessel form.

Stoneware

Stoneware is the most common ware type recovered from site 41BP585 (n=72). Stoneware hollowware vessel forms include fragments from a rounded bottom bowl (n=7), a one process hanging lid (n=6), indeterminate type lid (n=1), indeterminate crocks (n=2), a teapot (n=1), and straight-sided cylindrical jugs with tooled shoulders (n=2). The remaining 53 sherds and sherdlets could not be confidently assigned to either vessel category or form. Stoneware fragments recovered at the site include 14 rim sherds, 50 body sherds, five base sherds, and seven sherdlets. Stoneware is not commonly decorated but is frequently treated with a glaze or slip. At site 41BP585, 13 variations of glazes and/or slips are exhibited. These include Albany-like slip, Bristol glaze, Rockingham glaze, alkaline glaze, salt glaze, and slip glazes. Unglazed vessels, known as bisque ware, are also present. A total of two stoneware sherds display decoration while a third displays a capacity mark; the remaining sherds are undecorated and unmarked.

Surface Treatments

The most frequent surface treatments (**Table 2**) to the stoneware assemblage at site 41BP585 consist of variations of a Bristol glaze (n=29), followed closely by variations of Albany-like slips (n=28). Variations of Bristol glazes include use of this glaze alone or in combination with Albany-like slips. Bristol glazes were commonly seen on the exterior of vessels with an Albany-like interior from 1880 to around 1915 (Greer 1981). A total of three stoneware sherds were treated in this manner. After 1915, Bristol glazes were commonly used alone on stoneware vessels. Twenty-five sherds were glazed internally and externally with a Bristol glaze. Additionally, one split sherd retains only an external Bristol glaze.

The use of Albany-like slip glazes on both the interior and exterior of a vessel was a treatment that generally predates 1890 (Greer 1981). A total of 20 sherds in the assemblage exhibit this form of slip. Two split sherds retain only an external Albany-like slip. Albany like slip glazes were indentified on the exterior only of six fragments from a single crock lid.

Additional and less frequently occurring glazes and slips at the site include alkaline (n=1), salted slips or Frogskin (n=3), salt glaze (n=1), slips (n=3), and Rockingham (n=1). One Rhenish-like slip glazed sherd, a variation of traditional salt glazing, was also recovered; this sherd exhibits a brown color under a colorless, textured glaze.

Table 2. Stoneware Surface Treatments at 41BP585

Surface Treatment Exterior	Surface Treatment Interior	Total
Albany	Albany	20
Albany	Bisque	6
Albany	Split	2
Bristol	Bristol	25
Bristol	Albany	3
Bristol	Split	1
Salted Brown Slip	Salt	3
Split	Salt	1
Gray Slip	Gray Slip	2
Leon-like Slip	Leon-like Slip	1
Imitation Rhenish	Imitation Rhenish	1
Alkaline	Alkaline	1
Bisque	Bisque	4
Rockingham	Rockingham	1
Split Sherdlet	Split Sherdlet	1
	Total	**72**

Decorations

Of the 72 sherds in the stoneware assemblage, only two displayed evidence of decoration. The sole decorative technique is sgraffito or incised lettering through the slip (n=2). The two fragments are from a single jug with straight sides and tooled shoulders, which came into production around 1890 (Greer 1981). The partial lettering is incised into the neck and collar through an Albany-like slip. An exact match to the lettering and handwriting was observed in an identically formed jug reading, "From / Wallace & Gregory Bros. / Sprit.Essig / Paducah, KY. / Sold by Knocke & Eiband / New Braunfels, Tex." (ibid 143). Therefore, this jug definitely dates between the years of 1887 and 1907 when the Knocke and Eiband store was operating in New Braunfels (TARO & Sophienburg Museum and Archives).

Capacity Marks

Only one capacity mark was present within the stoneware assemblage. The mark consists of an impressed "6" on the surface of an Albany-like slipped lid. This number represents a capacity mark for a vessel. It is likely that the corresponding storage vessel held a volume of six gallons.

Refined Earthenware

Ironstone

Ironstone sherds are the second most frequently occurring sherd type at site 41BP585. Among the 51 ironstone sherds, 33 are undecorated, 16 are decorated, and one is marked. Decorative techniques (**Table 3**) include decalcomania (n=1); decalcomania, molding, and gilding (n=6); decalcomania and molding (n=2); and molding (n=7). Vessel forms represented are hollowware, such as fragments of tea cups (n=14), and flatware, such as fragments of plates (n=21). The remaining 16 sherds could not be confidently assigned to either vessel category or form. Ironstone sherds from these vessel categories comprised 13 rim sherds; 10 rim, body and base sherds; 13 body sherds; 13 base sherds; and two sherdlets.

Decorations

Decorative techniques can be useful chronological indicators for ceramics. Certain types of decoration have periods of popularity that are well-established, although there is some variability from region to region. Three distinct techniques of decorations are present on the refined earthenware sherds found at site 41BP585 and include decalcomania, molding, and gilding.

Table 3. Kitchen group refined earthenware decorations at site 41BP585

	Ironstone
Decalcomania	1
Decalcomania and Molding	2
Decalcomania, Molding, and Gilding	6
Molding	7
Total	**16**

Maker's Marks

Fragmentary maker's marks are present on two ironstone sherds. Transfer print marks were the only type of marks observed, which appear on the exterior surface of base fragments. Marks range in design from the British Royal Coat of Arms (n=1) to text only (n=1). The only observed color was black (n=2). These maker's marks were too incomplete to be attributed to specific manufactures and date ranges.

Glass

Kitchen container glass (n=941) includes fragments of vessel glass (n=217), bottles (n=716), jars (n=4), and jar lid liners (n=4). Vessel forms identified consist of rim shards, body shards, base shards, and complete containers. (**Table 4**). A total of 32 glass shards exhibit evidence of burning. Multiple attributes of glass containers can be temporally sensitive and can include color, technological characteristics, decorations, and manufacturing marks.

Table 4. Shard Forms of Glass Containers at 41BP585

Category	Artifact Form	Total
Bottle	Complete	1
	Body Shard	687
	Base Shard	13
	Rim Shard	15
	Total	**716**
Jar	Rim Shard	4
	Total	**4**
Jar Lid Liner	Rim Shard	3
	Complete	1
	Total	**4**
Vessel	Rim Shard	5
	Body Shard	203
	Base Shard	9
	Total	**217**
	Grand Total	**941**

Color

Glass colors present at the site include amber, aquamarine, aqua-tint, cobalt, colorless, dark olive, green, jadeite, olive, and opaline (**Table 5**). Colorless glass also includes the subcategory solarized glass or sun-colored amethyst. A total of 31 shards of solarized glass were identified. The most temporally sensitive glass colors are solarized glass, which dates from around 1890 to 1920, and dark olive, or black glass, which was not commonly produced after 1880 (SHA 2013).

Table 5. Glass Container Colors Present at 41BP585

Category	Artifact Color	Total
Bottle	Amber	679
	Aquamarine	4
	Aqua Tint	5
	Colorless (*Solarized)*	18 *2*
	Cobalt	1
	Dark Olive	1
	Green	1
	Olive	5
	Total	**716**
Jar	Cobalt	1
	Colorless	3
	Total	**4**
Jar Lid Liner	Opaline	3
	Aquamarine	1
	Total	**4**
Vessel	Amber	1
	Aquamarine	8
	Aqua Tint	10
	Colorless (*Solarized)*	167 *29*
	Green	1
	Jadeite	1
	Total	**217**
	Grand Total	**941**

Technological Attributes

Technological attributes of historic glass containers encompass a wide variety of characteristics, and in many cases, relate closely to the manner in which the container was produced. Temporally sensitive features include bubbles, suction scars, and finishes.

Bubbles

Air bubble inclusions were observed in 129 shards of container glass, accounting for roughly 15 percent of the container glass assemblage. These inclusions are the result of irregularities in the production process, which were all but successfully eliminated by 1920 (Polack 2000).

Suction Scars

No evidence of suction scars was observable within the glass assemblage. Suction scars are characteristic marks produced by the Owens Automatic Bottle Making Machine. Bottles produced with suction scars generally post-date 1910 and predate 1947 (SHA 2013). The fragmentary nature of many bottle bases or perhaps a dearth of recovered glass from this time period may account for the lack of this diagnostic feature.

Finishes

A total of 23 rim specimens from bottles and jars retained portions of the finishes, of which only 15 are identifiable. Seven different finishes are present within the assemblage, while only two methods of production were noted. The finishes include bead (n=1), crown (n=1), patent (n=2), brandy (n=1), double ring (n=1), oil (n=2), and external thread (n=7). All of these types are present on bottles, with the exception of the external continuous threads, which are also present on jars. These finishes are not temporally sensitive, as most were used from the nineteenth to twentieth century, including the external continuous thread, which dates from the early twentieth century and remains in production today.

The three methods of finish production present at the site include applied finishes (n=1), tooled finishes (n=3), and machine-made finishes (n=11). Applied finish specimens likely date to before 1915, while tooled finishing is still employed on specialty bottles (SHA 2013). Conversely the 11 fully machine-made finishes post-date 1905 and most likely 1915 (SHA 2013).

Decorations

A total of 170 glass shards exhibited molded characteristics beyond maker's marks, which can be considered decorative elements. Decorative treatments to glass containers within the Kitchen Group include molding, embossing, and pressing. Examples of decorations consist of text (n=20), base stippling (n=122), linear patterns (n=7), and indeterminate motifs (n=21). Temporally sensitive decorations present include embossed texts, which date from 1900 to the present.

Maker's Marks

Five maker's marks were found on the bases of glass bottles and jars, of which only three marks could be attributed to a specific manufacturer (**Table 6**). These marks date from around 1925 to 1980.

Table 6. Maker's Marks on Glass Containers from 41BP585

Object Form	Marker's Mark on Base	Maker	Date	Shard Count	Object Count	Reference

Bottle	"A"	Armstrong Glass Division	1938 to 1969	1	1	Toulousse 1971
Bottle	"B" in circle	Brochway Machine Bottle Co.	Post 1925	1	1	Toulousse 1971
Bottle	"15"	Unknown		1	1	
Bottle	"7"	Unknown		1	1	
Bottle	"I" in circle	Owen's Illinois	Post 1954	1	1	Toulousse 1971

Metal Closures

A total of 109 metal specimens were identified as complete or incomplete portions of glass vessel closures. Aluminum bottle caps (n=71) comprised the majority of the collection, while unidentified, ferrous alloy lids (n=37) accounted for the remaining with the exception of a single pull tab. These closures predominately date to the twentieth century.

Metal Utensils

One piece of metal cutlery was recovered from site 41BP585 belonging to the Kitchen Group. It consists of a single, iron alloy spoon cast in one piece. Due to the lack of oxidation, the spoon is likely composed of a rather sophisticated stainless steel, which likely post-dates 1930 (Dunning 2000:43).

SUMMARY OF KITCHEN GROUP ARTIFACTS

The kitchen material suggests that the primary domestic occupation of site 41BP585 dated to the twentieth century. Diagnostic ceramic materials imply that the site could have been occupied as early as 1842 based on the presence of ironstone and some salt-glazed stoneware; however, a lack of contemporaneous and earlier wares suggest a later date as evidenced by dated maker's marks from 1887 to 1907, as well as a predominance of decorations dated to after 1890. Decorative varieties encountered on ceramic wares, such as decal ware, are consistent with occupation into the mid to late twentieth century, as are stoneware glazes which were produced until the 1940s. Glass containers at the site indicate occupation after 1900, as evidenced by diagnostic colors dated mostly after 1920, and finish types dated predominantly after 1905 and likely 1920. The majority of the maker's marks on glass containers also date from around 1925 to 1969. The Kitchen Group represents occupation from around the end of the nineteenth century into the mid twentieth century.

Personal (n=8, less than 1 percent)

Eight artifacts recovered from site 41BP585 were placed within the Personal Group. There are five specimens related to tobacco consumption and three fragments related to hygiene. Only one artifact from the Personal Group exhibited evidence of burning.

Hygiene

Two of the three hygiene items recovered from the site are from a plastic hair comb. The comb is made from an unidentified plastic. Plastics were produced as early as the nineteenth century and continue to be made today; therefore, the comb is not considered to be temporally sensitive. A single opaline cosmetics jar was also recovered, which likely dates from 1920 to 1950 (SHA 2013).

Tobacco

Items related to tobacco consumption recovered at the site are fragments of snuff jars, distinguished by their characteristic amber coloration and square shape. A total of five fragments of machine-made snuff bottles were recovered.

SUMMARY OF PERSONAL GROUP ARTIFACTS

Artifacts recovered from site 41BP585 within the Personal Group are not considered temporally sensitive, however they are not inconsistent with nineteenth and twentieth century domestic discard. In summary, the Personal group reflects domestic occupation of 41BP585 during the nineteenth and twentieth centuries.

Unknown (n=384, 9 percent)

A total of 384 artifacts recovered from site 41BP585 were unknown or too fragmentary to confidently assign them to any one of the functional groups including metal fragments (n=364), thermally altered rock (n=1), burned matrix (n=15), plastic/rubber (n=1), and slate (n=3).

SUMMARY OF UNKNOW GROUP ARTIFACTS

The 384 artifacts within the Unknown Group could not be assigned to a particular functional group due primarily to specimen incompleteness; however, their presence at site 41BP585 is consistent with the range of other historic artifacts found at the site. In addition, they do not contradict any inferences drawn from the rest of the assemblage.

Site 41BP585 Historic Artifact Assemblage Analysis Summary

All of the temporally diagnostic artifacts recovered reflect a historic occupation from the late nineteenth century into the early twentieth century. The Architecture Group indicates building activities after the turn of the twentieth century and continuing as late as the 1930s or 1940s. Artifacts from the Activities, Arms, Clothing, Household, Kitchen, and Personal groups confirm an occupation that likely began before 1900 but occurred primarily after this time. The historic artifacts recovered from the site include common and widely available materials consistent with domestic and farming activities. The artifact assemblage as a whole reflects activities consistent with the occupation of a late nineteenth century to early twentieth century working farmstead with a domestic component.

FAUNAL MATERIALS

Faunal materials recovered from NRHP testing at site 41BP585 include 153 specimens (**Appendix D**, **41BP585 Faunal Remains**). Of the recovered remains, 14 (9.2 percent) could not be identified to any taxonomic category because of their small size, fragmentary nature, and poor condition of preservation. Of the remaining 139 identifiable specimens, 62 (44.6 percent) were attributable to mammals, 72 (51.8 percent) were attributable to birds, three (2.2 percent) were attributable to reptiles, one (0.7 percent) was attributable to amphibians, and one (0.7 percent) was attributable to invertebrates (**Table 7**).

Table 7. Faunal Remains from Site 41BP585 Categorized by Minimum Number of Individuals (MNI)

Taxonomic Classification	Common Name	MNI	%		Number of Identified Specimins (NISP)	%
MAMMALIA	Mammals					
	Medium-sized unidentified mammals (20-120 kg)		0.00%		21	15.1%
	Large unidentified mammals (>120 kg)		0.00%		1	0.7%
Artiodactyla	Cloven-hooved ungulates					
Tayassuidae	Swine and relatives					
Sus scrofa	Swine	2	22.22%		36	25.9%
Lagomorpha	Lagomorphs					
Leporidae	Rabbits and hares					
Sylvilagus sp.	Cottontail rabbit	1	11.11%		1	0.7%
Carnivora	Carnivores					0.0%
Canidae	Dogs and relatives					
Canis sp.	Large dog, coyote, or wolf	1	11.11%		1	0.7%
Felidae	Cats					
Felis domesticus	Domestic cat	1	11.11%		2	1.4%
AVES	Birds					
	Large unidentified birds		0.00%		5	3.6%
Galliformes	Turkeys, chickens, Pheasants and relatives					
Gallus gallus	Chicken	1	11.11%		67	48.2%
REPTILIA	Reptiles					
Testudinata	Turtles and tortoises					0.0%
Emydidae	Pond turtle	1	11.11%		3	2.2%
AMPHIBIA	Amphibians					
Salientia	Frogs and toads					
Ranidae	Bullfrogs and leopard frogs					
Rana sp.	Bullfrog	1	11.11%		1	0.7%
INVERTEBRATA	Invertebrates					
Bivalvia	Bilvalved invertebrates					
Mactridae	Marine clams					
Rangia cuneata	Common rangia	1	11.11%		1	0.7%
	TOTAL MNI	9	100%	TOTAL NISP	139	100%

Of the 62 mammalian remains, one specimen was categorized as belonging to a large-sized mammal, generally greater than 120 kg in live weight. In this size range, the most likely candidate would be cattle, horse, or a large example of swine.

Fifty-eight of the mammalian remains were attributable to medium-sized mammals (20–120 kg in live weight), numerically accounting for 93.6 percent of the mammalian total count. These medium-sized mammals include 36 specimens identified as swine (*Sus scrofa*) and one specimen identified as a large dog, coyote, or wolf (*Canis* sp.). The remaining 21 medium-sized mammal bones could not be further identified taxonomically. Swine is often the most common medium-sized mammal species in historic assemblages in this region, so it is likely that most of the 21 remaining medium-sized mammal bones are also swine remains. Other possible candidates in this size range include sheep, goats, immature cattle or horse, deer, pronghorn antelope, coyote, wolf, red wolf, or larger examples of dog or beaver.

Three specimens were categorized as a small-sized mammal, generally weighing between 0.5 and 20 kg in live weight. Two were identified as belonging to the common domestic cat (*Felis domesticus*) and one specimen was attributed to a cottontail rabbit (*Sylvilagus* sp.)

Of the 72 specimens that were attributable to birds, 67 were egg shell fragments. Based on shell thickness and size, all were consistent with eggs of chicken (*Gallus gallus*). The only other bird remains were five longbone diaphyseal fragments from a large bird, consistent in size with a chicken or similar-sized bird.

Three reptile remains were recovered, representing the only other faunal remains recovered from site 41BP585. All three were attributed to an unidentified pond turtle (Family Emydidae). The single amphibian bone was from a bullfrog or large leopard frog (*Rana* sp.)

The only other faunal specimen was a bivalve shell half from the common rangia (*Rangia cuneata*), a brackish water clam. Rangia is not native to the site area. Its closest natural occurrence is along the Texas Gulf coast, more than 150 km away.

Cultural Modification

The only evidence of cultural modification present in the faunal assemblage was burning, which was present on only one unidentified specimen, and sawing, which was present on two unidentified medium-sized mammal bones. The burned specimen was burned completely to a light gray, suggesting intentional discard in a fire rather than fortuitous blackening of exposed bone surfaces during cooking for consumption. This method of disposal was probably intended to inhibit flies and insects as well as larger scavenger species. The low incidence of burning of the faunal remains in Feature 1 indicates that the discarded remains were not consistently burned.

The two sawn specimens exhibited cut surfaces consistent with a power saw rather than a hand saw, indicating that they were discarded late in the historic period, almost certainly post-1920. No other evidence of cultural modification was observed in this assemblage.

Ageing

The only specimens for which ageing could be interpreted were two specimens attributable to swine: a single third upper molar (lot 32) and a mandibular fragment (lot 139). The condition of the teeth suggests at least two individuals, a juvenile about 9 to 12 months old and a young adult about 18 to 20 months old.

SITE 41BP585 ARCHIVAL RESEARCH

Site 41BP585 is located within the original 4,428-acre Joseph Black Bastrop First-class headright. First-class headrights were issued to individuals who arrived in Texas before March 2, 1836 and entitled heads of families to receive one league (4,428 acres) and one labor (177.1 acres), while single men received 1/3 league (1,476.1 acres) (Texas GLO n.d.). In an applicant list for Texas General Land Office First-Class certificates dated March 1838, Joseph Black is listed as having immigrated to Texas in 1823, which qualified him to receive a first-class headright. (Texas GLO n.d.). Black patented his league (4,428 acres) along Sandy Creek in Bastrop County on May 12, 1846. The associated abstract states that the survey contains 10 labors of improved land and 15 labors of pasture land (Texas GLO Records, Bastrop County Abstract 86). Prior to applying for a patent, Black more than likely had to fulfill conditions of the patent such as residing on the land for a certain amount of time and making improvements to the land. As part of his headright, Joseph Black also received one labor, which is located in Bastrop County.

Joseph Black's ownership of the 4,428-acre tract ended with his death in 1848, at which time a portion of the tract was sold to settle debts and the remainder was partitioned into five equal parts between his widow Elizabeth Black, daughter Tabitha and husband David Reynolds, daughter Christina and husband John Terry, daughter Malinda Black, and minor Polly Black (Bastrop County Deed Records H:489). Just a few days after the partition deed was filed, each of the heirs conveyed a share of the property they received to Elizabeth Black for a total of 1,475 acres, comprising the southeast third of the original Joseph Black League (Bastrop County Deed Records F:218). The subject tract is located within 591.5 acres that Malinda Black received during the partition of Joseph Black's land; it is unclear if she conveyed all or only a portion of her land to Elizabeth Black (Bastrop County Deed Records P:35). Elizabeth appears to have remarried by 1850, as she is recorded as Mrs. E. Smitz [sic] in the 1850 Bastrop County tax rolls and owning 1,350 acres in the Joseph Black League at a value of $300. She also paid taxes on a town lot whose name was illegible in the tax roll (1850 Bastrop County Tax Roll). Elizabeth (age 42) and her new husband Antonio Schmidt [sic], a carpenter (age 50), are enumerated in the 1850 Bastrop County census, along with C. Hart (age 18), J. Freestone (age 42), and K. Freestone (age 9) who were residing with the Schmidts in their home.

In 1853 Elizabeth and Antonio Schmitz [sic] conveyed 687 acres within the Black League to Sterling Edwards for $500. The deed states that both parties were residents of Bastrop County at the time of the transaction (Bastrop County Deed Records I:137). The Schmitz's also retained the remainder of their land within the Black league, as well as their town lot (1853 Bastrop County Tax Roll). The same day he purchased the land from the Schmitz's, Edwards sold 200 acres containing the subject parcel to James Dewes of Bastrop County for $150 (Bastrop County Deed Records I:138). Dewes retained the property for about a year, after which he sold the 200 acres to James Davis for $175 in 1854 (Bastrop County Deed Records I:373).

James Davis also did not retain the property long, as he conveyed the 200-acre parcel a month later for $300 to John Chenny [sic], who is listed in the 1854 deed record as a resident of Bastrop County (Bastrop County Deed Records I:373). Chenny [sic] retained the property for 12 years until he transferred ownership to J. S. Baker in 1869 for $600, at which time Chenny [sic] is listed in the deed record as a resident of Liberty County (Bastrop County Deed Record O:341). A review of the 1854 Bastrop County Tax Roll did not

reveal a John Chenny; however, a John Cherry [sic] is enumerated as owning 200 acres within the Joseph Black League worth $200 (1854 Bastrop County Tax Roll). Cherry remained a resident of Bastrop County until 1856, after which time he was listed as a resident of Liberty County (1856 and 1857 Bastrop County Tax Rolls). Cherry appears to have been a prosperous farmer while he we was a resident of Bastrop County. According to the Bastrop County Tax Rolls, Cherry owned up to nine slaves, many horses, a large herd of cattle, and many hogs while he resided in Bastrop County on the Joseph Black League. Cherry (age 55), is enumerated in the 1860 Liberty County Census with his wife Frances (age 27) and seven children. He is listed as a farmer living within the Tarkington Prairie community and owned $2,000 of real estate and $5,000 of personal estate (1860 Liberty County Census Records). According to an Official Texas Historic Marker (THC 2013) in Ryan Cemetery, Liberty County, John Cherry arrived in Texas in 1818, served in the Texas War for Independence and served as an Indian interpreter for General Sam Houston (OTHM). He patented 2 land grants in Liberty County, including a League in 1835 and a Labor in 1861 (Texas GLO, Liberty County Abstract Nos. 11 and 160). It is unknown why he spent time in Bastrop County, but he appears to have remained in Liberty County subsequent to 1860.

Historians did not locate a record of J. S. Baker conveying the property to a subsequent owner; however, in October of 1869, DeWitt Clinton Baker of Travis County sold 191.5 acres of the 200 acre tract (formerly owned by Cherry) for $381 to Peter Kellermeier, Sr. of Bastrop County (Bastrop County Deed Records P:35). DeWitt Clinton Baker was a wealthy Austin businessman and land agent, and it is unknown if he and J. S. Baker were related. Peter Kellermeier, Sr. was a native of Bavaria, Germany and may have immigrated to the U.S. as early as 1841 (Rootsweb 2013). Kellermeier first appears in the Bastrop County tax roll in 1849 and paid taxes on 50 acres within the Joseph Black League (1849 Bastrop County Tax Rolls). It is likely that the 50 acres were a portion of Black's land that was sold to settle debts after his death in 1848. Kellermeier was also married in 1849, and the 50 acres may have served as his homestead (Rootsweb 2013). He thus likely resided in the immediate vicinity for many years prior to his larger land purchase within the Black league. A year after Baker sold him the 191.5 acres, he is enumerated as Peter Kellermeyer [sic] in the 1870 Bastrop County Census as a 45-year-old farmer living with his wife Barbella (age 41) and their eight children, including sons Peter, Jr. (age 15), John (age 11), and William (age 6) (Bastrop County Census Records 1870). Kellermeier retained the 50 acres, as he is listed in the 1870 Bastrop County Tax Roll as owning 240 acres within the Black league at a value of $480. Five years later, the same property is valued at $800, which could indicate improvements to the property. In 1882, Peter Kellermeier, Sr. donated 1 acre from his homestead tract for a Catholic church and school, which adjoined a 1 acre cemetery tract previously donated by Kellermeier for use by several of the German Catholic families in the vicinity such as the Goerlitzs. The church was demolished, but the cemetery remains and is now known as the Three Oaks-Goerlitz Cemetery (Turpin 2003; Bastrop County Deed Records 3:517).

The value of Kellermeier's land remained similar until 1900, when he is listed as owning 245 acres in the Joseph Black survey at $1,000 (1900 Bastrop County Tax Rolls). Again, this increase in value could indicate improvements to the property. Peter Kellermeier, Sr. retained the property, which includes the subject tract until his death in 1908, at which time there was a lawsuit between the Kellermeier heirs and members of the Herring family, who have an unknown affiliation with the Kellermeiers. The lawsuit describes the disputed land as about equal portions of mixed pasture and farming lands; however, no improvements are noted. Instead of partitioning the land, the lawsuit resulted in its sale at public auction,

and the land was purchased by Peter's son, W. F. Kellermeier, for $2,200 (Bastrop County District Court Records Docket No. 4483). At the time of sale, the property was resurveyed, and the land that Peter Kellermeier, Sr. purchased from Baker in 1869 was found to consist of 236 acres and not 191.5 acres as recorded in the original field notes (Bastrop County Deed Records 43:487).

W. F. Kellermeier owned the property until his death in 1963 at the age of 81 (Bastrop County Probate Minutes 10:80). Kellermeier appears to have been a lifelong resident of Bastrop County and likely resided somewhere on the subject tract. According to Turpin (2003), family friend Erhard Goerlitz recalled that the former house that has been attributed to Peter Kellermeier, Sr. was dismantled in the 1930s. His estate was divided amongst his heirs, and in 1966 the 236 acres within the Joseph Black survey was conveyed to Leslie D. and Gloria Hurta for $27,025 (Bastrop County Deed Records 175:359). The property has had several subsequent land owners and does not appear to have been used for residential purposes in subsequent years.

Site 41BP585 Archival Research Summary

Archival evidence indicates that the land within the subject parcel was associated with members of the Black and Schmitz families from at least the 1840s to 1853. Joseph Black and his family, including wife Elizabeth, likely resided on some part of the 4,428-acre property for several years prior to Black's patent in 1846 to Black's death in 1848. It is likely that the portion of land that Elizabeth received at Black's death (which does not contain the subject parcel) contained the Black's homestead, which she retained after she remarried Antonio Schmitz. Thus if the structure at 41BP585 was extant during the mid 1800s it likely was not the Black's homestead, though it could have been associated with one of their children or tenants. Additionally, it is also possible that the Schmitz's may have lived on their town lot. The brief period of the property's ownership under Sterling Edwards, James Dewes, and James Davis during 1853 and 1854 suggests that none of the men resided on the property.

The next long-term owner of the property that contained the subject tract was John Chenny/Cherry, who owned the property from 1854 to 1869. Archival research revealed that during Cherry's residency of Bastrop County until 1856, he was a prosperous farmer and owned nine slaves and a large amount of livestock. Cherry does not appear to have owned additional property while he was a resident of the county, which suggests that he lived on the 200-acre property. Thus if the structure was extant while Cherry lived on the property, it could have been associated with him, his slaves, or tenants. Cherry became a resident of Liberty County in 1857 and lived there throughout the remainder of his ownership of the property; thus, the structure could have been associated with any tenants until he conveyed 191.5 acres to Peter Kellermeier, Sr. in 1869. Kellermeier had lived with his wife and family on 50 acres of the Joseph Black League for 20 years prior to his purchase of the Cherry property, and this property likely served as his homestead. His total property within the Black League was valued at $480 in 1875 and increased to $800 in 1880, which suggests improvements were made to the property. These improvements could have consisted of construction of the structure at 41BP585 or additions to it. If Peter Kellermeier, Sr. was residing at a house on his homestead, the structure could be attributed to one of his children or a tenant. William F. Kellermeier's ownership of the property in 1908 after Peter's death and subsequent lawsuit may indicate that he or a tenant resided in the structure. According to a 2000 telephone interview with Erhard Goerlitz,

who was a family friend of the Kellermeier's, the structure at 41BP595 was associated with the Kellermeier's and Mr. Goerlitz remembers it being dismantled in the early 1930s (Turpin 2003).

DISCUSSION AND RECOMMENDATIONS

Site 41BP585 appears to represent a farmstead occupation beginning during the late nineteenth century and continuing into the early twentieth century. Shovel testing and surface inspection revealed shallow eroded soil over most of the site. The deepest soils on site were limited in extent to the area immediately to the south of the former location of the structure. The artifacts recovered during testing represent a mixed assemblage that is thought to date from the late nineteenth century to the mid-twentieth century. It remains uncertain when the former structure on the site was originally built. The property value increase recorded in 1880 suggests the structure may have been built by this time. Artifacts recovered belonging to the architecture group indicate building activities continued after the turn of the century. According to an informant report, however, the structure appears to have been dismantled in the 1930s.

Site 41BP585 is not associated with events or individuals significant to history, and the site therefore does not appear to meet National Register eligibility criteria A or B. The absence of standing architecture on the site precludes eligibility under criterion C. The eroded nature of the soils on site and the mixed nature of the archeological deposits suggest further that the site does not harbor preserved cultural deposits significant to history that could qualify the site for listing under Criterion D. For these reasons, site 41BP585 does not appear to be eligible for NRHP listing. Consequently, no further investigation and granting cultural resources clearance are recommended.

SITE 41BP594

SETTING

Site 41BP594 is an historic site with an extant structure located on a shoulder slope at an approximate elevation of 520 ft msl (**Figure 6**). An unnamed intermittent drainage is located about 300 m to the north east of the site. A small depression is located to the east of the standing structure. The soil on site is Demona fine sandy loam 1 to 5 percent slopes (Baker 1979). Demona soils are slightly acid in the A horizon and strongly acid in the B horizon. Site 41BP594 was initially recorded during previous survey within the Three Oaks Mine and the standing structure was determined, at that time, to be eligible for NRHP listing (Penick 2001, Martin 2001, Turpin 2003).

PREVIOUS INVESTIGATIONS

Eight shovel tests were excavated encircling the standing structure when it was first recorded, of which three were culturally positive and yielded glass, rusted metal, and ceramic sherds (Turpin 2003). "Surface debris included crockery, glass, square nails, metal scraps, dimensional and split lumber, brick, wire, linoleum scraps, hinges, roofing metal, and a leather shoe sole that retained one square nail (Turpin 2003:188)."

SITE 41BP594 ARCHIVAL RESEARCH

Site 41BP594 has a similar history to Site 41BP585 in that it was part of the Joseph Black estate during the first half of the nineteenth century. Upon his death in 1848, Joseph Black's daughter Tabitha and husband David Reynolds were assigned 594 acres within the southwest corner of Black's League where the subject tract and site 41BP594 are located (Bastrop County Deed Records H:489). David Reynolds (32), a carpenter, and Tabitha (28) are enumerated in the 1850 Bastrop County Census along with their children (1850 Bastrop County Census Records). The Bastrop County Tax Rolls from the same year valued the Reynolds' property within the Joseph Black League as worth $150 and shows that Reynolds also owned and paid taxes on 250 acres within the nearby Albert Black Survey (1850 Bastrop County Tax Rolls). In 1853, the Reynolds conveyed all of their interest in the 594 acres within the Joseph Black survey to William E. Pinckey [sic] for $175 (Bastrop County Deed Records I:149). Pinckey is listed as a resident of Bastrop County within the deed record and he paid taxes on the sole property as a resident of the county until his 1862 conveyance of the entire 594 acres to A. C. Cooper (Bastrop County Tax Rolls 1854, 1855 and 1862; Bastrop County Deed Record M:438). During Pickney's ownership of the property, its value as listed in the Bastrop County Tax Rolls, increased from $250 in 1855 to $900 in 1862. This significant increase may suggest improvements to the property; however, it was sold to Cooper for only $500.

A. C. Cooper resided in Travis County in 1860, but had relocated to Bastrop County by 1862 when he purchased the property (1860 Bastrop County Census Records). Cooper only owned land within the Black League for the next 5 years which suggests that he resided somewhere on the property; however, by 1870 he owned just 300 acres within the Black League (1870 Bastrop County Tax Rolls). In 1872, Cooper conveyed a 134.5-acre tract containing the subject parcel to "freedman" Jeff Tinnen for $200 (Bastrop County Deed Record S:535). That same day, A. C. Cooper conveyed the remainder of the 300 acres to the

south to "freedman" Wright Parmer" for $200 (Bastrop County Deed Record R:410). Jeff Tinnen is listed in the 1870 Bastrop County Tax Roll as owning 160 acres in the John Hearn League at $320; however, he appears to have sold the property prior to purchasing the 134.5 acres in the Black League for $200. The value of Tinnen's land fluctuated while it was in his possession: rising to $546 in 1873, $408 in 1875, $800 in 1877, $314 in 1878 and $408 in 1881 (Bastrop County Tax Rolls 1873, 1875, 1877, 1878 and 1881). This change in value suggests improvements to the land such as structures or perhaps agricultural improvements. In the 1880 Bastrop County Census Jeff Tinnon (47) [sic] is recorded as a laborer residing with his wife Amanda (27), son Bob (18), son Charley (16) and daughter Mary (7) (1880 Bastrop County Census). His neighbors include two Goerlitz families, Peter Kellermeier and three Parmer families (all African American) including fellow "freedman" Wright Parmer.

Jeff Tinnen owned the property until 1884 at which time he moved to Milam County and conveyed the 134.5 acres to John Kellermeier (Peter Kellermeier's son) for $435.30 (Bastrop County Deed Record 6:153). When Kellermeier bought the property he was 25 years old and had purchased 200 additional acres in the Joseph Black League in an adjacent tract, 3 years earlier (1884 Bastrop County Tax Records). The total of 334.5 acres was valued at $668 in the 1885 Bastrop County Tax Roll (1885 Bastrop County Tax Records). As Kellermeier did not own any additional land, he likely resided somewhere on his property in the Black League. In 1890 Kellermeier's land within the Black League had increased to $768, though he had sold 17 acres of his property. This could indicate improvements to the property such as construction or additions to structures. By 1895 John Kellermeier increased his land holdings to include 99.5 acres in the R. H. Grimes League, 83 acres in the A. Martinez League and 3 lots in the town of Elgin. He also owned a small amount of livestock including horses, cows and hogs (1895 Bastrop County Tax Roll). In 1900 John Kellermeier is enumerated in the Bastrop County Census as a 40 year old farmer living with his wife Annie (24) and three small children. His neighbors include the Parmers, Goerlitzs and P. T. Kellermeier, which indicates that he and his family were residing on his property on the Black League (1900 Bastrop County Census Records).

John Kellermeier's land holdings remained stable until 1907 at which time he owned 288 acres in the Black League which was valued at $1200; just two years earlier the same land was valued at $725 (Bastrop County Tax Rolls 1905 and 1907). Additionally, the property was valued at $1600 in 1910 (1910 Bastrop County Tax Rolls). The increase in land value could indicate improvements to the property, including additions to structures. Kellermeier appears to have moved to Runnels County in 1910 as he is enumerated in the 1910 Census as a farmer and a resident of Runnels County, along with his family (1910 Runnels County Census). He likely continued to reside in Runnels County as he is listed as a Runnels County resident in 1927 when he conveyed 160 acres of the Joseph Black League (including the 134.5 acres that contains the subject tract) to Arthur and Ida Behrend of Bastrop County (Bastrop County Deed Records 83:568). Subsequent to 1910, the structure could have been associated with members of John Kellermeier's extended family or tenants. The property was owned by members of the Behrend family throughout the remainder of the twentieth century.

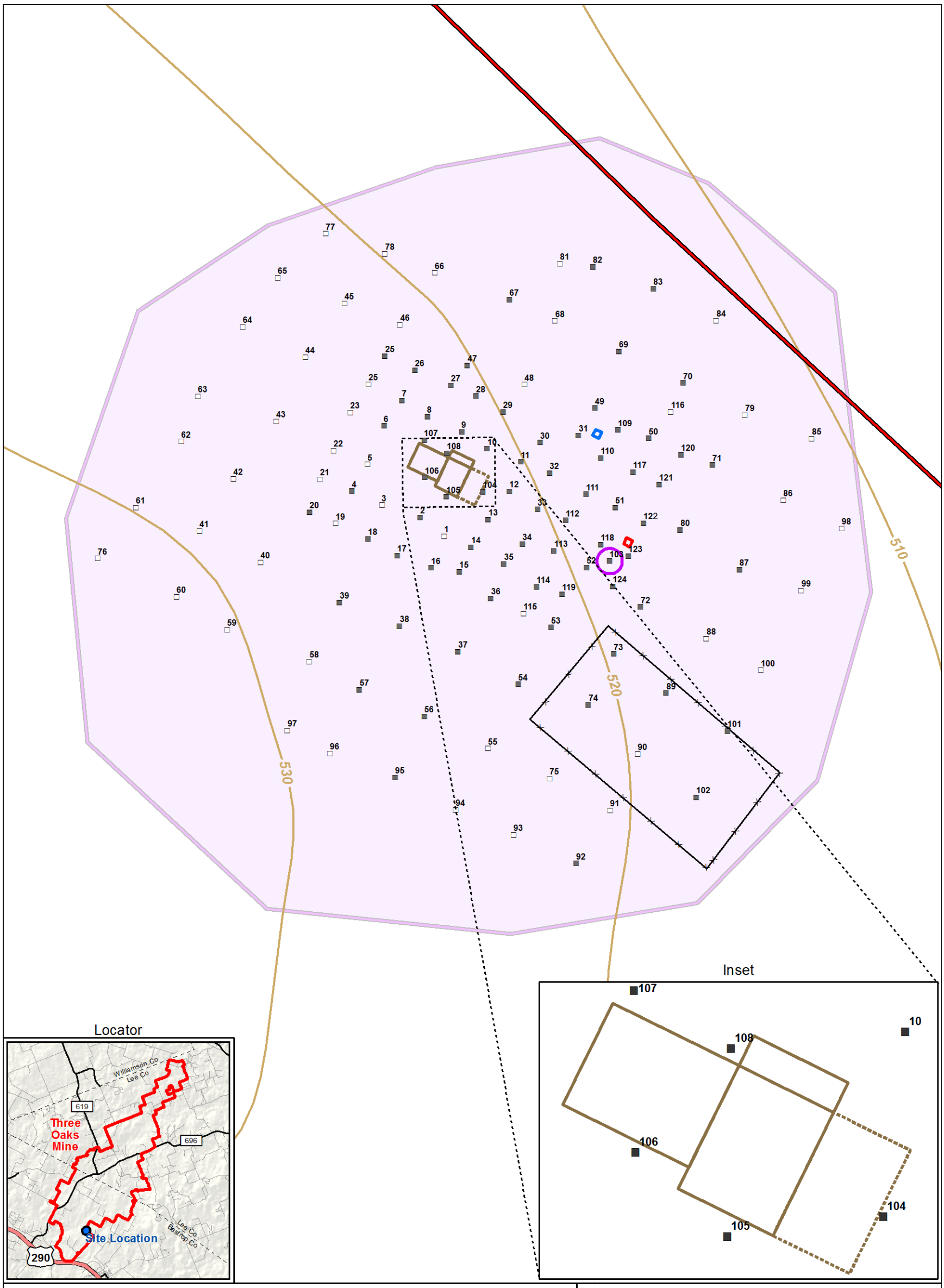

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Figure 6
41BP594 Site Plan

Luminant Three Oaks Mine
Bastrop and Lee Counties, Texas

Prepared By:	1 inch = 50 feet
Job No.:	Date: 9/19/2014

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Site 41BP594 Archival Research Summary

Archival evidence indicates that the land within the subject parcel was associated with members of the Black and Reynolds families from at least the 1840's to 1853. Joseph Black and his family including wife Elizabeth likely resided on some part of the 4,128-acre property for several years prior to Black's patent in 1846 until Blacks' death in 1848. However, it appears that the couple's homestead was located on a different parcel of the Black League and thus, if the log house was extant during their ownership it could have been associated with one of the Black children or tenants. The Reynolds short-lived ownership of the property coupled with the fact that they retained their property in the Albert Black League suggests they may never have resided on the land and if the house were extant it may have been associated with tenants of the Reynolds.

William E. Pinckey owned the 594-acre parcel of land for the next 9 years during which time the assessed property value increased from $250 in 1855 to $900 in 1862. This significant increase suggests improvements were made somewhere on the property which could include structures or agricultural improvements; though, it was conveyed in 1862 to A. C. Cooper for only $500 which could indicate that some of the improvements were temporary. However, it is still possible that the log house was constructed while Pinckney owned the property. Cooper appeared to sell almost half of the 594 acres by the 1860's and by 1870 he owned just 300 acres though it was assessed at $780 in the tax rolls. "Freedman" Jeff Tinnen purchased 134.5 acres from Cooper in 1872 for $200. On that same day, Cooper also conveyed the remainder of the 300 acres to "Freedman" Parmer Wright for $200. Being that Tinnen's land was sold at the same price as an adjacent tract that was larger by 30 acres suggests that Tinnen's land contained improvements at the time of purchase and thus A. C. Cooper may be associated with the construction of the log house at 41BP594.

Tinnen resided on the property for 12 years, during which time the value of his property fluctuated from one year to the next which could indicate structural or agricultural improvements to the land. John Kellermeier purchased the 134.5 acres from Jeff Tinnen and wife Amanda in 1884 for $435.30. Kellermeier's land holdings remained stable until 1907 at which time he owned 288 acres in the Black League which was valued at $1200; just two years earlier the same land was valued at $725. Additionally, the property was valued at $1600 in 1910. The increase in land value could indicate improvements to the property, including additions to structures. The additions and alterations to the dwelling at 41BP594 appear to be contemporaneous with John Kellermeier's ownership; it is likely that he, a family member or perhaps a tenant is responsible for them.

STANDING ARCHITECTURE AT 41BP594

Site 41BP594 contains an extant single-pen, hand-hewn, log house core with several phases of milled, wood framed alterations and additions that have resulted in a one-story, modified L-plan dwelling (**Figure 7** a, b, and c). The initial construction phase of 41BP594 appears to have been the single-pen log house core (**Figure 8** A) and attached porch (**Figure 8** B), which feature elements that suggest a construction date-range from the mid nineteenth to the late nineteenth century. Subsequent additions and alterations to the dwelling, including an ell addition extending past the attached porch (**Figure 8** C) on the west side of the log core, a second smaller addition on the north side of the log core (Figure 8D), and a porch with a shed

roof (**Figure 8** E) on the east side of the log core, appear to have been built during the late nineteenth century to early twentieth century.

The log house core was constructed as a one-story, side-gabled, single-pen dwelling measuring approximately 4.5 m x 4.5 m. It is situated about 20 cm above the ground surface, resting upon fieldstone piers. Two large oak sills are situated on the eave sides of the structure and are hewed on all four sides (**Figure 7** e). Three hand-hewn oak joists are lap-jointed to the sills and support milled floorboards which are likely historic-age replacements. The walls of the dwelling are comprised of rough-hewn oak logs and feature half-notched corners possibly secured with wood pegs (**Figure 7** f). The log core appears to have been originally constructed with one door and one window on the west façade and a chimney under the north eave. Apertures for all three elements were cut into the structure after the walls were built. The chimney and fireplace are no longer extant, though remnants of the chimney base, in the form of red-orange handmade bricks and lime mortar, are evident through a hole in the floor adjacent to the boarded-over chimney gap (**Figure 7** g). The chimney appears to have been replaced by a wood-burning stove as evidenced by a flue cut into the roof and a metal stove pipe on the roof (**Figure 7** h). Yellow hand-made bricks under the floorboards appear to have supported the wood-burning stove. Terry Jordan (1978) noted that the majority of log houses built after the Civil War did not include chimneys, and the chimneys in many of those built prior to the war were later replaced with a stove.

The log dwelling appears to have featured a contemporaneous porch, evidenced by two hand-hewn oak joists situated on round log piers on the west side (**Figure 7** i). The porch was removed, as an ell addition to this façade was built in its place at a later date. The exterior of the log core dwelling is clad in milled, vertical board and batten siding and affixed with cut nails which indicate that the siding was likely added no later than 1890. This same board and batten siding also serves as cladding and structural support to the walls of the shed roof addition on the north façade. This room is approximately half the width of the log core and was accessed through a door on the west façade. This addition was built subsequent to the removal of the chimney and perhaps at or around the same time the log house was clad in board and batten. The roof of the addition and the log core are supported by milled rafters and clad in corrugated metal strips. The milled rafters indicate that this is likely a replacement roof for the log dwelling and may not be original to the addition. Remnants of a shed roof porch, that was likely added subsequent to the ell addition, lie along the east façade of the log house.

The ell addition on the west façade is side-gabled and approximately 6 m x 4 m. It is framed in wide, vertical milled boards and is situated on the hewn sills of the original porch as well as milled sills, all of which rest on wood piers. The north façade of the ell and the majority of the tongue and groove flooring are no longer intact. It is clad in horizontal beveled weather board on the exterior and thin horizontal tongue and groove boarding on the interior. A combination of cut and wire nails were used throughout the room, potentially indicating at least two phases of alterations. Two tall window and/or door apertures punctuate the south façade and an additional window opening has been closed by weatherboard. A line of square wood foundation piers lies north of the ell addition and may indicate the location of a porch.

a) View of north elevation, camera facing south.

b) View of northwest oblique, camera facing southwest.

c) View of south elevation, camera facing north.

d) View of elevation, camera facing east.

f) Corner notching detail of log house core.

g) Detail of handmade bricks likely supporting former wood burning stove.

h) Log house interior. Note closed chimney gap and hole in ceiling for wood burning stove.

i) Detail of hand hewn sill of former porch, now supporting floor of addition.

e) Detail of stone piers and hand hewn sill and floor joist.

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Figure 7

Site 41BP594
Dwelling Photos

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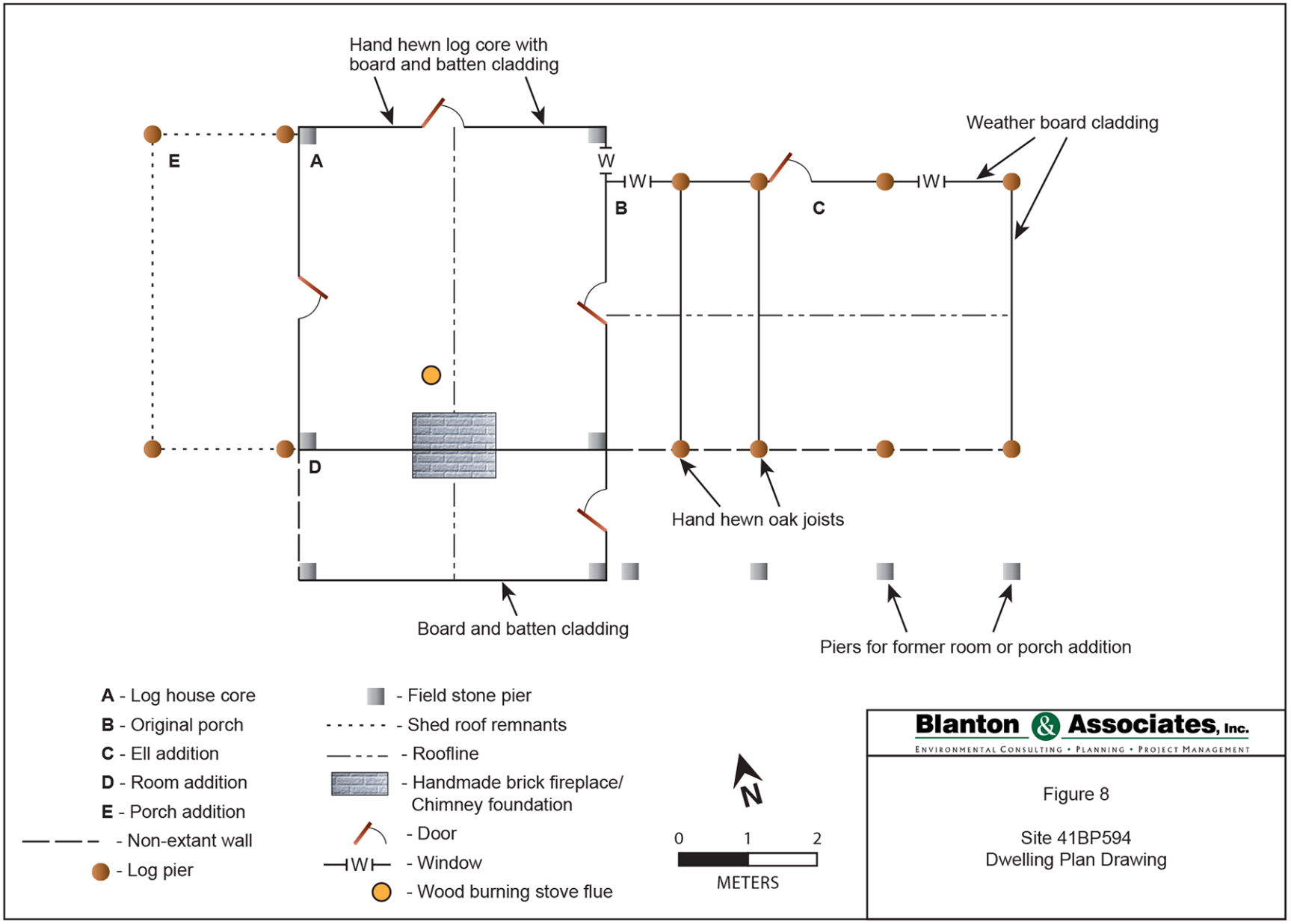
Hand hewn log core with board and batten cladding
Weather board cladding
E
A
W
W
B
W
C
D
Hand hewn oak joists
Board and batten cladding
Piers for former room or porch addition
A - Log house core
B - Original porch
C - Ell addition
D - Room addition
E - Porch addition
- Non-extant wall
- Log pier
- Field stone pier
- Shed roof remnants
- Roofline
- Handmade brick fireplace/ Chimney foundation
- Door
W - Window
- Wood burning stove flue
N
0 1 2
METERS
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Figure 8
Site 41BP594
Dwelling Plan Drawing

Site 41BP594 includes an extant mid- to late-nineteenth century single pen log house core (with later alterations and additions) and features some distinctive design characteristics of log house construction such as hand hewn logs, corner notching and stone piers. However, the original pen features several historic-age alterations including removal of the chimney, addition of two doors, and two attached room additions along with the addition of a shed-roof porch. The dwelling lacks sufficient individual architectural merit and physical integrity to meet the NRHP requirements under Criterion C.

As noted above, Turpin (2003) recommended that the structure be dismantled so that building techniques of regional log structure construction can be observed. Currently, 41BP594 is one of only a few extant dwellings in the area with a log house core and subsequent historic alterations. The board and batten cladding is missing at two of the corners of the log structure, exposing the half-notch corner notching. This type of notching does not create a secure lock and often includes pegging to create a corner lock. Observation of dismantling the structure will reveal the type of pegging used. Additionally, the type of chinking used in the construction of the log dwelling is also of interest as it has eroded at the exposed The altered dwelling also displays several instances of ornamentation. The interiors of the log house and the addition are clad in vertical siding both affixed with wire nails and remnants of paint indicate that it was once painted white. Red base boards also lined both rooms. The ceiling of the log dwelling, which appears to have been added at a later date, is chamfered and was once covered in some kind of paper. The ceiling of the ell addition was painted a light blue. The north addition of the log dwelling features a commercially made scalloped fascia, a detail usually seen on Victorian and folk-Victorian dwellings.

INTEGRITY AND NRHP ELIGIBILITY ASSESSMENT

In the final survey report for the Three Oaks Mine, Turpin (2003:191) recommended that the building at 41BP594 be considered eligible for NRHP listing, and stated further that dismantling of the log core could "uncover building techniques of interest to regional rural architecture." This recommendation is in accordance with the THC's determination that the log structure at site 41BP594 may be eligible for NRHP listing under Criterion D, for its potential to yield information concerning log building techniques in Central Texas (Martin 2001). Later that same year, the THC further determined that the structure at 41BP594 was eligible for listing in the NRHP as a contributing member of a rural historic district that included three additional standing structures (at sites 41BP202, 41BP275, and 41BP557) located in the vicinity (Pennick 2001). In 2008 Atkins evaluated these three additional structures (along with 41BP621) and recommended they be considered not eligible for NRHP inclusion under Criterion C (Foster 2008); the THC subsequently concurred with this recommendation (Smith 2008).

The extant structure at 41BP594 retains integrity of materials, workmanship, feeling, setting, and location. Integrity of design has been compromised due to the absence of the north wall of the ell addition, the partial collapse of the north shed room addition, and the collapse of the east shed roof porch addition.

The structure at 41BP594 may have been constructed as early as the 1850s-1860s with alterations and additions likely made until the late nineteenth and early twentieth centuries. Current archival research revealed that the land upon which the structure is situated was purchased and owned by freedman Jeff Tinnon from 1872 to 1884. Additionally, Tinnon lived adjacent to freedman Wright Parmer who purchased the property on the same day as Tinnon. Both families appear to have been the only black or mulatto families

in the area and the majority of their neighbors have German surnames. Tinnon appears to have farmed and owned a small amount of livestock and does not appear to have relied on whites for work as many of his counterparts did. Certainly African American land ownership in a non Freedmen's community during Reconstruction was very uncommon in Bastrop County. However, the current research effort, including property (deed, probate and other vital records) research, *ad valorem* tax record research, population census research and county history research did not reveal any conclusive evidence that Tinnon built, lived in, or made alterations to the dwelling at 41BP594. The standing structure at 41BP594, therefore, does not appear to meet the requirements for NRHP inclusion under Criterion A.

Although it appears that "freedman" Jeff Tinnon's ownership of a large parcel of land that was not located within a Freedmens' community was rare in Bastrop County, current research did not uncover evidence that conclusively demonstrates Tinnon himself is individually significant or that he built or occupied the structure at 41BP594. Therefore, the standing structure at 41BP594 does not appear to meet the criteria for NRHP inclusion under Criterion B.

B&A also recommends producing elevation drawings of the building to record the original log structure and its subsequent alterations which are part of the structure's historic fabric and representative of the evolution of a rural dwelling over many years.

SHOVEL TESTING

A total of 124 shovel tests were excavated on site 41BP594. Of these shovel tests, 56 were excavated at 5 m grid intercepts in the immediate vicinity of the standing structure, an area extending roughly 45 m east/west by 25 m north/south. The remaining shovel tests were excavated at 10 m grid intercepts surrounding this area (see **Figure 6**).

Of the 56 shovel tests excavated in the immediate vicinity of the standing structure at 5 m grid intercepts, 48 were culturally positive, yielding 200 glass shards, 175 metal artifacts, 22 ceramic artifacts, 11 faunal bone fragments, 11 mortar fragments, 3 slate fragments, 3 charcoal fragments, and 2 rubber fragments. Three pieces of non-diagnostic lithic debitage were also recovered. Of the 68 shovel tests excavated at 10 m grid intercepts surrounding the above area, 28 were culturally positive and yielded 42 glass shards, 139 metal artifacts, 4 ceramic sherds, 15 mortar fragments, 1 slate fragment, and 2 charcoal fragments. One piece of non-diagnostic lithic debitage was also recovered.

Most artifact categories were recovered in greater frequencies from the immediate vicinity of the standing structure, where shovel tests were excavated at 5 m grid intercepts. Metal artifacts, however, were slightly more frequent in the area surrounding the immediate vicinity of the standing structure, where shovel tests were excavated at 10 m grid intercepts. Most of the metal artifacts recovered from the former area came from just two shovel tests. Metal artifacts were more evenly distributed in the latter area, though most were recovered from the east half of the site.

Units

Two 1 x 1 m units were excavated at 41BP594 in an attempt to recover temporally diagnostic artifacts to determine the occupation date range of the site. Units were located in areas of high artifact density determined through shovel testing.

Unit 1
Unit 1 was excavated immediately north of shovel test 123, near the depression east of the structure. The unit was excavated to 60 cm below ground surface and terminated at clay subsoil. Artifacts recovered from Unit 1 include 1 handmade brick fragment, 1 piece of cement mortar, 4 historic ceramics, 3 charcoal fragments, 1 unidentifiable faunal bone fragment, 50 glass shards, and 68 ferrous metal artifacts, 2 chert debitage, and 1 thermally altered rock.

Unit 2
Unit 2 was excavated immediately east of shovel test 31, beneath the large oak trees present at the site. The unit was excavated to 20 cm below ground surface and terminated at clay subsoil. Artifacts recovered from Unit 2 included 47 brick fragments, 2 pieces of lime mortar, 10 historic ceramics sherds, 1 porcelain doll arm, 77 shards of glass, 1 glass marble, 1 charcoal fragment, 1 white tailed deer bone fragment, 43 metal artifacts including 1 lead alloy and 1 copper button and ferrous and copper bullets, and 1 unidentified artifact.

ARTIFACT ASSEMBLAGE ANALYSIS

In sum, 1,020 specimens were collected during NRHP testing at site 41BP594 (**Appendix D 41BP594 Specimen Inventory**). From this number, 998 specimens were identified as artifacts and 22 were identified as ecofacts. The majority of artifacts (n=985; 98 percent) are associated with the nineteenth and twentieth century occupation of the site. Several artifacts consist of lithic material that may be aboriginal in origin and may be prehistoric in age (n=6, less than 1 percent). The remaining artifacts are of uncertain time period and may date to either the historic or prehistoric era (n=7, less than 1 percent). The ecofacts recovered from the site are believed to date to the historic occupation due to their recovery context. These include food residue (n=22), such as faunal bone fragments (n=13); and charcoal samples (3.07 g).

Prehistoric Artifact Assemblage

Chipped stone artifacts comprise the prehistoric artifacts recovered from 41BP594. One formal tool and five nontools were identified from within the assemblage. The single formal tool is a Scallorn arrow point (Lot 55). The remaining chipped stone artifacts are non-tools or debitage. A total of five flakes were produced from chert (n=3), and thermally altered chert (n=2). None of the debitage exhibited evidence of utilization or modification.

The Scallorn arrow point was formed from fine grained 10YR 7/2 light gray chert. It is 17 mm in length by 12 mm in width by 3.5 mm in thickness. The stem is 5.9 mm in length. The lateral margins are slightly concave and sharp, suggesting that the point was re-sharpened prior to discard. It has corner notches and an expanding stem. The base is flat and nearly as broad as the shoulder barbs. Scallorn points date to the Austin Phase of the Late Prehistoric period, roughly from A.D. 700 to A.D. 1200 (Turner and Hester 1993).

Summary

The ephemeral nature of the prehistoric assemblage is indicative of a short duration occupation during the prehistoric period. The Scallorn arrow point suggests the occupation occurred during the Austin Phase of the Late Prehistoric Period

Historic Artifact Assemblage Analysis

A total of 985 historic artifacts were recovered from the site and categorized by function into seven groups. **Table 8** presents the functional groups and the total number of artifacts assigned to each group. The historic artifact assemblage is discussed within the framework of these artifact groups; however, when possible, contextual interpretations are offered concerning how these materials might have been used.

Table 8. Historic Artifact Functional Group Classification System at 41BP594

Artifact Group	Artifact Class	Examples	Count
Activities	Misc. Activity Toy	Slate fragment Porcelain doll fragment, marble	6
Agriculture	Animal Husbandry Fencing Horticulture	Horse Tack Fence Staples, Fence Wire Fragment Terra cotta pot sherd	33
Automotive	Tire	Rubber Fragment	1
Architecture	Structural Material Construction Hardware Interior Finishing	Brick, Mortar, Window Glass, Nail, Tack, Bolt, Roofing Nail Caps Miscellaneous Hardware	387
Arms	Ammunition	Cartridge Cases	3
Clothing	Fastener Shoe	Button Shoe Nail	5
Household	Lighting	Chimney Lamp Glass, Lamp Parts	32
Kitchen	Ceramic Wares Glass Container	Storageware, Tableware Vessel, Bottle, Jars, Jar Lid Liner, Unknown Vessel	354
Unknown	Unknown	Ferrous Metal Fragment	164
		Total	**985**

Activities (n=6; less than 1 percent)

The Activities Group includes items that may have been utilized by multiple occupants at the site during various pursuits. This group includes six artifacts that were classified as either toys or miscellaneous. Activities related artifacts include one marble fragment, one porcelain doll fragment, and four fragments of slate. No specimens within this group exhibited evidence of burning.

Toys

The marble type recovered was produced using an early machine method, which is indicated by a swirling pattern close to the surface of the marble. This technique is known as a transitional machine-made process, which generally dates from 1901 to 1926 (Randall 1971). The porcelain doll fragment consisted of a molded arm.

Miscellaneous
Miscellaneous activity items include four fragments of slate, which were possibly utilized as part of a slate, chalk board.

SUMMARY
The artifacts assigned to the Activities Group are consistent with a domestic occupation dating from the nineteenth century and extending into the early twentieth century. The toys are associated with leisure time activities of children, while fragments of a slate board indicate possible educational activities.

Agriculture (n=33; 3 percent)

The Agriculture Group includes items employed in animal husbandry and farming. All artifacts within this category, with the exception of a terra cotta pot fragment, were formed from ferrous alloy and were recovered in mostly incomplete forms. No specimens within this group exhibited evidence of burning.

Animal Husbandry
Objects relating to animal husbandry at site 41BP594 consist of fence wire fragments and fence staples. The predominant use for any type of fencing would have been for agricultural purposes, such as the containment of livestock.

Horticulture
A single terra cotta pot fragment is suggestive of raising flora in a contained location. Terra cotta pottery is not temporally diagnostic.

SUMMARY
While the Agriculture artifact assemblage is not temporally sensitive, the use contexts of the artifacts are consistent with a late-nineteenth to early-twentieth century farmstead occupation. The Agriculture artifacts, such as the fence staples, are indicative of materials and tools involved with animal husbandry and farming activities during that time period.

Architecture (n=387; 39 percent)

The Architecture Group includes structural materials, such as brick, mortar, and window glass; construction hardware, such as nails and bolts; and interior finishing items, such as hinges. A single machine made brick fragment within this group exhibited evidence of burning.

Structural Materials
Bricks
The 112 brick fragments recovered from site 41BP594 include handmade and machine made varieties. Handmade brick fragments total 103 specimens (352.14 grams [g]), and range in color from reddish brown (n=41, 39.64g), reddish yellow (n=59, 98.36g) to white (n=3, 214.14g). Machine made brick fragments total ten specimens (417.05 g), and range in color from dark reddish brown (n=5, 4.18g), reddish brown (n=3, 12.87g) to white (n=2, 400.00g). A single machine made brick exhibited an alkaline glaze. While no maker's marks were observed, in Texas machine-made bricks generally began replacing hand-made bricks in construction around 1900 (Steinbomer 1982).

Mortar

Mortar recovered from the site had an off white, sandy paste. A total of 18 specimens were recovered totaling 146.79 g. All recovered mortar was highly fragmented, and displayed no evidence of burning.

Window Glass

Window glass belongs to the structural materials subcategory of the Architecture Group. A total of 24 flat glass shards were identified as window pane fragments. Aqua-tint shards (n=7) and colorless shards (n=17) were both recovered from site 41BP594. Recovery of flat glass less than 3.2 mm in width indicates that at least one structure at the site contained paned windows.

Construction Hardware

Nails

A total of 204 nails and nail fragments were recovered and assigned to the Construction Hardware subcategory of the Architecture Group. Nails recovered from site 41BP594 were fragmentary and heavily rusted, which prohibited identification of any characteristics other than their basic manufacturing techniques. Cut nails (n=63) and wire nails (n=112) were recovered. A total of 29 specimens could not be confidently attributed to either manufacturing category. A total of 30 nails were complete and the rest were fragmentary. Additionally, 14 lead roofing nail caps were also recovered.

Miscellaneous

Bolts (n=3), screws (n=2), and an S-bracket (n=1) were recovered from the site, which are assumed to represent a portion of the architectural component. These items are not temporally sensitive and could date to either the historic or modern era.

Interior Finishing Items

Miscellaneous

Other items, which can be interpreted as finishing items within the Architecture Group, include hinges and hinge fragments (n=7), and a single tack. Many of these items could date to either the historic or modern period.

SUMMARY

Temporally diagnostic architectural remains at site 41BP594 provide production date ranges that span the period from 1790 to the present. The predominance of handmade bricks suggest significant building activities prior to the turn of the nineteenth century, with improvements, repairs or additions undertaken into the first half of the twentieth century (Steinbomer 1982). Identifiable nails recovered from the site are predominantly wire, suggesting construction activities were concentrated after around 1890 (Edwards and Wells 1993). In summary, the Architecture Group suggests building activities may have occurred prior to 1900, but the many materials dating to the first half of the twentieth century indicate continued construction activities.

Arms (n=3; less than 1 percent)

The Arms Group includes artifacts involved with the utilization of munitions. Artifacts assigned to the Arms Group include three cartridge cases. No specimens within this group exhibited evidence of burning.

Cartridge Cases

Cartridge cases recovered from site 41BP594 consist of rimfire (n=1) and centerfire (n=2) cases. The rimfire case is a spent .22 caliber cartridge made of brass of an indeterminate length. Rimfire .22 caliber cases have been in production since 1857, and due to the absence of a headstamp, this cartridge has a very wide temporal range. The two centerfire cases are both spent 16 gauge. The solid head cases exhibited a maker's mark associated with the Western Cartridge Company and their line of Field shells were produced from 1923 until around 1965, while the other displays a "Romax" stamp by the U.S. Cartridge Company, which was in production from 1879 to 1931 (Stadt 1984).

SUMMARY

The Arms Group artifacts recovered from the site could have been produced from 1857 to the present. The majority of the temporally sensitive items, however, date from the late nineteenth century into the 1930s.

Clothing (n=5, less than 1 percent)

Artifacts attributed to the Clothing Group include clothing fasteners, such as a buttons (n=3), and shoe parts, such as nails (n=2). No specimens within this group exhibited evidence of burning.

Buttons

Three buttons were recovered from the site including a snap button, stud button, and an indeterminate type rubber button. The snap button is a "Gripper" type, which was introduced in 1930 by Scovill. The stud button, also known as the "overall type" is commonly on men's work clothing, such as overalls in the twentieth century (Pool 1991). The rubber button also exhibited a maker's mark; however, the lettering was illegible and fragmentary.

Shoes

Two shoe nails were recovered. The type is identified as a heel nail and it likely secured a stacked heel.

SUMMARY

Artifacts attributed to the Clothing Group could date from the mid nineteenth century through the early twentieth century. While the rubber button is likely nineteenth century, the snap button was definitively produced after 1930 and is still in production today. This possibly suggests an occupation spanning both centuries.

Household (n=32; 3 percent)

This group includes items that are commonly found within a domicile and are presumed to have been utilized by multiple occupants at the site. Artifacts recovered belonging to the Household Group at site 41BP594 include lighting items. No specimens within this group exhibited evidence of burning.

Lighting Items

Lighting items recovered from the site consist of glass chimney lamp fragments and brass oil lamp parts. A total of 29 colorless and 2 solarized glass shards were recovered, one of which consists of a chimney base with a scalloped edge. All chimney lamp glass is presumably associated with kerosene lanterns, which required drafting in order to burn. A single lamp burner was recovered from the site. Kerosene lanterns

were generally in use between 1860 and 1880 (Spillman 1983), which is consistent with the June 23, 1863, patent date stamped on the burner.

SUMMARY

Few household items were recovered at site 41BP594. The presence of gas-burning lantern parts provide evidence for domestic occupation as early as 1863. Overall, the household assemblage, while not highly temporally sensitive, suggests a small domestic occupation during the late nineteenth century.

Kitchen (n=354; 36 percent)

The Kitchen Group includes subcategories of artifacts related to food preparation, storage, and consumption. These artifacts include ceramic vessel fragments and glass container fragments. Fourteen specimens within this group exhibited evidence of burning.

Ceramics

A total of 40 ceramic sherds belonging to the Kitchen Group were recovered, including ironstone (n=18), porcelain (n=8), redware (n=1), and stoneware (n=13). These specimens represent vessels designed for use as tableware and storageware. Decoration is evident on seven ceramic sherds and two sherds exhibit maker's marks. Although some sherds were undecorated, it is possible these specimens belonged to blank portions of decorated vessels. Three ceramic sherds exhibited evidence of burning.

Redware

One body sherd had a coarse red paste with an Albany-like slip on both the interior and exterior. It was too fragmentary to assign a vessel form.

Stoneware

Stoneware is the second most common ware type recovered from site 41BP594 (n=13). The sherds and sherdlets could not be confidently assigned to either vessel category or form. Stoneware fragments recovered at the site are all body sherds with the exception of one sherdlet. Stoneware is frequently treated with a glaze or slip, however less commonly decorated. At site 41BP594, only three variations of glazes and/or slips are present. The most frequently occurring surface treatment to stoneware at site 41BP594 consists of a Bristol glaze on the exterior and interior (n=11), followed by a single instance of an Albany-like slip and a salt glaze. All stoneware sherds are undecorated and unmarked.

Refined Earthenware

Ironstone

Ironstone was the most common ware type present on site. Among the 18 sherds, 14 are undecorated, 4 are decorated, and 2 are marked. Decorative techniques include decalcomania (n=2); molding (n=1), and gilding (n=1). The partial maker's marks were not identified, but it likely that both date to after 1891 due to the presence of the word "(M)ade" indicating production after the McKinley Tariff Act. One mark exhibited a British Royal Coat of Arms, which suggests either an English or American manufacturer. The sherds could not be definitely assigned to either vessel category or form. Ironstone sherds comprised 3 rim sherds, 10 body sherds, and 5 base sherds.

Porcelain

Porcelain sherds are the least frequently occurring ware type at the site. A total of 8 sherds were recovered, the majority of which were undecorated (n=6). However, one sherd exhibited gilding and another decalcomania. No vessel categories were assigned due to the fragmentary nature of the porcelain assemblage. However, bodies (n=2), rims (n=2), bases (n=2), and sherdlets (n=2) were all present.

Glass

Kitchen container glass (n=314) includes fragments of vessel glass (n=227), bottles (n=78), jars (n=1), and jar lid liners (n=8). Numerous artifacts representing each vessel form were recovered and consist of rim shards, body shards, and base shards. (**Table 9**). A total of 11 glass shards exhibit evidence of burning. Multiple attributes of glass containers can be temporally sensitive and can include color, technological characteristics, decorations, and manufacturing marks.

Table 9. Shard Forms of Glass Containers at 41BP585

Category	Artifact Form	Total
Bottle	Rim	6
	Body	69
	Base	3
	Total	**78**
Jar	Base	1
	Total	**1**
Jar Lid Liner	Rim	8
	Total	**8**
Vessel	Rim	8
	Body	192
	Base	11
	Shardlet	16
	Total	**227**
	Grand Total	**314**

Color

Glass colors present at the site include amber, aquamarine, aqua-tint, cobalt, colorless, dark amber, green, green-tint, olive, and opaline (**Table 10**). Colorless glass also includes the subcategory, solarized glass, or sun-colored amethyst. A total of 76 shards of solarized glass were recovered. Of these colors, the most temporally sensitive is solarized glass, which dates from around 1890 to 1920, and dark amber, or black glass, which was not commonly produced after 1880 (SHA 2013).

Table 10. Glass Container Colors Present at 41BP585

Artifact Color	Total
Amber	41
Aquamarine	17
Aqua Tint	3
Cobalt	1
Colorless	138
Colorless – Solarized	76

Table 10. Glass Container Colors Present at 41BP585

Artifact Color	Total
Dark Amber	21
Green	1
Green-Tint	2
Opaque Off-White	1
Olive	3
Opaline	10
Total	**314**

Technological Attributes

Technological attributes of historic glass containers encompass a wide variety of characteristics, and in many cases, relate closely to the manner in which the container was produced. Temporally sensitive features include bubbles, suction scars, and finishes.

Bubbles

Air bubble inclusions were observed in 120 shards of container glass, accounting for roughly one third of the assemblage. These inclusions are the result of irregularities in the production process, which were all but successfully eliminated by 1920 (Polack 2000).

Suction Scars

One suction scar was observed within the glass assemblage. Suction scars are characteristic marks produced by the Owens Automatic Bottle Making Machine. Bottles produced with suction scars generally post date 1910 and predate 1947 (SHA 2013). The fragmentary nature of many bottle bases or perhaps a dearth of recovered glass from this time period may account for the lack of this diagnostic feature.

Finishes

A total of 14 rim specimens from bottles and jars retained portions of the finishes, of which only eight are identifiable. Four different finishes are present within the assemblage, while only two methods of production were noted. The finishes identified are bead (n=2), brandy (n=1), crown (n=1), external continuous thread (n=2), and packer (n=2). All of these types are present on bottles with the exception of the continuous thread. These finishes are not highly temporally sensitive as most were used from the nineteenth to twentieth centuries.

The two methods of finish production present at the site include tooled finishes (n=6), and machine made finishes (n=2). Tooled finishing is still employed on specialty bottles, while fully machine made finishes post date 1905 and most likely 1915 (SHA 2013).

Decorations

A total of 43 glass shards exhibited molded characteristics beyond maker's marks, which can be considered decorative elements. Decorative treatments to glass containers within the Kitchen Group include applied color labels (n=1), embossing (n=9), and molding (n=33). Embossing and molding are common decorative

techniques; however, a proprietary mark for "McLean's Strengthening Cordial," dates this particular shard from circa 1865 to 1906 with the passing of the Pure Food and Drug Act. The single shard with the applied color label dates to the 1930s or after.

Maker's Marks

Five partial maker's marks were present on the bases of glass bottles and jars. Only a single mark could be identified and indicated production by the Anchor Hocking Glass Corporation after 1938 (Toulousse 1971). The other marks could not be attributed to particular glass houses, but likely date to after 1905.

Secondary Modifications

Glass recovered from the site was historically manufactured, but some was modified intentionally, or chipped, to form sharp edges. Worked glass at the site consists of two glass shards within the same context. The shards are from two distinctly different containers, one being a solarized body fragment from an indeterminate vessel type, and the second being a dark amber body fragment of a bottle. Both shards were unifacially chipped along one lateral edge. Macroscopic examination revealed wear patterns along this edge consistent with sawing of a medium soft material.

SUMMARY

The kitchen material suggests that the site dates primarily to the twentieth century. Diagnostic ceramic materials imply that the site could have been occupied as early as 1852, based on the presence of ironstone and some salt-glazed stoneware; however a lack of contemporaneous and earlier wares suggest a later date as evidenced by a predominance of decorations and maker's marks dated to after 1890. Decorative varieties encountered on ceramic wares, such as decal ware and gilding, are consistent with occupation into the mid- to late-twentieth century. Glass containers at the site further support a substantial occupation period dating after 1900 as evidenced by diagnostic colors dated mostly after 1920. However, the predominance of hand-tooled finishes versus fully machine made vessels suggests manufacture of several bottles before 1905 and likely 1920, while the single maker's marks dates to after 1938. In summary, the whole of the Kitchen Group appears to represent a primary occupation from around the end of the nineteenth century into the mid twentieth century.

Automotive (n=1, less than 1 percent)

One fragment of a rubber tire was recovered from the site. The tire fragment was likely from a vehicle or mobile machinery and dates to the twentieth century.

Unknown (n=164, 16 percent)

A total of 164 artifacts recovered were unknown or too fragmentary to confidently assign them to any one of the functional groups including metal fragments (n=163) and an unknown material (n=1). Additionally six pieces of thermally altered rock (totaling 3.2g) consisting of silicified wood and chert were recovered.

SUMMARY

The 302 artifacts within the Unknown Group could not be assigned to particular functional groups either due to incompleteness or lack of distinguishing characteristics; however their presence at the site is consistent with the range of other historic artifacts found at the site.

Historic Artifact Assemblage Analysis Summary

All of the temporally sensitive materials recovered on site reflect a historic occupation from the late nineteenth century into the early twentieth century. The Architecture Group suggests an emphasis on building activities after the turn of the twentieth century, while the other artifact groups confirm an occupation of multiple individuals, beginning before 1900 but primarily after this time. The historic artifacts recovered from the site include common and widely available materials. The artifact assemblage as a whole reflects activities consistent with occupation of a late nineteenth century to early twentieth century working farmstead with a domestic component.

DISCUSSION AND RECOMMENDATIONS

The results of shovel testing and hand unit excavation on site 41BP594 suggest that significant buried cultural deposits have not been preserved. The assemblage of artifacts recovered during testing contains few temporally sensitive items. This assemblage is mixed and distinct occupations cannot be isolated. For these reasons, the archeological deposits on site are unlikely to yield information important to local patterns of history and do not warrant NRHP inclusion under Criterion D.

The standing structure on site 41BP594 has been determined to be eligible for NRHP listing under Criterion D and as a contributing element of a rural historic district (Penick 2001, Martin 2001). For this reason it is recommended that impact to the standing structure be avoided. If this is not possible it is recommended that negative impacts stemming from mine related development be mitigated through additional research, such as producing elevation drawings and dismantling the walls to investigate building techniques, following a research design approved by the THC.

SITE 41BP595 EXCAVATION RESULTS

SETTING AND PREVIOUS INVESTIGATION

Site 41BP595 is situated on a ridge summit and shoulder at an elevation that ranges between 510 and 520 feet msl (see **Figure 3**). The nearest source of water is an unnamed tributary to Big Sandy Creek, located about 225 m west of the site. The soil on site is Robco loamy fine sand, 1 to 5 percent slopes (United States Department of Agriculture/National Resources Conservation Service [USDA/NRCS] 2013). These soils are deep, moderately well drained, and formed in upland loamy sediments on Pleistocene terrace deposits and are moderately acid (USDA/NRCS 2013). The surface geology on site consists of the Eocene aged Calvert Bluff Formation (Ecb), which is "mostly mudstone with various amounts of sandstone, lignite, ironstone concretions, and in the uppermost part locally glauconitic" (Proctor et al. 1981). The site's topographic setting suggests it has not been subject to significant aggradation since it was abandoned prehistorically, as sedimentary sources appear to be limited to colluvial deposition from slightly higher portions of the landform and Aeolian deposition.

The site covers approximately 32,000 square meters (m^2). Its maximum dimensions are 160 m east-west by 200 m north-south. Shovel testing during the present investigation revealed yellowish brown fine sandy loam extending more than 100 cm in depth on the top of the landform. Below the summit the soil was more variable in depth and strong brown clay was encountered below the fine sandy loam at depths ranging between 25 and 100 cm. Most of the site was vegetated with tall weedy grasses with oaks, cedar, and mesquite along the periphery (**Figures 9** and **10**). Ground surface visibility was less than 10 percent.

A total of 29 shovel tests were excavated when the site was originally recorded (Turpin 2003), of which 14 were culturally positive, yielding 18 pieces of lithic debitage, 2 utilized flakes, and 8 fragments of burned rock between 0 and 110 cmbs. A possible hearth was exposed in the southern quarter of the site in Shovel Test 10, between 50 and 60 cmbs (Turpin 2003).

Figure 9. Site 41BP595 overview, facing east

Figure 10. Site 41BP595 overview, facing south

SHOVEL TESTING

Shovel testing was undertaken in two phases during the current investigation (**Figure 11**). Initially, 85 shovel tests were excavated at 20-m grid intercepts to define the limits of the site and identify potential artifact high density and diversity areas. Of these shovel tests, 66 yielded cultural material that was presumably deposited during the prehistoric period and included 3 chipped stone tools, 38 ground stone fragments, 202 lithic nontools, 10 botanical charcoal fragments, and 103 pieces of thermally altered rock. One shovel test yielded a single historic artifact (an unidentified fragment of painted metal). The remaining 18 shovel tests were culturally sterile.

The most common classes of cultural material recovered during the first phase of shovel testing include lithic nontools, ground stone, and thermally altered rock. The lithic nontool recovery rate ranged from 1 to 16 specimens for each shovel positive for this material class, with an average of 3.42 and a standard deviation of 3.49. Eight shovel tests (4, 18, 22, 24, 37, 38, 53, and 58) had lithic nontool recovery rates more than one standard deviation above the mean. The recovery rate for ground stone fragments ranged from 1 to 6 for each shovel test positive for this material class and averaged 1.8 with a standard deviation of 1.29. Two shovel tests (6 and 38) had ground stone recovery rates more than one standard deviation above the mean. Between 1 and 8 fragments of thermally altered rock were recovered from each shovel test positive for this class of material with an average of 3.12 and a standard deviation of 4.0. A total of four shovel tests (4, 36, 53, and 55) had thermally altered rock recovery rates more than one standard deviation above the mean.

During the second phase of shovel testing, an additional 65 shovel tests were excavated at 10-m grid intercepts around shovel tests excavated during the first phase that yielded ten or more artifacts (based on field counts), pieces of fire-cracked rock, or fragments of botanical charcoal. All of the shovel tests excavated during this phase were culturally positive and yielded 6 chipped stone tools, 30 ground stone fragments, 383 lithic nontools, 2 faunal bone fragments, 20 botanical charcoal fragments, and 300 pieces of thermally altered rock.

Eight of the nine chipped stone tools recovered through shovel testing are expedient tools, representing either utilized flakes or unifacially modified flakes. The remaining chipped stone tool is a small biface fragment. Fragments from ground stone tools are more than seven times as common as chipped stone tools, suggesting that grinding activities were much more common than cutting activities on site.

DISTRIBUTION OF CULTURAL MATERIALS

The distribution of the most common classes of cultural material (debitage, ground stone fragments, and thermally altered rock) presumably better reflects the range of cultural and natural processes that have resulted in the current expression of the archeological record than less common classes of cultural material. The distributions of the other classes of cultural material recovered are thought to be less reliable indicators of post-abandonment processes due to sample size.

Cultural material was recovered from throughout the vertical column, from 0 to 110 cmbs. The vertical distribution of the various classes of cultural material, however, differed (**Table 11**). Lithic nontools were

concentrated in the upper part of the vertical column and gradually became less concentrated with depth. Thermally altered rock fragments were fairly evenly distributed from 0 to 100 cmbs but were concentrated in Levels 6, 7, and 8 (50–80 cmbs). Ground stone fragments were fairly evenly distributed throughout the vertical column but were somewhat concentrated in Levels 6 (50–60 cmbs) and 8 (70–80 cmbs).

Table 11. Site 41BP595, Cultural Material by 10-cm Level

Level	Chipped Stone Tool	Ground Stone Tool	Lithic Nontool	Faunal Bone	Charcoal	Thermally Altered Rock
1	3	2	76.5	0	0	31
2	1	2	98.5	0	1	38
3	1	8	78	0	1	34
4	1	1	64	1	4	33
5	0	9	48	1	2	34
6	2	10	51	0	3	61
7	1	5	52	0	9	48
8	0	17	52	0	3	53
9	0	6	31	0	4	34
10	0	8	33	0	3	37
11	0	0	1	0	0	0
Total	**9**	**68**	**585**	**2**	**30**	**403**

These patterns presumably resulted in part from a variety of post-abandonment turbative processes, including rodent and root activity, which can foster vertical artifact migration. The site's topographic setting on a ridge summit and shoulder suggest sedimentary sources are limited to colluvium from slightly higher slope elements or possibly Aeolian deposition. Consequently, it appears unlikely that the concentration of thermally altered rock and ground stone fragments in Levels 6 through 8 (50–80 cmbs) resulted from substantial post-abandonment aggradation. This is because larger cultural clastics, such as burned rock, are more likely to migrate down as a result of faunal turbation than smaller materials, such as lithic nontools, which are more likely to migrate both up and down the vertical column (Bocek 1986). The slight concentration of lithic nontools near the top of the vertical column is consistent with this conclusion.

Cultural materials were unevenly distributed across the site and were found to be concentrated in three isolable artifact high density and diversity areas, referred to as areas 1, 2, and 3 (see **Figure 11**). The boundaries of these areas were defined by the presence of adjacent shovel tests with high densities of at least one class of cultural material, represented by yields that were more than one standard deviation above the mean. Positive shovel tests that were surrounded on at least three sides by high density positive shovel tests were included within subsite areas.

Area 1 is the northern most area and is vaguely "U" shaped. It is roughly 90 m east to west and 25 m north to south. Area 2 is to the southeast of Area 1 and extends about 100 m north to south by 75 m east to west. Area 3 is southwest of Area 1 and is about 60 m east to west by 33 m north to south.

The material assemblages recovered from each of the site areas are essentially the same. The average density of cultural materials from each site area (number of specimens/shovel tests) is presented in **Table 12**. Site areas 1 and 3 both had 15 shovel tests and identical densities of chipped stone tools, ground

stone, and botanical charcoal, and nearly identical densities of thermally altered rock. Area 3, however, had the highest density of lithic nontools, with an average of 9.733 lithic nontools per shovel test. With 25 shovel tests, site Area 2 was also the largest subsite area. Area 2 had the highest density of ground stone, with an average of 0.840 specimens per shovel test, and botanical charcoal, with an average of 0.40 specimens per shovel test. Chipped stone tools were much more common in Area 2 than the other site areas, though any conclusions based on this observation must be considered with caution due to sample size.

The narrow range of cultural materials present within each of the site areas suggest each resulted in part from similarly narrow ranges of systemic activities. The larger size of Area 2 relative to the other site areas suggests it may have been utilized more intensively than the other site areas. The presence of faunal bone fragments in the Area 2 assemblage, along with a higher density of botanical charcoal, suggest subsistence remains may be better preserved in Area 2, possibly because Area 2 represents, in part, a more recent occupation.

Table 12. Average Density of Cultural Material (Specimens/Shovel tests) by Site Area

Area	Chipped Stone Tool	Ground Stone	Lithic Nontool	Faunal	Botanical Charcoal Sample	Thermally Altered Rock	Shovel Tests
1	0.067	0.600	6.000	-	0.200	6.267	15
2	0.240	0.840	7.360	0.040	0.400	4.600	25
3	0.067	0.600	9.733	-	0.200	6.733	15

A dark, organically rich, soil deposit was recorded in an east to west trending band of shovel tests (36, 37, 86, and 87) in Area 2. The dark soil was encountered as shallow as 30 cmbs in Shovel Tests 86 and 87 but was not encountered until 70 cmbs in Shovel Test 36. It was encountered at 50 cmbs in Shovel Tests 37 and 88. The darkened soil typically extended to the bottom of the shovel tests from where it was first identified. The origins of the organically rich soil deposit are presumably anthrogenic and associated with subsistence processing.

The concentration of botanical charcoal, thermally altered rock, and ground stone in each of the three subsite areas, suggest they resulted in part from activities associated with subsistence processing. These findings also indicate that cultural features may have been preserved within each site area, particularly in the southern half of Area 2, in the vicinity of shovel tests (37, 92, and 94) that yielded concentrations of charcoal, and adjacent shovel tests (36 and 88) that yielded concentrations of thermally altered rock.

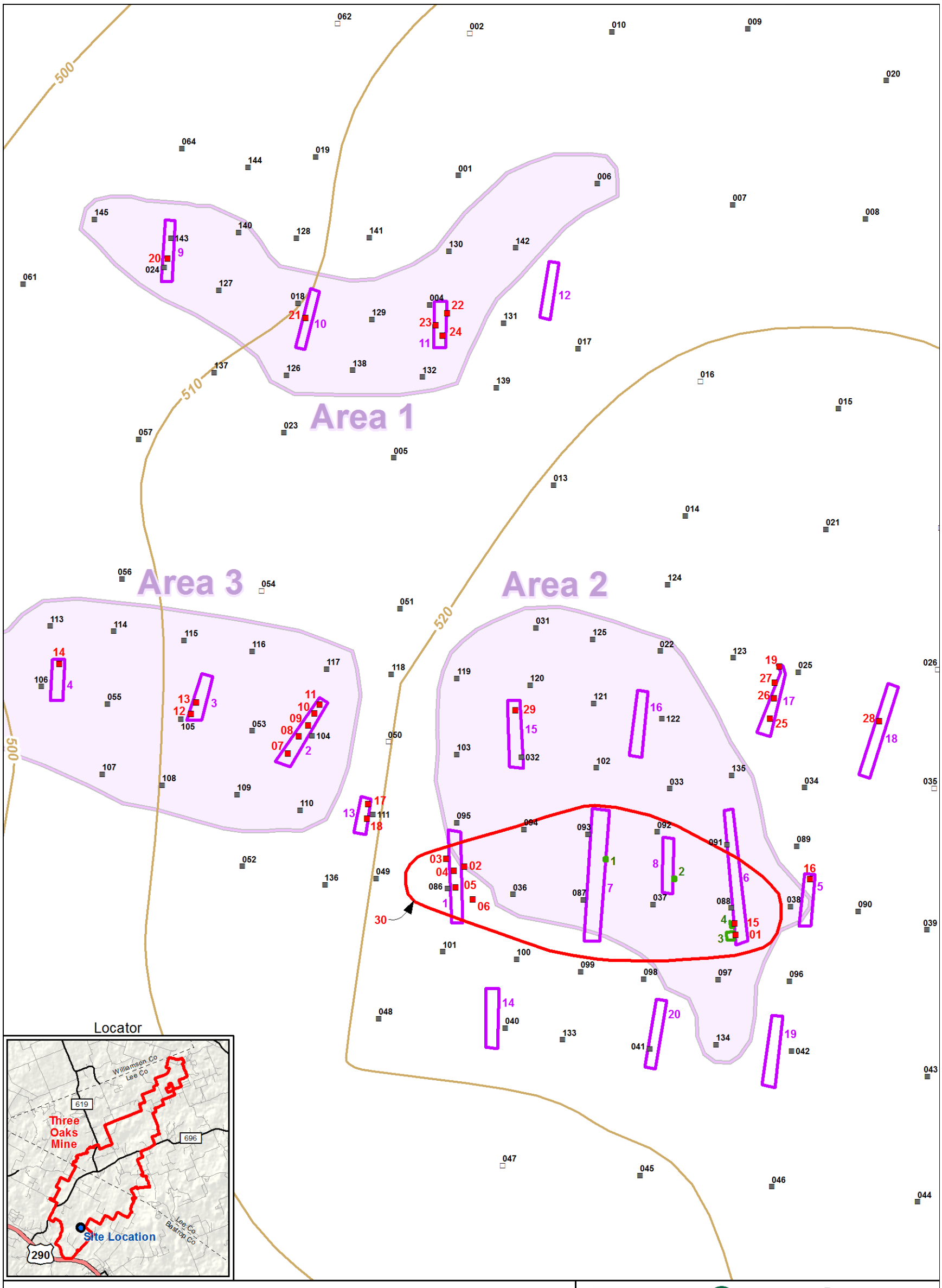

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Figure 11
41BP595 Site Plan

Luminant Three Oaks Mine
Bastrop and Lee Counties, Texas

Prepared By:	1 inch = 50 feet
Job No.:	Date: 9/11/2014

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TRENCH EXCAVATION

As noted above, 20 trenches were excavated in an effort to identify cultural features (see **Figure 11**). Trenches ranged in length between 4.5 m and 19.5 m and averaged 9.95 m. Trench excavation proceeded until one of the following conditions was met 1) cultural features were encountered, 2) the clay Bt horizon was encountered, or 3) a depth between 100 and 130 cm was achieved. A total of 30 features were exposed during trenching. Of these 28 were burned rock features, one (Feature 4) was a concentration of unburned

Table 13. Site 41BP595 Backhoe Trenches by Length, Depth, Features and Site Area

Trench	Length (m)	Depth (m)	Features	Site Area
1	13.5	75	2, 3, 4, 5, 6, 30	2
2	6.5	45	7, 8, 9, 10, 11	3
3	7	50	12, 13	3
4	6	50	14	3
5	8	65	16	2
6	20	95	1, 15, 30	2
7	19.5	130	30	2
8	8	100	30	2
9	9	100	20	1
10	9	50	21	1
11	7	79	22, 23, 24	1
12	9	134	none	East of 1
13	4.5	90	17, 18	Between 2 and 3
14	9	124	none	South of 2
15	8	80	29	2
16	10	100	none	2
17	14	45	19, 25, 26, 27	North East of 2
18	10	70	28	North East of 3
19	11	105	none	South of 2
20	10	100	none	South of 2

The concentration of features in areas 2 and 3 suggest both areas resulted from intensive utilization. The range of materials recovered from each of the areas is consistent with this interpretation.

Temporally diagnostic projectile points along with a representative sample of the lithic tools exposed through trenching were retained. During the course of testing, trench backdirt piles were periodically inspected for these materials, especially following rains. As a result of this effort, nineteen artifacts were recovered including 7 dart points or dart point fragments, 2 arrow points or point fragments, 4 lithic bifaces, 1 utilized flake, 1 uniface, 1 lithic core, 2 ground stone artifacts, and 1 projectile point fragment. These materials are listed in **Table 14** below by trench provenience. Where possible, type assignments are also provided.

Table 14. Artifacts Recovered with Trench Level Provenience

Trench	Artifact Description	Count
5	Biface	4
10	Dart point	1
16	Fairland like dart point	1
16	Gary dart point base	1
4	Grinding stone	1
1	Lithic Core	1
15	Metate	1
1	Montell dart point fragment	1
20	Probable Pedernales dart point preform	1
8	Projectile point fragment	1
15	Scallorn arrow point, untyped arrow point fragment	2
11	Scottsbluff dart point	1
17	Uniface	1
4	Untyped dart point fragment	1
4	Utilized Flake	1

Based on the distribution of temporally sensitive lithic artifacts, it appears that areas 1 and 3 saw the earliest occupations on site. Two late Paleoindian Scottsbluff points were recovered from Area 1, along with an un-typed lanceolate dart point. The presence of both arrow points and dart points in Area 2 suggests it represents the most intensively utilized portion of the site.

A GEOARCHEOLOGICAL EXAMINATION OF FEATURE 30, AREA 2, AT SITE 41BP595

by

Charles Frederick and Brittney Gregory

Introduction

This section reports the results of geoarcheological investigation of Feature 30, located by shovel testing within Area 2 at site 41BP595. The work has focused on identifying whether this feature is a natural or anthrogenic feature, and how it has been buried.

Setting

The site is located in an upland setting characterized by gently rolling hills with about 50 to 100 feet of local relief and is part of the Big Sandy Creek drainage basin. Big Sandy Creek is a tributary of the Colorado River and joins it just upstream of Bastrop. It drains the northern side of the Colorado River basin immediately west and north of Bastrop.

The site is underlain by the Eocene age Calvert Bluff Formation of the Wilcox Group (BEG 1974). The Wilcox Group comprises a body of fluvial-deltaic sediment and contains depositional facies typical of large lowland rivers, such as sandy channels, floodplain muds and floodbasin peats which through diagenesis have been transformed into lignite.

Soils

The gently rolling upland landscape is draped by sandy soils formed from weathering and subsequent erosion and re-deposition of the fluvial-deltaic sands and muds of the Wilcox Group. In broad, general terms these sandy soils are known as texture-contrast soils and are characterized by two parts that differ significantly in terms of texture and appearance (Phillips 2007). The upper portion of such soils is comprised of fine, loose sand, whereas the lower part of the soil is typically a firm sandy clay or sandy clay loam which is typically red or mottled red. The formation of this type of soil is the subject of considerable debate among soil scientists as well as archeologists. Among soil scientists, the debate hinges on whether the subsoil formed from the weathering of the upper sandy part of the soil, or is an older sedimentary deposit unrelated to it. Archeological concerns share this interest, but further consider the manner in which the unconsolidated sands are moved and disturbed, which has significant implications for the integrity of the cultural deposits contained within the sands. Although the paradox of texture contrast soils is often discussed as an either/or scenario, it is a potential problem in equifinality as both scenarios undoubtedly occur and discerning which for any given pedon is a complex problem.

The soil upon the hilltop occupied by the site is currently mapped as the Robco loamy fine sand (NRCS 2013a), but this soil was originally mapped as the Demona fine sand (Baker 1979). The Official Soil Series Description for the Demona series (NRCS 2013b) describes the soils as occurring “on uplands with mixed concave and convex surfaces” and that these soils “have formed mainly in the basal sands and sandy clays of Cretaceous age that have been reworked by wind”. The Demona series description in Baker (1979) makes no mention of wind alteration of the soil and the age of the parent material cited is clearly incorrect here. The same can be said for the official description of the Robco series which is described as “formed in loamy

sediments on Pleistocene terrace deposits about 35 to 100 feet above present streams or local outwash colluvial plains" (NRCS 2013c).

Immediately east of the hilltop is a saddle that lies between the site and a slightly higher hill immediately to the east; this saddle acts as a local drainage divide and has low order drainages that flow to the north and south away from the saddle. The headwaters of both of these small streams are eroded and support numerous small gullies that expose the reddened subsoil. The soils mapped in this area are the Crockett, Tabor and Edge (but originally mapped as the Axtell) series. The upland to the east of this hill is again mapped, like the site as the Robco series, and the Padina fine sand (originally mapped by Baker 1979 as the Patilo complex). Interestingly, the Patilo complex is described by Baker (1979:22) as consisting of "deep, gently sloping to strongly sloping, moderately drained sandy soils…formed in thick, sandy and loamy material that appears to be reworked by wind".

Research Questions

As noted earlier, the primary research question driving this work was *What is the origin and burial mechanism of the organic-rich deposit in Area 2* (in the vicinity of shovel tests 36, 37, 86, and 87). This matrix-defined buried organic-rich deposit identified near the hill summit is enigmatic for this landscape and it is critical to determine, if possible, if this is a natural, or anthrogenic feature, and if the latter, prehistoric or modern. There are several possible scenarios that can explain this deposit: 1) ancient gully fill; 2) gleyed sediment on top of the argillic horizon; 3) an ancient anthrogenic deposit (or midden); 4) historic burn/bulldozer push feature. Although other scenarios exist, these are considered the most likely and are amenable to geoarcheolgical examination and testing.

Ancient gully

Although it is unusual to encounter evidence of gullies in this landscape position, gullies are common in east Texas sandy mantle landscapes and often fill with homogeneous sandy sediment. If this is a gully, the basal and lateral margins will be abrupt, most likely cut into the argillic horizon, and the infilling sediment may exhibit evidence of sedimentary stratification or sedimentary structures. Furthermore, the edges of the organic-enriched deposit will respect the margins of the gully feature.

Gleyed Sediment

The soils associated with sandy mantle landscapes in East Texas typically exhibit prominent changes at the interface between the subsoil argillic (or Bt) horizon and the overlying unconsolidated sand. The Bt horizon generally has much lower permeability than the overlying sands and acts as an aquaclude and thereby promotes lateral flow of water within the soil, but it is possible that weathering of the Bt horizon could create a topographically low spot on top of the argillic horizon that would favor local waterlogging and gleying rather than leaching and lateral flow. If this is the case, the deposit above the Bt horizon (and possibly the top of the Bt horizon) will be dark colored but not owing to increased organic matter but associated with reduction of the iron minerals in the soil (or gleying). Gleyed sediment will also have a very low magnetic susceptibility, and will respect the margins of a depression formed at the top of the Bt horizon.

Ancient Anthrogenic Sediment (a midden or floor of structure)

Human subsistence activities are known to result in concentrated refuse deposits that generally have a dark color, increased organic matter content, and elevated artifact frequency. In Texas, prehistoric refuse middens are generally associated with discard of refuse on the ground surface and are only buried when natural landscape processes cover them with slopewash (colluvium) or eolian sediment. The landscape position of this deposit precludes a colluvial burial mechanism. Although the feature is not on the summit, the amount of slope above it is insufficient to explain the degree of burial observed in the shovel tests. Burial of a matrix-defined feature by pedoturbation is unlikely (especially if it is sitting on top of the Bt horizon) for burial could only occur if "clean" (not organic enriched) sand was transported from below it to above it (an upward biotransfer in the jargon of Donald Johnson (see Johnson et al., 2005) or laterally translocated. Lateral translocation in such low slope areas are uncommon, although have been argued to be the dominant process by which mima (or pimple) mounds form (cf. Horwath and Johnson 2012; 2006) although to our knowledge there are no such landforms present on the site). Alternatively, local burial by eolian reworking may be possible, and if so, the deposits burying the organic-rich deposit should exhibit slightly different textural properties than the sand at depth away from the buried organic-rich deposit.

Although the size of the anomalous feature is large for a structure, burial of house floors by sediment is common in structures that included sediment in the superstructure (such as adobe or earth plastered timber buildings; cf. Quigg et al. 2013). Although rare, these are not unheard of in Texas. If this is the case, then there should be some evidence in the deposit of the use of finer textured sediment on top of the organic-rich deposit. The sandy sediment by itself is too coarse textured for use as a plaster without the addition of some finer material. Second, the margins of the organic-rich deposit should be sharply defined, will most likely be inset into a shallow depression, and may exhibit enhanced magnetic susceptibility, organic matter and phosphorus. Obviously, the age of the included charcoal would be ancient rather than modern.

Recent Anthrogenic Sediment

The apparent linear nature, presence of charcoal in this deposit, and buried position on a hill top may be a stratigraphic manifestation of twentieth century land clearance aided by a bull dozer. If this is the origin of the deposit, it will have sharply defined lower and lateral edges, and may exhibit fill structures and crude stratification and rounded clods. The age of any charcoal will reflect the age of the standing forest (up to a couple of hundreds of years old).

Data Requirements

In order to test which hypothesis is most likely, several types of samples and exposures are desirable.

a. Cross-section exposure of the organic-rich buried feature in Area 2 that clearly exposes the upper and lower boundaries as well as the lateral margins, preferably accomplished by means of a trench.
b. Sample columns derived from inside and immediately outside the organic-rich buried feature in Area 2 that would permit clear comparison of the deposits.
c. Sample column(s) from slope settings below the hill summit (like Area 3) that permit comparison of the sand above the argillic horizon in various catenary (slope) relationships

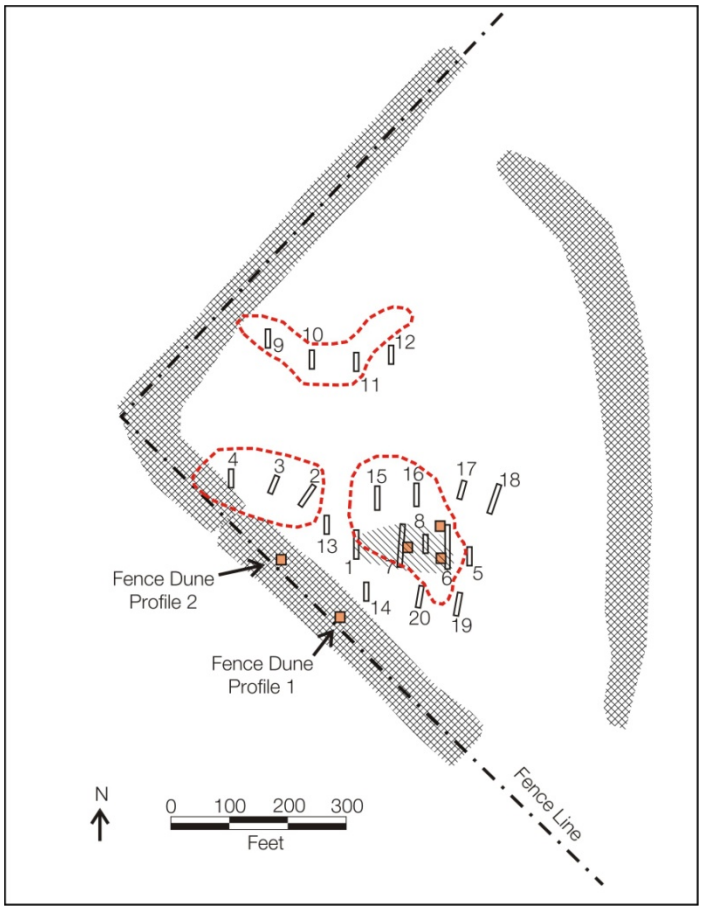
d. Samples collected should include a column of paleomagnetic sample boxes (to be used for granulometry, magnetic susceptibility and loss-on-ignition) as well as a column of samples for microartifact analysis.

Methods

Fieldwork involved the examination of profiles revealed by two backhoe trenches that were excavated across Feature 30 from south to north (see **Figure 12**). The results of the shovel testing indicated that

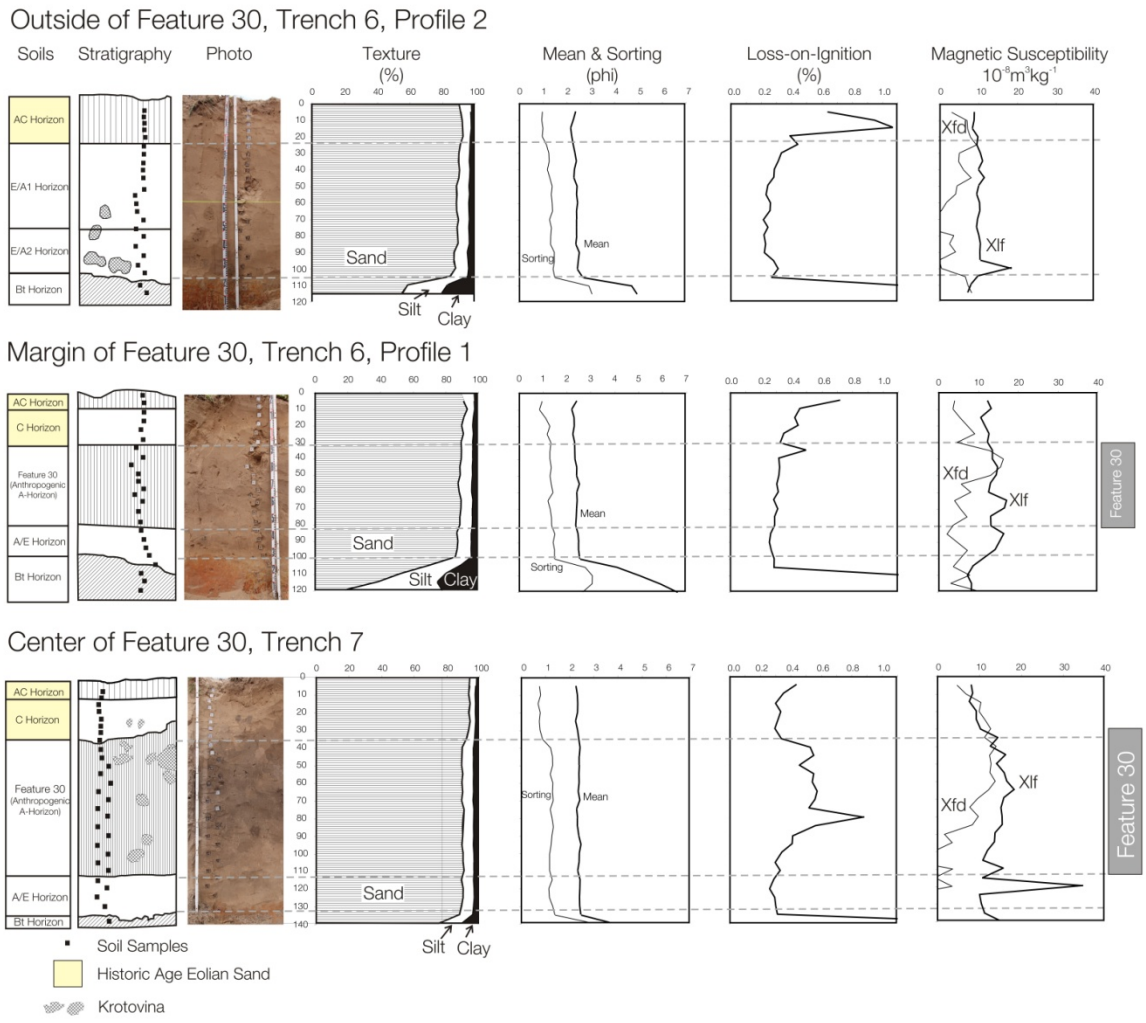
Feature 30 is elongated along an east-west axis, and Trench 6 was located near the east end, whereas Trench 7 appears to be located close to the center of the feature. Two soil profiles were examined and sampled within Trench 6, one outside of Feature 30 to the north (Trench 6, Profile 2), and a second that was within Feature 30, but where its expression was fairly subtle (Trench 6, Profile 1). Trench 7 nearly completely sectioned Feature 30 and a single soil profile was described and sampled near the center of the organic-enriched deposit. A second sample set was collected from Feature 30 in Trench 7, and this was a series of grab samples collected every meter from the center/most-organic-rich deposit present that was obtained in order to permit assessing the perceived variation of organic matter across the feature. In addition to the feature-oriented samples, two small sample columns were collected from a fence row dune on the southwest side of the site in order to document the nature of unambiguously eolian sand on this hill. **Figure 12** shows the location of the sample columns with respect to the trenches and other geomorphic features near the site.

In all, 102 samples were collected in the field and examined in the lab for a variety of properties. Soil samples from the columns were collected in 2.5 cm plastic cubes at 5 cm intervals (see **Figure 13**). For each column sample three analyses were performed: magnetic susceptibility, particle size distribution, and loss-on-ignition. Sediment samples from the two short column samples collected from the nearby fence row dune were processed for particle size analysis. Descriptions of the methods used for the analyses are provided below. The results of this work are presented in tabular form in **Table 15** and shown graphically on **Figure 13**.



Simplified map of 41BP595 showing the location of the trench excavations with respect to Feature 30 (the diagonal hatched area between trenches 1 and 6), and the fence row dunes present on and near the site. Places sampled for the geoarcheological investigation are shown by the orange squares.

Figure 12. Map of Site 41BP595 and Sample Locations



Results of the laboratory analysis of the soil samples collected from the three column samples located in and adjacent to Feature 30, at 41BP595.

Figure 13. Plot of Lab Data for Column Profiles

Table 15. Site 41BP595, Geoarcheological Laboratory Data

Profile	Sample	Depth	Sand	Silt	Clay	USDA Soil	Mean	Median	Sorting	Skewness	Kurtosis	LOI	Xlf	Xfd
		(cm)	(%)	(%)	(%)	Texture Class	(phi)	(phi)	(phi)	(phi)	(phi)	(%)	$10^{-8}m^3kg^{-1}$	(%)
BT6-1	1	5	91.4	5.46	3.14	Sand	2.45	2.34	0.98	0.41	1.99	0.72	12.52	4.10
Edge of Feature 30	2	10	93.9	3.51	2.59	Sand	2.25	2.19	0.87	0.20	1.54	0.46	13.53	3.69
	3	15	91.7	4.24	4.06	Sand	2.34	2.25	1.12	0.36	2.26	0.43	10.82	5.42
	4	20	90.4	4.88	4.72	Sand	2.35	2.25	1.30	0.40	2.59	0.45	195.33	2.06
	5	25	91.4	4.49	4.11	Sand	2.29	2.22	1.19	0.33	2.32	0.35	12.94	9.19
	6	30	90	5.15	4.85	Sand	2.37	2.26	1.35	0.40	2.68	0.33	12.54	4.62
	7	35	90.2	5.08	4.72	Sand	2.38	2.27	1.30	0.41	2.63	0.50	13.80	12.95
	8	40	90.1	5.13	4.77	Sand	2.38	2.27	1.30	0.41	2.67	0.32	13.72	16.33
	9	45	89.2	5.45	5.35	Sand	2.46	2.33	1.36	0.45	2.80	0.33	15.08	15.64
	10	50	89.5	5.55	4.95	Sand	2.45	2.32	1.31	0.45	2.61	0.32	14.75	13.17
	11	55	88.2	5.9	5.9	Sand	2.57	2.41	1.36	0.52	2.83	0.31	13.23	5.73
	12	60	88.8	5.34	5.86	Sand	2.46	2.32	1.42	0.45	2.90	0.32	12.80	8.18
	13	65	90	5.3	4.7	Sand	2.47	2.34	1.21	0.47	2.62	0.29	17.33	4.07
	14	70	89.9	5.12	4.98	Sand	2.45	2.33	1.31	0.44	2.69	0.32	16.76	5.56
	15	75	89.4	5.45	5.15	Sand	2.43	2.30	1.37	0.43	2.71	0.29	13.24	7.27
	16	80	89.4	5.25	5.35	Sand	2.41	2.28	1.37	0.45	2.79	0.30	13.26	3.72
	17	85	87.4	6.23	6.37	Loamy Sand	2.51	2.33	1.51	0.48	2.85	0.27	16.66	2.14
	18	90	88.1	5.87	6.03	Sand	2.54	2.38	1.43	0.48	2.85	0.26	202.04	46.09
	19	95	87.6	6.09	6.31	Loamy Sand	2.54	2.37	1.50	0.48	2.90	0.27	14.40	7.36
	20	100	86.4	7.43	6.17	Loamy Sand	2.57	2.38	1.50	0.49	2.69	0.29	43.23	0.93
	21	105	70.5	11.3	18.2	Sandy Loam	4.13	2.63	2.78	0.75	1.11	0.29	8.80	3.74
	22	110	53.1	16	30.9	Sandy Clay Loam	5.08	3.61	3.08	0.62	0.61	1.21	7.49	7.91
	23	115	39.2	20.9	39.9	Sandy Clay Loam	5.95	5.69	3.07	0.15	0.56	2.91	8.50	3.05
	24	120	19.1	34.1	46.8	Clay	6.67	7.18	2.68	-0.21	0.81	2.83	8.48	10.19

Table 15. Site 41BP595, Geoarcheological Laboratory Data

Profile	Sample	Depth	Sand	Silt	Clay	USDA Soil	Mean	Median	Sorting	Skewness	Kurtosis	LOI	Xlf	Xfd
		(cm)	(%)	(%)	(%)	Texture Class	(phi)	(phi)	(phi)	(phi)	(phi)	(%)	$10^{-8}m^3kg^{-1}$	(%)
BT6-2	1	5	91.8	4.73	3.47	Sand	2.42	2.32	0.99	0.34	1.91	0.64	9.19	3.13
Outside Feature 30	2	10	92.6	4.4	3	Sand	2.32	2.25	0.96	0.26	1.77	0.95	9.15	7.14
	3	15	92.9	4.25	2.85	Sand	2.21	2.18	1.01	0.19	1.71	1.07	8.69	7.25
	4	20	93.1	3.28	3.62	Sand	2.25	2.21	0.98	0.23	1.85	0.39	10.13	7.96
	5	25	91.6	4.29	4.11	Sand	2.31	2.24	1.15	0.34	2.23	0.45	9.86	9.59
	6	30	90.7	4.76	4.54	Sand	2.39	2.30	1.25	0.38	2.54	0.34	10.74	5.08
	7	35	90.4	4.81	4.79	Sand	2.45	2.33	1.27	0.43	2.72	0.32	11.35	4.94
	8	40	91	4.7	4.3	Sand	2.36	2.27	1.19	0.37	2.40	0.29	10.25	6.19
	9	45	90.6	4.78	4.62	Sand	2.34	2.26	1.30	0.36	2.58	0.29	11.85	8.26
	10	50	89.1	5.47	5.43	Sand	2.47	2.35	1.39	0.43	2.84	0.25	10.30	4.50
	11	55	89.5	5.41	5.09	Sand	2.45	2.33	1.36	0.42	2.72	0.24	9.82	4.17
	12	60	89.1	5.39	5.51	Sand	2.50	2.38	1.39	0.43	2.84	0.27	10.53	1.79
	13	65	89.2	5.18	5.62	Sand	2.45	2.33	1.41	0.43	2.89	0.26	10.62	0.43
	14	70	90.3	4.98	4.72	Sand	2.46	2.36	1.29	0.40	2.55	0.22	10.04	-1.40
	15	75	89.6	5.09	5.31	Sand	2.46	2.34	1.37	0.43	2.88	0.25	9.75	-3.81
	16	80	89.9	5.06	5.04	Sand	2.46	2.35	1.34	0.41	2.74	0.22	10.35	3.72
	17	85	90.1	4.94	4.96	Sand	2.42	2.31	1.33	0.41	2.71	0.24	10.75	2.59
	18	90	87.7	5.66	6.64	Loamy Sand	2.57	2.41	1.50	0.49	2.99	0.22	10.62	4.15
	19	95	87.7	5.86	6.44	Loamy Sand	2.52	2.36	1.49	0.47	2.92	0.29	10.65	0.00
	20	100	88.6	5.51	5.89	Sand	2.49	2.35	1.43	0.45	2.93	0.32	18.77	0.49
	21	105	85.1	7.17	7.73	Loamy Sand	2.71	2.46	1.50	0.58	2.77	0.27	10.11	6.67
	22	110	59.4	12	28.6	Sandy Clay Loam	4.77	3.03	2.94	0.77	0.62	1.16	8.32	7.31
	23	115	55.8	12	32.2	Sandy Clay Loam	5.00	3.35	3.07	0.69	0.59	1.79	7.48	8.33
BT7-1	1	5	94.6	2.77	2.63	Sand	2.31	2.25	0.77	0.19	1.51	0.44	8.35	4.79
Middle of Feature 30	2	10	94	2.8	3.2	Sand	2.37	2.31	0.82	0.21	1.59	0.36	8.69	6.91
	3	15	94.9	2.35	2.75	Sand	2.39	2.33	0.71	0.20	1.37	0.30	7.84	10.47
	4	20	94	2.92	3.08	Sand	2.37	2.31	0.80	0.24	1.54	0.34	9.59	10.05
	5	25	94.9	2.53	2.57	Sand	2.30	2.25	0.76	0.17	1.42	0.32	9.60	11.48
	6	30	94	3.05	2.95	Sand	2.37	2.31	0.80	0.23	1.54	0.30	10.45	12.83
	7	35	92.7	3.67	3.63	Sand	2.42	2.34	0.90	0.35	1.87	0.34	14.73	11.32

Table 15. Site 41BP595, Geoarcheological Laboratory Data

Profile	Sample	Depth	Sand	Silt	Clay	USDA Soil	Mean	Median	Sorting	Skewness	Kurtosis	LOI	Xlf	Xfd
		(cm)	(%)	(%)	(%)	Texture Class	(phi)	(phi)	(phi)	(phi)	(phi)	(%)	$10^{-8}m^3kg^{-1}$	(%)
	8	40	90	5.34	4.66	Sand	2.48	2.35	1.24	0.45	2.64	0.53	12.92	14.13
	9	45	89.8	5.35	4.85	Sand	2.45	2.32	1.30	0.43	2.71	0.56	16.61	12.53
	10	50	89.7	5.29	5.01	Sand	2.45	2.32	1.31	0.45	2.74	0.46	14.43	12.90
	11	55	90.5	4.96	4.54	Sand	2.44	2.33	1.22	0.41	2.55	0.56	16.19	12.64
	12	60	89.8	5.21	4.99	Sand	2.44	2.32	1.32	0.43	2.76	0.55	16.83	13.90
	13	65	90.3	4.88	4.82	Sand	2.41	2.30	1.30	0.41	2.72	0.58	18.63	12.29
	14	70	89.7	5.04	5.26	Sand	2.47	2.34	1.33	0.46	2.87	0.56	15.99	9.70
	15	75	91.2	4.43	4.37	Sand	2.34	2.26	1.22	0.36	2.44	0.52	15.42	7.76
	16	80	90.6	4.71	4.69	Sand	2.38	2.28	1.29	0.39	2.61	0.89	15.68	9.88
	17	85	90.2	4.86	4.94	Sand	2.38	2.27	1.34	0.41	2.68	0.56	15.76	8.43
	18	90	90.4	4.86	4.74	Sand	2.43	2.32	1.29	0.41	2.63	0.42	13.93	1.73
	19	95	89.8	5.2	5	Sand	2.51	2.38	1.25	0.49	2.71	0.42	13.87	3.67
	20	100	90.7	4.81	4.49	Sand	2.45	2.34	1.20	0.42	2.55	0.34	12.16	-0.75
	21	105	90.7	4.85	4.45	Sand	2.44	2.33	1.19	0.43	2.51	0.30	11.11	-6.94
	22	110	91.1	4.42	4.48	Sand	2.38	2.28	1.20	0.41	2.54	0.34	15.99	3.74
	23	115	89.7	5.29	5.01	Sand	2.48	2.35	1.30	0.45	2.76	0.30	10.80	-0.44
	24	120	90.7	4.9	4.4	Sand	2.47	2.36	1.16	0.43	2.45	0.27	34.94	3.60
	25	125	90.6	5.05	4.35	Sand	2.45	2.34	1.18	0.42	2.47	0.30	10.32	-7.49
	26	130	89.7	5.31	4.99	Sand	2.46	2.34	1.31	0.43	2.76	0.31	10.73	-11.11
	27	135	88.4	5.79	5.81	Sand	2.51	2.36	1.41	0.48	2.91	0.32	11.32	-8.94
	28	140	75.4	8.8	15.8	Sandy Loam	3.70	2.31	2.84	0.73	1.69	2.26	15.01	-4.40
Fence Row	1	2	93.8	4.23	1.97	Sand	2.45	2.38	0.75	0.27	1.40	na	na	na
Dune 1	2	7	93.8	3.4	2.8	Sand	2.41	2.34	0.79	0.24	1.49	na	na	na
	3	12	95.5	2.65	1.85	Sand	2.31	2.26	0.69	0.19	1.31	na	na	na
	4	19	95.5	2.07	2.43	Sand	2.38	2.33	0.69	0.15	1.36	na	na	na

Table 15. Site 41BP595, Geoarcheological Laboratory Data

Profile	Sample	Depth	Sand	Silt	Clay	USDA Soil	Mean	Median	Sorting	Skewness	Kurtosis	LOI	Xlf	Xfd
		(cm)	(%)	(%)	(%)	Texture Class	(phi)	(phi)	(phi)	(phi)	(phi)	(%)	$10^{-8}m^3kg^{-1}$	(%)
Fence Row	1	2	93	3.91	3.09	Sand	2.35	2.28	0.93	0.27	1.79	na	na	na
Dune 2	2	7	93.8	2.83	3.37	Sand	2.36	2.28	0.82	0.32	1.76	na	na	na
	3	12	94.8	2.26	2.94	Sand	2.32	2.26	0.74	0.21	1.47	na	na	na
	4	18	95.2	2.01	2.79	Sand	2.30	2.25	0.71	0.18	1.42	na	na	na
	5	23	96.4	1.3	2.3	Sand	2.24	2.20	0.62	0.14	1.29	na	na	na
Samples Across	0	na	na	na	na	na	na	na	na	na	na	0.48	12.10	5.34
Feature 30	1	na	na	na	na	na	na	na	na	na	na	0.40	26.49	3.85
	2	na	na	na	na	na	na	na	na	na	na	0.43	15.55	7.56
	3	na	na	na	na	na	na	na	na	na	na	0.55	16.61	7.87
	4	na	na	na	na	na	na	na	na	na	na	0.61	15.75	8.91
	5	na	na	na	na	na	na	na	na	na	na	0.59	16.74	9.12
	6	na	na	na	na	na	na	na	na	na	na	0.80	16.46	9.49
	7	na	na	na	na	na	na	na	na	na	na	0.77	19.38	8.73
	8	na	na	na	na	na	na	na	na	na	na	0.58	15.89	10.12
	9	na	na	na	na	na	na	na	na	na	na	0.68	17.43	11.76
	10	na	na	na	na	na	na	na	na	na	na	0.58	18.32	12.59
	11	na	na	na	na	na	na	na	na	na	na	0.56	15.56	7.76
	12	na	na	na	na	na	na	na	na	na	na	0.52	13.82	7.88
	13	na	na	na	na	na	na	na	na	na	na	0.50	13.83	9.33
	14	na	na	na	na	na	na	na	na	na	na	0.46	13.25	8.53
	15	na	na	na	na	na	na	na	na	na	na	0.42	12.22	10.37
	16	na	na	na	na	na	na	na	na	na	na	0.33	12.00	4.56
	17	na	na	na	na	na	na	na	na	na	na	0.27	10.48	4.55
	18	na	na	na	na	na	na	na	na	na	na	0.28	9.87	2.39

Magnetic Susceptibility

Magnetic susceptibility is a general measure of the degree to which a sample may be magnetized, and provides basic information on the magnetic mineralogy of the sample, which may vary owing to a variety of factors, such as depositional processes, soil development, and human occupation. The application of magnetic susceptibility to archeological research has been discussed in detail by Dalan (2008) and Dalan and Bannerjee (1998). In order to determine the magnetic susceptibility samples were first dried, weighed, and then the low frequency (470 Hz) and high frequency (4700 Hz) volume magnetic susceptibility (kappa) was measured on the o.1 setting on a Bartington MS2 meter and an MS2b sensor (Dearing 1999). The mass corrected magnetic susceptibility (chi, or χ_{lf}) and coefficient of frequency dependency (χ_{fd}) were then calculated. The coefficient of frequency dependency (χ_{fd}), is the percent difference in magnetic susceptibility measured at low and high frequencies (calculated as: $\chi_{fd} = (\chi_{lf} - \chi_{hf})/ \chi_{lf})*100$). Elevated values of χ_{fd} (ca. >10%; Gale and Hoare 1991:213) are indicative of increased concentrations of fine-grained ferrimagnetic minerals, most often maghemite, in top soils (Dearing et al., 1996). The magnetic susceptibility values are presented on **Table 15** and are reported in SI units ($10^{-8}m^3kg^{-1}$).

Particle Size Analysis

The particle size distribution (or texture) of the sediment samples was determined on a Beckman-Coulter LS 13-320 multi-wavelength laser sizer. Following completion of the magnetic susceptibility analysis, samples were subsampled, with a small amount placed in a small beaker which was then put on a hot plate and to which concentrated (30 percent) hydrogen peroxide was added in order to remove organic matter and a 5 percent solution of sodium hexametaphosphate was added to disperse the clay minerals. The liquid was then brought to a boil and then left on the hot plate until the reaction had ceased or the color of the sediment had changed, at which point the sample was removed from the hot plate, cooled and then measured on the LS-13-320. The results of these analyses are presented as percentages of sand, silt and clay, as well as in the form of descriptive statistics that are presented in phi units (a negative log base 2 conversion of millimeters). In the phi system, sands exhibit phi values between 0 and 4, silts between 4 and 9, and clay > 9 phi. Comparisons with traditional particle size data and laser sizer granulometry (e.g. Ramaswamy and Rao 2006; Konert and Vandenberghe 1997) suggest that using the silt-clay boundary at either 6 or 8 microns yields results most comparable with traditional particle size methods and this is the method used to determine percentage clay on **Table 15**. The USDA soil texture class for each sample was determined using the Soil Texture calculator provided by the NRCS website (NRCS 2013d).

Loss-on-ignition (LOI)

The organic matter content of the samples was estimated using the weight loss-on-ignition method following Schulte and Hopkins (1996; see also Heiri et al 2001 and Nelson and Sommers 1996). Loss-on-ignition (or LOI) provides a reasonable estimation of organic matter content in the absence of minerals with structural water (e.g. smectite clays, gypsum) and in many cases, drying samples at 150˚ can minimize organic matter overestimation where problematic minerals are present. To determine the loss-on-ignition, samples were placed into porcelain crucibles, weighed, and dried at 150˚C overnight, after which they were weighed again, and then placed in a muffle furnace at 450˚C for 4 hours. Samples were removed from the

furnace and weighed while hot, and the percentage weight loss-on-ignition was calculated. Given that most of the sands contain very little clay, the LOI values for these samples most likely are reasonable estimates, but all of the samples derived from argillic horizons exhibit significant LOI values, but do not appear to have a color that would support this so these values should be viewed with skepticism.

Lidar Digital Elevation Model

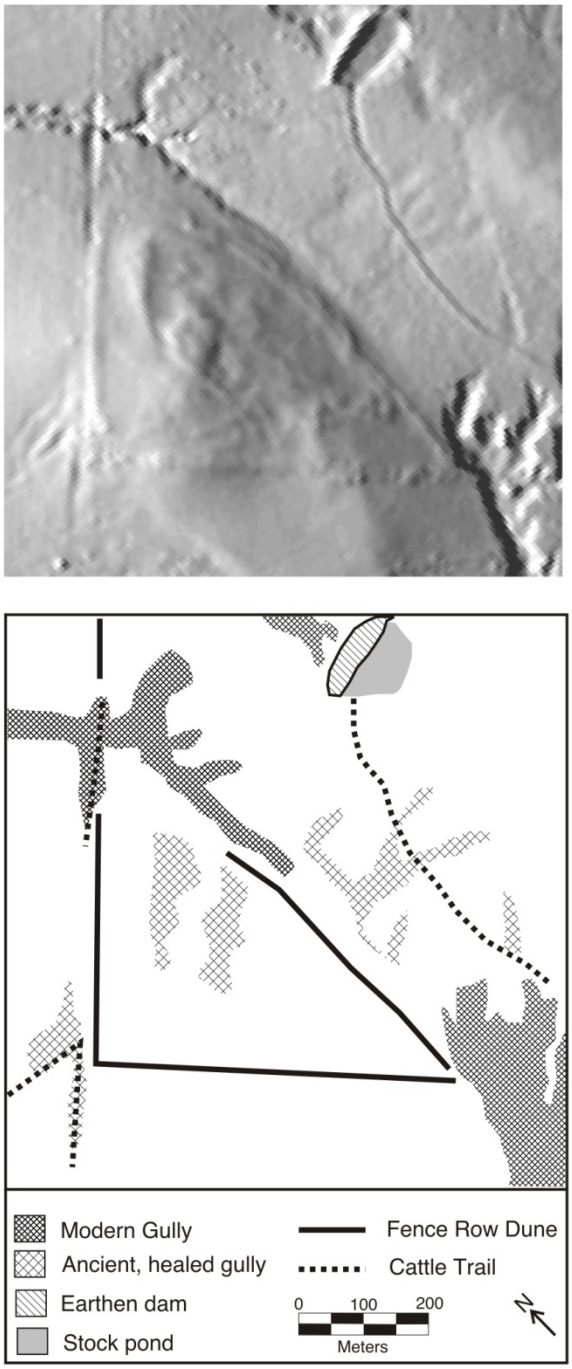
Following fieldwork, lidar data obtained from the mine was used to compile a digital elevation model (DEM) that was useful in examining and documenting local geomorphic features on and near the site (see **Figure 14)**. These data provide an exquisite view of low-relief landforms associated with historic land use in this area and clearly show the location and size of the minor landforms like fence row dunes, which are visible in the field but too small to show on normal topographic maps (see also **Figure 15**). Because the lidar images were compiled following fieldwork, the interpretations presented below have not been ground truthed.

Geomorphology

The landscape in the immediate vicinity of the site contains numerous geomorphic features created by soil erosion and re-deposition primarily associated with Historic period farming. The two most conspicuous features are fence row dunes and gullies.

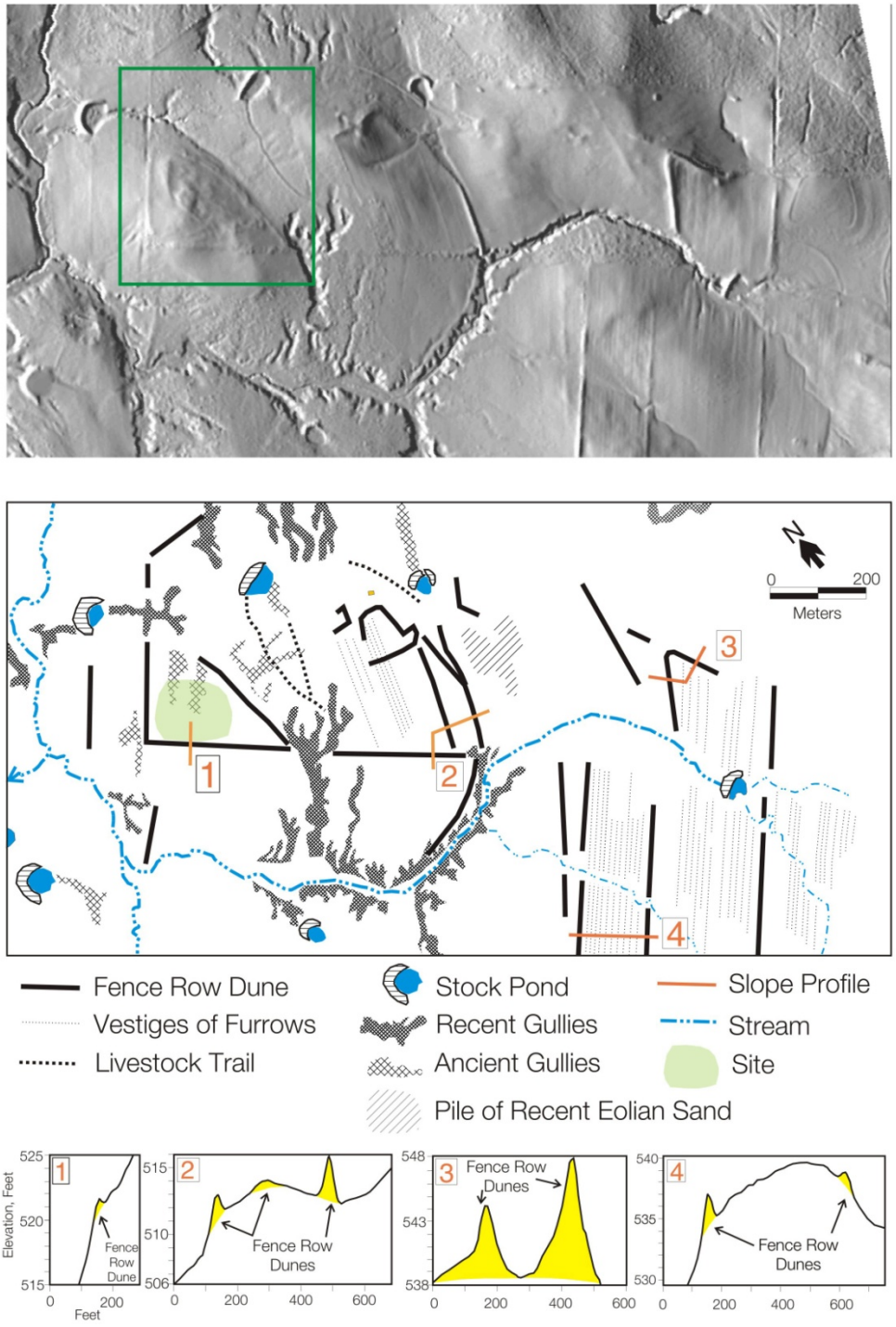
Fence Row Dunes

One of the surprising attributes of the landscape around the site is the presence of numerous fence row dunes. These dunes are accumulations of windblown sand that form along fence lines owing to the reduction in wind speed associated with the fence itself and vegetation growing along it and or trapped by it. The ability of fences to cause eolian sand deposition has long been used to build up sand dunes (e.g. Pye and Tsoar 2009; Grafals-Soto 2012; Grafals-Soto and Nordstrom 2009; López and Marcomini 2006; Miller et al 2001; Hotta et al., 1987) and the accumulation of sand along fence lines has been noted as an unintended consequences of fencing in areas with sandy soils and abundant wind, like the Southern High Plains of Texas. For example, in the soil survey of Garza County, Texas, on the Southern High Plains Richardson et al (2013:39) note that fence row dunes are upwards of 2 m thick and between 7 m and "several hundred feet across" and in another reference describe them as "dunes as much as 20 feet high are common along fence rows" (Richardson et al 2013:45). On the southern High Plains, these dunes are large enough to be mapped by the soil surveys where they are delineated as the Tivoli fine sand and occur in landscapes underlain by fine sandy soils such as the Brownfield fine sand and the Miles loamy fine sand. Newman et al (1960:21) show photos of two such dunes, including one such dune that formed from just two dust storms in 1960. Once such dunes reach heights in excess of 10 feet they are often depicted on USGS Topographic maps (for an example from the Southern High Plains see Holliday 2001:100, **Figure 7**).



Top Panel: shaded relief digital elevation model derived from lidar data. Lower Panel: Map made from the shaded relief lidar map showing the location of recent and older gullies and fence row dunes in direct proximity to the site

Figure 14. Geomorphic Features



Fence Row Dunes and Elevation Profiles in the Vicinity of 41BP595

Figure 15. Lidar Image of Site and Environs

In Texas, most fence row dunes are often considered to be products of the dust bowl but analytical evidence supporting this assertion is scant. Such dunes have been OSL dated in two instances (cf. Feathers et al., 2006; and Lepper and Holliday 2007). Feathers et al., (2006:1662) dated sand built up behind a Historic

fence at the Milnesand Site that yielded an single aliquot age of A.D. 1880±20, which the authors note is older than local residents suggest for the age of the dune. More recently Lepper and Holliday (2007) dated fence row dunes on the Southern High Plains of Texas and New Mexico and obtained results with an average age of A.D. 1917±8 (89 ± 8 years) and with 1 sigma ages ranging from A.D. 1899 to 1935. These ages support the formation of such dunes in the early period of Historic land use but fail to restrict such features to the Dust Bowl years (generally considered to be the 1930s). The accuracy of these OSL dates is dependant upon the dose rate (primarily amount of background radiation in the sediment), with low dose rates generally yielding less precise depositional ages (Lepper and Holliday 2007).

Although fence row dunes are a common element of the Southern High Plains historic landscape, evidence supporting eolian erosion and transport of sandy soils in East Texas is generally lacking. Work on a summit site at one locality in East Texas by Frederick et al (2002) identified a soil profile that was thought to exhibit evidence of eolian sedimentation. Although more recent work on the effects of pedoturbation on single aliquot OSL dating casts some doubt on the chronology derived from this work, the granulometric attributes of those deposits are clearly consistent with eolian sedimentation (see results, below for comparison of the granulometric attributes of those sands with the Historic eolian sand observed during this fieldwork). Hence the fence row dunes that exist in proximity to 41BP595 and presumably associated with Historic farming are worth noting for the fact that they provide *prima facie* evidence of eolian reworking of these East Texas sandy soils as well as silent testimony to the location of historic field boundaries and fence lines, many of which are no longer part of the present land divisions.

Fence Row Dunes Near 41BP595

As note previously, fence row dunes are a common component of the landscape near 41BP595. These features can be easily seen on the shaded relief digital elevation model derived from Lidar data (**Figures 14** and **15**). Two such dunes were noted in the field, in direct proximity of the site, aligned with the fences that border the hill summit on the northwest and southwest. Examination of the lidar derived digital elevation model suggests a third such dune encircles the hill summit on the east side of the site. These dunes are low relief and subtle features, with the most obvious one on the southwest side of the hill being about 0.7 m tall and 15 m wide (see **Figure 15,** elevation transect 1). However, there are much larger dunes in the immediate vicinity, the largest of which is a chevron shaped fence row dune about a kilometer east of the site, one side of which is about 3 m tall and 60 m wide (see **Figure 15,** elevation transect 3).

Gullies

As noted previously in the discussion of the soils, the saddle immediately east of the site supports small streams that flow south and north away from the saddle, and both of which are extensively gullied today. These gullies have an abrupt form with more than 2 m of local relief in places, and are often augmented by cattle trails, especially along fence lines.

Also apparent in the lidar DEM are a series of older, somewhat healed gullies that still have topographic expression today. One set of these is on the northeast side of the site, and another set is in the saddle to the east of the site in between the modern gullies (see **Figure 15**). The east slope of the hill upon which the site is situated exhibits numerous small relief undulations which appear to be healed/buried gullies that

originated from small streams draining into the saddle. A few of these are shown on **Figure 15** above, but these gullies are most likely more extensive than this map suggests. The age of these older gully features is unknown.

Results

Nature of the deposits

Away from Feature 30 (as in Trench 6-Profile 2), the soil profile exhibited an AC-E/A1-E/A2-Bt sequum. The AC horizon consisted of a grayish brown (10YR 5/2) sand that was loose, had a single grain structure and a smooth gradual lower boundary. Although it was impossible to tell in the field, granulometric data from this horizon indicated that the upper 20 to 30 cm is of eolian origin. The underlying E/A horizon consisted of brown (10YR 5/3) to pale brown (10YR 6/3) sand and became slightly finer (loamy sand to sandy loam) immediately above the argillic (Bt) horizon. This deposit was loose, single grained, and had an abrupt wavy boundary where it rested upon the underlying argillic horizon. Krotovina of burrowing fossorial mammals, most likely pocket gophers or moles, were present within this horizon and had sharp edges, ranged from 5 to 12 cm in diameter and were generally either circular to ellipsoidal in cross-section. These burrow fills often contained small (~1cm diameter) rounded fragments of different colored soil and in this particular profile there were dark colored fragments of A-horizon in burrows situated immediately above the Bt horizon. A few thin (1-2 mm) brown (10YR 4/2) wavy clay lamellae are present in this sand as well. The Bt horizon was a yellowish red (5YR 5/8) sandy clay loam that was firm, exhibited very coarse prismatic structure, and had between 10 percent and 50 percent gray (10YR 6/1) to light brownish gray (10YR 6/2) iron depletions which imparted a mottled appearance to the horizon.

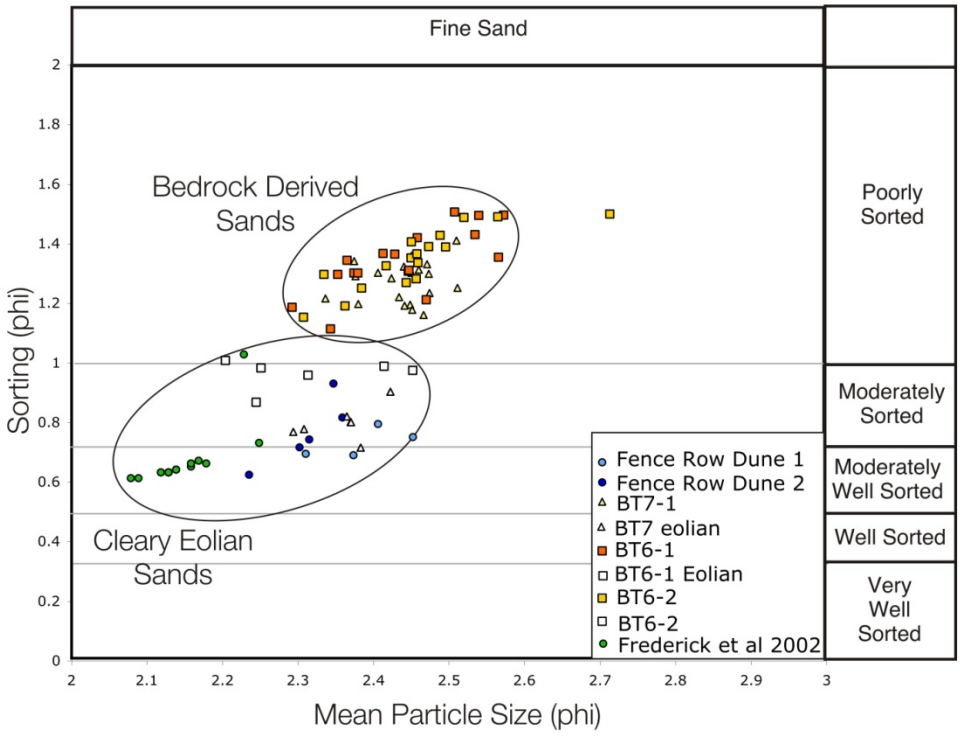
Within Feature 30, the soil profile exhibited an AC-C-2Ab-2E/A-2Bt horizon sequence and a recent drape of younger sand was apparent in most places, and clearly evident in the center of the feature where the color contrast between the younger sand and the organic-rich buried A horizon of Feature 30 was pronounced. In the center of Feature 30, the stratigraphy was most clear, but essentially the same as observed near its edge. A thin (~10 cm) AC horizon had formed in the top of the 30 to 40 cm thick, younger sand, which is presumably a Historic age eolian deposit, and this weakly developed top soil was a light brownish gray (10YR 6/2) sand, that was loose, single grained and had a clear smooth lower boundary. The majority of the recent eolian drape was a C horizon that was comprised of pale brown (10YR 6/3) sand which was loose, single grained, and met the buried A horizon at a clear irregular boundary, which had primarily been disturbed by small animal bioturbation. A few krotovina were apparent in the eolian sand, but they were not as prevalent as in the buried A-horizon that comprises Feature 30. The latter is a buried A-horizon that ranged in color from very dark gray (10YR 3/1) to a grayish brown (10YR 5/2) sand that was loose to very friable, single grain, and had a gradual to diffuse lower boundary. This sand exhibited common to many rodent/mole krotovinas, the appearance of which was facilitated by color contrast of the material. An A/E horizon was present between the base of the buried soil and the argillic horizon, and this sand was generally a brown (10YR 5/3) to pale brown (10YR 6/3) sand and like the profile outside Feature 30, became slightly finer (loamy sand to sandy loam) immediately above the argillic (Bt) horizon. A clear to abrupt irregular boundary separated the A/E horizon from the Bt horizon. The argillic horizon under Feature 30 was

essentialy the same as it was outside, characterized by yellowish red (5YR 5/8) sandy loam to sandy clay loam that had a mottled appearance owing to iron depletions along roots/pore and ped faces.

Historic Eolian Mantle

As noted above, a thin mantle of relatively clean sand was observed burying Feature 30. This drape of recent sand was difficult to impossible to discern away from Feature 30. Although an eolian depositional origin is most likely for this deposit, in order to assess this hypothesis, two profiles were collected from a clearly eolian fence row dune that parallels one of the fences on the site. The logic of this approach was to see how different, if at all, the fence row dune sediments are from the rest of the sands on the hill.

In all of the profiles that were characterized in the lab, the particle size of the deposits comprising the buried soil and the A/E horizon beneath it were broadly similar, with a mean particle size between 2.3 and 2.6 phi and with sorting values between 1.1 and 1.5 phi **(Figure 16**). In verbal terms these deposits are a poorly sorted fine sand. These sands are most likely bedrock derived sand.



Plot of the mean particle size versus the sorting (standard deviation) for the sands above the argillic horizon in and near Feature 30 at 41BP595. The blue points are the eolian sands collected from the fence row dune on site, and the white squares and triangle are deposits identified as eolian on the basis of their sorting. For comparison, the green circles are sands identified by Frederick et al (2002) for another hill summit in east-central Texas.

Figure 16. Plot of Mean vs. Sorting for sediment samples

The nine samples collected from the nearby fence row dune were all fine sand, but as a group were slightly finer (2.2 to 2.45 phi) and notably better sorted (moderately to moderately well-sorted) with values between 0.6 and 1.0 phi. The deposits of the top 30 to 40 cm of the column profiles collected from Trenches 6 and 7 were similar to the fence row dune, and in most of the column profiles the drape of recent sand is clearly evident in terms of the sorting, which is notably better than the underlying sand (see **Figure 13**). Hence, the sands draping Feature 30 closely resemble the eolian fence row dune, and are therefore interpreted as an eolian deposit.

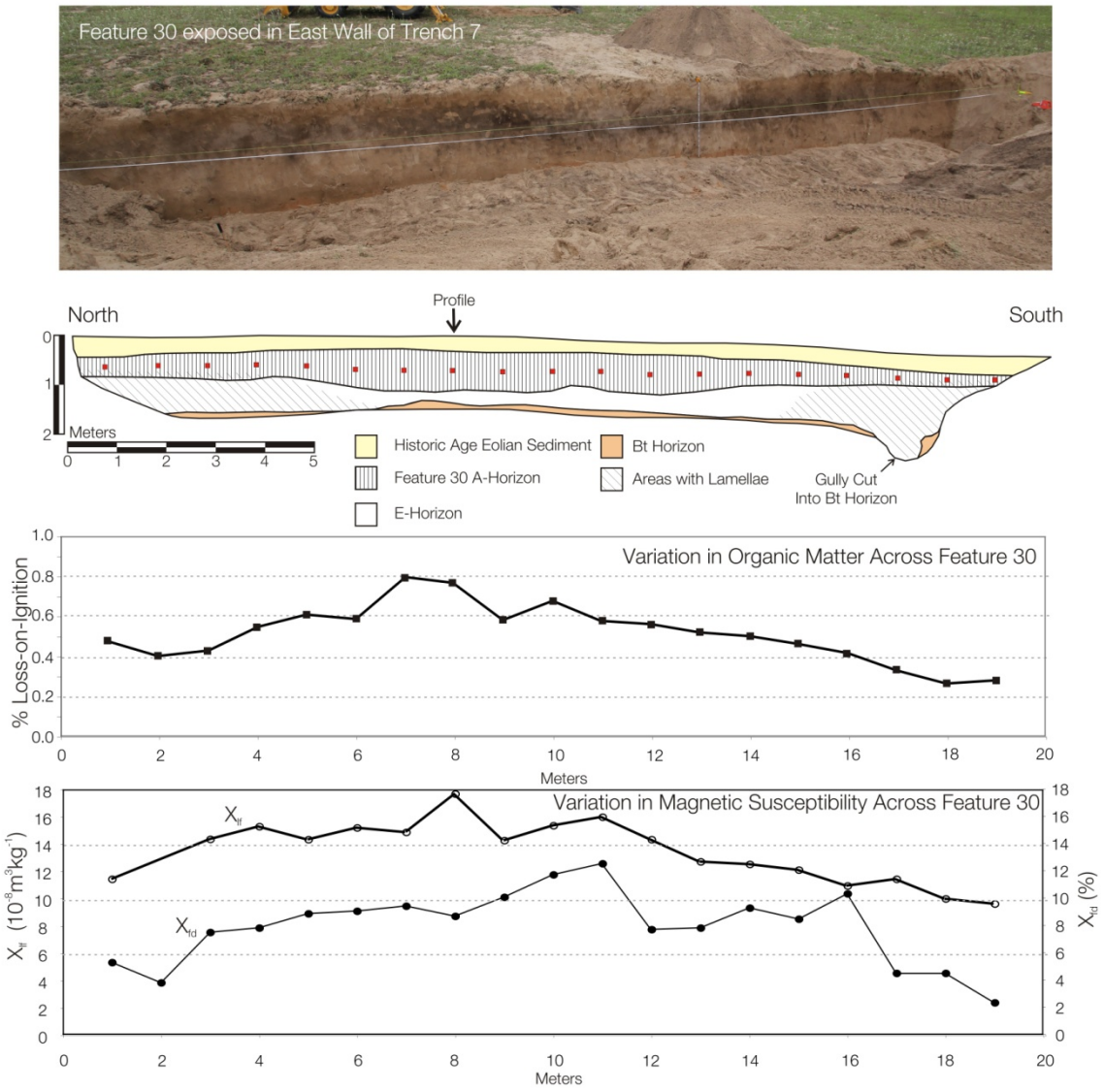
Just for comparison, also plotted on **Figure 16** are samples collected from a hill summit in Lee County that Frederick et al., 2002 argued were of eolian origin. Note how well these samples compare in terms of mean and sorting to the fence row dune samples collected at 41BP595.

Attributes of Feature 30

Examination of the stratigraphic exposures of Feature 30 and subsequent analysis of the deposits provides several insights on the context and origin of this deposit. First, the sediment comprising the feature and the sediment in the same stratigraphic position outside of it are texturally similar, which suggests that this feature has formed within the existing sediment, which is most likely weathered Eocene Wilcox Group fluvial-deltaic sand (see **Figures 13** and **16**). Second, the organic matter that comprises the feature is greatest in the center and diminishes towards the margins, and there is approximately three times more organic matter in the center than in the margins of the feature (see **Figure 17**). The area of organic enrichment respects neither a surface topographic depression nor a depression in the top of the underlying subsoil (argillic horizon), indicating it is not a product of poor drainage or gleying. In fact, prior to burial Feature 30 appears to have been slightly domed, with the organic-enriched center slightly higher than the margins. The profile of Trench 7 indicates that before burial by recent eolian sand, the top of Feature 30 was at the ground surface and the feature is deepest in the center and feathers out towards the margins.

Although the A horizons of many soils exhibit magnetic susceptibility enhancement in the form of elevated X_{lf} and X_{fd}, the soils of East Texas sandy mantle deposits typically do not. But both the magnetic susceptibility and the coefficient of frequency dependency are elevated within the center of Feature 30 and diminish towards the margins of the feature (see **Figure 17**). The low frequency mass corrected magnetic susceptibility (X_{lf}) is twice as high in the center of the feature as it is at the edge, and the coefficient of frequency dependence (X_{fd}) is as much as five times greater in the center than at the margin. Together, these indicate a process of magnetic susceptibility enhancement that is abnormal for east-central Texas sandy soils and clearly *not* the product of gley or water logging.

Finally, although somewhat anecdotal, it was noted when drawing the profile of the feature in Trench 7 that there are numerous thin (1-2 mm) clay lamellae in the lower half of Feature 30 and beneath it along the margins of the feature, but *there are none* under the center, the most organic rich part of the feature (see **Figure 17**, next to top panel). The absence of lamellae beneath the center of the feature is perplexing unless this feature and its organic matter derived from thermal refuse contributed by people. The extensive and ubiquitous argillic horizons common in this landscape indicate that the soils are low in



Results of the laboratory analysis of the soil samples collected in a transect across Feature 30 in Trench 7, at 41BP595. Top Panel: A slightly oblique photograph of the east wall of Trench 7 showing Feature 30 (the dark band in the middle of the wall). Red squares denote the location of soil samples collected in the transect across the feature, the results of which are shown below. Next to Top Panel: Line drawing of the east wall of Trench 7. Next to Bottom Panel: Variation in organic matter (loss-on-ignition) across Feature 30. Bottom Panel: Variation on the low frequency mass corrected magnetic susceptibility (Xlf) and the coefficient of Frequency dependence (Xfd) across Feature 30.

Figure 17. Cross-Section of Feature 30 and Lab data

bases such as calcium. Schaetzl and Anderson (2005:365) note that the process of clay translocation or lessivage is weak or almost non-existent in calcareous materials, and will not occur until most of the calcium has been stripped from the soil. Calcium carbonate is one of the primary constituents of wood ash. Although the amount of calcium carbonate in these samples was not assayed, the apparent stratigraphic pattern of clay lamellae is suggestive of one where calcium has not been entirely leached from the thickest part of the

feature. It would be interesting to see if the spatial and stratigraphic occurrence of calcium is inversely related to that of the clay lamellae, which if so would indicate that Feature 30 is most likely the result of the disposal of thermal refuse.

Considered together, the evidence gathered here indicates that the most plausible origin of Feature 30 is human activity, more specifically, the disposal of thermal refuse. Although there are a few burned rocks within Feature 30, there appeared to be several intact burned rock features around it, but *not* in the center. This suggests that if this hypothesis is correct, that the feature resulted from discard of thermal refuse rather than an *in situ* creation of thermal refuse as occurs with an earth oven. It is tempting to consider this feature as a manifestation of a common space between thermal activity areas rather than a site appliance like feature. The most compelling and useful information in understanding the origins of this feature will most likely be the spatial and stratigraphic occurrence of in situ thermal features with respect to Feature 30.

Summary

This chapter presents the results of a geoarcheological examination of Feature 30 at 41BP595. Cross-sections of the feature made with a backhoe, together with examination of the deposits present, indicate that this dark-colored, organic-rich deposit, which is situated near the crest of a hill, is most likely the result of human activity, specifically the deposition of organic refuse, at least some of which, and possibly most, was thermal refuse. The feature consists of a lenticular body of organic-rich sand that is about 70 cm thick in the center and feathers to a thin edge on the sides. The feature was present on the ground surface before it was buried by 30 to 40 cm of recent eolian sand. The organic matter within this feature is elevated in the middle where the deposit is thickest, and the magnetic susceptibility is also greatest in this location as well. The degree of magnetic susceptibility enhancement is considerably greater than normally observed in sandy topsoils in this region. The magnetic susceptibility of the feature is too high for a gleyed deposit, and the feature is not restricted to a topographic low or a depression in the top of the underlying subsoil. The curious absence of clay lamellae beneath the thickest part of the feature as exposed by Trench 7 may be an artifact of the presence of calcium presumably derived from ash in the central part of the feature, the presence of which inhibits the processes of lessivage that creates clay lamellae.

Both lidar derived shaded relief digital elevation models and the profile of a trench excavated through the feature, indicate that this hill slope has been stripped by gully erosion in the not too distant past. The north and east slopes of the hill bear tangible scars of ancient gullying which are prominent even today when walking across the site, and a recent group of gullies are now cutting headwards onto the site from a saddle immediately east of the site. Feature 30 has formed in sand that partly overlies a small ancient gully that was cut into the argillic horizon near the south end of Trench 7, but this small gully appears to be unrelated to Feature 30. Despite clear evidence of active small mammal pedoturbation, this matrix-defined feature retains spatial integrity, and the deposits appear to retain some semblance of stratigraphic integrity. Burnt rock features discovered around the margins of the feature appear to retain good integrity and it is likely that the distribution of such features may hold considerable clues to understanding what Feature 30 was in the past. Although the scale and some aspects of the appearance of this feature are consistent with site appliance-like thermal features (think burned rock midden without the rock) the presence of intact thermal

features on the periphery suggest an alternative origin, namely a common space between dispersed thermal activity areas where thermal and organic refuse was disposed.

FEATURE AND UNIT EXCAVATION

Feature 1

Feature 1 was a subsurface circular concentration of thermally altered rock thought to represent the remains of a prehistoric hearth (**Figure 18**). It was exposed in the southern half of Trench 6 at 50 cmbs and was contained within the buried anthrogenic A soil horizon referred to as Feature 30 (**Figure 19**). Feature 1 was found near the southeastern edge of Feature 30. Here, Feature 30 appeared to be less organically rich than it did in Trench 7, where it was more massive. A portion of Feature 1 extended into the western wall of the Trench and was sampled with Unit 3. The eastern portion of the feature exposed within the trench was mapped, excavated and drawn in profile before the western portion was exposed in Unit 3. In plan, it extended 110 cm north-south by 100 cm east-west. In profile the feature was 8 cm thick, consisted of a single layer of burned rock, and terminated in a slight basin. Its volume was 41,887.90 cubic centimeters (cc).

The east half of the feature consisted of 120 Chert rocks (8.5 kg), 110 quartzite rocks (14.7 kg), and 29 hematite rocks (2.5 kg). The total mass of all of the burned rocks from the eastern half of the feature was 25.7 kg. The count of the rocks from the western half of the feature (the portion exposed within Unit 3) was not recorded. The total mass of each rock type, however, was recorded. The west side of the feature contained 9.3 kg of burned quartzite, 4.3 kg of burned hematite, four burned chert fragments with a combined mass of 0.9 kg, and one piece of silicified wood with a mass of 0.9 kg. The total mass of all of the rock recovered from the west half of the feature was 15.4 kg.

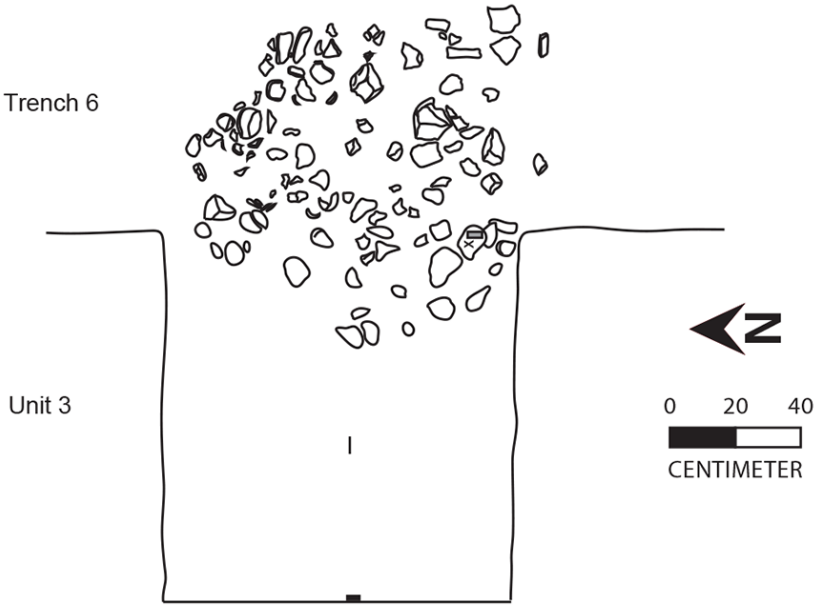
Unit 3

Hand excavated unit 3 extended 120 cm east west by 110 cm north south (See **Figure 18**). Unit 3 yielded 123 pieces of lithic debitage, 8 ground stone fragments, 1,970.43 g of burned rock, 1 projectile point, 1 lithic biface, 1.87g of burned nut shell, and 0.33g of wood charcoal. The vertical distribution of cultural materials from Unit 3 is presented in **Table 16** below. The burned rock recovered from Level 6 presumably was associated with Feature 1.

Table 16. Site 41BP595, Unit 3, Cultural Material by 10 cm Level

Level	Debitage	Ground Stone	Thermally Altered Rock	Projectile Point	Burned Nut Shell	Biface	Wood Charcoal (g)
1	14	1	178.94				
2	9		530.58				
3	31		80.33	1	0.63		
4	26		139.88		0.09	1	
5	12	1	7.32				0.33
6	13	2	620.98		0.09		
7	13	3	141.67		1.06		
8	5	1	270.73				
Total	**123**	**8**	**1,970.43**	**1**	**1.87**	**1**	**0.33**

Figure 18. Site 41BP595 Feature 1 Profile, West Wall Trench 6



I Anthrogenic A Horizon, Feature 30, 10YR5/6 yellowish brown sand, with mottles of 10YR4/4 dark yellowish brown sand and 10YR4/3 brown sand around feature rocks, fine blocky sub-angular structure, weak grade.

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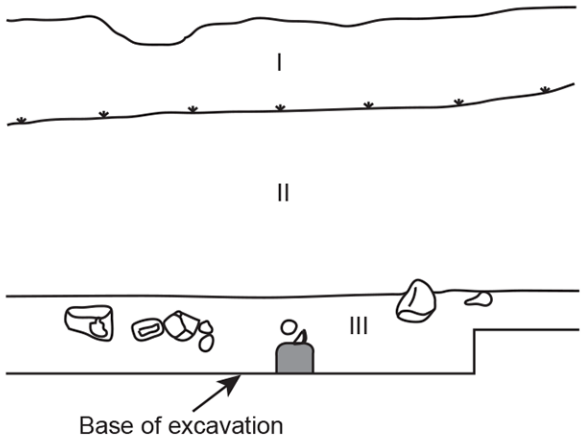
Figure 18

Site 41BP595
Feature 1 Plan View



I Back dirt, 0 – 20 cmbs
II C horizon, 10YR5/6 Yellowish brown sand, 20 – 60 cmbs, thickly bedded, fine blocky sub-angular structure, weak grade.
III Anthropogenic A horizon (Feature 30), 10YR5/6 Yellowish brown sand with mottles of 10YR4/4 dark yellowish brown sand and 10YR4/3 brown sand around feature rocks, fine blocky sub-angular structure, weak grade.

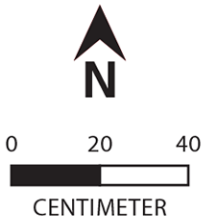


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Figure 19

Site 41BP595
Feature 1 Profile, West Wall
Trench 6

The Feature 1 assemblage of cultural materials recovered in the ¼ inch screens includes 25 pieces of lithic debitage, 3 ground stone tool fragments, 1 burned nutshell, 0.33 g of wood charcoal, and 18 fragments of thermally altered rock with a combined mass of 628.3 g. Just over half of the debitage specimens (n = 13) were thermally altered. The 18 fragments of thermally altered rock include 3 chert fragments (4.78 g), 1 fragment of hematitic sandstone (220 g), 1 fragment of hematite (0.46 g), 3 fragments of metaquartzite (16.8 g), 10 fragments of quartz arenite (380.7 g) and 1 fragment of silicified wood (5.56g).

The rocks comprising the feature occurred in a single layer. As mentioned above, the feature was found contained within Feature 30 near its southeastern edge, where it was expressed as a 10YR5/6 yellowish brown fine sand, with mottles of 10YR4/4 dark yellowish brown sand and 10YR4/3 brown sand around the feature rocks. Many fine roots and minor rodent disturbance were recorded in the field notes. A single burned rock was retained for FTIR, starch, pollen, and phytolith analysis. The phytolith record from Feature 1 indicates that it may have been used to process grass seeds. The recovery of a broken Cyperacea achene seed phytolith suggests that sedge seeds may have been processed.

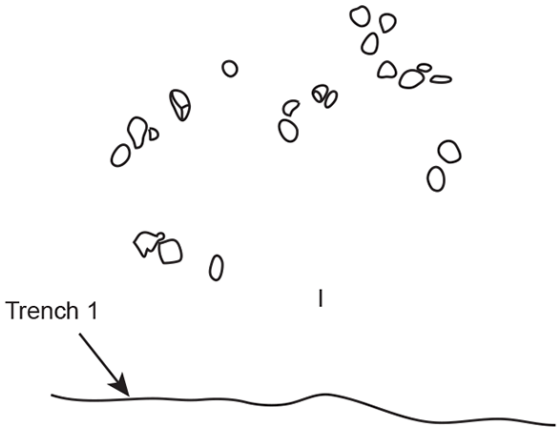
Two soil samples, comprising 17.10 cubic decimeters (cu dm), were retained for flotation from the eastern half of Feature 1 and submitted to Macrobotanical Analysis for flotation and analysis. Flotation yielded 0.07 g of wood charcoal which consisted of 0.03 g of Oak, 0.01 g of Hickory, and 0.03 g of unidentified hardwood. Flotation also yielded 0.10 g of burned nutshell including 0.07 g of Hickory and 0.03 g of Hickory/Walnut. A total of 0.02 g of indeterminable charred remains and 0.03 g of burned bark were also recovered through flotation. One burned hickory nutshell recovered from the Feature 1 flotation sample was submitted for radiocarbon analysis and returned a two sigma calibrated date range of A.D. 4 to A.D. 130.

Feature 2

Feature 2 was an amorphous and diffuse scatter of thermally altered rock (**Figure 20**) exposed in Trench 1 at roughly 26 cmbs. The feature was found contained within Feature 30 near its western edge. The rock scatter was limited to an area extending 80 cm north-south by 64 cm east-west. The feature consisted of 21 thermally altered quartzite rocks (2.5 kg) that occurred in a single layer resting on a level plane. The estimated volume was 64,340 cc. The feature was limited to the anthrogenic A soil horizon and the soil in and surrounding it was a 10YR6/3 pale brown sand with no visible mottling. No artifacts were recovered in association with this feature. Rodent activity and small roots were noted on the field forms. This feature is thought to represent a disarticulated hearth or possibly secondarily deposited material from a nearby feature, rather than an intact cooking facility. For these reasons, the feature was mapped in plan and the feature rocks were weighed, but it was not further sampled.

Feature 3

Feature 3 was an ephemeral subsurface scatter of thermally altered rock (**Figure 21**) exposed in Trench 1 approximately 15 cmbs. The feature was found contained within Feature 30 near its southwestern edge. The rock scatter was limited to a 58 cm north-south by 20 cm east-west area and consisted of five thermally altered quartzite rocks (0.5 kg). The rocks occurred in a single layer resting on a level plane.



I Anthrogenic A horizon (Feature 30), 10YR6/3 pale brown sand, fine blocky sub-angular structure, weak grade.

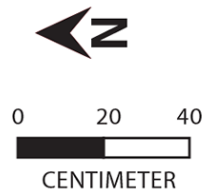


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Figure 20

Site 41BP595
Feature 2 Plan View

I C horizon, 10YR6/3 pale brown sand, fine blocky sub-angular structure, weak grade.
II Rodent Run, 10YR6/3 light brownish gray sand, fine blocky sub-angular structure, weak grade.

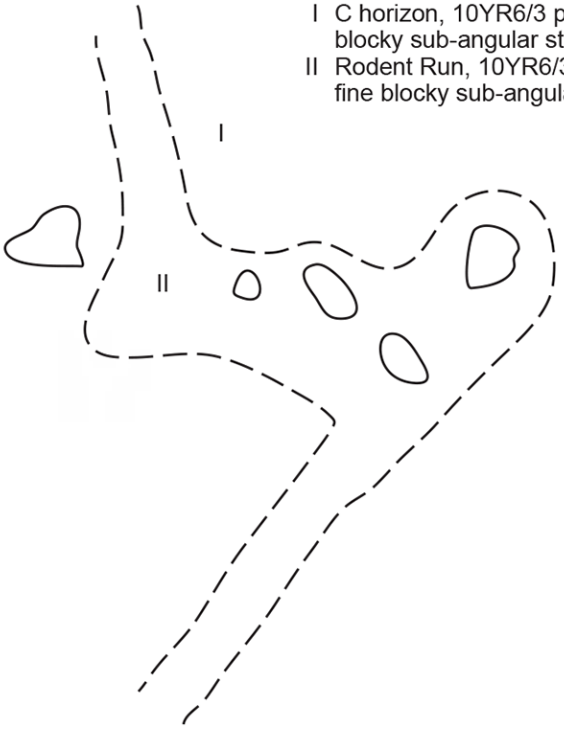

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Figure 21

Site 41BP595
Feature 3 Plan View

The estimated volume was 4,640 cc. The feature was contained within the C horizon, above the buried anthrogenic A horizon, and the soil within and around it was a 10YR6/3 pale brown sand. Four of the five feature rocks were contained within a rodent run that was a 10YR 6/2 light brown gray fine sand. Many fine roots were observed throughout the feature. No artifacts were found in association with the feature. Feature 3 is thought to represent secondarily deposited rock from a burned rock cooking facility. Consequently, once it was maped in plan and the feature rocks were weighed it was not sampled further.

Feature 4

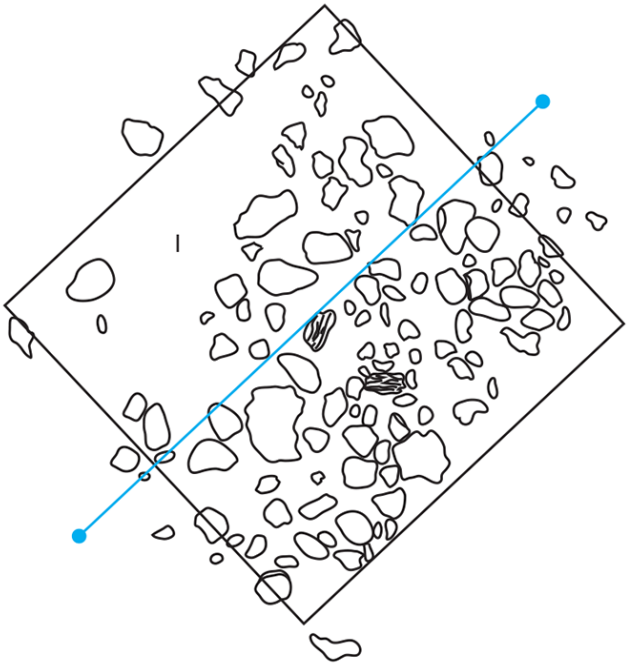
Feature 4 was a large subsurface concentration of rock that, for the most part, lacked any evidence of thermal alteration (**Figure 22**). A small number of thermally altered rocks, representing about 1 percent of the feature, was present. It was exposed in Trench 1 at about 90 cmbs and was contained within an area extending roughly 135 cm north-south by 100 cm. Feature 4 was exposed below the buried anthrogenic A horizon (Feature 30), at the bottom of the A/E horizon near its conformation with the B_t horizon. Here the A/E horizon was a 10YR5/4 yellowish brown sand while the underlying Bt horizon was a 5YR5/6 strong brown sandy clay. The volume of Feature 4 was approximately 38,024 cc. The western half of the feature was excavated by hand and screened through ¼ inch mesh. This effort recovered no artifacts but did yield 86 quartzite rocks (23.6 kg), 5 silicified wood rocks (2.2 kg), 4 hematitic sandstone rocks (1.4 kg), and 2 chert cobbles (0.3 kg). The combined mass of all the rock removed from the western half of the feature was 27.5 kg. Once the western half of the rock concentration was removed, the feature was drawn in profile (**Figure 23**). In profile, the base of the feature undulated and it did not appear to be resting on a level plane or in a basin.

Based on its near complete absence of thermally altered rock, Feature 4 is thought to have primarily non-cultural origins. The rare pieces of thermally altered rock that were found are thought to be intrusive. It is conceivable that the rock represents a cache of raw materials gathered systemically for possible later use in a cooking facility.

Feature 5

Feature 5 was a subsurface cluster of thermally altered rock (**Figure 24**) that was exposed in Trench 1 at about 40 cmbs. The feature consisted of a 35 by 42 cm oval shaped cluster of burned rocks with several additional burned rocks scattered in an adjacent triangular area that extended 16 by 25 cm. A 12 by 22 cm void was located near the center of the feature. The feature's volume was about 7,697 cc. It consisted of 52 thermally altered quartzite rocks (7.9 kg). The rocks occurred in a single layer resting on a level plane. The feature was found contained within the western edge of Feature 30, which was expressed in the feature's vicinity as a 10YR3/2 to 10YR2/2 very dark grayish sand. Many fine roots were present in the matrix. No artifacts were recovered in association with this feature.

The feature was drawn in plan and a flotation sample was taken from amongst and below the feature rocks. The feature appeared to be relatively intact. The central void within the oval shaped portion of the



I A/E horizon, 10YR5/4 yellowish brown sand, fine blocky sub-angular structure, weak grade.

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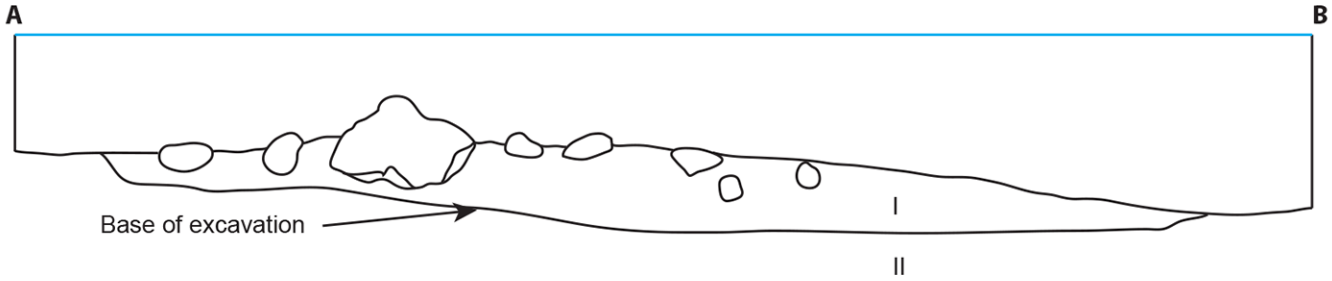
Figure 22

Site 41BP595
Feature 4 Plan View



I A/E horizon, 10YR5/4 yellowish brown sand, fine blocky sub-angular structure, weak grade.
II Bt horizon, unexcavated, 7.5YR5/6 strong brown sandy clay, blocky sub-angular structure, moderate grade.

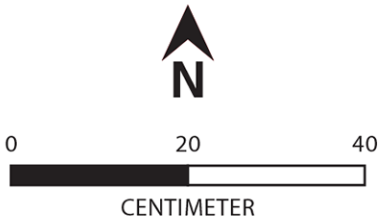


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Figure 23

Site 41BP595
Feature 4 Profile, East

I Anthropogenic A horizon (Feature 30), 10YR3/2 very dark grayish brown to 10YR2/2 very dark brown sand, fine blocky sub-angular structure, weak grade.

Rocks

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Figure 24

Site 41BP595
Feature 5 Plan View

feature, along with the adjacent rock scatter, are thought to represent the partial dismantlement of the feature at the end of its use life. Feature 5 is thought to represent a prehistoric hearth. A 4.45 cu dm soil sample was retained from the feature for flotation and macrobotanical analysis. Flotation yielded 0.10 g of wood charcoal, consisting of 0.06 g of Oak, 0.02 g of Hickory, and 0.02 g of unidentified hardwood. No burned nut shells were recovered from the flotation sample. An additional 0.02 g, of unidentified charred botanical remains was also recovered.

Feature 6

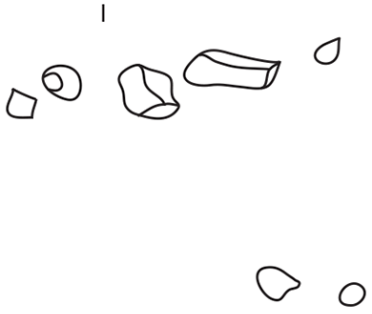
Feature 6 was an ephemeral and amorphous scatter of burned rock (**Figure 25**) exposed in Trench 1 at roughly 36 cmbs. The rock scatter was contained within a 40 cm north-south by 30 cm east-west area. Its volume was 4,320 cc. The feature consisted of nine thermally altered quartzite rocks (1.0 kg). The rock occurred in a single layer resting on a level plane. The feature was found contained within Feature 30. The soil surrounding the feature ranged from a 10YR5/4 yellowish brown sand to a 10YR4/3 brown sand with signs of rodent activity and many fine roots. The feature is thought to represent a secondarily deposited concentration of burned rocks. For this reason, it was not further sampled.

Feature 15

Feature 15 was a subsurface cluster of burned rock thought to represent a portion of a partially intact cooking surface (**Figure 26**). It was first exposed in profile in the west wall of Trench 6, at a depth ranging between 35 and 46 cmbs and extending for 56 cm along the trench wall (**Figure 27**). A portion of the feature along its eastern edge was likely removed when Trench 6 was excavated. The feature was sampled with Unit 4, which extended 1 m north/south along the trench wall by 64 cm east/west. Feature 15 was exposed in plan in Level 4 of Unit 4 where it was shown to extend 58 cm north-south by 38 cm east-west. The feature rocks occurred in a single layer and were found to be resting on a level plane. Its volume was 6,042 cc. The feature was composed of 5.6 kg quartzite and 2.3 g of hematite that had a combined mass of 7.9 kg. The feature was contained within the eastern edge of the culturally enriched soil horizon referred to as Feature 30, which was expressed in the vicinity of Feature 15, as a 25 cm thick zone of 10YR5/3 brown sand that differed only slightly from the 10YR6/3 pale brown C horizon above it and the A/E horizon below it.

Unit 4

Unit 4 was a 1 m x 64 cm hand excavated unit used to sample the remaining portion of Feature 15 exposed in the western wall of Trench 6. In addition to the burned rock from Feature 15, recovered from Level 4, Unit 4 yielded 38 pieces of lithic debitage, 3 ground stone fragments, 0.79 g of wood charcoal, and 411.42 g of thermally altered rock. The vertical distribution of these materials is presented in **Table 17** below.



I Anthropogenic A horizon (Feature 30), 10YR4/3 brown to 10YR5/4 yellowish brown sand, fine blocky sub-angular structure, weak grade.

Rocks

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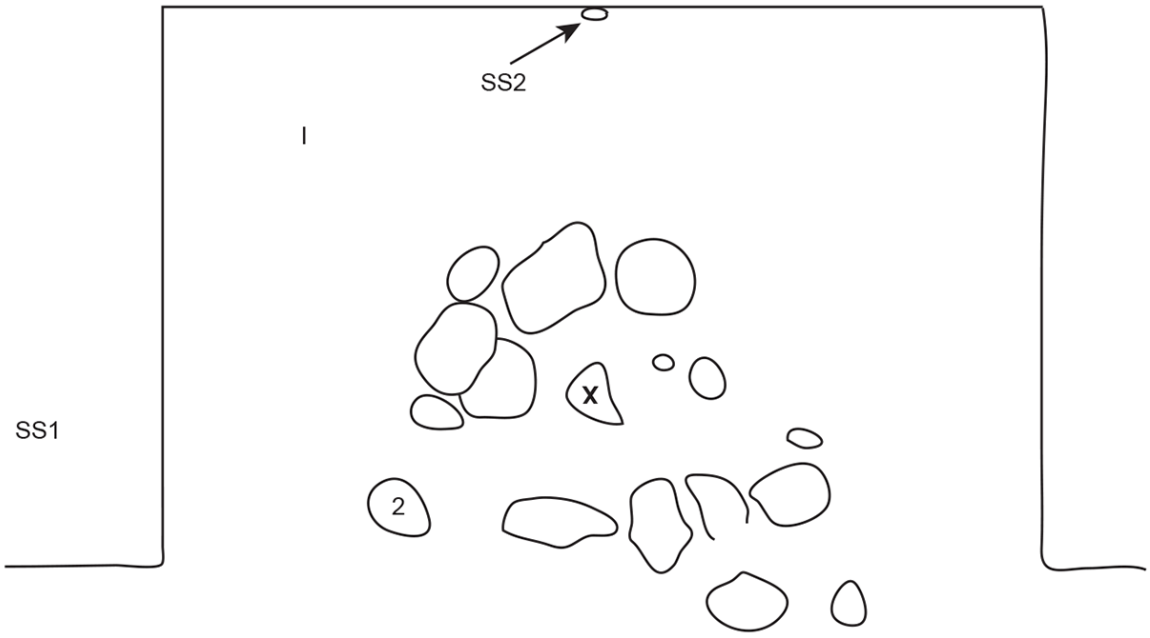
Figure 25

Site 41BP595
Feature 6 Plan View
Trench 1



I Anthropogenic A horizon (Feature 30), 10YR5/3 pale brown sand, fine blocky sub-angular structure, weak grade.

X - FTIR Sample rock

◯ - Burned rock

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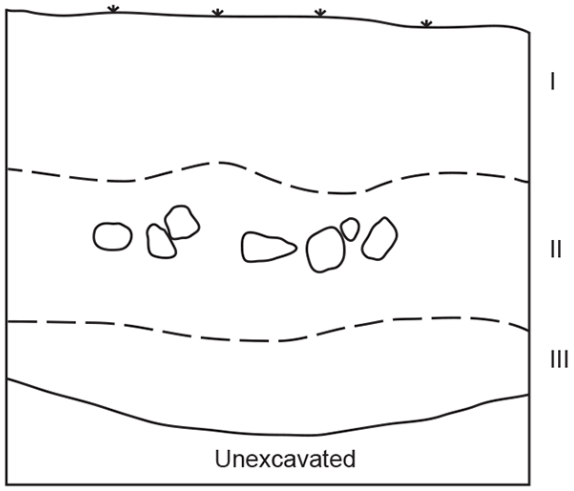
Figure 26

Site 41BP595
Feature 15 Plan View



I C horizon, 10YR6/3 Pale brown sand, fine blocky sub-angular structure, weak grade, 0-30 cmbs, medium bedded, gradual lower boundary

II Anthropogenic A horizon (Feature 30), 10YR5/3 brown sand, fine blocky sub-angular structure, weak grade, 30-60 cmbs, medium bedded, gradual lower boundary

III A/E horizon, 10YR6/3 Pale brown sand, fine blocky sub-angular structure, weak grade, 60+ cmbs, medium bedded, unknown lower boundary

◯ Burned rock

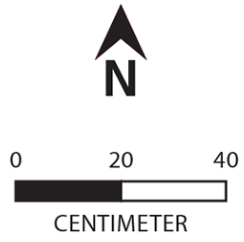


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Figure 27

Site 41BP595
Feature 15 Profile, West
Unit 4

Table 17. Site 41BP595, Unit 4, Cultural Material by 10 cm Level

Level	Debitage	Ground Stone	Thermally Altered Rock	Wood Charcoal
1	3		121.12	
2	5		4.85	
3	11	1	202.5	
4 (feature 15)			790	
5	11	2		0.11
6	5		8	0.68
7	3		74.95	
Total	**38**	**3**	**1201.42**	**0.79**

A 5.15 cu dm soil sample was retained for flotation and macrobotanical analysis. Flotation yielded 0.07 g of wood charcoal including 0.03 g of Oak and 0.04 g of unidentified hard wood. A total of 0.06 g of burned nut shell was recovered from flotation including 0.04 g of hickory and 0.02 g of hickory/walnut. An additional 0.01 g of unidentified burned botanical remains was also recovered.

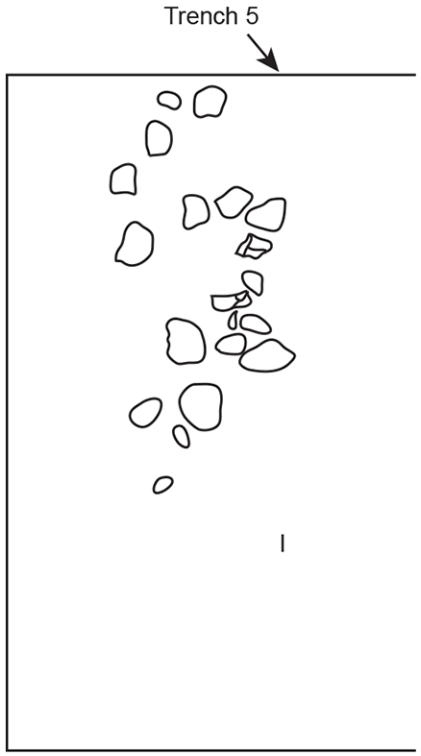
A single feature rock was retained and submitted for FTIR, phytolith, pollen, and starch analysis. No phytoliths or starches were identified that reasonably could be interpreted as evidence of subsistence processing. The FTIR analysis identified the presence of fats/oils/lipids and/or plant waxes with fingerprint region peaks consistent with Sagittaria.

Feature 16

Feature 16 was a shallowly buried linear scatter of thermally altered cobbles (**Figure 28**) exposed in Trench 5 at approximately at 27 cmbs. The feature was contained within a 78 cm east-west by 36 cm north-south area and its volume was 12,480 cc. It was found just to the east of the eastern limits of Feature 30 and contained within the E/A soil horizon. The feature consisted of 20 quartzite rocks (5.0 kg), and three hematitic sandstone rocks (0.5 kg). The soil both surrounding and within the feature was a 10YR6/3 pale brown sand. Feature 16 is thought to represent secondarily deposited burned rocks rather than an intact cooking facility. For this reason, it was not sampled further.

Feature 19

Feature 19 was a subsurface cluster of thermally altered rocks exposed 37 cmbs along the northern edge of Trench 17. The exact size and shape of the feature remains undetermined, as it extended into the north and west trench walls. The portion of the feature that was exposed appeared as a partial oval (representing roughly 60 percent) aligned northeast to southwest with portions near the focal points extending into the trench walls. The exposed portion of the feature extended 45 cm north-south by 48 cm east-west. Once the exposed portion of the feature was mapped in plan (**Figure 29**) and excavated the remainder was mapped in profile in the trench walls (**Figure 30**). The feature's maximum thickness was 10 cm. The excavated portion consisted of 48 quartzite rocks (6.8 kg), 8 hematite rocks (0.9 kg), and 2 petrified-wood rocks (0.1 kg) that had a combined mass of 7.8 kg. The volume of the sampled portion of the feature was about 24,881 cc. The soil surrounding and within the feature was a 10YR5/4 yellowish brown sand E/A



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I E/A horizon, 10YR6/3 pale brown sand, fine blocky sub-angular structure, weak grade.

Burned Rock

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Figure 28

Site 41BP595
Feature 16, Plan View

I 10YR5/4 yellowish brown sand.

Burned Rock - feature 19.

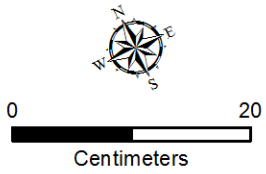

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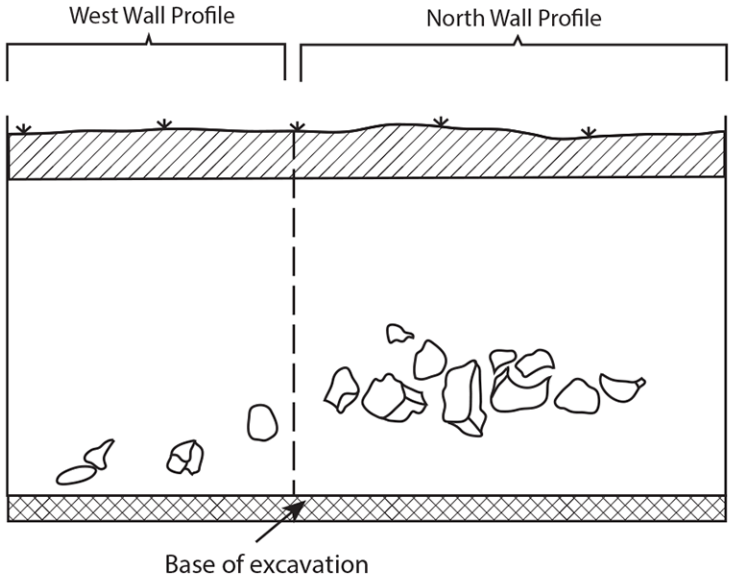
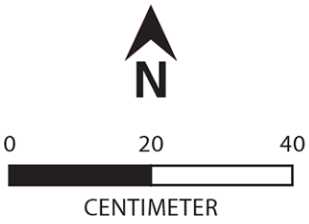
Figure 29

Feature 19 Plan View





AC Horizon

E/A Horizon

Bt Horizon

Burned Rock

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Figure 30

Site 41BP595
Feature 19 Profile, North

horizon. The feature rocks occurred in a single layer resting on a level plane. Four pieces of lithic debitage (all thermally altered) were recovered from beneath the feature in the ¼ inch screens. The feature appeared to represent a mostly intact cooking facility. Minor rodent disturbance and many fine roots were noted on the feature form. A 4.25 cu dm soil sample was retained for flotation and macrobotanical analysis. Flotation yielded 0.01 g of unidentified hardwood charcoal and 0.01 g of burned hickory/walnut nutshell.

Feature 20

Feature 20 was an ephemeral scatter of burned rock (**Figure 31**), thought to represent materials secondarily deposited from a nearby cooking feature. The feature was exposed in Trench 9 at an approximate depth of 60 cmbs. The feature was contained within the E/A soil horizon, which was a 10YR7/2 pale gray sand. The feature consisted of ten burned rocks resting on a level plane and confined to an area extending 40 cm east/west by 50 cm north/south. No charcoal or soil staining were found in association with feature 20. Once the feature was exposed and mapped in plan it did not appear to represent an intact cooking facility. For this reason it was not further sampled.

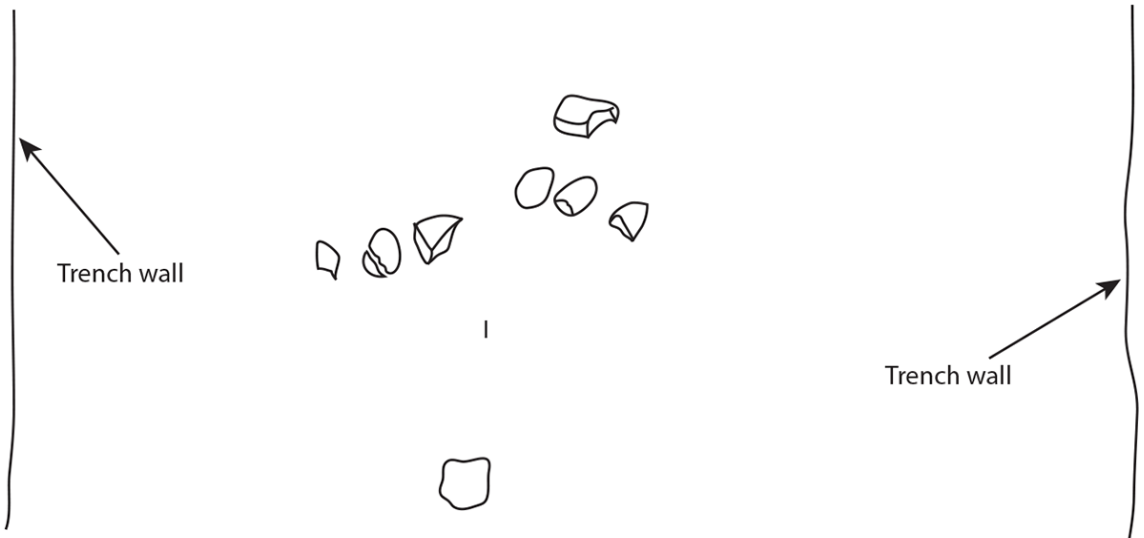
Feature 21

Feature 21 was a small tight cluster of burned rock with a light scatter of burned rock surrounding it (**Figure 32**). The feature was exposed in Trench 10 at a depth of approximately 54 cmbs (**Figure 33**). In plan, the tightly clustered portion of the feature had a semi-oval outline that extended 38 cm east/west by 34 cm north/south. The associated scatter of rocks was found within 30 cm of the limits of the tightly clustered portion. Rodent runs and small roots were recorded in the field notes. After the portion of the feature exposed in the trench was recorded and removed it was shown to extend west into the wall of the trench, where it was drawn in profile. The feature rocks occurred in a single layer on a level plane and had a maximum thickness of 8 cm. The volume of the sampled portion of the feature was 8,294 cc and consisted of 28 quartzite rocks (4.7 kg) and two hematite rocks (0.1 kg) that had a combined mass of 4.8 kg. Two ground stone tool fragments were recovered from the ¼ inch screens. The Feature was contained within the E/A2 horizon which was a 10YR5/6 yellow brown sand.

One feature rock was retained for FTIR, phytolith, starch, and pollen analysis. The phytolith record from Feature 21 reflects the environment. A single Poaceae pollen grain was identified. Starches, apparently representing subsistence, were abundant and appear to represent subsistence processing of grass seeds and tubers/roots. The FTIR analysis identified the presence of fats/oils/lipids and/or plant waxes with fingerprint region peaks consistent with Sagittaria.

Unit 7

Once the portion of Feature 21 within the trench was removed, a 50 cm x 50 cm unit (7) was excavated off of the western trench wall, adjacent to the former location of the feature. Unit 7 yielded 15 pieces of lithic debitage, 1 lithic biface, and 269.9 g of thermally altered rock. **Table 18** below lists the cultural materials recovered from Unit 7 by 10 cm level.



I E/A horizon, 10YR7/2 pale gray sand.

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Figure 31

Site 41BP595
Feature 20 Plan view
Trench 9

X - FTIR Sample rock

Feature rock

I E/A2 horizon, 10YR5/6 yellow brown sand, fine blocky sub-angular structure, weak grade.

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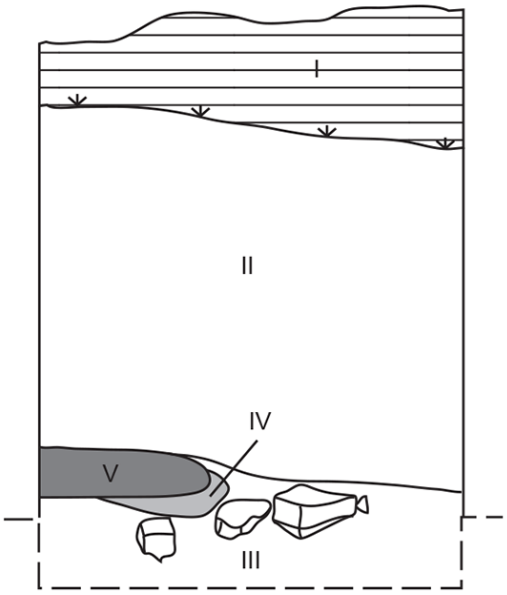
Figure 32

Site 41BP595
Feature 21 Plan View
Trench 10



I Back dirt, 0 – 15 cmbs
II E/A1 horizon, 10YR5/4 yellowish brown sand, 15 – 60 cmbs, thickly bedded, fine blocky sub-angular structure, weak grade.
III E/A2 horizon, 10YR5/6 yellowish brown sand, 60+ cmbs, thickly bedded, fine blocky sub-angular structure, weak grade.
IV Rodent Run, 10YR6/6 brownish yellow sand
V Rodent Run, 10YR5/4 yellowish brown sand

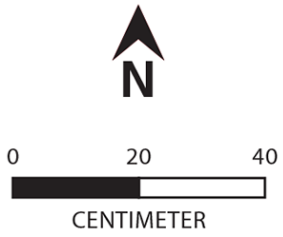


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Figure 33

Site 41BP595
Feature 21 Profile, West

Table 18. Site 41BP595, Unit 7, Cultural Material by 10 cm Level

Level	Debitage	Biface	Thermally altered rock
1	2		
2	2		
3	4		
4 and 5	4		1.15
6	1		110.91
7	1	1	156.91
8	1		0.93
Total	**15**	**1**	**269.9**

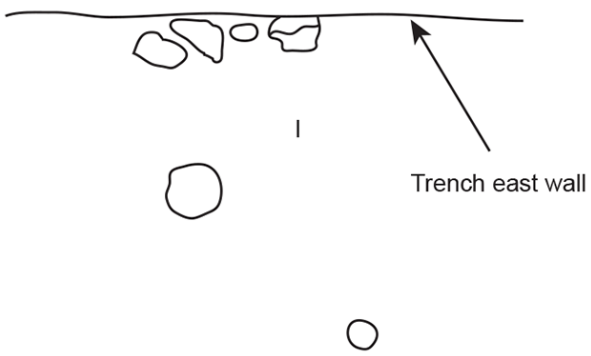
A 5.15 cu dm soil sample was retained from the portion of the feature exposed in Trench 10 for flotation and macrobotanical analysis. Flotation yielded 0.03 g of wood charcoal including 0.01 g of oak, 0.01 g of hickory, and 0.01 g of unidentified hardwood. Flotation also yielded 0.04 g of burned nutshell including 0.01 g of hickory/walnut, and 0.03 g of black walnut. The black walnut nutshell was submitted for radiocarbon analysis and returned a calibrated two sigma date range of 44 B.C. to A.D. 84.

Feature 22

Feature 22 was a small cluster of burned rocks (**Figure 34**) partially exposed in Trench 11 at 30 cmbs, along the eastern trench wall. The feature was contained within the E/A soil horizon, which was a 10YR5/4 yellowish brown fine sand. The portion of the feature exposed in the trench was drawn in plan and photographed. It consisted of five burned rocks contained within an area extending 22 cm north/south by 20 cm east west. The origins of Feature 22 are ambiguous. The rocks may represent the edge of a larger feature that extends east into the east wall of the trench. It is also possible that the rocks represent a disarticulated hearth or discarded lid rocks. Due to the small size of the exposed portion of Feature 22, its uncertain origins, along with the fact that it was found relatively close to the ground surface, a flotation sample was not taken.

Feature 23

Feature 23 was a tight circular cluster of burned rock with an associated light scatter of burned rock surrounding it (**Figure 35**). The feature was exposed in the floor of Trench 11 at an approximate depth of 60 cmbs (**Figure 36**). The rock cluster had a diameter of 36 cm while the exposed portion of the surrounding rock scatter was contained within an area extending 166 cm north-south by 80 cm east-west. A portion of the rock cluster extended into the west wall of the trench. The feature consisted of 72 hematite rocks (3.2 kg), 67 quartzite rocks (9.9 kg), and 4 silicified wood rocks (0.2 kg) that have a combined mass of 13.3 kg. The feature was contained within the E/A soil horizon and the soil within and around it was a 10YR7/2 light gray sand. Once the portion of the circular cluster exposed in the trench floor was excavated, the portion extending into the trench wall was drawn in profile. The feature rocks occurred in a single layer that was resting on a level plane with a maximum thickness of 5 cm. The volume of the sampled portion of the cluster was 3,534 cc.



I E/A horizon, 10YR5/4 yellowish brown sand, fine blocky sub-angular structure, weak grade

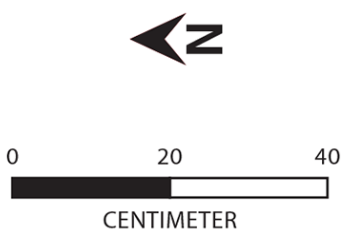


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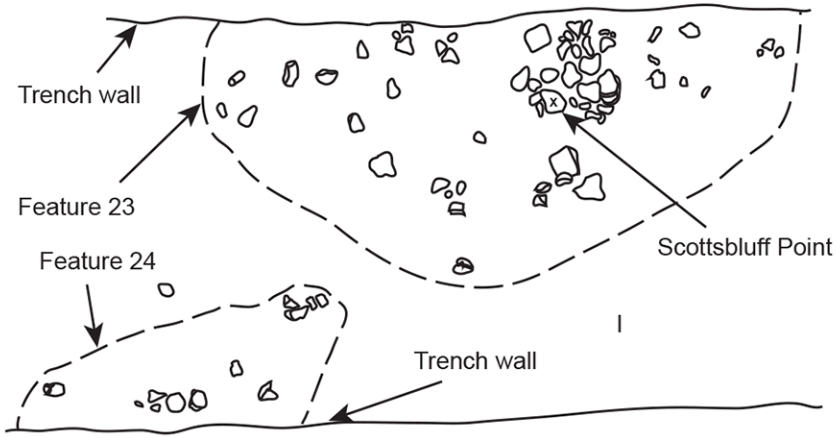
Figure 34

Site 41BP595
Feature 22 Plan View



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I E/A horizon, 10YR7/2 light gray sand, dry, blocky sub-angular structure, weak grade.

X - FTIR Sample rock

Natural boundary

Arbitrary boundary

Rodent run

Burned rock

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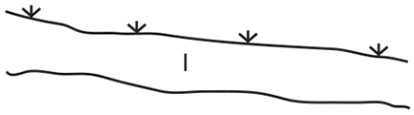
Figure 35

Site 41BP595
Feature 23 and 24 Plan View



II

I AC Horizon, 10YR7/2 light gray sand, dry, loose, single grain structure.
II E/A horizon, 10YR7/2 light gray sand, dry, blocky sub-angular structure, weak grade.

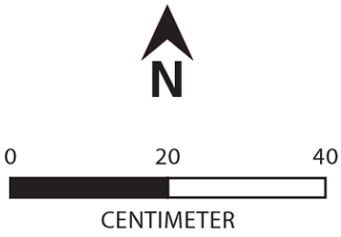


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Figure 36

Site 41BP595
Feature 23 Profile, West

A single piece of hematite was retained from the feature for FTIR, pollen, starch, and phytolith analysis. Cyperaceae achene phytoliths were recovered which could represent an environmental signature or processing sedge seeds for subsistence. The starch record suggests that tubers (most likely Sagittaria) and possibly grass seeds were processed in the feature. The FTIR analysis identified the presence of fats/oils/lipids and/or plant waxes with fingerprint region peaks consistent with Sagittaria.

The circular rock cluster is thought to represent a largely intact prehistoric cooking surface while the scatter of rocks surrounding it is thought to represent materials displaced from the cluster following its last use. A Scottsbluff dart point was found just beneath the rock retained for residue analysis. The dart point showed no signs of thermal alteration, suggesting it was discarded after the feature was last used, perhaps when the associated rock scatter became displaced from the rest of the feature. In addition to the dart point, other cultural materials recovered in the ¼ inch screens include two pieces of thermally altered lithic debitage and one ground stone fragment.

Unit 8

Once the portion of Feature 23 within the trench was removed, Unit 8, a 50 by 50 cm unit, was excavated adjacent to its former location, off of the western wall of Trench 11. Unit 8 yielded 26 pieces of lithic debitage, 1 ground stone artifact, and 285.01g of thermally altered rock (**Table 19**).

Table 19. Site 41BP595, Unit 8, Cultural Material by 10 cm Level

Level	Debitage	Ground Stone	Thermally altered rock
1	4		57.01
2	4		52.07
3			
4	4		
5	2		11.88
6	5		71.54
7	4	1	92.51
8	3		
Total	**26**	**1**	**285.01**

A 6.9 cu dm soil sample recovered from the feature was retained for flotation and macrobotanical analysis. Flotation yielded 0.01 g of unidentified hardwood charcoal.

Feature 24

Feature 24 was a loose scatter of thermally altered rock (**Figure 35**) exposed in Trench 11 at an approximate depth of 40 cmbs. The feature rock was found widely scattered within an area extending 100 cm north-south by 50 cm east-west. Once it was fully exposed, Feature 24 was thought to represent secondarily discarded burned rocks, rather than an intact cooking facility. It may represent materials displaced from Feature 23. The feature was contained within the E/A soil horizon which was a 10YR7/2 light gray dry sand. The feature was mapped, photographed and left in place.

Feature 25

Feature 25 consisted of a small, partially complete oval shaped cluster of burned rock with an associated light scatter of burned rock to the northwest and southeast (**Figure 37**). The burned rocks were contained within an area 50 cm wide by 110 cm long, with the long axis oriented northwest to southeast. The central oval shaped cluster extended 46 cm x 35 cm x 8 cm in maximum thickness; several internal voids were also present. The volume of the oval cluster was 6,597 cc. Feature 25 was exposed 46 cmbs and was found contained within the E/A soil horizon which was a 10YR5/4 yellowish brown sand. The feature was composed of 41 quartzite rocks (5.6 kg), 5 hematite rocks (0.7 kg) and 1 silicified wood rock (0.2 kg). The total mass of the feature rocks was 6.5 kg.

The feature was mapped in plan, photographed, and excavated. No additional artifacts were recovered from the ¼ inch screens. Slight disturbance from rodent and root activity was noted on the feature form. The oval cluster of burned rocks is thought to represent a disarticulated hearth. The loose scatter of burned rock presumably represents materials removed from the oval shaped cluster following its last systemic use. Because the feature appeared to be largely disarticulated it was not sampled for flotation.

Feature 26

Feature 26 consisted of a roughly oval shaped cluster of burned rocks, with several large internal voids, and a surrounding light scatter of burned rock (**Figure 38**). It was exposed at 55 cmbs in Trench 17. These materials were contained within an area extending 114 cm north-south by 100 cm east-west. The oval shaped cluster was roughly 85 cm x 60 cm with the long axis oriented north, northwest by south, southeast. The feature was bisected along a northeast by southwest line crossing the central portion of the cluster. The southeast half was excavated first and the remaining portion of the feature was drawn in profile (**Figure 38**). The profile crossed one of the interior feature voids. Due to the presence of the void in the profile, the base of the feature is not fully depicted in profile and it remains uncertain if this feature terminated in a basin or was resting on a level plain. The feature was contained within the E/A soil horizon, which was a 10YR6/3 pale brown sand. The portion of the profile that was present suggests that the feature was constructed with two layers of rock and had a maximum thickness of 10 cm. The volume of the oval rock cluster was 37,699 cc. The burned rock comprising the feature included 435 quartzite rocks (60.1 kg), 36 hematite (1.1 kg), and 18 petrified rocks (1.5 kg). The combined mass of these materials was 63.2 kg. Only one piece of thermally altered debitage was recovered from the ¼ inch screen. Feature 26 is thought to represent a prehistoric cooking facility that has been partially disarticulated. Two soil samples, comprising 11.70 cu dm, were retained for flotation and macrobotanical analysis. Flotation yielded 0.01 g of oak charcoal and 0.02 g of unidentified hardwood charcoal.

Feature 27

Feature 27 was a large burned rock feature consisting of two distinct clusters, referred to as Clusters 1 and 2 (**Figure 38**) exposed in Trench 17. The feature was contained within the E/A soil horizon, which was a 10YR6/3 pale brown sand. The feature was not distinguished by a change in soil color or texture. No visible charcoal was present when the feature was exposed.

Cluster 1 was a roughly circular burned rock bed with a diameter ranging between 110 and 120 cm. It was exposed 66 cmbs. Once Cluster 1 was fully exposed and mapped in plan in the trench, it was bisected from northeast to south west and the south east half was removed first. In profile the feature extended up to 10 cm in thickness and was composed of two layers of rock (**Figure 38**). Cluster 1 terminated in a shallow basin. Its volume was 50,256 cc. The northwest half of the feature was subsequently removed. The rock from both halves of Cluster 1 include 820 quartzite rocks (140.8 kg), 148 hematite fragments (6.8 kg), 40 silicified wood rocks (3.4 kg), 1 unidentified rock resembling granite (0.1 kg), 1 coarse sandstone rock (1.2 kg) and 3 thermally altered chert rocks (0.3 kg). The volume of Cluster 1 was 69,115 cc. A single lithic biface was recovered from amongst the feature rocks in Cluster 1 that showed no signs of thermal alteration. Artifacts recovered from the ¼ inch screens include 16 pieces of lithic debitage, of which 12 had been thermally altered, 14 ground stone artifacts, of which 13 had been thermally altered, 1 utilized flake and one 0.1 g fragment of wood charcoal.

Three soil samples, comprising 21.25 cu dm, were retained from Cluster 1 for flotation and macrobotanical analysis. Flotation yielded 0.03 g of unidentified hardwood charcoal and 0.01 g of hickory/walnut burned nutshell.

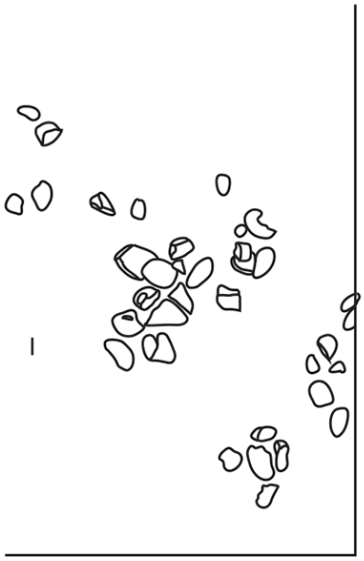
Unit 6

Unit 6 was excavated off of the east wall of Trench 17 adjacent to Cluster 1 (**Figure 38**). It extended 1 m north south by 1.2 m east west. Unit 6 yielded 35 pieces of lithic debitage, 1 lithic scraper, 155.86 g of thermally altered rock, 1 lithic core, and 1 utilized flake. The vertical distribution of these materials is presented in **Table 20** below.

A light scatter of burned rock was exposed and mapped in Level 6 (**Figure 38**). The origins of the burned rock recovered from Unit 6 in Levels 6 and 7 (consisting of 31 quartzite rocks, 2 chert fragments, 5 hematite fragments, and 1 piece of coarse sandstone) remained ambiguous after the unit was excavated. These materials may have been displaced from Cluster 1 following its last use or they may represent secondary discard from another nearby cooking facility.

Table 20. Site 41BP595, Unit 6, Cultural Material by 10 cm Level

Level	Debitage	Scraper	Thermally altered rock	Wood Charcoal	Lithic Core	Utilized Flake
1	6		8.1			
2	6		14.01			
3	1		110.81			1
4	6		22.94			
5	4					
6	2	1			1	
7	4					
8	6					
Total	35	1	155.86	0	1	1



I E/A Horizon, 10YR5/4 yellowish brown sand, blocky sub-angular structure, weak grade.

◯ Burned rock

N

0 20 40

CENTIMETER

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Figure 37

Site 41BP595
Feature 25 Plan View

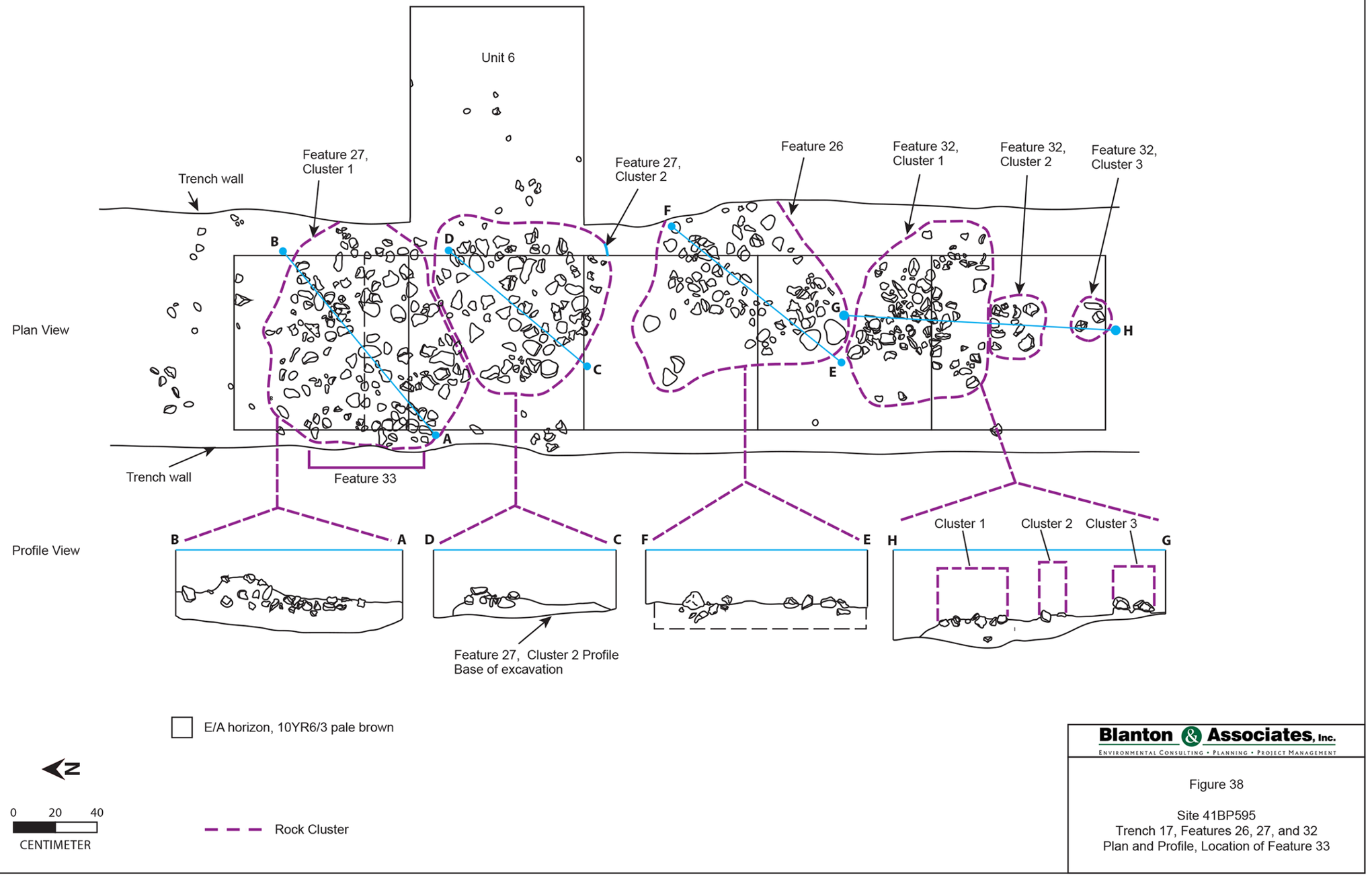

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Figure 38

Site 41BP595
Trench 17, Features 26, 27, and 32
Plan and Profile, Location of Feature 33

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Cluster 2 was a roughly circular burned rock bed exposed in Trench 17 at 65 cmbs with a diameter ranging between 100 and 120 cm (**Figure 38)**. Cluster 2 was found directly adjacent to Cluster 1. Based on the orientation of the rocks in both clusters, Cluster 1 appears to intrude into Cluster 2. Two amorphous voids were also noted in plan. The western void was roughly 25 cm east/west 25 by 20 cm north/south while the eastern void was about 20 cm north/south by 10 cm east west. Once Cluster 2 was exposed and mapped it was bisected from southwest to northeast. The line of bisection crossed a roughly 36 cm long intact portion of the Cluster as well as the eastern void. The portion of the cluster that was visible in profile had two layers of rock with a maximum thickness of 8 cm (**Figure 38)**. The volume of Cluster 2 was 50,266 cc. Due to where the line of bisection was placed, it was not possible to determine the shape of the base of the cluster. The rock from both halves of the cluster included 163 quartzite rocks (42.2 kg), 121 hematite rocks (9.3 kg) and 11 silicified wood rocks (1.0 kg). Artifacts recovered in the ¼ inch screens from Cluster 2 include 4 pieces of lithic debitage, of which 2 were thermally altered, 2 thermally altered ground stone artifacts, 2 lithic bifaces, and 2 faunal bone fragments. In plan, Cluster 2 appeared to be less intact than Cluster 1 and is consequently thought to pre-date it. This interpretation is supported by the observation that the boundary of Cluster 1 was better defined than that of Cluster 2 where the two clusters joined.

Two soil samples, comprising 16.70 cu dm were retained for flotation and macrobotanical analysis from Cluster 2. Flotation yielded 0.08 g of wood charcoal, including 0.02 g of oak, 0.03 g plateau live oak, 0.02 g of hickory, and 0.01 g of unidentified hardwood. Additionally, 0.01 g of hickory/walnut burned nutshell was recovered.

Feature 29

Feature 29 was a large complex subsurface burned rock feature spanning most of the floor of Trench 15 (**Figure 39**). It is composed of five partially overlapping rock clusters thought to represent multiple events. The top of the feature was encountered at roughly 69 cmbs. Together, the rock clusters extended approximately 5.2 m north south by 1.5 m east west.

Clusters 1, 2, 4, and 5 were composed of a single layer of rock while Cluster 3 was composed of up to three layers of rock that together ranged between 20 and 28 cm in thickness. The combined mass of rock from the five clusters was 392.2 kg, which included 3,473 quartzite rocks (367.1 kg), 404 hematite rocks (23.4 kg), and 36 silicified wood rocks (1.7 kg). The feature was contained within the E/A2 soil horizon which was a 10YR5/4 yellowish brown fine sand with no visible mottling. Disturbances recorded on the field notes include rodent activity and fine to small roots.

Cluster 1 was a small tight cluster of burned rock thought to represent the remains of a prehistoric cooking surface. It extended 60 cm north/south by 80 cm east/west. Once exposed, it appeared to be largely intact aside from a small void near the center. Cluster 1 contained 41 quartzite rocks (7.8 kg) and 4 hematite rocks (1.1 kg). One ground stone fragment was recovered from the ¼ in screens. No other cultural materials were recovered in association with the cluster. In profile, Cluster 1 was shown to be resting on a level plane and the rocks occurred in a single layer with a maximum thickness of 4 cm. Its volume was 8,796 cc.

One burned rock from cluster 1 was retained for FTIR, starch, pollen and phytolith analysis from the eastern ½ of the cluster. Starches recovered from the cluster 1 sample suggest that *Sagittaria*-type roots/tubers

along with a variety of grass seeds may have been processed. The FTIR analysis identified the presence of fats/oils/lipids and/or plant waxes with fingerprint region peaks consistent with Sagittaria.

A 5.65 cu dm soil sample was retained from Cluster 1 for flotation and macrobotanical analysis. Flotation yielded 0.01 g of oak charcoal and 0.02 g of hickory/walnut burned nut shell. The burned hickory/walnut nutshell was submitted for radiocarbon analysis and returned a calibrated two sigma date range of A.D. 1049 to 1084, A.D. 1124 to 1136, and A.D. 1150 to 1256.

Cluster 2 was a small amorphous cluster of burned rocks located between cluster 1 and 3 that is thought to represent a disarticulated burned rock cooking feature or a discard pile associated with one of the nearby clusters (**Figure 39**). Cluster 2 extended roughly 60 cm north/south by 90 cm east west. Because the cluster did not appear to represent an intact cooking facility, no soil sample was retained for flotation. The cluster contained 43 quartzite rocks with a combined mass of 7.3 kg. The cluster was composed of a single layer of burned rock resting on a level plane with a maximum thickness of 4 cm. Its volume was 8,495 cc.

Cluster 3 consisted of a large and very dense oval shaped cluster of burned rocks that extended 130 cm north/south by 95 cm east west and was surrounded by a less dense scatter of burned rocks contained within an area extending roughly 1.75 cm north south by 140 cm east/west (**Figure 39**). Cluster 3 was the largest rock cluster identified during NRHP testing. It is thought to represent a relatively intact cooking facility. At its widest, cluster 3 extended across the width of the trench. In profile the cluster was shown to be composed of three to four layers of rock and terminate in a shallow basin, suggesting it was built in a shallow pit (**Figure 39**). Cluster 3 was composed of 2,989 quartzite rocks (297.0 kg), 368 hematite rocks (20.8 kg) and 34 silicified wood rocks (1.4 kg). Its maximum thickness was 26 cm and its volume was 220,540 cc. Clay lamellae were noted two to four cm below the feature rocks in profile. Three quartzite ground stone artifacts and three pieces of lithic debitage were recovered in the ¼ inch screens. Two soil samples, comprising 13.35 cu dm, were retained for flotation and macrobotanical analysis. Flotation yielded 0.01 g of unidentified hardwood charcoal and 0.01 g of hickory/walnut burned nutshell.

A single burned rock was retained for FTIR, phytolith, and pollen analysis, recovered from the western ½ of cluster 3. Celtis seed phytoliths were recovered from the cluster 3 sample and may indicate that hackberrys were processed. No starches were found in the cluster 3 sample. The FTIR analysis identified the presence of fats/oils/lipids and/or plant waxes with fingerprint region peaks consistent with Sagittaria.

Unit 5

Unit 5, a 1 x 1.2 m unit, was excavated adjacent to Cluster 3 off of the east wall of Trench 15 (**Figure 39**). A small concentration of burned rock, extending 42 cm north/south by 8 cm east/west was exposed in Levels 8 and 9 (95-107 cmbd, 74-86 cmbs) and represents a portion of the outer edge of cluster 3. A small area of burned soil, extending 16 cm north/south by 2 cm east/west was exposed within the portion of Cluster 3 identified in Unit 5. Unit 5 (**Table 21**) yielded 307 pieces of lithic debitage – of which 229 had been thermally altered, 2 ground stone artifacts, 1 lithic uniface, 0.31g burned nut shells, 0.56g of wood charcoal, and 730.91 g of burned rock. One unidentified metal fragment was also recovered.

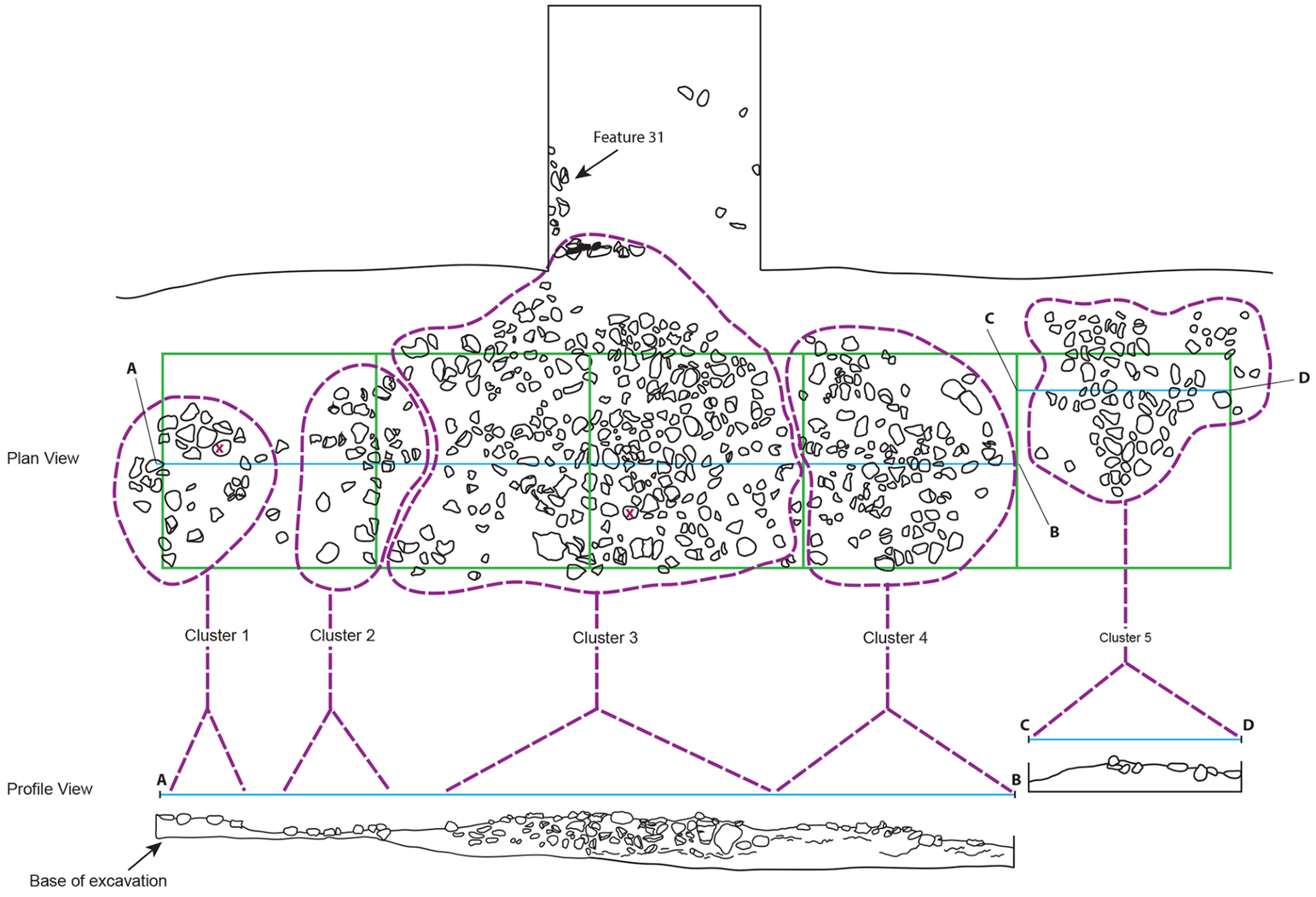

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Figure 39

Site 41BP595
Trench 15, Feature 30 Plan View and Profile,
Feature 31 Plan View in Unit 6

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Table 21. Site 41BP595, Unit 5, Cultural Material by 10 cm Level

Level	Debitage	Ground Stone	Thermally altered rock	Nutshell	Wood Charcoal	Uniface
1	24					
2	38		0.15			
3	88					
4	84		214.21	0.11	0.2	
5	26		117.46	0.2		
6	21	1	42.84		0.3	
7	17		214.74		0.06	1
8	9	1	141.51			
Total	**307**	**2**	**730.91**	**0.31**	**0.56**	**1**

Cluster 4 consisted of an amorphous cluster of burned rock that occurred in a single layer resting on a level to slightly sloping plane (**Figure 39**). Its maximum thickness was 6 cm. In plan it extended roughly 1 m north/south by 1.1 m east/west. Its origins are uncertain. The rocks comprising the cluster may represent a disarticulated cooking facility or perhaps discarded lid rocks from cluster 3. Once the feature rocks were removed and flotation samples retained, the remaining feature fill was screened with ¼ inch hardware cloth. This effort yielded 6 pieces of lithic debitage, of which 2 had been thermally altered, and 1 projectile point base that had been thermally altered. Cluster 4 was composed of 254 quartzite rocks (27.0 kg) and 13 hematite rocks (0.7.0 kg). The cluster's volume was 49,244 cc.

A 6.5 cu dm soil sample was retained for flotation and macrobotanical analysis. Flotation yielded 0.01 g of indeterminate hardwood charcoal, 0.1 g of burned hickory nutshell, and 0.01 g of burned hickory/walnut nutshell. The burned hickory nutshell was submitted for radiocarbon dating and returned calibrated two sigma date range of 1110 B.C. to 894 B.C. and 867 B.C. to 854 B.C..

Cluster 5 was an amorphous cluster of burned rock that occurred in a single layer (**Figure 39**). In profile, the feature's base was uneven and its maximum thickness was 5 cm. It extended roughly one m north/south by 90 cm east west. It consisted of 146 quartzite rocks (28.0 kg), 19 hematite rocks (0.8 kg), and 2 silicified wood rocks (0.3kg) that had a combined mass of 29.1 kg. The cluster's volume was 40,500 cc. The cluster appeared to extend into the west wall of the trench. The origins of cluster 5 remain ambiguous. It may represent a systemically disturbed or disarticulated cooking feature or discarded lid rocks from a nearby feature. It did not appear to represent an intact cooking facility.

A 5.20 cu dm soil sample was retained for flotation and macrobotanical analysis. Flotation yielded 0.02 g of wood charcoal, including 0.01 g of white oak and 0.01 g of indeterminate hardwood. Flotation also yielded 0.01 g of burned hickory/walnut nutshell.

Feature 30

Feature 30 was an expansive, buried anthrogenic horizon or midden expressed as a dark, organically rich soil deposit in the walls of four backhoe trenches (1, 6, 7, and 8) as well as four shovel tests (36, 37, 86, and 87). This deposit extended roughly 55 m east/west by 22 m north south. Feature 30 was sampled with two 50 cm x 50 cm units excavated by hand off of trenches 7 and 8. Unit 1 was excavated off trench 7 while

Unit 2 was excavated off of Trench 8. One m sections of trenches 7 and 8, encompassing Units 1 and 2, were drawn in profile (**Figures 40** and **41**).

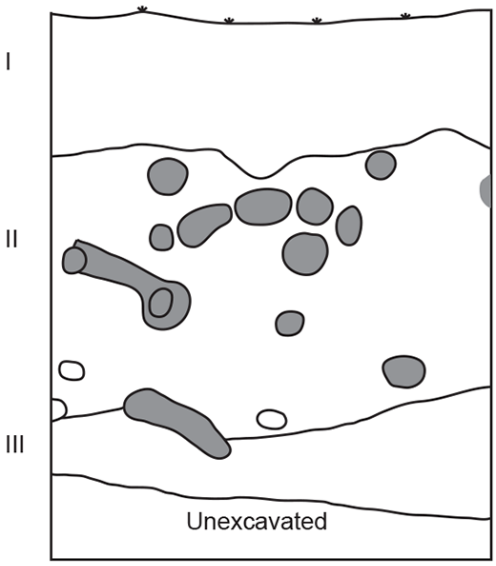
Units 1 and 2

One soil sample from each of levels 5 through 10 was retained for flotation and macrobotanical analysis from Unit 1. For Unit 2, one soil sample from each of levels 5 through 9 was retained for flotation and analysis. The soil samples ranged in size from 7.00 cu dm to 9.10 cu dm. The combined volume of all of the flotation samples from Unit 1 was 46.45 cu dm while the combined volume of the Unit 2 samples was 40.10 cu dm. The most common remains recovered through flotation from both units were wood charcoal and burned nutshells.

The Unit 1 flotation samples yielded a total of 1.24 g of wood charcoal, including 0.19 g oak, 0.02 g white oak, 0.01 g plateau live oak, 0.35 g hickory, 0.66 g of indeterminate wood charcoal, and 0.01 g of wood charcoal not examined for species. The Unit 1 samples also yielded a total of 0.47 g of burned nutshell including 0.33 g hickory, 0.13 g hickory/walnut and 0.01 g acorn. Additionally, the unit 1 flotation samples yielded 0.03 g of hickory nut hull and 0.01 g of an indeterminable bulb, 0.22 g of indeterminable botanical remains, and 0.02 g of plant gall.

The Unit 2 flotation samples yielded a total of 0.74 g of wood charcoal, including 0.16 g Oak, 0.07 g white oak, 0.02 g plateau live oak, 0.18 g hickory, 0.28 g indeterminate hardwood, and 0.03 g not examined for species. The Unit 2 flotation samples also yielded 0.93 of burned nutshell including, 0.83 g hickory, 0.08 g hickory/walnut, and 0.02 g acorn. Other remains include 0.02 g indeterminable bulb and 0.08 g indeterminable botanical remains.

To illustrate the vertical distribution of the charred botanical remains recovered from units 1 and 2, the combined mass of the wood charcoal and burned nutshells recovered from each of the flotation samples is presented in **Table 22** below by level. To facilitate comparison of these results, **Table 22** also lists the combined density of burned nutshell and wood charcoal for each level as g/cu m. The vertical distribution of these remains in Unit 1 is fairly even while the vertical distribution of these remains in Unit 2 was uneven. In Unit 2, wood charcoal and burned nutshell were nearly twice as dense in Level 8 than they were in the next most productive Level (Level 7).



I C Horizon, 10YR7/4 very pale brown dry sand, loose, single grain structure, 0 – 30 cmbs, medium bedded, gradual wavy lower boundary

II Anthropogenic A horizon (Feature 30), 10YR5/2 grayish brown dry sand, blocky sub-angular structure, weak grade, 30 – 90 cmbs, thickly bedded

III A/E Horizon, 10YR5/3 brown, dry sand, blocky sub-angular structure, weak grade, 90+ cmbs, unknown lower boundary

IV Rodent runs, 10YR6/3 pale brown to 10YR5/3 brown sand.

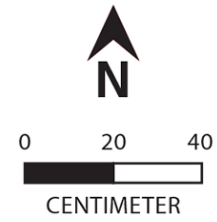


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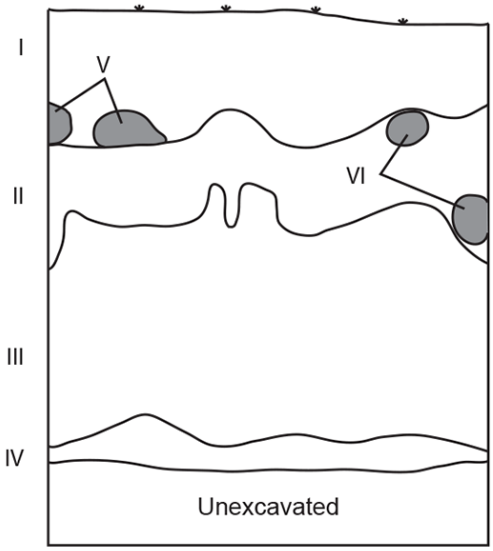
Figure 40

Site 41BP595
Trench 1 (at Unit 1) Profile, East



I AC Horizon, 10YR7/3 very pale brown dry sand, loose, single grain structure, 0 – 22 cmbs, medium bedded, gradual wavy lower boundary

II C Horizon, 10YR6/3 pale brown sand, blocky sub-angular structure, weak grade, 22 – 40 cmbs, medium bedded, gradual and wavy lower boundary

III Anthropogenic A horizon (Feature 30), 10YR4/2 dark grayish brown sand, blocky sub-angular structure, weak grade, 40 – 95 cmbs, thickly bedded, gradual and smooth lower boundary.

IV A/E Horizon, 10YR5/4 yellowish brown sand, sand, blocky sub-angular structure, weak grade, 95+ cmbs, unknown lower boundary

V Rodent runs, 10YR6/4 pale brown sand.

VI Rodent runs, 10YR5/4 yellowish brown to 10YR6/4 light yellowish brown sand.

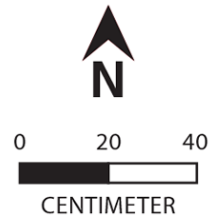


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Figure 41

Site 41BP595
Trench 8 (at Unit 2) Profile, East

Table 22. Site 41BP595 Vertical Distribution of Wood Charcoal and Burned Nutshells Recovered from Unit 1 and Unit 2 flotation samples By 10 cm Level.

	Unit 1		Unit 2	
Level	**Mass (g)**	**Density (g/cu m)**	**Mass (g)**	**Density (g/cu m)**
5	0.29	41.43	0.14	18.42
6	0.37	50.00	0.28	36.36
7	0.32	39.51	0.37	45.12
8	0.18	19.78	0.68	86.08
9	0.18	24.83	0.2	22.99
10	0.37	48.68		
Total	**1.71**		**1.67**	

The sediment excavated from units 1 and 2 not retained for flotation was screened through ¼ inch (0.635 cm) mesh. Unit 1 yielded 43 pieces of lithic debitage, 1 ground stone fragment, 1,342.44 g of thermally altered rock, 2 faunal bone fragments, 0.22 g of burned nut shell, 0.89 g of wood charcoal, and 1 projectile point from screening. The projectile point is similar to a small Edwards arrow point and presumably dates to the same period, around A.D. 900-1100 (Turner et al. 2011), The vertical distribution of these materials is presented in **Table 23** below.

Table 23. Site 41BP595, Unit 1, Cultural Material by 10 cm Level

Level	Debitage	Ground Stone	Thermally Altered Rock	Faunal Bone	Burned Nut Shell	Wood Charcoal (g)	Projectile Point
1	1						
2	3						
3	3		0.49				
4	5		40.43	1			
5	4		0.21				
6	9		0.39			0.04	1
7	6		821.25	1	0.22		
8	8		79.76			0.85	
9	3		151.27				
10	1	1	218.03				
11			30.61				
Total	**43**	**1**	**1342.44**	**2**	**0.22**	**0.89**	**1**

Unit 2 yielded 36 pieces of lithic debitage, 273.16 g of thermally altered rock, 0.84 g of burned nutshell, and 0.21 g of wood charcoal from screening. The vertical distribution of these materials is presented in **Table 24** below.

Table 24. Site 41BP595, Unit 2, Cultural Material by 10 cm Level

Level	Debitage	Thermally Altered Rock	Burned Nut Shell	Wood Charcoal (g)
1	1	2.33		
2	1	38.49		
3	3	1.2		
4	6			
5	4	56.11		
6	3	19.47		
7	7	4.41		
8	3	68.55		0.21
9	3	72.97	0.46	
10	3	9.63	0.1	
11	2		0.28	
Total	**36**	**273.16**	**0.84**	**0.21**

The vertical distribution of cultural materials in Unit 1 and 2 is uneven, with high yielding 10 cm levels bracketed by low yielding levels. The culturally richest ten cm levels were however, generally consistent with the buried anthrogenic A horizon in levels 6 through 10.

Feature 30 is thought to represent a midden that resulted primarily from the deposition of organic refuse from multiple episodes of hot rock cooking. Four radiocarbon assays were obtained from burned hickory nutshell fragments recovered from four of the flotation samples taken from Feature 30 (Unit 1 levels 7 and 9 and Unit 2 levels 6 and 8). The sample from Unit 1, Level 7 returned a calibrated two sigma date range of A.D. 902 to 920, A.D. 962 to A.D. 1041, and A.D. 1108 to A.D. 1116. The Edwards like arrow point recovered from Level 6 in Unit 1 conceivably could represent the same occupation. The sample from Unit 1, Level 9 returned a calibrated two sigma date range of A.D. 433 to A.D. 459, A.D. 467 to A.D. 488, and A.D. 533 to A.D. 638. The sample from Unit 2, Level 6 returned a calibrated two sigma date range of B.C. 808 to B.C. 749, B.C. 684 to B.C. 667, B.C. 640 to B.C. 588, and B.C. 579 to B.C. 561. The sample from Unit 2, Level 8 returned a calibrated two sigma date range of A.D. 400 to A.D. 538. The Unit 1 dates occurred in their expected stratigraphic sequence; the Level 7 sample returned an earlier date than the Level 9 sample. The inverse is true with the Unit 2 dates, where the Level 6 sample returned an older date than the Level 8 sample. The calibrated two sigma results suggest Feature 30 arose during the period ranging from 800 B.C. to A.D. 1030.

The vertical distribution of the cultural materials recovered from units 1 and 2, including those recovered in the 1/4 inch screens and those recovered through flotation is uneven, suggesting they have been subjected to some post depositional mixing. A variety of natural and cultural processes, including those that occurred prior to and following the site's prehistoric abandonment, may account for this pattern. Systemic discard behavior and trampling during the site's prehistoric occupation conceivably could have resulted in some mixing to Feature 30 during the roughly 2000 year period in which it appears to have arisen. Post-abandonment cultural processes associated with historic land use practices also may have contributed to the observed expression of the archeological record. Faunal turbation from burrowing rodents also may have contributed to the vertical displacement of cultural materials throughout the vertical column.

Feature 31

Feature 31 is a burned rock cluster exposed in the floor of Unit 5 (see **Figure 39**) along its northern wall (**Figure 42**) at 68 cmbs. The feature was found adjacent to the eastern edge of Feature 29, Cluster 3, and at roughly the same depth below ground surface. Only a small portion of the feature was exposed in the unit and most of it remains un-sampled. The feature was contained within the E/A soil horizon, which ranged from a 10YR5/4 yellowish brown to a 10YR5/6 yellowish brown sand. The portion of the feature that was exposed was a semicircle extending 40 cm east west by 10 cm north south. Several burned rocks were found scattered across the unit floor at the same elevation as Feature 31 and Feature 29, Cluster 3, but could not be confidently associated with either. The portion of Feature 31 that was sampled consisted of 14 quartzite burned rocks (3.0 kg).

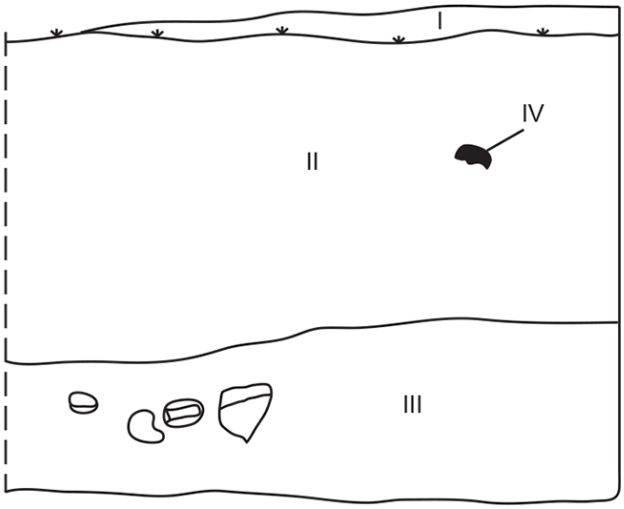
Feature 32

Feature 32 is a burned rock feature represented by three distinct clusters, referred to as Clusters 1, 2, and 3 (see **Figure 38**). Feature 32 was exposed in Trench 17 just to the south of Feature 26 at 60 cmbs. The feature was contained within the E soil horizon which was a 10YR5/4 yellowish brown sand. Feature 32 was bisected north/south. The western half of each cluster was removed first and a profile facing east was drawn (see **Figure 38**) before the eastern half was removed.

Cluster 1 was an amorphous burned rock scatter contained within an area extending 80 cm north/south by 95 cm east/west. The rocks in the central portion of Cluster 1, an area extending roughly 50 cm north/south by 40 cm east/west, were more closely spaced while the rocks in the surrounding area were more scattered. Cluster 1 is thought to represent a disarticulated cooking facility, whose rocks may have been borrowed for use in an adjacent cooking facility. Alternatively, this disarticulation might have resulted from bioturbation associated with burrowing animals and/or tree roots. In profile the feature rocks occurred in a single layer resting on a level plane. A flotation sample from Custer 1 was retained. Flotation failed to yield any cultural remains. The burned rock in Cluster 1 included 173 quartzite rocks (21.0 kg), 1 chert rock (0.1 kg), 1 hematite rock (0.1 kg), and 7 silicified wood rocks (0.4g).

Cluster 2 was a smaller concentration of burned rocks confined to a roughly circular area with a diameter of 30 cm. Cluster 2 was found at a slightly higher elevation than Cluster 1. The origins of Cluster 2 remain ambiguous. It may represent secondarily discarded rocks associated with Cluster 1 or an as yet unidentified hot rock cooking facility. The burned rock in cluster 2 included 14 quartzite rocks (3.7 kg).

Cluster 3 was an even smaller burned rock concentration that was confined to a roughly circular area with a diameter of 20 cm. The origins of Cluster 3 are unknown. The cluster may represent secondarily deposited material associated with a nearby cooking facility. The burned rock in cluster 3 included 3 quartzite rocks (0.4 g) and 1 silicified wood rock (0.1 kg).



I Back Dirt, 0 – 5 cmbs

II E/A1 Horizon 10YR5/4, yellowish brown sand, blocky sub-angular structure, weak grade, 5 – 65 cmbs, thickly bedded.

III E/A2 Horizon, 10YR5/6 yellowish brown sand, blocky sub-angular structure, weak grade, 65+ cmbs, unknown lower boundary

IV Rodent run, 10YR5/6 yellowish brown sand.

Feature rock

N

0 20 40

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Figure 42

Site 41BP595
Feature 31 Profile, North
Unit 5

Feature 33

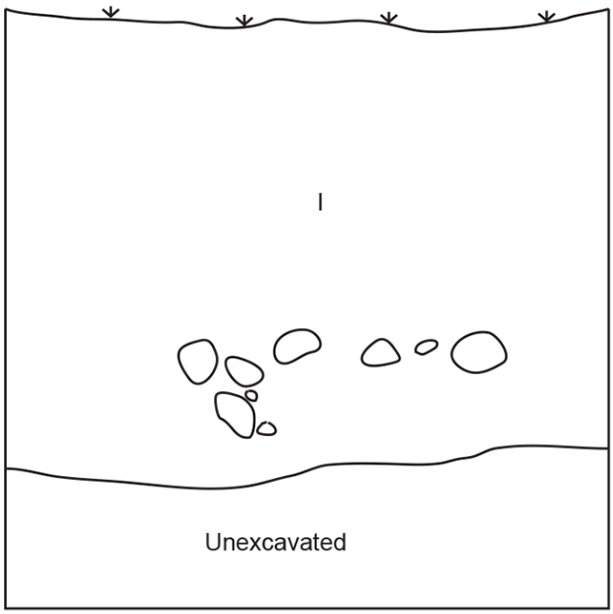
Feature 33 was a small cluster of burned rock exposed in Trench 17 at 57 cmbs (**Figure 43**). The feature was contained within the E/A soil horizon which was a 10YR6/3 pale brown fine sand. When Feature 33 was first exposed in the floor of Trench 17, it was not distinguished from Feature 27 directly below and several of the feature rocks were removed with and attributed to Feature 27. Once Feature 27 was removed, Feature 33 was readily discernible in the west wall of the trench as a separate cluster of burned rock extending 64 cm north/south along the wall of the trench (**Figure 43**). The three burned rocks depicted on the slight rise in the western half of the Feature 27 cluster 1 profile drawing (see **Figure 38**) can reasonably be attributed to Feature 33. These three rocks were separated from the underlying Feature 27 by 2 to 5 cm of sediment. The origins of Feature 33 are uncertain as most of it appeared to extend into the western wall of Trench 17. Based on its expression in the western wall of the trench and its superposition above Feature 27, Feature 33 is thought to represent a largely intact burned rock hearth that was utilized after Feature 27 was abandoned.

FEATURE VARIABILITY

The burned rock features identified at 41BP595 varied with respect to volume, rock mass, morphology, and composition. The volume of the sampled burned rock features, and the individual burned rock clusters that comprise the complex features, ranged from 1,257 cc to 220,540 cc, and averaged 32,036.07 cc with a standard deviation of 45,768.27. Only the very largest of these, Feature 29, Cluster 3, had a volume that was more than one standard deviation above the mean. The total mass of rock in each feature ranged from 0.50 kg to 319.20 kg, and averaged 33.78 with a standard deviation of 68.82. Only the two largest features, Feature 27, cluster 1, and Feature 29, Cluster 3 had a total mass more than one standard deviation above the mean. The rock density of each feature, and each cluster in the complex features, was derived using the formula (Total mass of feature rocks in grams/ Volume in cc). Feature density ranged from 0.04 to 3.76 and averaged 0.95 with a standard deviation of 1.74. Two features, Feature 23 and Feature 27 cluster 1, had densities greater than one standard deviation of the mean. Two features, Features 2 and 3, had densities more than one standard deviation below the mean.

The features and individual clusters in complex features were categorized by their shape in plan and profile. In plan, most features were either circular (n = 6) or oval (n = 11). The remaining features were amorphous in outline. The base of the features and clusters were typically either flat (16) or shallow basins (7). The base of feature 4, however, was uneven. Burned rocks were virtually absent from Feature 4 and it does not appear to have resulted from hot rock cooking. The majority of the features were constructed with only one layer of rock. Four features (26, 27 Cluster 1, 27 Cluster 2, and 29 Cluster 3) were constructed of two or more layers of rock.

The most common rock type used in the features excavated on site was quartzite, which represents nearly 90 percent of all the combined rock used in all of the features sampled. The percentage of quartzite within individual features and clusters, however, varied and ranged from 65.2 percent to 100 percent by mass.



I E/A Horizon, 10YR6/3 pale brown dry sand, fine blocky sub-angular structure, weak grade, 0 – 85+cmbs, thickly bedded, unknown lower boundary.

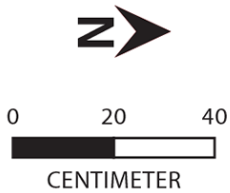


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Figure 43

Site 41BP595
Feature 33 Profile, West

Hematite and hematitic sandstone were the second most common rock types found in the sampled features and clusters and comprises 6.54 percent of all of the rock recovered from feature contexts. A total of 16 features, out of the 24 sampled, had hematite and/or hematitic sandstone, which comprised between 0.46 percent and 29.11 percent of these 16 features by mass. Silicified wood was the third most common rock type represented in the sampled features and clusters, representing 1.4 percent of the combined burned rock present in all of the sampled features and clusters. Silicified wood was present in 12 of the features and clusters sampled and comprised between 0.44 percent and 20 percent of each. Chert was the fourth most common rock type in the features and clusters sampled, comprising 2.22 percent of all of the rock present in feature contexts. Chert was identified in 4 of the features sampled and comprised between 0.20 and 25.54 percent of each by mass. Rock classified as "other" represents 0.21 percent of the rock in these features, and was present in only two features, representing between 0.79 and 0.86 percent by mass of each.

The type of rock used for feature construction may have been chosen based on its physical properties and/or its availability. The physical properties of quartzite make it especially suitable for hot rock cooking. Ellis (1997:54) notes that "quartzite appears to be more resilient than other types of lithic raw material when heated and allowed to cool in place. In experiments where quartzite cobbles were exposed to repeated heating/dowsing episodes, the cobbles could be re-used for long periods before they exhibited noticeable color changes and jagged breaks."

Feature 4 is thought to represent, primarily, a natural concentration of unburned rock and may be a remnant of a Quaternary high gravel deposit. The small amount of burned rock that was present in Feature 4 (about 1 percent) is thought to represent a fortuitous inclusion; burned rock is scattered widely across the site. The composition of the sampled portion of Feature 4 was 86 percent quartzite, 5 percent hematite, 8 percent silicified wood, and 1 percent chert. It is notable that the composition of Feature 4 is consistent with the remainder of the features sampled on site, which were mostly quartzite with small amounts of other rock types.

This pattern is also consistent with the composition of burned rock recovered from non-feature contexts. The burned rock recovered from feature contexts was categorized by raw material type in the field, weighed, and then discarded. The burned rock recovered from non-feature contexts in shovel tests and excavation units was brought back to the Atkins laboratory where it was placed into raw material categories. The raw material categories used in the field were more general while those used in the laboratory where more detailed. The categories used in the field include: quartzite, chert, hematite, hematitic sandstone, coarse grained sandstone, silicified wood, and granite-like. Although finer grained material distinctions were made in the lab than in the field (see **Table 25** below), the results remain comparable. In the lab, quartzite (including quartz arenite and metaquartzite) was found to comprise just over 87 percent of all of the burned rock recovered from non-feature contexts. Hematitic sandstone (7.07 percent) and silicified wood (1.89 percent) were the next most common burned rock types followed by chert (1.54 percent). The remaining nine raw material categories together comprise only 2.33 percent of the burned rock from non-feature contexts.

Table 25. Site 41BP595 Thermally Altered Rock from Non-Feature Contexts by Raw Material Category

Burned Rock Type	Mass	Percent
Quartz Arenite	14,924.25	78.32
Metaquartzite	1,686.72	8.85
Hematitic Sandstone	1,346.63	7.07
Silicified Wood	360.54	1.89
Chert	292.76	1.54
Chert/Quartz	148.67	0.78
Chert/Silicified wood	61.39	0.32
Quartz Crystal	59.84	0.31
Quartz Arenite/ Silicified wood	49.85	0.26
Siltstone	42.77	0.22
Chert/Quartz Arenite/Silicified wood	30.59	0.16
Chert/Quartz Arenite	24.06	0.13
Hematite	22.56	0.12
Chert/Hematite sandstone	4.09	0.02
Total	**19,054.72**	**100.00**

The burned rock composition of most features sampled on site, along with the composition of burned rock recovered from non-feature contexts, as well as the composition of unburned rock in Feature 4, remained fairly stable. It is therefore reasonable to predict that the more Features differ from the normative pattern, the more likely they are to have resulted from processes that likewise differ.

Feature 1, with its very high proportion of chert (25.54 percent) and low proportion of quartzite (65.22 percent) stands out as anomalous compared to the other features sampled on site. Although the origin of this pattern remains uncertain, the simplest source is inter-observer variability, as the distinction between chert and the fine grained quartzite present on site was sometimes difficult to make in the field. This interpretation is bolstered by the fact that, outside of Feature 1, very little chert was identified on site in feature and non-feature contexts.

Feature 15 and Feature 27, Cluster 2, have high concentrations of burned hematite/hematitic sandstone (29.11 percent and 17.71 percent respectively) relative to the other features sampled on site. Hematite and hematitic sandstone are readily distinguished from other lithic raw material categories encountered. For this reason, the apparent concentration of hematite and hematitic sandstone in these features is not likely due to observer error. The origins of this patter, however, remain ambiguous.

Feature 32, Cluster 3 had the highest proportion of silicified wood (20 percent) of the features sampled. The origins of this pattern are almost certainly sample size, as the entire mass of all of the rocks in this cluster was only 0.5 g, making it one of the two smallest features or clusters sampled.

The preservation of charcoal within the features identified on site was generally poor. Although charcoal was recovered from flotation samples taken from feature contexts, for the most part, charcoal was not visible in feature matrices during excavation. One possible explanation for this observation is that the fuel used to heat the burned rocks was entirely consumed during the cooking process. Ellis (1997:53) noted that:

> In the case of the sealed pit, the earth covering would effectively reduce the amount of oxygen found in the cooking environment. Due to the decreased oxygen content, any fuel that was not reduced to ash by the time the pit was covered would probably not be entirely consumed. Therefore, it is likely that the soil matrix surrounding the feature rocks would contain chunks of charcoal. By contrast, the uncovered pit provides a more oxygen-rich environment that would promote the complete combustion of large charcoal lumps, leaving mostly ashes and few, if any, charcoal fragments, especially if the coals are stirred frequently.

The foregoing suggests the possibility that the small amount of charcoal recovered from burned rock feature contexts reflects use as open pit cooking facilities. Other processes, including both cultural and natural transformations that occurred both before and after the site was abandoned may have also contributed to this pattern. It is possible that much of the charcoal contained within the features was broken down by natural turbative processes since the features were last used. It is also possible that the absence of charcoal in the features resulted from how the features were used. If, for example, the features were cleaned out after they were used and the charcoal and other refuse were re-deposited at another location, lower amounts of charred remains would be expected. Such a pattern could explain, in part, how the midden (Feature 30) arose. The fact that burned rock clusters were concentrated around the perimeter of the midden in Area 2 appears consistent with this hypothesis. Alternatively, the absence of charcoal within the features may have resulted from the feature rocks having been heated before being deposited in the feature pit.

CHIPPED STONE ARTIFACT ASSEMBLAGE

The following section first identifies patterned variability between the chipped stone artifact-assemblages recovered from each of the sub-site areas at 41BP595 and second explores possible origins of this variability. The entire chipped stone artifact assemblage recovered during testing consists of 1,313 specimens, and includes 1,274 pieces of lithic debitage, 14 projectile points, 10 bifaces/biface fragments, 8 utilized flakes, 3 unifacially modified flakes, 2 cores, and 1 scraper.

The distribution of these materials across the site remained fairly consistent. **Table 26** below lists the artifacts by type recovered from each site area, along with the "off area" artifacts, those recovered from the site through shovel tests that were not associated with a sub-site area.

Table 26. Site 41BP595, Chipped Stone Artifacts by Sub-Site Area.

Artifact	Area 1	Area 2	Area 3	Off Area
Debitage	134	832	147	161
Projectile Point	3	10	1	
Biface	1	8		1
Utilized Flake		6	2	
Uniface	1	2		
Core		2		
Scraper		1		
Total	**139**	**861**	**150**	**162**

Although each area differed by size, sampling intensity, and artifact density, the types and ratios of the various classes of material recovered from each remained fairly consistent. For the purposes of this discussion, hand excavation refers to all hand excavated units as well as all positive shovel tests. Area 2 was by far the most heavily sampled sub site area (**Table 27**). Area 2 was sampled with 6 m^2 of hand excavation, while Area 1 received 1.5 m^2 and Area 3 received only 1m^2. Of the 14 trenches that yielded artifacts, 7 were in Area 2 while 6 were in Area 1 and only 1 was in Area 3. Nine out of the eleven sampled features were located in Area 2.

Table 27. Site 41BP595 Artifact Recovery Context by Site Area

Chipped Stone Artifact Recovery Context	Area 1	Area 2	Area 3	Off Area
Hand Excavation m^2 (units and positive shovel tests)	1.5	6.04	1	5.4
Features sampled	2	9		
Trenches	6	7	1	0
Density (Artifacts/hand excavation m^2)	88.67	137.09	146.00	28.89

Table 27 also presents the artifact density of each sub site area, which refers to the total number of lithic artifacts recovered for each square meter of hand excavation. The apparent high artifact density in Area 3 is likely due in part to sample size. Area 3 received the least amount of hand excavation of any of the sub-site areas. The high artifact density in Area 2 is thought to represent a more robust pattern as Area 2 was the most intensively sampled sub-site area.

Lithic debitage was by far the most common class of material recovered and comprises more than 95 percent of the chipped stone artifact assemblages recovered from each of the site areas as well from off of these areas. The second most common class of artifacts in all site areas was projectile points and/or bifaces. The remainders of the sub-site area chipped stone assemblages consist of expedient tools (utilized flakes, unifaces, and a scraper) and lithic cores, which were recovered in low numbers across the site.

The greater diversity and quantity of materials recovered from Area 2, compared to the other site areas, is thought to have resulted more from sampling intensity and systemic use intensity rather than profound functional variability. In short, the range of lithic reduction strategies conducted within each sub-site area, along with the ways the lithic tools were used, is likewise thought to have remained relatively consistent. Area 2, however, appears to have resulted from significantly greater systemic use intensity than the other site areas. This conclusion is based on the observation that 20 of the 33 features identified on site were found within Area 2 or just outside of it, as well as the fact that the large midden represented by Feature 30 was also contained within Area 2.

The range of raw material types represented in the sub-site lithic assemblages similarly remained consistent across the sub-site areas. In all sub-site areas, chert was by far the most common material type recovered, representing nearly 90 percent of the raw material types within each sub-site assemblage. **Table 28** below shows the ratios of lithic raw material types within each of the sub-site area chipped-stone assemblages. Silicified wood, quartz arenite, and metaquartzite represent the three next most common raw material types. The remaining raw material types, including hematite, chert/quartzite, quartz crystal and quartzite occurred infrequently across the site.

Notably, the raw material types present within the chipped stone assemblage are present within the thermally altered rock assemblage, but in vastly different ratios. Nearly ninety percent of the thermally altered rock assemblage recovered from feature contexts was composed of quartzite while close to ninety percent of the chipped stone assemblage was chert. Two hypotheses may be proposed from this observation. First, both raw material types were relatively easily obtained by the prehistoric occupants of the site. Second, chert was the preferred raw material for chipped stone tools while quartzite was the preferred raw material for hot rock cooking.

Table 28. Site 41BP595 Ratios of Lithic Raw Material Types by Sub-Site Area

Raw Material	Area 1	Area 2	Area 3	Off Area
Chert	89.21	90.94	92.72	81.48
Silicified Wood	1.44	3.72	0.66	6.79
Quartz Arenite	5.76	2.44	3.97	7.41
Metaquartzite	2.88	2.21	2.65	4.32
Hematite	0.72	0.23		
Chert/Quartz Arenite		0.23		
Quartz Crystal		0.12		
Quartzite		0.12		
Total	**100**	**100**	**100**	**100**

Sub-site Area 2 evidenced the greatest raw material diversity. This pattern presumably resulted in part from variability in sampling density across the sub-site areas. This pattern also is thought to reflect the more intensive prehistoric utilization of Area 3 with respect to the other site areas.

Patterned variability within the sub-site debitage assemblages suggests some possible minor differences between their origins. The debitage assemblage from 41BP595 was categorized by morphology into complete flakes, broken flakes, flake fragments and debris. **Table 29** below compares the ratios of debitage categories within each sub-site debitage assemblage.

Table 29. Site 41BP595 Ratios of Debitage Categories by Sub-Site Area

Debitage Category	Area 1	Area 2	Area 3	Off Area
Broken Flake	30.83	24.03	33.56	26.92
Complete Flake	17.29	32.49	13.70	16.03
Debris	22.56	5.43	20.55	25.64
Flake Fragment	29.32	38.04	32.19	31.41
Total	**100.00**	**100.00**	**100.00**	**100.00**

Sub-site Area 2 is distinguished from the other sub-site areas by its low proportion of debris, high proportion of complete flakes, and elevated proportion of flake fragments relative to the other sub-site areas. The low debris ratio in Area 2 suggests a reduction strategy less dependent upon primary core reduction. The high ratios of complete flakes and flake fragments may reflect a reduction strategy geared more towards tool production, use, and maintenance.

Variation between the sub-site chipped stone artifact assemblages is thought to have resulted in part from variability in the formation histories of each area as well as the intensity with which each area was sampled. The ratios of tool types and raw material remained relatively consistent across each sub-site area suggesting that the activities represented also remained consistent. The Area 2 assemblage appears conspicuous by its high artifact density and diversity as well as by its high density of cultural features. These patterns suggest Area-2 resulted from more frequent and/or longer duration systemic occupations than the other site areas.

PROJECTILE POINTS

Fourteen projectile points and projectile point fragments were recovered during NRHP testing at 41BP595. Nine of these specimens are dart points; the remaining five are arrow points. These artifacts represent discard spanning the period from the Late Paleoindian to the Late Prehistoric.

Lot 543. This Montell dart point was manufactured from a very fine-grained, slightly translucent, brown thermally altered chert. It has a long, narrow body with very straight lateral margins extending from a broad bifurcated base with square corners (**Figure 44** a). The artifact is 62.2 millimeters (mm) in length, 21.0 mm in width, and 5.6 mm in thickness, with a maximum blade width of 13.9 mm. Minor utilization damage is present to the lateral margins, suggesting cutting usage against a soft to medium material. The extremely narrow body of the artifact may be the result of retooling to revitalize a damaged tool, or it is possible that the thinning of the body was for some specialized purpose. The Montell point type suggests a Late Archaic date, ca 800-400 B.C. (Turner et al. 2011). This specimen was recovered from Trench 1.

Lot 544. This untyped dart point fragment was manufactured from a fine-grained grayish brown chert. The artifact appears to have been truncated on the lower body, just above the shoulder. The cross section is thin and slightly convex. The lateral margins are moderately convex with a very regular serrated edge (**Figure 44** b). The point does not appear to be finished, suggesting that the artifact may have been discarded following a manufacturing failure, either during initial manufacture or retooling. Only slight evidence of utilization is apparent, suggesting some short term unidentified usage against a soft or medium material. The artifact is 50.5 mm in length, 28.6 mm in width, and 7.4 mm in thickness. This specimen was recovered from Trench 4.

Lot 548. This Scottsbluff dart point was manufactured from a fine-grained gray chert with a large coarse-grained inclusion on the upper body near the margin (**Figure 44** c). The lateral margins are nearly straight, becoming more convex closer to the tip, and basally recurve out slightly to form weak shoulders. It has a narrow lanceolate outline with a thick biconvex cross section. The flaking is irregular rather than parallel and the specimen has been extensively retooled such that no evidence of utilization is apparent. The stem is squared with base and margins exhibiting very slight grinding. The artifact is 97.2 mm in length, 26.0 mm in width, and 10.7 mm in thickness with a stem 20.5 mm in length and 9.2 mm in width. The Scottsbluff type dates to the Late Paleo-Indian period, ca 7120-6650 B.C. (Turner et al. 2011). This specimen was recovered from Trench 11.

Lot 549.1. This Scallorn arrow point was manufactured from a fine-grained chert (**Figure 44** d). The point tip has been broken in an apparent impact fracture. One barb and one basal corner have also been truncated. A large heat spall is present on one face of the body that appears to be post-discard. The artifact is a dark

reddish brown in color, probably as the result of the heat alteration that produced the spall. The lateral margins are straight to slightly concave and slightly denticulate with strong, downward pointing barbs and deep corner notches. The base is relatively flat and narrower than the shoulders. No evidence of utilization is apparent. The artifact is 22.3 mm in length, 18.1 mm in width and 3.6 mm in thickness with a stem 7.5 mm in length and 11.1 mm in width. The Scallorn type in indicative of the Austin Phase of the Late Prehistoric period, ca. A.D. 700 – 1200 (Turner et al. 2011). This specimen was recovered from Trench 15.

Lot 549.2. This artifact is an arrow point distal fragment of an unidentified type, missing the stem and most of the body. It has been truncated in a hinge fracture, probably a result of bending force. It was manufactured from a fine-grained light brown chert with an intermittent reddish brown surface effect resulting from post manufacture heating. The artifact is thin and bi-convex in cross section with finely flaked, relatively straight lateral margins (**Figure 44** e). Little if any edge wear is present. The artifact is 18.1 mm in length, 12.1 mm in width, and 2.8 mm in thickness. This specimen was recovered from Trench 15

Lot 555. This artifact is an arrow point proximal fragment of an unidentified type with only the stem present. It has been truncated in a hinge fracture at the narrow juncture between body and stem. It was manufactured from a fine-grained light brown chert with an intermittent reddish brown surface effect resulting from post manufacture heating. The stem has finely flaked, straight, expanding edges and a slightly concave base, lending a "fish tailed" appearance (**Figure 44** f). No utilization wear is apparent. The artifact is 7.0 mm in length, 13.7 mm in width, and 2.8 mm in thickness. The general morphology is comparable with a small example of the Edwards type, suggesting a date of ca A.D. 900-1100 (Turner et al. 2011), but in the absence of the body this conclusion remains speculative. This specimen was recovered from Unit 1.

Lot 585. This artifact is an arrow point manufactured from a fine-grained grayish brown chert which was probably heat treated prior to manufacture. It exhibits significant reduction to the lateral margins by resharpening. The artifact is triangular with slightly convex, beveled lateral margins, weak shoulders, a broad, slightly expanding stem and a slightly convex base (**Figure 44** g). The pattern of wear suggests final use as a drill against a medium material such as wood. Beveling of lateral margins was probably to facilitate drill use. The artifact is 25.8 mm in length, 17.5 mm in width, and 4.9 mm in thickness with the stem about 10.8 mm in length. This specimen was recovered from Unit 3.

Lot 594. This artifact is a thin, corner notched, triangular arrow point with straight to slightly recurved, slightly serrated lateral margins, very prominent barbs, an expanding stem, and a flat base (**Figure 44** h). It is nearly complete, lacking only the point tip. It was manufactured from a fine-grained brown chert. It is 19.2 mm in length, 22.6 mm in width, and 3.7 mm in thickness with a stem 7.1 mm in length and 9.6 mm in width. Its general appearance is most similar to the Edwards or Sabinal types although the base is less prominent and unbifurcated compared with the Edwards type and more prominent and expanding compared with the Sabinal type. It's similarity to these types suggests a date in the early middle to middle of the Late Prehistoric period (Turner et al. 2011). This specimen was recovered from Unit 4.

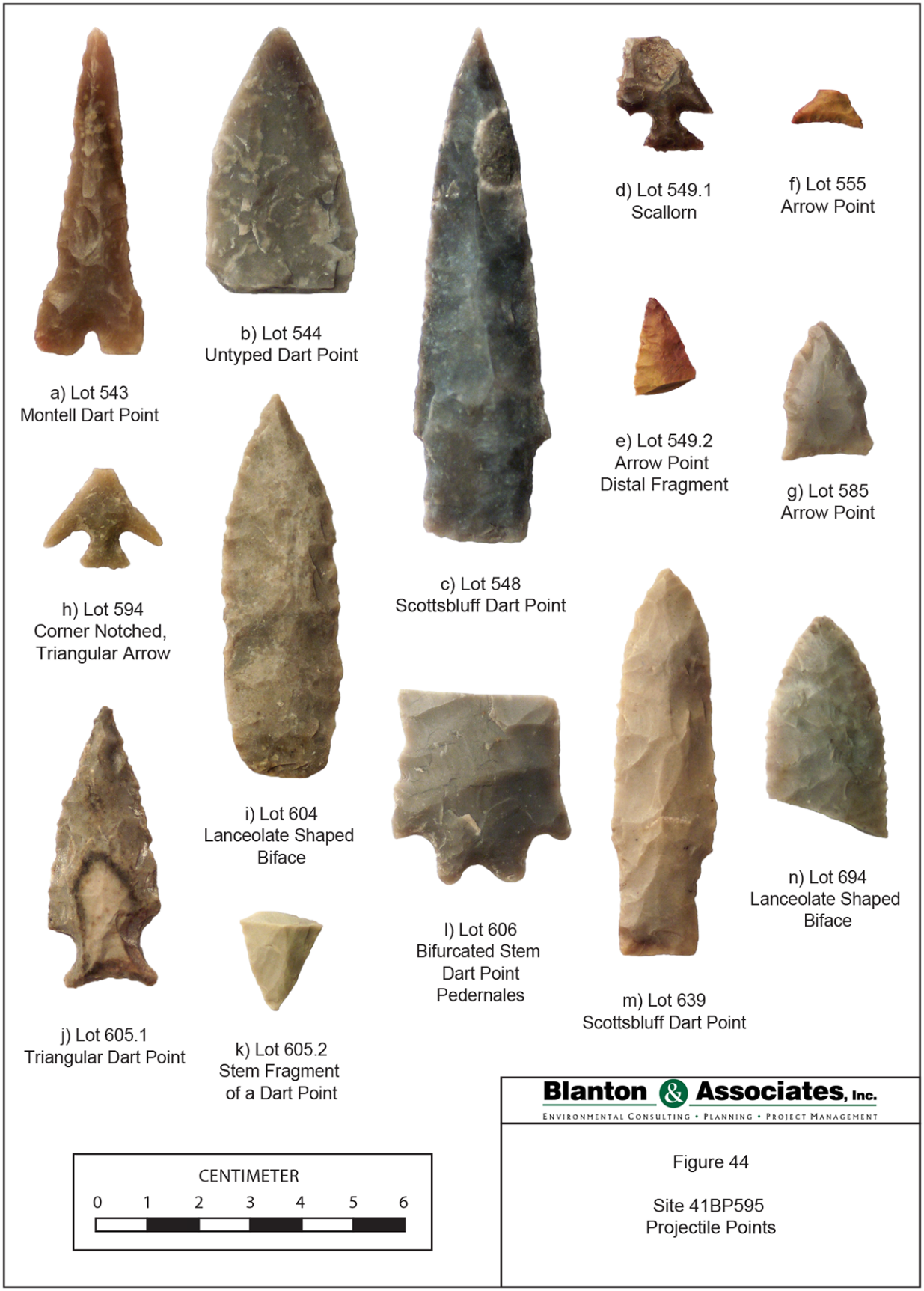
a) Lot 543
Montell Dart Point
b) Lot 544
Untyped Dart Point
c) Lot 548
Scottsbluff Dart Point
d) Lot 549.1
Scallorn
e) Lot 549.2
Arrow Point
Distal Fragment
f) Lot 555
Arrow Point
g) Lot 585
Arrow Point
h) Lot 594
Corner Notched,
Triangular Arrow
i) Lot 604
Lanceolate Shaped
Biface
j) Lot 605.1
Triangular Dart Point
k) Lot 605.2
Stem Fragment
of a Dart Point
l) Lot 606
Bifurcated Stem
Dart Point
Pedernales
m) Lot 639
Scottsbluff Dart Point
n) Lot 694
Lanceolate Shaped
Biface
CENTIMETER
0 1 2 3 4 5 6
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Figure 44
Site 41BP595
Projectile Points

Lot 604. This artifact is a long, relatively thin, lanceolate shaped biface or dart point manufactured from a grayish brown fine to medium-grained chert. It has straight to convex lateral margins tapering to a sharp point and a broad, rounded to slightly flattened base (**Figure 44** i). The artifact is 72.9 mm in length, 22.5 mm in width and 7.0 mm in thickness. The base and the lateral margins within about 25 mm of the base exhibit slight edge rounding, probably indicative of haft wear. The lateral margins within about 30 mm of the point exhibit edge rounding and crushing and intermittent step fracturing associated with longitudinal usage against medium material such as cutting and/or sawing woody material. The margins within 10 mm of the tip exhibit the most intense wear, suggesting perforating or boring of a medium material. The medial portion of the lateral margins exhibit very slight nonspecific wear. No wear suggests usage as a projectile point and it was more likely used as a knife. This specimen was recovered from Trench 10.

Lot 605.1. This is a complete example of a large, thick, triangular dart point with slightly convex lateral margins, broad corner notches, and an expanding stem with a convex base (**Figure 44** j). The artifact was manufactured from a grayish brown, medium to fine-grained chert. It is most similar to the Fairland dart point type, although the base is somewhat narrower than average for that type. The artifact is 53.2 mm in length, 21.8 mm in width, and 8.4 mm in thickness with a stem 13.5 mm in length and 17.9 mm in width. The Fairland type typically dates to the Transitional Archaic period (Turner et al. 2011). This specimen came from Trench 16.

Lot 605.2. This artifact appears to be a stem fragment of a dart point. It has been truncated in a snap fracture. It is manufactured from a fine-grained light grayish brown chert. Over its 18.4-mm length, the artifact expands to 15.9 mm in width and 6.7 mm in thickness. It has a bi-convex cross section and relatively straight margins (**Figure 44** k). Little if any edge wear is present. The marked expansion in width and thickness from the tip is consistent with a Gary type dart point fragment and suggests a Late Archaic date (Turner et al. 2011), although it is possible that the artifact is simply a fragment of a perform or other biface. This specimen came from Trench 16.

Lot 606. This artifact probably represents a fragment of an unfinished preform of a large bifurcated stem dart point which most closely resembles the Pedernales type. The stem is relatively straight with rounded bifurcated corners and a deep central concavity. (**Figure 44** l). The artifact was manufactured from a fine-grained, gray chert and is 36.7 mm in length, 34.2 mm in width, and 6.6 mm in thickness. One lateral margin shows pronounced use wear to the ventral edge suggesting unidirectional scraping or shaving against a medium material such as wood with the dorsal edge leading. The Pedernales type dates to the Middle Archaic period, ca 2500-3500 B.P. (Turner et al. 2011). This specimen was recovered from Trench 20.

Lot 639. This Scottsbluff dart point was manufactured from a fine-grained light gray chert. The lateral margins are straight to slightly convex, becoming more convex closer to the point, with weak shoulders (**Figure 44** m). Its outline is a narrow lanceolate; it has a moderately thick biconvex cross section. The flaking is generally parallel on one face and more irregular on the opposite face. Although the point is bi-convex in cross-section, it has been retooled such that the tip section is relatively thin. Because of the retooling, no evidence of utilization is apparent. The stem is squared with base and margins exhibiting slight grinding. The artifact is 73.3 mm in length, 20.4 mm in width, and 8.4 mm in thickness with a stem 20.7

mm in length and 15.7 mm in width. The Scottsbluff type dates to the Late Paleo-Indian period, ca 7120-6650 B.C. (Turner et al. 2011). This specimen was recovered from Trench 11.

Lot 694. This artifact, recovered from Trench 8, is a distal fragment of a long, relatively thin, lanceolate shaped biface or dart point manufactured from a light gray fine-grained chert. It has straight to convex lateral margins tapering to an oblique point that has been crushed slightly. The artifact has been truncated medially in a snap fracture so that the base is completely absent. The extant portion is 42.2 mm in length, 23.7 mm in width and 5.1 mm in thickness. Both lateral margins have been beveled slightly and the margin edges have been microflaked bifacially, creating a very regular denticulate appearance (**Figure 44** n). Both margins exhibit slight edge rounding and crushing with fine fracturing suggestive of longitudinal usage such as cutting or sawing against a soft or medium material. No wear clearly indicative of usage as a projectile point was observed and the artifact was more likely used as a knife.

GROUND AND BATTERED STONE TOOLS FROM 41BP595

One-hundred and fourteen ground, battered, and/or polished stone tools were recovered at 41BP595 (**Table 30**). Many are fragmented or highly weathered and approximately 50 percent exhibit thermal alteration, with a large number of them having been recovered from burned rock feature contexts.

Ground and battered stone tools are generalized tools in the sense that a single tool may not be functionally specific with regard to the manner in which it is used or the things it is used to process or prepare. Since a variety of processes can produce distinctive wear, tools were assigned to specific analytical categories on the basis of several key variables: the mechanical processes (e.g., pounding or rubbing), the outcome of those processes, and the material being processed. Microscopic examination of each tool aided in the identification of the key mechanical processes and the subsequent wear patterns still visible on the tool.

As with all classification systems, there are always those tools that could easily fit into more than one functional category. Because any specific tool can be used in a range of activities, multi-functional tools were categorized on the basis of the predominate type of wear still visible on the tool. For example, an abrader may be small enough to be held in the hand, but it is still the lower anvil stone that absorbs the pressure of rubbing an object across its surface. By contrast, a mano is a hand-held tool that supplies the pressure used for grinding. If both types of wear occur on the same tool then the tool would have served as both a mano and an abrader (e.g., Specimen 618.1). Thus, this tool would be, by strict definition, both an upper hand-held tool used to supply the pressure for grinding and a lower anvil stone that absorbs the pressure of some rubbing activity. Examination under 10–20 X power binocular magnification revealed the presence of eight types of wear on one or more of the tools: grinding, polishing, pecking, battering, pitting, striations, grooves, and notches. On the basis of examination, the recovered tools were assigned to 16 functional categories (**Table 30**).

Table 30. Site 41BP595, Ground Stone Tools by Functional Category

Category	Count
Abrader	10
Indeterminate Grinding Stone Fragment	17
Mano	10
Mano Fragment	33

Table 30. Site 41BP595, Ground Stone Tools by Functional Category

Category	Count
Mano/ Hammerstone	8
Mano/Abrader	4
Mano/Scraper	2
Milling Stone	1
Milling Stone Fragment	4
Muller	13
Muller Fragment	3
Pestle	1
Pitted Anvil Stone Fragment	1
Polishing Stone	4
Polishing Stone Fragment	1
Seriating Tool	1
Total	**113**

Both lower anvil stones and upper hand-held stones were recovered. The upper hand-held stone is the most easily manipulated and *supplies* pressure during the two primary mechanical operations of pounding and rubbing. The lower anvil stone serves as a stationary platform that *absorbs* the pressure of pounding and/or rubbing. By far, upper hand-held stones represent the largest percentage of the ground and battered stone artifacts recovered at the site.

Among the 113 ground, battered, and/or polished stone tools, six raw material types were observed (**Table 31**). Stones made from quartz arenite were the most common, and 66 percent of the tools recovered were made from this raw material.

Table 31. Lithic GS Raw Material. Count and percent of ground stone raw material types

Raw Material	Count	Percent
Chert	10	8.8
Hematitic Sandstone	5	4.4
Granite	1	0.9
Metaquartzite	11	9.7
Quartz Arenite	75	66.4
Quartzite	3	2.7
Silicified Wood	8	7.1
Total:	**113**	**100.0**

Lower Anvil Stones

As previously noted, the lower anvil stone serves as a stationary platform that absorbs the pressure of pounding and rubbing, and both processes produce certain outcomes. Apart from the objective of the process (such as dehulling nuts or grinding grass seeds), the process itself (i.e., rubbing or pounding), as well as, the types of surface-to-surface contacts involved (i.e., hard-object-to-hard-object or hard-object-to-soft-object) will ultimately result in different types of wear on the stone. At 41BP595, 16 lower anvil stones or stone fragments were identified. These included 1 pitted anvil stone fragment, 1 milling stone, 4 milling stone fragments, and 10 abrader/abrader fragments.

Pitted Anvil Stone Fragments (n=1)

Specimen 676.3 was recovered from the SE ½ of Cluster 1 in Feature 27. It is heavily eroded. The fragment is an edge section from a large platform stone that exhibits numerous jagged pits on its remaining face. This type of wear suggests a pounding, pulverizing or crushing action that dehulls or reduces mass through the exertion of pressure. The process could have involved dehulling of nuts, or pounding tough and stringy dried meats to soften their texture (Carter 1977).

Milling Stone/Milling Stone Fragments (n=5)

In contrast to pitted anvil stones, the wear patterns noted on milling stones result primarily from the rubbing or grinding process. *Rubbing* combines pressure and friction in order to reduce mass through abrasive action, such as the grinding down of coarse particles into finer particles, by scouring or scraping away the surface, or by sharpening, smoothing, or refining. The surface-to-surface contacts vary depending on the type of material being processed which in turn results in wear patterns with different characteristics. For example, the mechanical operation of rubbing can be used to reduce the mass of vegetal material (such as corn kernels, roots, grains, or seeds) or non-plant material (such as clay or ocher). During this process, the material(s) to be ground are placed on the hard stationary surface or platform, and processing occurs when an upper hand-held stone slides across the lower anvil stone (see Carter 1977; Kraybill 1977).

Four of the five stones in this category have oval or circular-shaped grinding surfaces that suggest they functioned as platforms for grinding down substances. On these four specimens (Lots 215.3, 549.1, 679.3, and 679.9), movement of the upper hand stone was in a circular or rotary motion that created a basin-shaped surface on the lower stone. For example, specimen 549.1 is a well-worn basin-shaped milling stone. The peck marks dotting its face indicate that its grinding surface had been refurbished many times. The presence of distinct areas of polish points to the grinding of vegetal material such as nut meats, seeds, or grains (see Kraybill 1977; Riddell and Pritchard 1971).

Specimen 677.1 differs somewhat from the other milling stones with regard to its overall shape and wear pattern. This specimen is a refitted section of a rectangular, bi-planar slab made of hematitic sandstone. Although weathered, grinding is still visible on the high relief areas of the stone and polished patches dot its surfaces. Unlike the milling stones described above, the striations on this tool indicate that grinding was done in a back-and-forth motion rather than a circular or rotary motion. This suggests that whatever was being ground probably required a heavier exertion of pressure on the stone.

Abraders (n=10)

The tools assigned to this category exhibit a variety of wear patterns, but all have at least one or more grooves cut into the surface. These types of tools result from the abrasive use of the stone to grind, smooth, shape, or sharpen a variety of implements such as grinding the base of a projectile point, straightening and polishing an arrow shaft, and/or sharpening the tip of a bone awl. Although all of the tools assigned to this category are small enough to comfortably be held in the hand, functionally they all serve as stationary platforms that absorb the pressure of rubbing. The distinct areas of polish present on most of these tools suggest they were being used to work softer material such as wood or bone.

Of the 10 abraders recovered from the site, seven are modified sections of silicified wood. All have ground areas and one or more grooves. Four of them are composed of rather distinct varieties of petrified wood that have large quartz crystals embedded in the silicified layers. On these four tools, intensive grinding and abrasion has caused differential wear on the large quartz inclusions layered between the lamina. Specimen 253.1 had been thermally altered, but has a series of deep, lengthwise running grooves that cross cut both plane surfaces. On three specimens (75.1, 666.1, and 688.1), the grinding has created grooves that follow the silicified layers in the wood, and many of the grooves are highly polished.

Specimen 315.2 is a fragment of thermally altered silicified wood that is ground and polished on one plane surface, one side, and one end. Two deep grooves run lengthwise across the plane surface. Specimen 75.1 is a small disc-shaped tool that is battered on both ends. Specimen 666.1is a large square section of silicified wood exhibiting highly polished areas. While both these tools are polished, the location of the polish indicates that they were used in a somewhat different manner. On specimen 75.1, the polish is located in the hollow of wide grooves indicating that an object, such as a wooden arrowshaft, was laid in the basin of the groove and drug back and forth. On specimen 666.1, one side of the tool has narrow grooves that follow the silicified layers, and grooves are smooth, but not polished. On the opposite face, grinding has smoothed the silicified layers and the polished areas occur atop the layered edges. This indicates that one side of the tool involved surface-to-surface contacts that entailed a back-and-forth motion that followed the individual grooves, while on the opposite face the surface-to-surface contact involved the entire face of the tool. The wear pattern on this face suggests contact with a soft material that left polish on the high relief areas.

Specimen 688.1 is an especially interesting tool. This bi-planar piece of silicified wood is paddle-shaped in overall form, and wedge-shaped in profile. Wear along the narrow end of the tool suggests that it may have been hafted. The wide portion of the tool has distinct areas of polish on both plane surfaces. The tool had been flaked along the wide side of the tool to produce an edge, where distinct notches are visible. Wear along this edge has left the notches rounded and polished, suggesting that it was used to work softer material such as wood or fiber such as cordage for baskets.

Specimen 215.2 is a bi-planar chunk of silicified wood found in Level 6 of shovel test 80. Wear occurs on one end and three faces. Intensive grinding and abrasion has leveled the quartz inclusions layered between the lamina. A series of polished, shallow grooves, of varying lengths, occur across two of the working surfaces. Ground and polished areas occur on one plane surface and one end.

Three other abraders were recovered from shovel tests. Specimen 495.1 is a rectangular shaped abrader fragment made of hematitic sandstone that was found in Level 6 of shovel test 140. Wear occurs on the two plane surfaces. One side exhibits a smoothly ground surface that terminates in a broad notch, angled toward one corner. The surface of the notch exhibits abrasion, with traces of red and yellow ocher embedded in the abraded areas. On the opposite side, the surface has been ground and polished, with diagonal, unidirectional striations cross cutting one end.

A wedge-shaped abrader fragment (Specimen 54.1) was recovered from shovel test 22, Level 4. This tool is made of metaquartzite and is missing portions of one side and one end; however wear is still visible on

its two remaining surfaces and on one end. A series of shallow grooves cross-cut both surfaces and it is ground and highly polished on one end.

A quartz arenite abrader was also recovered. Specimen 119.1 is a small square stone whose edges have been rounded by grinding. Two closely spaced narrow, grooves cross-cut one plane surface. The wear patterns on this tool suggest that it was used to grind and abrade relatively hard objects such as stone.

Upper Hand Stones

The ground stone assemblage at 41BP595 includes 80 upper hand-held stones. On the basis of microscopic examination, these 80 stones were assigned to eight functional categories: mano/mano fragments, muller/muller fragments, mano/hammerstone, mano/abrader, mano/scraper, polishing stones, seriating tool, and pestle. Seventeen indeterminate grinding stone fragments were also recovered. Although these 17 stones were too fragmented to determine their functional categories, most were probably sections of upper hand-held stones.

Mano/Mano Fragments (n=43)

Ten manos and 33 mano fragments were recovered at the site. Manos are hand held stones that are generally controlled by the palm of the hand. Typically, the direction of use is in a back-and-forth motion that results in flat facets at right angles to the long axis of the tool (Kraybill 1977; Riddell and Pritchard 1971). While they are frequently used in conjunction with lower anvil stones, they are also used in combination with other surfaces, such as wood or hides.

The majority of the manos recovered at 41BP595 are made of quartz arenite (n=34). Twenty-seven of the 43 stones exhibit evidence of thermal alteration; many of them had been recycled for use as hearthstones. All eight types of wear patterns were identified in varying combinations on these 43 tools and tool fragments, indicating their use in a range of activities that involved the grinding and processing of both hard and soft substances.

For example, specimen 61.1 is an ovoid shaped stone that is wedge-shaped in profile. Several old, well-worn flake scars encircle the stone, indicating that it had been modified to comfortably fit in the hand. Patches of grinding occur across the face of both surfaces. Its overall wear patterns suggest that it was used in a back and forth motion on one side and a circular motion on the opposite side. On the flat face of the tool, grinding has obliterated the interstices between the grains, leaving distinctive patches of polish. A deep groove had been cut into the surface, and unidirectional striations run the length of the stone. Areas of polish also occur around the sides of the tool. On the mounded side, grinding is concentrated on the high relief areas and there is micro-fracturing of the interstices between the grains giving this surface an opaque look. Randomly oriented striations occur across the surface. This mixture of wear types suggests that this tool may have been a multi-purpose food processing tool used to grind both relatively hard substance(s) and softer vegetal material.

Specimen 596.1 is a sub-triangular shaped stone that was recovered from Unit 4, Level 5. This thick stone is made of quartz arenite and is bi-planar in profile. A well-worn flake scar along one side would have

served as a comfortable finger rest. Battered and crushed areas are visible on its narrow end. On both surfaces and two sides of the tool, grinding has obliterated the interstices between the grains, leaving distinctive patches of polish. This type of wear suggests that the substance(s) being ground was relatively hard, with repeated grinding producing a heavy buildup of debris.

Also recovered from Unit 4, Level 5 was specimen 596.2, a quartz arenite stone that is sub-triangular in overall form and plano-convex in profile. On the mounded face, the grinding is concentrated on the high relief areas and there is micro-fracturing of the interstices between the grains giving this surface an opaque look. On the flat face of the tool, grinding has obliterated the interstices between the grains and numerous peck marks dot the surface. This type of wear suggests that the substance(s) being ground was relatively hard.

Specimen 674.3 is a refitted, sub-triangular mano that was recovered from the NW1/2 of Cluster 2 in Feature 27. Made of quartz arenite, this large, heavy tool exhibits evidence of battering on its flattened end. Grinding occurs primarily on the high relief areas on one face of the tool and around its curved edges. On its opposite face, the tool is highly polished. The polish fills the interstices between the grains and covers a shallow, but distinct, trough-shaped depression that runs horizontally across the entire face of the tool. The orientation of the depression indicates a back-and-forth motion that horizontally bisected this face of the tool. This type of wear suggests surface-to-surface contact with a softer curved surface and not a hard, flat surface.

Muller/Muller Fragments (n=16)

Thirteen mullers and three muller fragments were recovered at the site. These small multi-purpose grinding tools differ from manos in that they are generally smaller and manipulated with the fingers rather than the palm of the hand. They often exhibit distinctive wear patterns such as polishing and/or shallow striations that are oriented in a more circular or horizontal direction. Both experimental evidence (Adams 1988, 1996; Semenov 1964) and ethnographic evidence (Kraybill 1977; Riddell and Pritchard 1971) suggest that these types of wear patterns result from the pressure of a hard object against a soft object (such as a hide, a wooden bowl, or a basket) and/or they were used to grind or crush softer and more fragile seeds or grains.

The mullers identified at 41BP595 range from 12 mm to 65 mm at their widest point. Four of the 16 stones are small, irregular fragments; however, based on their overall size and shape, the remaining 12 mullers fall into roughly four sub-groups. The stones in the first sub-group are sub-triangular in shape and have one more-or-less flat surface.

Specimen 56.1 is a small quartz arenite stone that is sub-triangular in plan and plano-convex in profile. Its ground and flattened surface has curved linear striations that run the length of one edge, and curved linear striations cover half of its convex side. Polish is visible on the high relief areas, but does not fill the interstices between the grains. This wear pattern is consistent with wear that results from the pressure of a hard object against a soft object (such as a wooden bowl) while processing grains or seeds.

By contrast, specimens 15.1 and 613.1 are larger in overall size, but have extremely polished surfaces that fill the interstices between the grains. Remnants of curved striations occur randomly across at least one

face. Such smooth, shiny, or glossy surfaces could have resulted from actions such as rubbing this fine-grained stone against a coarser-grained piece of stone; from friction against a softer material such as a hide; or from the residual buildup of the materials being ground (e.g., oily sunflower seeds) (Adams 1996; Semenov 1964; Vaughan 1975).

Sub-group 2 includes four quartz arenite stones that are predominately ovoid shaped with one flattened end. Although weathered, the wear patterns on all four stones are similar where grinding has obliterated the interstices between the grains, leaving distinctive patches of polish. On specimens 476.1 and 590.1, polishing is more extensive. On each stone, the flattened end also exhibits extensive polishing.

Sub-group 3 consists of three ovoid-shaped stones that exhibit similar wear patterns. All three stones are made of quartz arenite, and range in size from 37 mm to 56 mm in maximum dimension. Intensive grinding has rounded the edges of each stone and left a distinctive polished surface crosscut by curved striations.

The two stones in sub-group 4 are roughly square in overall form. Specimen 392.2 is made of quartz arenite and is more wedge-shaped in profile. Specimen 679.1 is a well-worn granite fragment and is bi-planar in cross-section. On both stones, grinding has leveled the grains and the interstices have been obliterated in places. Patches of polish occur on the high relief areas of the grains. Together, the flattened grains, the obliteration of the interstices between the grains, and the lustrous appearance of these specimens suggest a heavy build-up of debris from whatever was being ground.

Mano/Abrader (n=4)

The four stones assigned to this category appear to have functioned as both upper hand-held grinding implements, as well as abraders considering they all have obvious grooves cut into their sides or surfaces. All four tools are heavily weathered and thermally altered, but their remaining observable wear patterns suggest they were used to grind, smooth, shape, or sharpen a variety of relatively hard substances.

Specimen 119.3 is a bi-convex stone made of quartz arenite. Although weathered, traces of grinding still occur on the high relief areas. On one side, a deep groove has been cut into the surface. Specimen 248.2 is an oval shaped stone that is plano-convex in profile. Although it is a thermally altered hearthstone, evidence of grinding is still visible on some of the high relief areas of the stone. A series of shallow, curved grooves cross cut its convex surface.

Specimens 589.3 and a 618.1 are both end fragments of larger tools. Specimen 589.3 is made of metaquartzite and has been thermally altered. It is bi-planar in profile and its remaining surfaces and sides are heavily ground and polished. Portions of a deep groove run diagonally across one surface.

Specimen 618.1 is a wedge-shaped end fragment that exhibits a range of wear patterns on multiple surfaces. The wide end of the tool has a shallow smooth pit that is polished. Grinding is visible on the high relief areas of both the flat and the convex surface; however, on the convex side of the tool, two wide grooves cross-cut the surface.

Mano/Hammerstone (n=8)

Based on their visible wear patterns, eight tools were classified as mano/hammerstones. These eight stones vary in overall size and shape, but all appear to have functioned as both grinding implements and implements for delivering forceful impact. In addition to ground, polished, and/or pitted areas, they all exhibit battering.

For example, Specimen 248.1 is wedge-shaped stone made of quartz arenite that exhibits wear on multiple faces. Visible patches of grinding occur on its convex surface and along its angled end. The flat surface of the tool has numerous shallow, well-smoothed pits distributed across its surface. Its wide end exhibits crushed and battered areas. A well-worn flake scar on one side of the stone would have provided a comfortable place for the thumb to rest while gripping the stone. The wear patterns noted on this tool suggest that it was used primarily for the pounding and grinding of hard substances.

Two small specimens (Lots 17.1 and 589.1) are broken fragments of manos that exhibit battering in one or more areas. These small stones may be pecking stones used to refurbish the working surfaces of other ground stone tools.

Mano/Scraper (n=2)

Two relatively unusual tools were classified as manos/scrapers. Both appear to be end fragments of manos that continued to be used after they were broken. On both, the break left an angled circular edge that had been utilized. On specimen 509.1, grinding is evident on one side. Microscopic examination of the grinding surface shows that polish occurs on the high relief grains and there is little micro-fracturing of the interstices between the grains suggesting that this stone may have been used primarily to grind or process softer vegetal material, such as fresh corn kernels or fruits, or was used in tandem with a softer grinding platform, such as a basket (see Smith 1986). This type of sheen could also result from adding water during the grinding process (see Kraybill 1977). At some point in its use-life the stone appears to have broken and/or been modified to perform another function. The circular edge of the stone has one flattened edge and one notched area, both of which are highly polished. This distinctive type of edge wear indicates something pliable was worked, such as the sinewy fibrous material used in basketry or the debarking of tree branches (Adams 2006).

Specimen 133.1 appears to be the end fragment of a mano that exhibits micro-fracturing of the interstices between the surface grains and grinding has obliterated the interstices between the grains, leaving distinctive patches of polish on the high relief areas. This type of wear suggests that this tool was used to grind or process relatively hard vegetal substance(s) such as dried nuts or corn. At some point, the stone was modified to form a circular edge that was then used in cutting and/or scraping activities. Two wide, polished notches occur along the circular edge of the tool. The polish extends outward onto the surface surrounding the notches. As with the previously described tool, this type of edge wear suggest that it was used to work something pliable such as the sinewy fibrous material used in basketry or the debarking of tree branches (Adams 2006).

Polishing Stones /Polishing Stone Fragments (n=5)

The majority of stones in this category are small, hard stones with well-weathered rinds. They vary in overall shape and size, ranging from 24 mm to 38 mm in length. Although weathered, sections of their smooth polished surfaces and well rounded edges remain. Both ethnographic and archeological evidence suggest that these small, smooth stones were often elements in potters' tool kits (see Cosgrove and Cosgrove 1932; Price and Griffin 1979; University of Arizona 2007); however, the wear patterns noted on the 41BP595 specimens indicate they were probably used in a range of activities.

Seriating Tool (n=1)

Specimen 164.2 is a flake off a large chert nodule that was recovered from Level 9 of shovel test 56. The large inclusions in the raw material form jagged v-shaped notched edges along the circular edge of the flake. At various points along the edge, the notches are worn, and polish is visible within the notch and extends onto the surrounding surface. Striations are also visible on many of the polished areas. The polish occurs on the high relief grains and is consistent with plant polish. It may be that the seriated edge of this tool was used to split some type of wide-leafed, fibrous plant for use in basket making.

Pestle (n=1)

A small, loaf-shaped pestle (Lot 224.1) made of silicified wood was recovered from Level 7 of shovel test 90. The tool is plano-convex in profile and exhibits grinding on all surfaces. A shallow groove cross-cuts one end of the convex side of the tool and a series of striations run lengthwise across the flat side of the tool. The presence of the linear striations and micro-fracturing of the interstices between the grains suggests that heavy pressure was applied in a back and forth motion. This tool may have started as a small, rectangular mano, but extensive grinding may have worn away the edges separating the surfaces resulting in a cylindrical appearance. Due to the scratches and cracks created by surface fatigue and abrasive wear, its surfaces have a frosted appearance. This wear pattern suggests that the substance(s) being ground was relatively hard.

SUMMARY

In general, many of the recovered tools appear to be multi-purpose tools and their general morphology and associated wear patterns point to their use in a diverse range of activities such as food processing, tool manufacturing and maintenance, and the working of sinewy fibrous material. Such identifications provide clues to the range of activities carried out at the site and the resources exploited.

The recovered ground stone assemblage includes primarily upper hand stones. Only six lower anvil/milling stones or stone fragments were recovered. Although small in number, the wear patterns noted on these lower stones is heavily weighted toward milling stones (n=5) that involve the processing of substances through the grinding down of mass rather than through a pulverizing or crushing action such as the dehulling of nuts. This assessment is further confirmed by the low number of pitted stones with jagged pits (e.g., nutting stones) recovered at the site.

Since battering and jagged pitting are the wear patterns most commonly associated with pounding, their representation at 41BP595 is low; only 21 percent of the recovered tools exhibited evidence of battering.

Further, only 27 percent of the recovered tools exhibited pitting and on the majority of those, the pits were smooth rather than jagged. This suggests that processing activities carried out at the site were more heavily weighted toward the rubbing or grinding down of substances.

The macrobotanical analysis shows that the recovered subsistence remains are heavily weighted toward nutshells, primarily hickory nuts. Since hickory nutshells generally require heavy pounding, this seems to contradict the above assessment; however, it may be the evidence for battering was unrecognizable due the fact that a great many of the recovered ground stone were fragmented, highly weathered, and exhibited thermal alteration. Since 27 percent of the stones exhibited both jagged and smooth pits, this would support the grinding down of kernels. Given the emphasis on grinding activities suggested by the analyzed ground stone tools and the presence of grape leaves that are known to have been used as insulating or packing material (Bush, this volume), it may be that some type of nut cakes or bread were being prepared at the site. Earth oven baking is also supported by the bulb fragments recovered from Feature 30.

A number of non-food related activities are also indicated. The presence of the ten abraders and four mano/abraders exhibiting trough-shaped grooves and/or deep notches point to the manufacture and maintenance of a variety of wood, fiber, stone, and/or possibly bone implements. In addition, the interesting seriating tool and the two mano/scrapers type of edge wear point to the working of pliable substances such as the sinewy fibrous material used in basketry or the debarking of tree branches (Adams 2006). The presence of the grape seeds and leaves at the site also supports these types of activities, as grape vines are known to have been used to make cordage and baskets (Bush, this volume).

The ground, polished, and battered stone assemblage present at 41BP595 offers interesting clues to the range of activities carried out at the site. These tools also are consistent with processing the range of subsistence remains identified at the site.

PLANT REMAINS FROM ELEVEN FEATURES
By Leslie Bush

Thirty soil samples from eleven features at Site 41BP595 were submitted for flotation processing and identification and analysis of botanical macroremains. The site is a prehistoric occupation located near the top of a slope overlooking a tributary of Big Sandy Creek in northern Bastrop County. Big Sandy Creek drains into the Colorado River near Bastrop. Soils at the site are sandy near the surface, and the sands were clearly represented in the flotation samples. The sands overlie red clay, which was not represented in the flotation samples. The site area is currently in pasture. Notable vegetation consists of bermuda grass (*Cynodon dactylon*, a non-native grass) with post oak (*Quercus stellata*), juniper (*Juniperus virginiana*), and mesquite (*Prosopis glandulosa*) trees at the pasture edges (THC site form 3/13/2000).

Site 41BP595 is situated in the Post Oak Savannah ecological region, which many ecologists conceptualize as a transition zone between the Eastern Woodlands and the grasslands of the mid-continent (Diggs et al. 2006). The Post Oak Savannah is broadly characterized by sandy soils, grasslands, and widely spaced trees. The most common trees in relatively undisturbed areas are post oak (*Quercus stellata*) and blackjack oak (*Q. marilandica*). Ferdinand Roemer mentioned walnut trees (*Juglans nigra*) among the oaks when he crossed the Post Oak Savannah in 1946 (Roemer 2011 Chapter V), but today the closely-related black

hickory *(Carya texana*, associated with the uplands) and pecan *(C. illinoinensis*, associated with stream valleys) are more common in the southern Post Oak Savannah. Benny Simpson notes that walnut trees in Texas have been extensively harvested (Simpson 1999:178), so in Roemer's day walnuts may well have been more common. Common grasses in undisturbed areas of the Post Oak Savannah include the tallgrass prairie trio of little bluestem (*Schizachyrium scoparium*), Indian grass (*Sorghastrum nutans*) and switchgrass (*Panicum virgatum*) (Diggs et al. 2006:116). There is much local variation within the Post Oak Savannah, however. Near Site 41BP595, variation would have been conditioned by the slopes associated with tributaries of Big Sandy Creek. North- and east-facing slopes provide protection from the drying effects of sun and wind and possibly some protection from wildfires as well. Grape vines (*Vitis* spp.), elm trees (*Ulmus* spp.), and forbs such as white avens (*Geum canadense*) would have grown in these locations.

Vegetation Reconstructions

Modern equivalents exist for most prehistoric plant communities in Texas despite changes in the abundance and structure of the communities (Diggs et al. 2006:87). The most notable changes on the Post Oak Savannah since presettlement times include an increase in woody vegetation and the loss of "bottom prairie" communities along major rivers such as the Colorado River (Diggs et al. 2006:115-116). Pollen studies indicate that use of the modern vegetation zones described above is appropriate for understanding the plants and attendant animal resources available to people for much of the Holocene. Boriak Bog, in adjacent Lee County, shows Pleistocene spruce-hardwood forests giving way to Holocene oak-grass savannahs with dry conditions peaking around 5,000 B.P. The Boriak pollen sequence is truncated at 3,000 B.P., but Weakly Bog, in Leon County, indicates oak and later oak-hickory woodlands during the last 3,000 years, suggesting that modern plant communities provide especially good analogs for late Holocene Texas plant communities. A recent study by Bruce Albert in southwest Upshur County offers supporting data (Albert 2007). Some fluctuations in rainfall and temperature have taken place (Bousman 1998:204), but even decades-long fluctuations in rainfall patterns seem to be part of the natural background of Late Holocene climate patterns (Stahle and Cleaveland 1992). In addition, more frequent fires would have made the woody vegetation less prominent in the distant past than during the last century or so (Diggs et al. 2006, MacRoberts et al. 2002).

Methods

Flotation samples from Site 41BP595 were processed by Macrobotanical Analysis personnel using the Texas Archeological Society Method, a manual flotation process using 0.3 mm light fraction mesh that has been shown to provide good recovery (Bush 2012). Flotation heavy fractions were caught in 1.0 mm bottom mesh due to the sandy soils. In the laboratory, dried heavy fractions were scanned under a light microscope for carbonized botanical material. One fragment of hickory nutshell (0.01 g) in the light fraction of Feature 20, FS #568 was found and added to the light fraction for that sample. Any flakes that were spotted were placed in small bags within the heavy fraction bags.

Thirteen flotation light fractions, those from Features 1 and 30, were scanned for material suitable for radiocarbon dating prior to full analysis. During this stage of analysis, samples were subject to full radiocarbon protocols. They were sorted on freshly cleaned glassware and handled only with latex gloves and metal forceps. Screens used to size-sort material were cleaned between samples. Contact with paper and other plant products was avoided. Only one sample was open at a time in the laboratory. Writing

instruments used for data recording of samples were plastic mechanical pencils. Material removed from these light fractions for radiocarbon dating is shown in Appdeix B, Table B.1. The material, all nutshell, is also included in the full identification tables (see **Table 32**, **Appendix B Tables B.3**, and **B.4**).

Table 32. Carbonized Plants from Site 41BP595, site total

30 samples, 11 features		
209.9 cubic decimeters processed		
	Number	**Weight (g)**
Wood		
Oak *(Quercus* sp.)	63	0.52
White group oak *(Quercus* subg. *Quercus)*	12	0.1
Plateau live oak (*Quercus fusiformis*)	4	0.06
Hickory *(Carya* sp.)	46	0.59
Hardwood	130	1.15
Not examined for species	14	0.04
Total wood	269	2.46
Nutshell		
Hickory *(Carya* sp.)	72	1.37
Hickory/walnut family (Juglandaceae)	54	0.36
Black walnut (*Juglans nigra*)	2	0.03
Acorn *(Quercus* sp.)	3	0.03
Total nutshell	131	1.79
Nut hull, hickory *(Carya* sp.)	3	0.03
Seeds		
Indeterminable	8	
Grass family (Poaceae)	5	
Grape *(Vitis* sp.)	3	
Avens *(Geum* sp.)	1	
Panicoid grass (Panicodae)	1	
Bulb scale, indeterminable	2	0.03
Other		
Indeterminable botanical	61	0.38
Gall	2	0.02
Bark	1	0.03

Once radiocarbon material was removed, samples were treated according to standard procedures for sorting and identification at the Macrobotanical Analysis laboratory in Manchaca, Texas (Pearsall 2000). Each sample was weighed on an Ohaus Scout II 200 x 0.01 g electronic balance before being size-sorted through a stack of graduated geologic mesh. Material that did not pass through the No. 10 mesh (2 mm square openings) was completely sorted, and all carbonized botanical remains were counted, weighed, recorded, and labeled. Uncarbonized botanical material larger than 2 mm (roots and rootlets) was weighed, recorded, and labeled as "contamination". Material that fell through the 2 mm mesh ("residue") was examined under a stereoscopic microscope at 7-45 X magnification for carbonized botanical remains. Any identifiable plant material that had not been previously identified in the material larger than 2 mm was removed from residue, counted, weighed, recorded, and labeled. Small seeds were placed on the scale pan for weighing, but since their weights rarely registered on the balance they are not reported here. Uncarbonized macrobotanical remains were recorded on a presence/absence basis on laboratory forms.

Wood charcoal identification was attempted for twenty randomly-selected specimens larger than 2 mm from each sample. When fewer than twenty fragments were present, identification was attempted for progressively smaller fragments until identification became impractical or until twenty fragments were identified. Wood charcoal 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 intervessel pitting, and other minute characteristics that can only be seen at the higher magnifications of this range.

Botanical materials were identified to the lowest possible taxonomic level by comparison to materials in the Macrobotanical Analysis comparative collection and through the use of standard reference works (Core et al. 1979; Davis 1993; Hoadley 1990; Martin and Barkley 2000; Musil 1963; Panshin and de Zeeuw 1980). Botanical nomenclature follows that of the PLANTS Database (USDA, NRCS 2013).

Results

Table 32 summarizes carbonized plant material identified in the thirty flotation samples. The identifications are detailed by feature and lot number in **Appendix B**, **Tables B.3** and **B.4**, and shows the uncarbonized, modern plant taxa identified on the site.

Preservation. In all except the driest areas of North America, uncarbonized plant material on open-air sites can be assumed to be of modern origin unless compelling evidence suggests otherwise (Lopinot and Brussell 1982; Miksicek 1987:231). Bastrop County received an annual average of 36.5 inches (927 mm) of precipitation for the period 1941-1980 (NFIC 1987), and it is not arid enough that routine preservation of uncarbonized plant remains on open sites can be expected. Uncarbonized plants in the flotation samples are interpreted as parts of modern plants currently or recently growing on the site. This interpretation is supported by the habits of the plants recovered: They consist of grasses, weedy forbs, and oak and juniper leaves (**Appendix B Table B.2**). In addition, there is an inverse relation (r=-0.45) between the number of uncarbonized taxa recovered and depth in the six levels of Feature 30, indicating that uncarbonized seeds originate at the modern surface.

Discussion

Wood charcoal. A total of 269 fragments of wood charcoal weighing 2.46 g were recovered from Site 41BP595. Identification was attempted for 255 wood charcoal fragments, of which 125 could be identified to family, genus, or species. Of these, 79 (63.2 %) belong to the oak genus. Both live oak (*Quercus fusiformis*) and white group oaks (*Quercus* subg. *Quercus*) were identified. As noted above, post oak is the most common white group oak in the region. The remaining 36.8% percent of the identifiable wood charcoal assemblage consists of hickory, probably black hickory. Hickories and especially oaks have dense wood that burns at high temperatures and produces excellent coals (Graves 1919). They would have provided good fuel sources for earth oven cooking.

Nutshell. One hundred thirty-one fragments of nutshell were recovered from the site, more than half of which could be identified as hickory (n=72). Two fragments were identifiable as black walnut and three as acorn. The remaining 54 nutshell fragments were identifiable only to the family Juglandaceae, which

includes hickory and walnut but not acorn. Three fragments of hickory nut hull were identified from Feature 30, Level 8.

Small seeds. Eighteen small seeds or seed fragments were recovered in carbonized form. Of these, ten were in good enough condition to be identifiable. Six belong to the grass family (Poaceae), including one panicoid grass (panicgrass or bristlegrass). Three grape seeds and one avens fruit were also identified. Avens fruits have a hooked appendage, enabling them to cling to animal fur and human clothing. The avens fruit at 41BP595 probably represents a nuisance bur that was disposed of in a fire. Ethnographic accounts indicate grapes were an especially useful plant, and not just for the edible fruits. Native people in California used grape leaves as an insulating, moisture-retaining layer in earth ovens. Grape vines and roots are useful for lashing and in craft production (e.g., basketry), and various parts of the grape plant have medicinal uses (Moerman 1998).

Bulbs. Two bulb scales were recovered from Levels 7 and 9 of Feature 30. The bulb fragments could not be identified to species, but they do indicate geophyte exploitation at the site. Ethnographically, bulbs such as camas and onion are frequently cooked in earth ovens for extended periods to optimize their nutritional value to humans (Kolande 1972; Wandsnider 1997).

Distribution of carbonized plants. Feature 30 had a higher density and diversity of ancient plant remains than any other feature. Even the sample within Feature 30 with the lowest botanical density (FS# 567) had a higher botanical density than all but two of the samples from other features (**Appendix B**, **Table B.4**). Feature 30 was also the only feature from which bulbs and identifiable seeds were recovered. Two unidentifiable seeds were recovered from Feature 1. All other features contained only wood, nutshell, and/or unidentifiable botanical material.

Summary

Notable macrobotanical remains recovered from Site 41BP595 consist of wood (oak and hickory), nutshell (hickory, walnut, and acorn), an assortment of small seeds, and two bulb scale fragments. The wood charcoal assemblage reflects trees that would have been readily available in the site area and which would have made high quality fuel. Hickory nuts, acorns, and walnuts would have been similarly abundant. Additional food plants are represented by the grape seeds and bulb fragments.

PHYTOLITH, STARCH, AND ORGANIC RESIDUE (FTIR) ANALYSIS OF SAMPLES FROM SITE 41BP595, BASTROP COUNTY, TEXAS

By

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Introduction

Site 41BP595 is a Late Archaic site situated between 510 and 520 ft. above sea level on a ridge summit and shoulder 225 m east of a tributary to Big Sandy Creek in Bastrop County, Texas. Excavations completed in 2013 exposed several thermal features from multiple occupations between 2,500 and 1,000 B.P. Six thermally altered rocks (TAR) from five thermal features were submitted for phytolith, starch, and organic

residue analysis. Organic residues were examined using Fourier Transform Infrared Spectroscopy (FTIR), which provides information concerning compounds that were extracted from the thermally altered rocks. Information concerning foods that may have been processed in association with thermal features was derived from matches with our reference library of processed plants and animals, while information concerning the environment is inferred from matches with our reference library of raw plants and animals. Phytoliths and starch recovered from these TAR were interpreted as representing either the natural environment or plants that might have been processed.

Methods

Phytolith and Starch Extraction from Thermally Altered Rock

Soil adhering TAR was removed using tap water and gentle rubbing with a gloved hand. This step is critical, because the phytolith record from post-use soil yields an environmental signal that can "dilute" and overwhelm phytoliths and other microfossils representing the prehistoric use of this item. A sonicating toothbrush with a new brush head was used to clean several areas of the TAR surface with a few drops of a mild detergent (5% Triton X-100) added to target areas to aid the removal of particles that bonded to or were deeply lodged within microscopic crevices. Reverse osmosis deionized (RODI) water was used periodically to flush removed particles into a plastic container. The liquid wash solution from each TAR containing the removed particles was then transferred to a 50-ml centrifuge tube. Each sample was rinsed thoroughly and centrifuged removing clay particles with short-duration spins (10 seconds at 3000 rpm). To assess the sample a test slide was made. Following this the samples were dried under vacuum, mixed with sodium polytungstate (SPT, density 2.3 g/ml), and centrifuged to separate the phytoliths and starches, which will float, from the heavier inorganic silica fraction, which will not float. After several water rinses and a final alcohol rinse, the samples were mounted in optical immersion oil for counting with a light microscope under 500X magnification. A percentage phytolith diagram that includes frequency data for any starch grains observed was produced using Tilia 2.0 and TGView 2.0.2.

FTIR (Fourier Transform Infrared Spectroscopy)

A mixture of chloroform and methanol (CHM) was used as a solvent to remove lipids and other organic substances that had soaked into the surface of the thermally altered rock. This mixture is represented in the FTIR graphics as CHM. The CHM solvent and sample were placed in a glass container, covered, and allowed to sit for several hours. After soaking the solvent was pipetted into an aluminum evaporation dish, where the CHM evaporated, concentrating the organic residue in the aluminum dish. The aluminum dishes were tilted during the process of evaporation to separate the lighter fraction of the residue from the heavier fraction. The lighter and heavier fractions, often visible as bands in the dish, are designated upper (lighter fraction) and lower (heavier fraction), respectively, in the subsequent analysis. The residue remains in the aluminum dish for FTIR spectral analysis.

FTIR is performed using a Bruker Alpha optical bench with an ATR (attenuated total reflection) accessory and a diamond crystal. The dish containing the organic residue was placed on the FTIR crystal with the residue in contact with the crystal, and the spectra were collected by a specially encoded infrared beam, which passes through the sample producing a signal called an "interferogram." The interferogram contains information about the frequencies of infrared light that are absorbed and the strength of the absorptions,

which is determined by the sample's chemical make-up. A computer reads the interferogram, uses Fourier transformation to decode the intensity information for each frequency (wave numbers), and presents a spectrum.

Fourier Transform Infrared Spectroscopy (FTIR) Review

Infrared spectroscopy (IR) is a technical method that measures the atomic vibrations of molecules. It is currently one of the more powerful methods used in organic and analytical chemistry for the extraction and identification of organic compounds. The infrared spectrum is produced by passing infrared radiation through a sample, whether the sample is from a liquid, paste, powder, film, gas or surface. The measurement of this spectrum is an indication of the fraction of the incident radiation that is absorbed at a particular energy level (Stuart 2004). This provides information on infrared radiation absorption, heat conversion, and the structure of the organic molecules. Analysis of specific regions and peaks in the infrared spectrum enables identification of organic compounds, including both plant and animal fats or lipids, plant waxes, esters, proteins, and carbohydrates.

The Fourier Transform Infrared Spectrometer is an instrument that converts the raw data and measures the infrared spectrum to be interpreted. Advantages of using this technique over others include the simultaneous measurement of all wavelengths, a relatively high signal-to-noise ratio with a short measurement time. Since molecular structures absorb vibrational frequencies (i.e. wavelengths) of infrared radiation we can use the bands of absorbance in the identification of organic compound compositions. The spectrum is divided into two groups, the functional and the fingerprint regions. These groups are characterized by the effect of infrared radiation on the respective group's molecules. The functional group region is between 4000 and c. 1500 wave numbers, and the fingerprint region is below 1500 wave numbers. The molecular bonds display vibrations that we can interpret as characteristic of the vibrations of fats, lipids, waxes, lignins, proteins, and carbohydrates. The portion of the infrared spectrum most useful for this research and in the identification of organic compounds (e.g., carbohydrates, lipids, proteins) is the electromagnetic spectra between 4000 and 400 (Isaksson 1999:36-39). The recorded wavelengths of the electromagnetic spectra are what we compare to the reference collections housed in the PaleoResearch Institute (hereafter PRI) library. That is, we compare the results from the sample with the reference collection aiming to identify the closest match. For example, plant lipids and fats are identifiable between 3000 and 2800 wave numbers. This portion of the spectrum can be suggestive of the presence of animal fats, plant oils, oily nuts (e.g. hickory, walnut, or acorn), or plant waxes.

Samples from archeological contexts are difficult to analyze because they often result from complex compound mixtures. For instance, groundstone tools and ceramic cooking vessels are often multipurpose artifacts used to process (e.g. crush, grind, cook) a variety of foodstuffs or ingredients. Thus, multipurpose artifacts can create a spectra of overlapping absorption bands with few distinctive characteristics. In particular, FTIR is a useful technique in the examination of organic compounds in TAR because so few other techniques can be used. Organic compounds often are deposited on rocks during cooking. Fats, lipids, waxes, and other organic molecules could be deposited onto rock surfaces as a result of (a) dropping, (b) oozing from foods being cooked or baked in a pit, or (c) seepage out of or spill over from cooking vessels. Re-use of rocks is possible, in which case the organics recovered from the FCR might represent multiple cooking episodes. The PRI extraction method gently removes these organic molecules from the

groundstone, ceramics, and/or rocks so they can be measured with FTIR and subsequently identified. Organic molecules from sediments also can be extracted, measured, and identified. This is useful in the identification of dark horizons that result from the decay of organic matter, whether plant or animal. For example, if the dark horizon is the result of decaying organic matter, FTIR will yield a signature of decaying organic remains. If the dark horizon is the result of ash blown from a cultural feature (i.e. hearth), then the signature will be considerably different. Below is a discussion of the common organic materials that can be identified in archeological samples using FTIR.

Lipids

Lipids that are solid at room temperature are called fats and those that are liquid at room temperature are referred to as oils (Wardlaw and Insel 1996:108). Both forms of lipids can be detrimental, as well as beneficial, to human health. Consumption of certain animal fats rich in saturated fatty acids can lead to heart disease, but ingesting omega-3 fatty acids such as EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid), found in both fish and plants, is essential for good health. Lipids, whether fats or oils, are noted between 3000 and 2800 wave numbers on the FTIR spectrum.

Fatty acids are components of most lipids in humans, animals, and plants foods (Wardlaw and Insel 1996:108). A fatty acid is considered saturated if the carbons are connected by single bonds. Saturated fatty acids occur in high proportions in animal fats. If the carbon chain has only one double bond between two of the carbons, then the fatty acid is monounsaturated. If there are two or more double bonds between carbons, then the fatty acid is polyunsaturated. Essential fatty acids are those lipids necessary for human health, including normal immune function and vision. Essential fatty acids comprise omega-3 and omega-6, alpha-lineolic, and linoleic (Wardlaw and Insel 1996:110-111). Diets high in essential fatty acids reduce the risk of heart attacks because they minimize the tendency for blood to clot (Wardlaw and Insel 1996:112).

Esters

Esters are components of the biological compounds fats, oils, and lipids, and as such are an important functional group. In an ester, the basic unit of the molecule is known as a carbonyl. Esters may be recognized using FTIR by three strong bands appearing near 1700, 1200 and 1100 wave numbers. Esters are divided into aliphatic and aromatic groups (Stuart 2004:78) or into saturated and aromatic groups (Smith 1999:108). Aromatic esters take their name from their ability to produce distinctive odors and occur naturally in many plant foods. They are defined by the presence of a benzene ring as part of the alpha carbon (Smith 1999:108). This is recognizable in the FTIR by the wave number assignment of the peaks. Aromatic esters are expressed in the FTIR spectrum by distinct peaks located at 1730–1715, 1310–1250, 1130–1100, and 750–700 wave numbers. In contrast, aliphatic esters do not contain a benzene ring. Some have distinctive odors, while others do not. Saturated esters are defined by saturation of the alpha carbon (Smith 1999:108). Saturated (or aliphatic) esters are represented by peaks in the ranges 1750–1735, 1210–1160, 1100–1030, with a unique peak for acetates expressed at approximately 1240 wave numbers, the latter of which can be very strong (Smith 1999:110-112). It is easy to identify the distinction between saturated/aliphatic and aromatic esters when all three bands are present since they occupy different wave number regions.

Proteins

The majority of the building blocks for proteins, or amino acids, are produced by plants. Humans do not have all the enzymes required for biosynthesis of all the amino acids, which are organic compounds that contain both an amino and a carboxyl group, so many must be supplied by diet. The human body uses protein from both plant and animal sources to perform key bodily functions (e.g., blood clotting, fluid balance, hormone and enzyme production, cell growth and repair, and vision). The human body requires thousands of different types of proteins that are not all available within the body (Wardlaw and Insel 1996:152). Through a process known as translation, amino acids are linked in a variety of ways to form necessary proteins (Rodnina 2007). The order of amino acid arrangement is determined by the genetic code of the mRNA template, which is a copy of an organism's genetic code (Creighton 1993). Amino acids are divided into standard and non-standard types. The 20 naturally occurring standard amino acids (Creighton 1993) are divided into essential and nonessential types, essential because they are necessary for human growth and are not produced by the body (Young 1994). Essential amino acids must be obtained from food sources and comprise histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine (Furst and Stehle 2004; Reeds 2000; Wardlaw and Insel 1996:154).

Nonessential amino acids also are essential for human health, but they do not need to be obtained from diet because the body can produce them. Sometimes nonessential amino acids, can become essential particularly when an individual's health is compromised (Wardlaw and Insel 1996:155), in a manner that interferes with the body's ability to produce these amino acids. Nonessential amino acids comprise alanine, arginine, asparagine, aspartate (aspartic acid), cysteine, glutamate (glutamic acid), glutamine, glycine, proline, serine, and tyrosine (Furst and Stehle 2004; Reeds 2000; Wardlaw and Insel 1996:154). Also present are nonstandard amino acids in two groups, that is, those chemically altered after incorporation into a protein and those that exist in living organisms but are not found in proteins (Driscoll and Copeland 2003).

Carbohydrates

Carbohydrates are a product of photosynthesis in green plants and are the most prevalent group of compounds on earth. They include sugars, starches, and fibers: sugars are the simple carbohydrates found in table sugar, honey, fruit, and molasses; starches are simple or complex carbohydrates present in legumes, grains, vegetables, and fruits; and fibers (cellulose, hemicellulose, and pectin) are present in whole grains, legumes, vegetables, and fruits (Garrison and Somer 1985:13). The four groups of carbohydrates, classified based on their molecular structure, are monosaccharides, disaccharides, oligosaccharides, and polysaccharides. The following discussion presents a brief overview of the different carbohydrates with a more detailed discussion of the polysaccharides.

Monosaccharides, Disaccharides, and Oligosaccharides

Monosaccharides are naturally occurring simple sugars containing three to seven carbon atoms. Variations in the carbon chains create different sugars, including glucose, D-glucose, fructose, galactose, and mannose. The most important dietary monosaccharides are hexoses ($C_6H_{12}O_6$). Disaccharides form when two monosaccharides combine (Wardlaw and Insel 1996:72). Sucrose, lactose, and maltose are the three most common disaccharides found in nature (Wardlaw and Insel 1996:72). Oligosaccharides consist of two or more hexoses with the exclusion of one water molecule ($C_{12}H_{22}O_{11}$). These carbohydrates are water soluble and are able to crystallize. Raffinose and stachyose are oligosaccharides found in legumes. Humans (and

other monogastric animals) are missing the α-GAL enzyme that allows for the digestion of these two carbohydrates (Wardlaw and Insel 1996:80). Thus ingestion of raffinose and stachyose results in gas-producing bacteria in the lower intestine (carbon dioxide, methane, and/or hydrogen) that leads to flatulence (and discomfort).

Polysaccharides

Polysaccharides ($C_6H_{10}O_5$) are complex starchy compounds (cellulose in plants and glycogen in animals). These carbohydrates are not sweet, do not crystallize, and are not water soluble. They are formed of repeating units of mono- or disaccharides that are joined together by glycosidic bonds. Polysaccharides are often heterogeneous, and slight modifications of the repeating units result in different FTIR signatures. The different types of polysaccharides comprise storage (starches and glycogen), structural (cellulose and chitin), acidic (containing carboxyl groups, phosphate groups, and/or sulfuric ester groups), neutral (presumably without the acid features), and bacterial (macromolecules such as peptidoglycan, lipopolysaccharides, capsules and exopolysaccharides).

The two primary storage polysaccharides are starch and glycogen, both digestible by humans (Murray et al. 2000:155; Wardlaw and Insel 1996:80-81). Cooking starches allows for easier digestion by making them more water soluble and available for breakdown by digestive enzymes (Wardlaw and Insel 1996:80). The two primary types of plant starch are amylose and amylopectin, both are sources of energy for plants and subsequently for animals (Murray, et al. 2000:155; Wardlaw and Insel 1996:80). Glycogen, often referred to as animal starch, is a storage polysaccharide found in the liver and muscles of humans and other animals. Structurally, glycogen is similar to amylopectin. Glycogen has a more complex branching pattern of glucose molecules, however, that allows for easier energy conversion because its enzyme breakdown occurs only at the ends of chains of glucose molecules. This makes glycogen an ideal form for carbohydrate storage in the body (Wardlaw and Insel 1996:81). Breakdown of glycogen yields glucose-phosphate molecules that either can be converted into glucose by the liver and transferred into the blood stream or broken down in the muscles through a nonenzymatic process termed glycolysis (Wardlaw and Insel 1996:81,335). Glycolysis in the muscles during intense physical activity or stress yields lactic acid under anaerobic conditions or carbon dioxide and water under aerobic conditions (Wardlaw and Insel 1996:336). Therefore, glycogen is absent in meat from butchered and hunted animals because in response to stress and/or intense physical activity the glycogen is broken down into lactic acid and/or metabolized by the animal (Food and Agriculture Organization of the United Nations 2009; Green et al. 2006; Sheeler and Bianchi 2004; Wardlaw and Insel 1996:81).

Humans and other animals cannot digest structural polysaccharides, also known as dietary fibers. Structural polysaccharides are composed primarily of cellulose, hemicellulose, pectin, gum, and mucilage (Wardlaw and Insel 1996:82). Lignins are complex alcohol derivatives that make up the only non-carbohydrate component of insoluble plant fibers (Wardlaw and Insel 1996:82). However, pectin, gums, and mucilages, on the other hand, are soluble fibers found inside and around plant cells that help "glue" them together (Wardlaw and Insel 1996:82).

Acidic polysaccharides are defined as containing carboxyl groups, phosphate groups, and/or sulfuric ester groups. Carboxylates often are identified in FTIR with a signature peak between 1560 and 1410 wave

numbers. Neutral polysaccharides (chitin, chitosan, curdlan, dextran, glucan, inulin, arabinogalactan, arabinogalactorhamnoglycan, and other compounds that are a result of fermentation or are plant-specific) lack carboxyl groups, phosphate groups, and/or sulfuric ester groups.

Bacterial polysaccharides are diverse macromolecules that include peptidoglycan, lipopolysaccharides, and exopolysaccharides. Peptidoglycans function as a structural component of cell walls. Pathogenic bacteria can produce a thick, mucous-like, encapsulating layer of polysaccharide that cloaks the antigenic proteins on the bacteria surface. These proteins are used by the host organism to provoke an immune response, leading to the bacteria's destruction. These are referred to as "bacterial capsular polysaccharides." This encapsulating layer also protects the bacterium from harsh environments, such as *Pseudomonas* in the human lung. Bacteria, fungi, and algae can secrete polysaccharides to help them adhere to surfaces and/or to prevent them from drying out. Humans use some of these polysaccharides, such as xanthan gum, as thickening agents in food.

Ethnobotanic Review

It is a commonly accepted practice in archeological studies to reference ethnographically documented plant uses as indicators of possible or even probable plant uses in prehistoric times. The ethnobotanic literature provides evidence for the exploitation of numerous plants in historic times, both by broad categories and by specific example. The presence of numerous sources of evidence for exploitation of a given resource can suggest widespread utilization and strengthens the possibility that the same or similar resources were used in prehistoric times. Ethnographic sources both inside and outside the study area have been consulted to permit a more exhaustive review of potential uses for each plant. Ethnographic sources document that the historic use of some plants was a carryover from the past. A plant with medicinal qualities is likely to have been discovered in prehistoric times, with its use persisting into historic times. There is, however, likely to have been a loss of knowledge concerning the utilization of plant resources as cultures moved from subsistence to agricultural economies and/or were introduced to European foods during the historic period. The ethnobotanic literature serves only as a guide indicating that the potential for use existed in prehistoric times, not as conclusive evidence that the resources were used. Pollen, phytoliths, starch, and macrofloral remains, when compared with the material culture (artifacts and features) recovered by the archeologists, can become indicators of use. Plants represented by phytoliths, starch, and organic residues are discussed in the following paragraphs to provide an ethnobotanic background for discussing the remains.

Native Plants

Poaceae (Grass Family)

Members of the Poaceae (grass) family have been widely used as a food resource, including *Agropyron* (wheatgrass), *Hordeum* (little barley grass), *Elymus* (ryegrass), *Eragrostis* (lovegrass), *Achnatherum* (ricegrass), *Poa* (bluegrass), *Sporobolus* (dropseed), and others. Grass grains could be eaten raw but usually were parched and ground into a meal to make various mushes and cakes. Several species of grass contain hairs (awns) that were singed off by exposing the seeds to flame. Young shoots and leaves were cooked as greens. Roots were eaten raw, roasted, or dried and ground into a flour. Grass also is reported to have been used as a floor covering, tinder, basketry material, and to make brushes and brooms. Grass seeds ripen from spring to fall, depending on the species, providing a long-term available resource (Chamberlin 1964:372;

Colton 1974:338, 365; Cushing 1920:219, 253-254; Ebeling 1986; Harrington 1967:322; Kirk 1975:177-190; Whiting 1939:65-66).

Celtis *(Hackberry)*
All species of *Celtis* (hackberry) produce edible, berry-like drupes that can be eaten raw or dried. The Comanche would pulp the berries, mix them with fat, and shape them into balls that they would roast at the end of a stick. Species of *Celtis* found in Bastrop County include

C. occidentalis (common hackberry), *C. laevigata* (Sugar hackberry, Southern hackberry, Texas hackberry) and *C. reticulata* (netleaf hackberry). Hackberry fruits are typically orange-red and ripen in September or October. The wood is close-grained, soft, and heavy but not strong. This tree is found throughout the southeastern United States, ranging west into central and west Texas, southern Oklahoma, southern New Mexico, and northeast Mexico. It is a small tree, seldom growing over 25 feet high, and can be found growing along streamsides, in moist soil, on rocky bluffs, on the sides of draws, in washes, and in the deep gorges of Texas mountains (Angell 1981:80-82; Gould 1962:36; Peattie 1953:465-466; Petrides and Petrides 1992:171; Wallace and Hoebel 1986:73).

Cyperaceae (Sedge Family)
The Cyperaceae (sedge family) are grasslike or rushlike herbaceous plants commonly found in riparian habitats. Several members are noted to have been important resources for Native Americans. Many species of *Cyperus* (flatsedge, nutgrass) have a tuber-like thickening at the base of the plant or possess tubers at the end of slender rootstalks. These tubers were eaten raw, boiled, dried and ground into a flour, or baked in a fire. The nut-like roots also can be roasted until dark brown and ground to make coffee. The seeds of *Cyperus odoratus*, as reported by E. Palmer, were eaten by the Cocopah Indians, while the Apache are noted to have eaten the underground parts of *Cyperus fendlerianus* (Kearney and Peebles 1960:149, 150). The Pima are reported to have eaten the small tubers of *Cyperus ferax. Cyperus esculentus* is noted to have been a famous plant food since ancient Egyptian times. Fresh or dried tubers of *Cyperus esculentus* were chewed by the Pima to treat coughs. *Cyperus* is a grass-like perennial found in moist ground, especially in damp sandy soil and waste places, and can be common weeds in cultivated fields and pastures (Harrington 1967:174; Kearney and Peebles 1960:98-99, 149-150; Kirk 1975:176; Peterson 1977:230). *Eleocharis* (spikerush) is an annual with round, grooved, and spiked sheathing and a bulb-like base. *Eleocharis* bulbs can be eaten raw or cooked. Medicinal uses of *Eleocharis* include as an analgesic, anti-diarrheal, urinary aid, and a ceremonial emetic. Stems and leaves were used for making beads, pillows and bedding, baskets and woven dishes, cooking tools, toys, and games (Hickman 1993:1140; Moerman 1998:208).

Scirpus-type (bulrush, tule) plants are mostly perennial herbs with triangular or circular stems. Recent studies by taxonomists have resulted in the creation of several new genera, such as *Amphiscirpus*, *Bolboshoenus*, *Isolepis*, *Shoenoplectus*, and others. At one point, the *Scirpus* genus held almost 300 species, but many of the species once assigned to this genus have now been reassigned to the new genera, and it now holds an estimated 120 species. In general, bulrushes have cylindrical, bullwhip-like stems, while three-squares have triangular stalks. These plants were used extensively by native groups. Young shoots were gathered in the spring and eaten raw or cooked. Old stems were woven into mats and baskets. Pollen was collected and mixed with other meal to make breads, mush, and cakes. Seeds also were parched and

ground into a flour. The starchy roots are edible and were eaten raw, roasted, or dried and ground into a flour for cooking. Young rootstocks were crushed and boiled to make a sweet syrup. Plants also were used as a ceremonial emetic. *Scirpus*-type plants can be found in woods, thickets, meadows, pastures, ricefields, ditches, swamps, bogs, marshes, and in other low, wet places (Britton and Brown 1970:326; Duke 1986:141; Kearney and Peebles 1960:151; Kirk 1975:175-176; Martin 1972:31; Moerman 1986:446; Muenscher 1980:151; Peterson 1977:230).

Sagittaria *(Arrowhead, Swamp Potato, Wapato)*

Sagittaria (arrowhead, swamp potato, wapato) species are perennial plants found in the shallow water of streams and lake margins. The plants have large, arrow-shaped or ribbon-shaped leaves and edible tubers borne at the end of long rootstocks. Their tubers are solid and white-colored inside, covered with overlapping scales, and are noted to be much larger in the fall. They are found well below the ground surface and can be located some distance from the main cluster of stems and leaves. Tubers are noted to have been used widely by Native Americans. Lewis and Clark described how Native American women waded into the water and dug the tubers up with their toes. The tubers would float up to the surface where they could be collected. Some groups also would raid muskrat caches to obtain *Sagittaria* tubers. The tubers can be eaten raw, but they have a bitter taste that is removed by boiling or roasting. Native groups often pit roasted the tubers or boiled and dried them for later use. Dried tubers were later boiled or ground into a flour. The common arrowhead (*Sagittaria latifolia*) is the most widespread species in North America (Harrington 1972:29-32).

Discussion

Site 41BP595 is located east of Austin, Texas at an elevation of 510–520 ft in a pasture with native grasses (Poaceae) and hardwood trees. This site rests on a ridge summit and shoulder in deep, moderately drained Robco loamy fine sand on a 1–5 % slope. Fine roots and rodent bioturbation have damaged site integrity.

Six TAR samples from five spatially distinct thermal features within the site were analyzed for phytolith, starch grain, and organic residue (FTIR) to gain an understanding of prehistoric cultural activities between 2,500 and 1,000 B.P. (**Table 33**).

Table 33. Provenience Data for Samples from Site 41BP595, Bastrop County, Texas

Sample No.	Cat. No.	Feature No.	Unit	Level	Depth (cmbs)	Provenience/ Description	Analysis
1	591	1	3	6	60–70	Thermally altered rock	Phytolith Starch FTIR
4	599	15	4	5	50–60	Thermally altered rock	Phytolith Starch FTIR
7	645	21	TR10	East ½		Thermally altered rock	Phytolith Starch FTIR
10	644	23	TR11			Thermally altered rock	Phytolith Starch FTIR

Table 33. Provenience Data for Samples from Site 41BP595, Bastrop County, Texas

Sample No.	Cat. No.	Feature No.	Unit	Level	Depth (cmbs)	Provenience/ Description	Analysis
13	614	29	TR15	Cluster 1 - East ½		Thermally altered rock	Phytolith Starch FTIR
16	612			Cluster 3 - West ½		Thermally altered rock	Phytolith Starch FTIR

FTIR = Fourier Transform Infrared Spectroscopy

The phytolith records from each of these samples exhibits similarities indicating that the majority of the phytoliths are associated with an environmental signal. Typically cool season and warm season phytoliths both are well represented in the samples. Rondels dominate the C3 (cool season) grass record (**Figure 45**). Rondels that are elongated, horned, keeled, or that are noted in side view because they are approximately twice as long as they are broad also were observed intermittently. These C3 grass forms represent leaves and stems of grass rather than reproductive structures surrounding seeds, so are part of the environmental rather than economic record. Saddles formed in Chloridoid C4 warm season grasses also are moderately abundant. These forms represent short grasses that tolerate drought and the high temperatures of mid-summer. Bilobates and crosses, representing Panicoid or tall grasses, were present, but not abundant. This mixture of grass short cells indicates a local grass population that included cool season grasses that thrive in the cooler growing months of the year and/or in shady locations and short grasses that prefer sunny locations and relatively hot, dry conditions. Little evidence of tall grasses, which usually are found growing in moist or wet areas, particularly in sunny areas along streams, rivers, or springs, was observed.

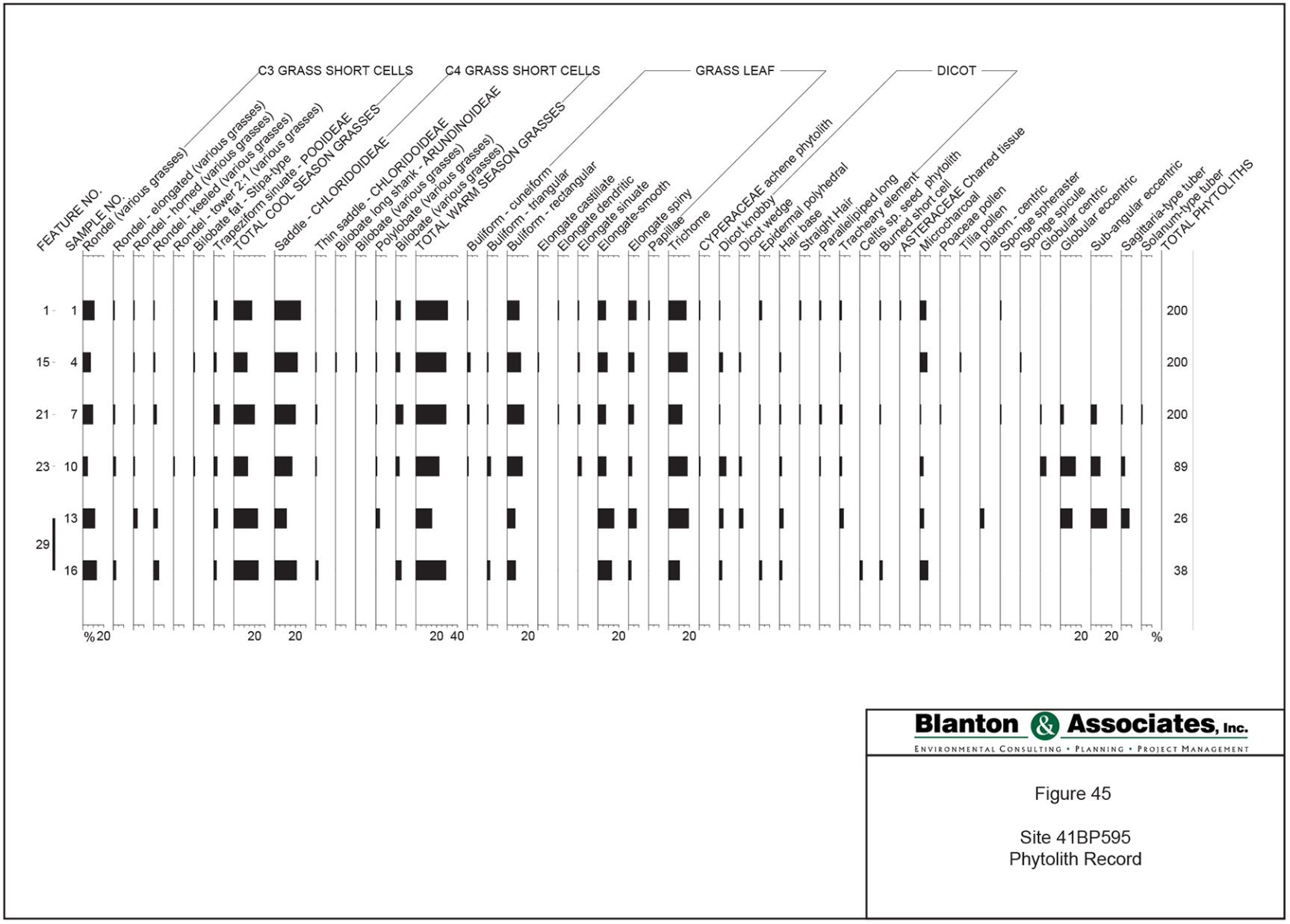

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Figure 45

Site 41BP595
Phytolith Record

Phytoliths representing grasses in general include buliforms, which control leaf rolling in response to drought. Elongate forms, whether smooth, castillate, spiny, or sinuate, are typical of grasses, although smooth elongate forms also may be observed in Cyperaceae and occasionally dicotyledenous plants. Trichomes are hairs usually associated with grasses and sedges, while papillae are hairs with pitted bases typical of grasses.

The hair bases noted are typical of those produced by Asteraceae, but since they are the bases only, other dicots cannot be ruled out as potential producers of these forms. Dicot knobby forms are often observed in *Quercus*, but these were not considered to be diagnostic of oaks or acorns, therefore, were "downgraded" to representing woody or shrubby plants. Parallelepiped long forms also represent dicots. Tracheary elements are observed in woody plants and are part of the structure of plants that transports fluids.

Microscopic charcoal was present in all TAR wash samples and likely represents charred bits adhering to the surface of the rocks. Occasionally burned grass short cells were observed, indicating the presence of grasses in the features at the time of their use.

All of the FTIR spectra were very similar, exhibiting a major peak with a doubling at the top near 1007–1029 wave numbers (Tables 2 and 3). Due to this similarity, the basic FTIR signature for these samples will be discussed here. Samples 4, 7, 10, 13, and 17, from Features 15, 21, 23, and 29 respectively, match the baked *Sagittaria* (arrowhead) root drippings reference with peaks at 1007 and 916 wave numbers. Shoulder peaks consistently at 1161, 1083, and 914 wave numbers representing cellulose and/or polysaccharides and a doubling of the carbohydrate peak at 1029 and 1007 wave numbers match our baked *Sagittaria* reference (**Table 34**). *Sagittaria* grows in wetland communities with *Sagittaria graminea*, *S. platyphylla*, and *S. pedunculata* noted in modern Bastrop County (Lewis 1962:17; Turner et al. 2003:686-687; USDA Natural Resources Conservation Service 2011). Matches to specific roots/tubers are interpreted to represent the general category of roots/tubers, specifically when matching cooked items. This is because there is a significant overlap in compounds present in roots/tubers of different genera and even families. Therefore, in spite of the fact that we report a match with *Sagittaria* baked tubers for this sample, it also is possible that this signature was produced by baking another type of root/tuber for which we do not have a reference. Additional low amplitude peaks in Samples 4 and 7 show esters/triglycerides and protein appearing respectively at 1741; 1578 and 1459 wave numbers, though no additional matches could be made with our reference libraries. The double peak at 795 and 777 wave numbers in Samples 4, 7, 10, 13 and 17 also matches with calcium oxalates, which is a compound found in many cacti and xeric plants such as saltbush and mesquite.

Table 34. Matches Summary for FTIR Results from Site 41BP595, Bastrop County, Texas

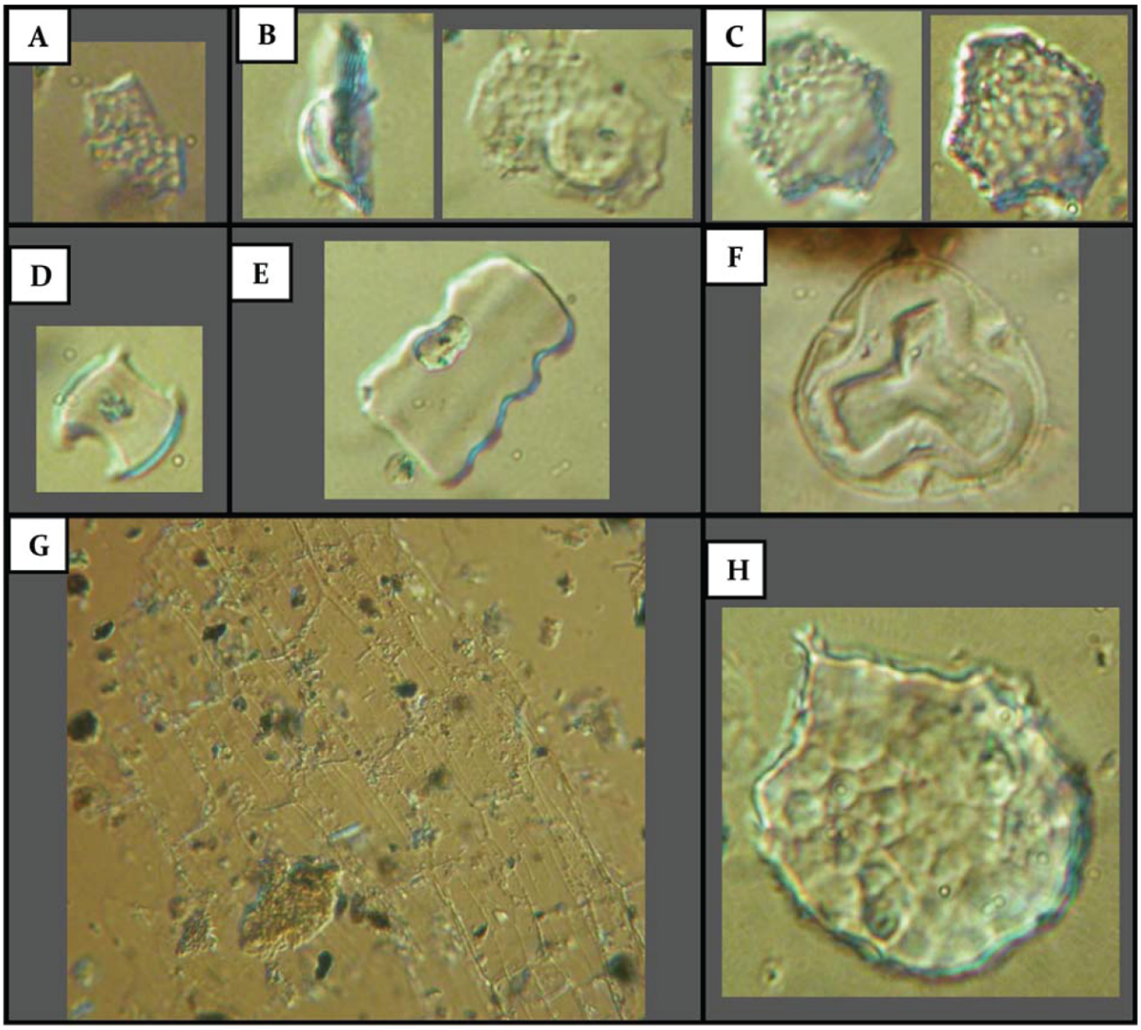
			Feature 1	Feature 15	Feature 21	Feature 23	Feature 29	
Match (Scientific Name)	**Match (Common Name)**	**Part**	**1 - TAR (Range)**	**4 - TAR (Range)**	**7 - TAR (Range)**	**10 - TAR (Range)**	**13 - TAR (Range)**	**16 - TAR (Range)**
ECONOMIC								
Sagittaria	Arrowhead	Root drippings (baked)		1015–847 806–759 706–688	1483–1401 1009–818 803–768	1021–847 806–759	1012–892 800–768	1012–833 803–771
ENVIRONMENTAL								
Deteriorated Cellulose	Deteriorated cellulose		1056–1015					

Feature 1

Feature 1 is a subsurface circular TAR concentration interpreted as an *in situ* hearth. Rocks within the feature include chert, quartzite, and hematite as a single level plane. One TAR (Sample 1) was submitted for phytolith, starch, and FTIR analysis.

The phytolith record from the TAR wash exhibited the typical environmental signal, described above. Papillae were recovered only in this sample, which might represent processing grass seeds, since these forms occur as part of the structure of the glumes surrounding the seeds. A single dendritic phytolith, which are produced in the glumes surrounding grass seeds, also was noted. These two forms together suggest processing grass seeds, even though the quantity of dendritic phytoliths observed in this sample does not rise above the quantity considered to be "typical" or expected as part of the background phytolith signature. Recovery of a broken Cyperaceae achene (seed) phytolith (**Figure 46** A) indicates the possibility that sedge seeds were ground before being cooked in this feature. These phytoliths are usually observed whole, not broken. A burned grass short cell was recovered from this sample that might be present as a result of processing grass seeds. A small quantity of charred Asteraceae tissue suggests burning a member of the sunflower family in the feature, possibly as fuel. Overall the phytolith record is environmental, reflecting the local vegetation at the time of the site's occupation rather than revealing any specific use of TAR.

Recovery of a single sponge spheraster might represent use of water, since these globular echinate forms are produced in fresh water sponges (Spongillidae) where they are found loose in the sponge body or fused to the main skeleton (Boury-Esnault and Rutzler 1997). Sponges typically thrive in water that is alkaline (above pH 7), and their abundance is negatively correlated with turbidity and sediment load (Barton and Addis 1997; Cohen 2003; Droscher and Waringer 2007; Harrison 1988). Alternatively, it is possible they grew in moist sediments in the feature. No starches were observed.



(micrographs taken at 500x magnification, unless otherwise noted)

A) Sedge (Cyperaceae) achene phytolith – Sample 1.
B) Cyperaceae achene phytolith in side (left) and top (right) view – Sample 10.
C) *Celtis* seed coat phytolith – Sample 16.
D) Saddle phytolith produced by Chloridoideae, a warm season grass – Sample 4.
E) Trapeziform sinuate phytolith produced by Pooideae, a cool season grass – Sample 4.
F) Tilia pollen – Sample 4.
G) Plant epidermal sheet element comprised of elongate cells *in-situ* – Sample 4 (200x magnification).
H) Cuneiform buliform demonstrating pitting on the surface indicating partial dissolution – Sample 7.

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Figure 46

Site 41BP595
Micrograph Compilation of Select Phytoliths

Sample 1, representing TAR from Feature 1, yielded low amplitude peaks reflecting major categories (functional groups) of compounds (4000–1500 wave numbers), and specific compounds noted in the fingerprint region (1500–400 wave numbers) of the spectrum. Functional group peaks indicate the presence of absorbed water, fats/oils/lipids, and/or plant waxes (Tables 2 and 3). Lipids are organic compounds insoluble in water, but soluble in nonpolar organic solvents such as chloroform, ether, and/or methanol, which along with proteins and carbohydrates constitute the principal structural components of living cells. Lipids include fats, waxes, sterols, triglycerides, phosphatides, cerebrosides, and related/derived compounds. Peaks observed within the fingerprint region represent the presence of aromatic rings; saturated esters; triglycerides; protein; calcium oleate; calcium oxalates; pectin; starch; cellulose and carbohydrates; and the polysaccharides arabinogalactan, arabinoglucuronoxylan, glucomannan, galactoglucomannan, glucuronoxylan, glucan, and xyloglucan.

The match with deteriorated cellulose was most common, likely representing detritus from the sediments or feature fill. A match with calcium oleate is likely associated with cooking, as this compound is formed when calcium is heated in the presence of fats/lipids. No other good matches were made with material in our reference libraries.

The presence of peaks representing cellulose, starch, pectin, and polysaccharides including arabinoglucuronoxylan, glucomannan, galactoglucomannan, glucuronoxylan, xyloglucan, arabinogalactan, glucan, rhamnogalacturonan, arabinan, arabinogalactorhamnoglycan, and α- and β-D-glucose suggests the presence and deterioration of plant material, although no specific match could be made with this signature.

Feature 15

Feature 15 is a subsurface cluster of TAR interpreted as an *in situ* prehistoric cooking surface. Quartzite and hematite occur as a single level plane within the feature with root and rodent disturbance. One TAR, represented by Sample 4, was submitted for washing to recover phytoliths and starch for analysis. First, organic residues were extracted at PaleoResearch Institute for FTIR analysis.

The phytolith record was very similar to that of Sample 1, discussed above, and appears to reflect the local vegetation community and environment. No phytoliths were documented that might provide evidence of food processing using this feature. No starches were observed. Additionally, a *Tilia* pollen grain (**Figure 46** F) recovered in this sample documents local growth of basswood. A saddle phytolith (**Figure 46** D), and a trapeziform sinuate (**Figure 46** E) illustrate well preserved grass short cells. Although difficult to see, **Figure 46** G illustrates epidermal tissue containing multiple cells. Recovery of only a few sponge (Spongillidae) spicules represents freshwater sponges that live on a hard stratum, such as rocks in this feature. While they indicate moisture, they cannot be interpreted to represent standing water.

Sample 4, representing TAR from Feature 15, yielded functional group peaks reflecting the presence of fats/oils/lipids and/or plant waxes. Fingerprint region peaks indicate aromatic rings; saturated esters; triglycerides; protein; calcium oxalates; starch; cellulose and carbohydrates; and the polysaccharides arabinogalactan, arabinoglucuronoxylan, galactoglucomannan, rhamnogalacturonan, and glucan.

Feature 21

Feature 21 is a tight cluster of quartzite and hematite TAR, in a semi-oval shape. Post depositional disturbance is due to small roots and rodent burrows. One TAR, represented by Sample 7, was submitted for phytolith, starch, and organic residue analysis (FTIR).

The phytolith record from this TAR also exhibits a typical environmental signal. Burned grass short cells were present, indicating that grasses also were burned in the feature, either accidentally or as part of processing. A cuneiform phytolith (**Figure 46** H) displays surface pitting indicating partial dissolution. This signals the probability that smaller phytoliths have been completely dissolved in these sediments. A single Poaceae pollen was noted in this sample. Starches were particularly abundant, representing food processing activities.

Starches were divided into several categories including globular starch with centric hilum, globular starch with eccentric hilum, sub-angular starch with eccentric hilum, root starch, and *Solanum jamesii*-type starch (**Figure 45**). Recovery of globular starches with centric hila probably represents processing grass seeds. Some of the globular eccentric starches are typical of those produced by *Sagittaria* tubers, but not necessarily diagnostic of wapato tubers. Sub-angular to angular starches with slightly eccentric hila also probably are attributable to seeds. Angularity results from tight packing of starches within the seeds or other plant parts.

This rich starch record suggests processing diverse resources such as grass seeds, possibly *Sagittaria* tubers, and wild potato. Modern distribution of *Solanum jamesii* and *S. fendleri* includes the extreme southwestern corner of Texas (El Paso, Hudspeth, Culberson, Jeff Davis, Presidio, and/or Brewster Counties) (Turner, et al. 2003:589). The USDA Plants website also notes *Solanum jamesii* growing in Ellis County to the north (USDA Natural Resources Conservation Service 2011). It is rare for any atlas of plants to be 100% exhaustive in its plotting of modern locations of plants. This discrepancy is not surprising. In addition, recovery of this starch from TAR in Bastrop County suggests several possibilities. First, the prehistoric distribution of *Solanum jamesii* and/or *S. fendleri* might have been different than modern. Second, wild potato tubers might have been traded or packed as a food to be carried while "on the road".

Sample 7, representing TAR from Feature 21, yielded low amplitude functional group peaks reflecting compounds including absorbed water and fats/oils/lipids and/or plant waxes. Other peaks identified in the fingerprint range indicate the presence of aromatic rings; saturated esters; triglycerides; protein; calcium oxalates; pectin; starch; cellulose and carbohydrates; α- and β-D-glucose; and polysaccharides including glucuronoxylan, glucomannan, and galactoglucomannan.

Feature 23

Feature 23 is a quartzite, hematite, and silicified wood TAR circular cluster interpreted as an *in situ* prehistoric cooking surface. Many TAR are scattered around the feature, suggesting a disturbance subsequent to its last use. One TAR, represented by Sample 10 was submitted for phytolith, starch, and organic residue analysis (FTIR).

The phytolith signature for this sample is very similar to that of Sample 1, recovered from Feature 1, including the presence of Cyperaceae achene phytoliths (**Figure 46** B). As before, it is possible that the

Cyperaceae achene phytoliths might be associated with the environmental record or might represent cooking sedge seeds (achenes). No dendritic elongate forms were noted that would suggest processing or cooking grass seeds. The starch record holds the clue to plant processing for this TAR and feature. Five globular centric and 13 eccentric starches, as well as eight sub-angular to angular eccentric starches were observed. Centric starches are usually attributed to seeds. In this case, all of the globular centric starches could originate in grass seeds. The globular eccentric starches exhibited mild to moderate hilum eccentricity, suggesting that some could represent grass seeds, while others might originate in roots/tubers. All of the sub-angular to angular eccentric starches most likely represent roots/tubers that were processed. In addition, three starches could be separated out as most likely representing *Sagittaria*, although the variety of starches produced in wapato encompasses nearly the entire variety of starches observed in this sample. Unfortunately, not all starch shapes are diagnostic. Due to the fact that multiple shapes of starches may be noted in one root or tuber and the fact that individual shapes of starches may be observed in many different types of roots or tubers, assigning each individual starch to a genus or even family is extremely difficult. In this case, it is likely that the majority of starches recovered from this TAR are attributable to wapato and that the remainder represent grass seeds.

Sample 10, representing TAR from Feature 23, did not exhibit functional group peaks (4000–1500 wave numbers). Fingerprint region peaks indicate aromatic rings, calcium oxalates, starch, cellulose and carbohydrates, and the polysaccharide arabinogalactorhamnoglycan.

Feature 29

Feature 29 is a large *in situ* TAR cluster exhibiting five partially overlapping clusters of quartzite, hematite, and silicified wood interpreted to represent multiple events. Post depositional disturbances include rodent burrows and small roots. Two TAR samples from different clusters were submitted for phytolith and starch analysis. Sample 13 was collected from the eastern half of Cluster 1, while Sample 16 represents the western half of Cluster 3.

The phytolith records for these two samples is somewhat different, suggesting local growth of different grasses following use and abandonment of these clusters. Specifically, Sample 16, exhibits more warm season grass short cells, particularly Chloridoid saddles, than did Sample 13. These Chloridoid forms indicate local growth of short grasses that thrive in hot, dry conditions during the summer. Sample 16 also contained *Celtis* seed phytoliths (**Figure 46** C), suggesting cooking hackberry seeds. Recovery of burned grass short cell phytoliths in Sample 16 suggests burning grasses, which might include parching grass seeds. Sample 13 displayed starches, while Sample 16 did not. Starches observed in Sample 13 include globular eccentric, sub-angular to angular eccentric, and *Sagittaria*-type root/tuber forms. These starches suggest parching or processing a variety of grass seeds and roots/tubers that probably included wapato in the area of Cluster 1. A few diatoms also were noted in Sample 13, which contained starches. Diatoms might be present as a result of cooking seeds and/or roots/tubers in water.

Sample 13 and 16, representing TAR from Cluster 1 and 3 respectively of Feature 29, yielded no functional group peaks (4000–1500 wave numbers). Fingerprint region peaks indicate aromatic rings; saturated esters; calcium oxalates; starch; cellulose and carbohydrates; and the polysaccharides glucuronoxylan,

glucomannan, and galactoglucomannan. Sample 16 did contain additional peaks demonstrating the presence of polysaccharides arabinan and arabinogalactorhamnoglycan.

Summary and Conclusions

Phytolith analysis of TAR from five features yields an environmental record of grasses that grew in the TAR clusters after they ceased being used. Cool season and warm season short grasses both appear to have been common. Warm season tall grasses were represented by relatively few phytoliths. Dissolution of phytoliths was recorded, particularly on large forms such as buliforms, which is typical. Dissolution is common in alkaline sediments that are moist for at least part of the year. Moisture is indicated by recovery of diatoms and sponge spherasters/spicules in Feature 1 Sample 1, Feature 15 Sample 4, Feature 21 Sample 7, Feature 29 Sample 13. Phytolith analysis provides evidence of processing or perhaps merely deterioration of Cyperaceae achenes (seeds) in Features 1 and 23. Celtis (hackberry) seed phytoliths were recovered only in Sample 16, representing Cluster 3 in Feature 29, where they might represent either processing hackberries or deterioration of hackberry seeds that dropped from a tree that grew in the vicinity of this feature. The best evidence of probable economic activity associated with these TAR clusters is the presence of starches in Features 21, 23, and Cluster 1 of Feature 29. Features 21 and 23 contain globular centric starches that suggest processing grass seeds. Grasses that are not represented by this shape of starch include wheatgrass, ryegrass, barley grass, and ricegrass. Neither is this shape of starch indicative of Cyperaceae or Sagittaria tubers. All three features that contain starch exhibit globular eccentric starches that also suggest processing grass seeds or perhaps tubers such as Cyperaceae or Sagittaria. Once again, this shape starch is not found in wheatgrass, ryegrass, barley grass, and ricegrass. Sub-angular to angular starches with eccentric hila also were observed in all three features that contained starch. These starches suggest processing roots/tubers, as eccentric hila are not common in seeds. Finally, Sagittaria-type root/tuber starches were noted in each of these three features, suggesting cooking wapato tubers in Features 21, 23, and Cluster 1 of Feature 29. In addition, recovery of Sagittaria-type starch helps to verify the specificity of the FTIR match to baked Sagittaria-type tubers that was observed in these three features and also Feature 15 and Cluster 3 from Feature 29. Deteriorated cellulose was noted in the FTIR record for Feature 1, where it represents deterioration of vegetation in the sediment or feature fill. Calcium oleate, which is produced when fats/lipids are heated in the presence of calcium, is represented by paired peaks in Feature 1. Peaks representing calcium oxalates, which are present in many cacti as well as plants in the Chenopodiaceae (goosefoot family), Salicaceae (willow family), legumes (including mesquite) and other families were noted in Features 15, 21, 23, and 29, where it likely represents part of the environmental signal.

RESULTS OF THE RADIOCARBON ANALYSIS

Eight radiocarbon samples were submitted to Beta Analytic for analysis. The conventional radiocarbon dates returned from Beta Analytic were calibrated using Calib version 5.0 (Stuiver and Reimer 1993). The two sigma date ranges are depicted graphically in **Figure 47** below, with the relative area under the probability curve. All of the materials selected for radiocarbon analysis were recovered through flotation. Four of the flotation samples were taken from Feature 30, the buried anthrogenic A soil horizon. The remaining flotation samples were obtained from between the rocks of burned rock cooking facilities. Two

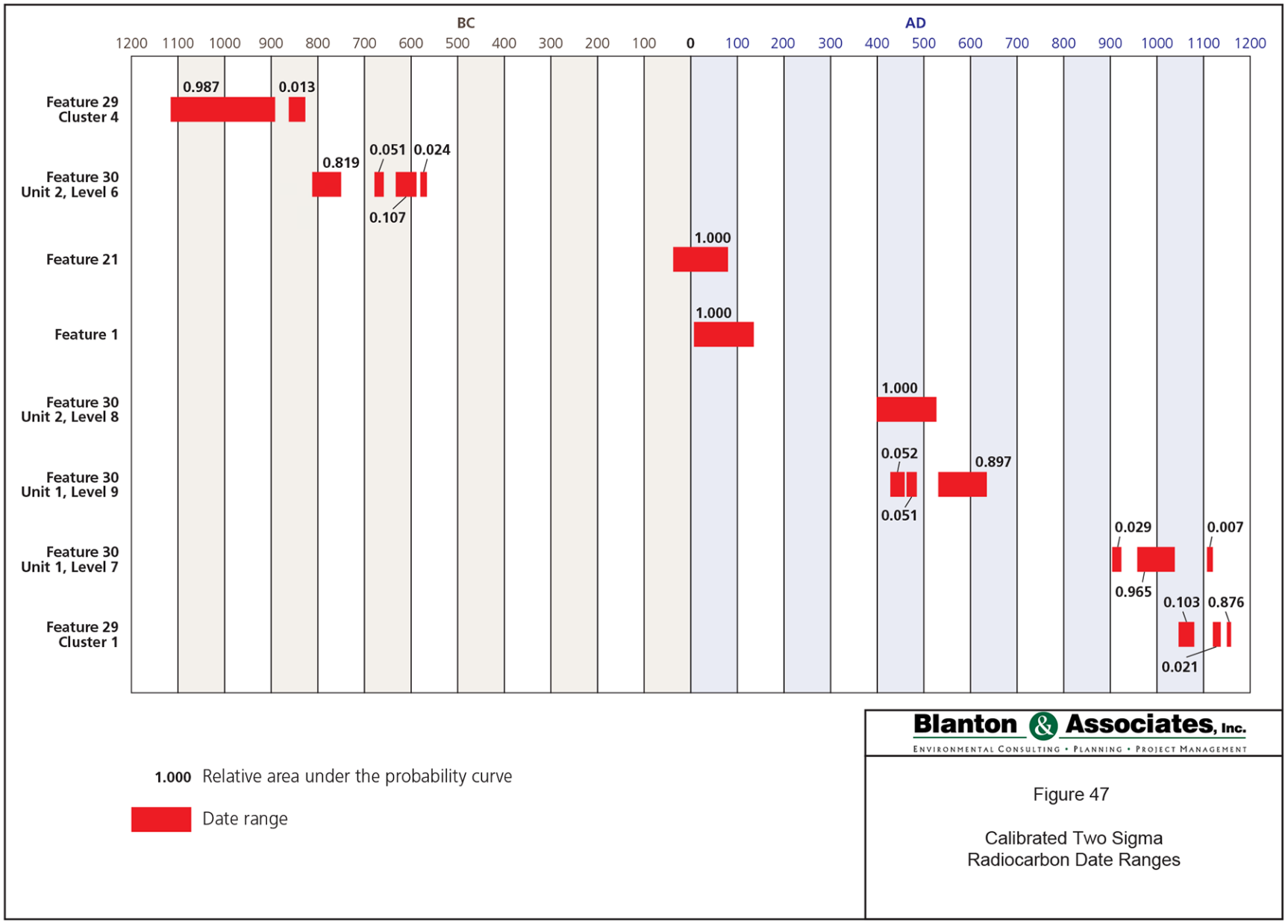
BC
AD
1200 1100 1000 900 800 700 600 500 400 300 200 100 0 100 200 300 400 500 600 700 800 900 1000 1100 1200
Feature 29 Cluster 4
Feature 30 Unit 2, Level 6
Feature 21
Feature 1
Feature 30 Unit 2, Level 8
Feature 30 Unit 1, Level 9
Feature 30 Unit 1, Level 7
Feature 29 Cluster 1
0.987
0.013
0.819
0.051
0.024
0.107
1.000
1.000
1.000
0.052
0.897
0.051
0.029
0.007
0.965
0.103
0.876
0.021
1.000 Relative area under the probability curve
Date range
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Figure 47
Calibrated Two Sigma
Radiocarbon Date Ranges

samples were recovered from Feature 29, one from cluster 1 and the second from cluster 2. One sample came from Feature 1 and one came from Feature 21. All of the charcoal samples were burned nutshells. The sample from Feature 21 was from a black walnut and the sample from Feature 29 cluster 1 was from a hickory/walnut. All of the remaining samples were from hickory nuts. Burned nut shells were chosen because they reasonably can be considered to be a byproduct of systemic human behavior, specifically, food production.

The calibrated two sigma date ranges overlap only twice. The assays from Feature 1 and Feature 21 overlap during an 80 year period from A.D. 4 to A.D. 84. The date ranges from two of the four Feature 30 samples, those from Unit 1 Level 9 and Unit 2, Level 8, overlap during a 105 year period extending from A.D. 433 to A.D. 538. The samples from Feature 29 cluster 1 and Feature 30, Unit 1, Level 7, appear to represent events that may have been separated by as little as 34 years. Similarly, the samples from Feature 29, cluster 4 and Feature 30, Unit 2, Level 6, appear to represent events that may have been separated by as little as 44 years.

The date ranges for the samples from Feature 30, Unit 1, Level 7 and Feature 29, nearly overlap, suggesting they represent occupations that occurred closely in time. However, when the portion of the date ranges under the probability curve is considered, the sample from Feature 30, Unit 1, Level 7 appears to predate the sample from Feature 29, Cluster 1, perhaps by as much as 100 years. Similarly, the date ranges from Feature 29, Cluster 4 and Feature 30, Unit 2, Level 6 are close but do not overlap and most likely represent separate occupations.

Clusters 1 and 4 of Feature 29 are thought to have resulted from distinct cooking events. Cluster 1 and 4 were separated by about 3.5 m, a space taken by two other burned rock clusters (2 and 3). Cluster 1 was a small tight cluster of burned rocks thought to represent a relatively intact cooking facility. Cluster 4 was a larger, somewhat looser, cluster of burned rocks thought to represent a partially disarticulated cooking facility. The rocks from Cluster 4 may have been partially scavenged to build Cluster 3, which is thought to represent a largely intact cooking facility. The two sigma date range for Cluster 1 was A.D. 1049 to 1084, A.D. 1124 to 1136, and A.D. 1150 to 1256. The two sigma date range for Cluster 4 was much earlier, extending from 1110 B.C. to 894 and 867 B.C. to 854. These are the earliest and latest dates returned from the site. The events represented by clusters 1 and 4 were separated minimally by 1,903 years.

The dates returned from the burned rock cooking facilities and the buried anthrogenic A horizon, suggest a pattern of repeated occupation during a period potentially lasting more than 2,000 years, from 1110 B.C. to A.D. 1150. The fact that there is very little overlap between the date ranges is consistent with the interpretation that the site resulted from multiple occupational episodes. The buried anthrogenic A horizon and the burned rock features presumably arose concurrently and resulted from related systemic cultural processes, namely the large scale subsistence processing of a variety of resources, including hickory nuts, and the secondary discard of the refuse generated from this activity.

The assemblage of temporally diagnostic lithic artifacts recovered during testing from 41BP595 includes nine dart points and five arrow points that span the period from the Late Paleoidnian to the Late Prehistoric Period. Six of the dart points and three of the arrow points were sufficiently complete to assign, at least

provisionally, to a type. The remainder of this assemblage was categorized only generally as either dart points or arrow points.

The assemblage of typed dart points includes 2 Late Paleoindian (Scottsbluff) specimens, 1 Middle Archaic Specimen (Pedernales), 1 Middle to Transitional Archaic (Gary) specimen, and two Late Archaic specimens (Montell and Fairland). The assemblage of typed arrow points includes 1 Edwards/Sabinal-like specimen, 1 Edwards-like specimen, and 1 Scallorn specimen, all of which are thought to date to the Late Prehistoric. All of these specimens, with the exception of the Scottsbluff and the Pedernales points, were likely discarded during the roughly 2000 year period defined by the calibrated two sigma radiocarbon date ranges returned from samples recovered from feature contexts. Site 41BP595 appears to have been most intensively occupied during this period.

SITE 41BP595 CONCLUSIONS AND RECOMMENDATIONS

Site 41BP595 is an expansive burned rock hearth field and lithic scatter that resulted from multiple occupational episodes during the period from the Late Paleoindian to the Late Prehistoric. A large, buried, organic-rich anthrogenic horizon, or midden, was identified that is thought to have arisen through the discard of organic refuse produced through subsistence processing , including the use of the burned rock cooking facilities present on site. Based on four calibrated two sigma radiocarbon dates, returned from radiocarbon assays of burned nutshell samples recovered from the midden, the midden appears to have arisen during the period from the Late Archaic to the early part of the Late Prehistoric.

Three sub-site areas were defined based on clinal variation of artifacts across the site. Based on the density and diversity of cultural materials, sub-site Area 2 was the most intensively utilized part of the site. Calibrated two-sigma radiocarbon dates returned from Area 2 samples, along with the assemblage of temporally sensitive projectile points from the area suggest Area 2 was most intensively utilized during the latter part of the Late Archaic to the early part of the Late Prehistoric period.

Sub-site Area 1 appears to have witnessed the earliest occupation identified on site, represented by two Scottsbluff dart points and potentially by an un-typed lanceolate dart point. Area 1, like Area 2, appears to have resulted from multiple occupational episodes. A burned nutshell recovered from Area 1 returned a two sigma calibrated date range extending from 40 B.C. to A.D. 80. No temporally sensitive artifacts were recovered from Area 3 and no radiocarbon dates were obtained. Based on the high number of cultural features identified in Area 1, it seems very likely that it resulted from multiple occupational episodes.

A sample of burned rocks recovered from feature contexts was submitted to Paleo Research Institute for residue, starch, and phytolith analysis. This work suggests that the features resulted in part from processing tubers and perhaps grass seeds and hackberry fruit for subsistence. Macrobotanical analysis of flotation samples recovered from feature contexts suggests that these features were also used to process mast resources for subsistence.

Research at 41BP595 identified intact burned rock features and a large midden area with preserved subsistence and spent fuel remains. This work indicates that the site is likely to yield additional information important to prehistory. Consequently, site 41BP595 is thought to merit NRHP listing under Criterion D.

For this reasons, it is recommended that impact to 41BP595 stemming from mine related development be avoided. If this is not possible, it is recommended that impacts to the site be mitigated though the implementation of data recovery investigations following a research design approved by the THC.

PROJECT SUMMARY AND RECOMMENDATIONS

At the request of Luminant, National Register of Historic Places (NRHP) eligibility testing was conducted at historic sites 41BP585 and 41BP594 and prehistoric site 41BP595. These sites are located in Bastrop County, Texas within the Three Oaks Mine, owned and operated by Luminant. Impacts to all three sites are anticipated as a result of planned mine development. This work took place between October 2012 and July 2013.

This work demonstrated that significant archeological deposits, which contribute to the overall NRHP eligibility statuses of the historic sites, are absent at both. Standing architecture at 41BP594, however, has previously been determined to be eligible for listing on the NRHP (Martin 2001). Archival research conducted as part of the current investigation into the histories of the historic sites remains inconclusive with respect to the identity of their 1870's and earlier occupants.

Site 41BP585 does not appear to warrant NRHP inclusion under any eligibility criteria. No further investigation and granting cultural resources clearance are recommended. Although no archeological deposits at site 41BP594 appear to warrant NRHP inclusion, the standing structure has previously been determined to be eligible for NRHP listing. It is recommended that impact to the standing structure on 41BP594 be avoided. If this is not possible it is recommended that mine impacts be mitigated following a research design approved by the THC.

Testing at prehistoric site 41BP595 indicated it resulted from multiple occupational episodes during the period from the late Paleoindian to the Late Prehistoric. Shovel testing and mechanical trenching revealed the presence of an expansive buried anthrogenic A soil horizon, or midden, replete with preserved subsistence remains. Mechanical trenching also exposed a variety of burned rock cooking facilities partially surrounding the midden area. Radiocarbon assays of burned nut shells recovered from feature contexts, along with the assemblage of diagnostic lithic artifacts, suggest the site was most intensively occupied from the Late Archaic to the early Late Prehistoric. A suite of special studies was conducted on burned rock samples recovered from four of the better preserved burned rock features. These studies, which include residue, starch, and phytolith analysis, suggest that the burned rock features were used in part to process tubers/roots and grass seeds and potentially hackberry fruit for subsistence. Macrobotanical analysis of flotation samples recovered from feature contexts identified spent fuel remains including oak and hickory wood and subsistence remains including oak, hickory, black walnut, and acorn burned nut shells. A small amount of burned bulb, possibly representing wild onion, was also recovered through flotation. The presence of these remains in the NRHP testing assemblage indicates that data resources significant to understanding the prehistoric period in Bastrop County have been preserved on site. For these reasons site 41BP595 is thought to merit NRHP listing under Criterion D. It is recommended that impact to 41BP595 stemming from mine related development be avoided. If this is not possible, it is recommended that impacts to the site be mitigated though the implementation of data recovery investigations following a research design approved by the THC.

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APPENDIX A

PHYTOLITH, STARCH, AND ORGANIC RESIDUE (FTIR) ANALYSIS

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Table A.1. FTIR PEAK SUMMARY FOR SAMPLES FROM SITE 41BP595, BASTROP COUNTY, TEXAS							
		Feature 1	**Feature 15**	**Feature 21**	**Feature 23**	**Feature 29**	
Peak Range	**Represents**	**1 - TAR**	**4 - TAR**	**7 - TAR**	**10 - TAR**	**13 - TAR**	**16 - TAR**
Absorbed Water:							
3600–3200	Absorbed Water (O-H Stretch)	3381		3354			
Fats, oils, lipids, waxes:							
3000–2800	Aldehydes: fats, oils, lipids, waxes	2920, 2851	2921, 2849	2920, 2851			
	Lipids: Saturated Esters:						
1750–1730	Saturated esters (C=O Stretch)	1741	1741	1741			
1742	Lipids (Triglycerides, C=O Stretch)	1741	1741	1741			
1100–1030	Saturated esters	1083, 1077		1087,1082		1084	1086,1083, 1081
	Lipids: Aromatic Esters:						
692	Aromatic ring bend (phenyl ether)	692	693	693	694/93	693	694/93
Proteins:							
1500–1400	Protein	1461	1578, 1459	1578, 1458			
1465–1455	Protein/lipids	1461	1459	1458			
1490–1350	Protein	1461	1459	1458, 1364			
Carbohydrates (General):							

Table A.1. FTIR PEAK SUMMARY FOR SAMPLES FROM SITE 41BP595, BASTROP COUNTY, TEXAS							
		Feature 1	**Feature 15**	**Feature 21**	**Feature 23**	**Feature 29**	
Peak Range	**Represents**	**1 - TAR**	**4 - TAR**	**7 - TAR**	**10 - TAR**	**13 - TAR**	**16 - TAR**
1170–1150, 1050, 1030	Cellulose	1164/63, 1161, 1034/33, 1026	1163,1160, 1029	1163/62, 1031/30, 1028	1162, 1029/28	1163/62, 1030/29/28	1163/62, 1030/29
1162	Cellulose	1164/63, 1161	1163,1160	1163/62	1162	1163/62	1163/62
1028–1000	Cellulose Carbohydrates	1026, 1005	1029, 1007, 1005/04	1030,1028, 1007/06, 1004	1029/28, 1006/05	1030/29/28, 1008/07	1030/29, 1006/05
1059, 1033	Cellulose	1034/33, 1026	1029	1031/30	1029/28	1030/29/28	1030/29
916, 908	β-D-cellulose		916				
796	Deteriorated cellulose		795,793	796,794	796	795	796
	Polysaccharides (Specific):						
1161, 1151	Arabinoglucuronoxylan + Galactoglucomannan	1161	1160				
1084	Glucuronoxylan (GX)	1083		1087		1084	1086,1083
1082, 1051	Pectin	1083		1082			1083,1081
1082	Starch	1083		1082			1083,1081
1078	Arabinogalactan, Arabinogalactan (Type II), Xyloglucan	1077					
1076	Glucan	1077					
1034, 960	Galactoglucomannan	1034/33		1031/30		1030	1030
1034		1034/33		1031/30		1030	1030

Table A.1. FTIR PEAK SUMMARY FOR SAMPLES FROM SITE 41BP595, BASTROP COUNTY, TEXAS							
		Feature 1	**Feature 15**	**Feature 21**	**Feature 23**	**Feature 29**	
Peak Range	**Represents**	**1 - TAR**	**4 - TAR**	**7 - TAR**	**10 - TAR**	**13 - TAR**	**16 - TAR**
	+Glucomannan (9:1, w/w), Glucomannan						
1026	Starch	1026	1029	1028	1029/28	1029/28	1029
951, 916	Rhamnogalacturonan		916				
918	Arabinan						919
916	Arabinogalactan (Type II), Glucan		916				
915, 840	α-D-glucose			915			
	Polysaccharides (Specific) (Continued):						
915, 900	β-D-glucose			915			
914	Arabinogalactor-hamnoglycan			914	914/13		914
Minerals:							
1577, 1539	Calcium oleate	1577,1540					
780	Calcium oxalate	775/74	777/76	777/76	778/77	777/76/75	777
Other:							
2959, 2938, 2936, 2934, 2931, 2930, 2926, 2924, 2922	CH_2 Asymmetric stretch	2920	2921	2920			
2876, 2872, 2863, 2858, 2855	CH_2 Symmetric stretch	2851		2851			
1384, 1364	Split CH3 umbrella mode, 1:1 intensity			1364			

Table A.1. FTIR PEAK SUMMARY FOR SAMPLES FROM SITE 41BP595, BASTROP COUNTY, TEXAS							
		Feature 1	**Feature 15**	**Feature 21**	**Feature 23**	**Feature 29**	
Peak Range	**Represents**	**1 - TAR**	**4 - TAR**	**7 - TAR**	**10 - TAR**	**13 - TAR**	**16 - TAR**
914	C-C-C Stretch			914	914/13		914
660, 648	O-H Out-of-plane bend		647,645	646,644	646,644,642	648,645/44	647/46

Table A.2. Index Of Organic Compounds Noted In The Samples From Site 41bp595, Bastrop County, Texas		
Compound	**Description**	**Source**
LIPIDS:		
Aldehydes	· Organic compounds that contain the carbonyl group (〉C=O) (Davis et al. 1984:851). · Ubiquitous in nature (O'Brien et al. 2006).	· Compounds naturally emitted by plants (O'Brien, et al. 2006). · Formed by the oxidation of alcohols (e.g. formaldehyde (methanol), acetaldehyde (ethanol), propionaldehyde (propanol) (Davis, et al. 1984:851).
ESTERS: (Components of fats, oils, and lipids)		
Triglycerides	· Esters with fairly high molecular masses derived from fats and oils. · These esters are more saturated if they come from animal fats, and less saturated if they come from plant fats.	· Plants and animals. · Nuts, seeds, meat.
Aliphatic esters (saturated and unsaturated)	· Esters of fatty acids (more saturated from fats, less saturated from oils) (Davis, et al. 1984:844).	· Common in plants and animals (Davis, et al. 1984:845).
Aromatic esters	· Responsible for flavors and smells (Davis, et al. 1984:843).	· Plant parts (fruits, flowers, bark, etc.) (e.g. cinnamon, mint) (Davis, et al. 1984:843).
CARBOHYDRATES:		
Monosaccharides:		
Glucose (syn. D-glucose, Dextrose)	· A simple monosaccharide found in plants, soluble in both hot and cold water, crystallizes.	· Plants.
Polysaccharides (storage):		
Glucan	· Polysaccharide composed only of glucose molecules linked by glycosidic bonds (specific type of bonds linking sugars). · Found in association with pectin (Stephen et al. 2006).	· Resides in the cell walls of plants and trees and many forms of bacteria and fungi (Stephen, et al. 2006).
Polysaccharides (structural):		
Cellulose	· Straight-chain glucose polymer linked by beta bonds (Wardlaw and Insel 1996:82).	· Plants.
Hemicelluloses:		
Galactoglucomannan	· Water-soluble hemicellulose, consisting of galactose, glucose and mannose (Willför et al. 2008).	· Plants (Stephen 1982). · Woody tissue of all coniferous plants (Bochicchio and Reicher 2003), *Trifolium* (clover) (Buchala and Meier 1973).
Glucomannan	· Soluble fiber used to treat constipation by decreasing fecal transit time (Bochicchio and Reicher 2003; Marzio 1989).	· Roots or corms and in the wood of conifers and dicotyledons (dicots) (Bochicchio and Reicher 2003).

Table A.2. Index Of Organic Compounds Noted In The Samples From Site 41bp595, Bastrop County, Texas		
Compound	**Description**	**Source**
Glucuronoxylans (abbreviated GX)	· Hemicellulosic plant cell wall polysaccharide composed primarily of glucuronic acid and xylose (Awano et al. 2000).	· Secondary cell walls of hardwoods (Awano, et al. 2000:72). · Fruits, nutshells, sunflower hulls, and coneflower (*Rudbeckia*) (Ebringerova et al. 2005:8).
Xyloglucan	· Important for plant cell wall growth and repair (Moore and Saehelin 1988).	· Most dicotyledonous plants and in all vascular plants (Fry 1989).
Pectin, Gums, and Mucilages:		
Arabinan	· Essential for the function of guard cells, which play a key role in the ability of plants to survive on dry land (Jones et al. 2003:11783).	· Terrestrial plants.
Arabinogalactan	· Composed of arabinose and galactose. · Sugar found in plant carbohydrate structures, particularly gums and hemicelluloses. Bonds with proteins to repair damage (Nothnagel 2000).	· Most plants. · Widely distributed in flowering plants.
Arabinogalactor-hamnoglycan (pectic)		· Terrestrial plants (cell walls) (Capek et al. 1999; Kacurakova et al. 2000).
Arabinoglucuronoxylan	· Often used for its gelling or thickening action.	· The cell walls of softwoods and herbaceous plants (Sjostrom 1981).
Rhamnogalacturonan (pectic)	· Composed primarily of rhamnose and galacturonic acid (Willats et al. 2001). · Results from the degradation of pectin (Willats, et al. 2001).	· Terrestrial Plants (cell walls) (Willats, et al. 2001).
Pectin, Gums, and Mucilages (Continued):		
Pectin	· Composed of linear or branched forms of simple sugars, primarily rhamnose. · Often used for its gelling or thickening action.	· Apples, plums, gooseberries, and citrus.
MINERALS:		
Calcium Oleate		· Calcium salt formed when calcium-containing alkaline materials, such as limestone or shell, are combined with oleic acid (common in many plant and animal fats) through heating.
Calcium Oxalate (abbreviated CaOx)	· CaC_2O_4 or Ca $(COO)_2$ · Crystal forms include styloids, raphids, pyramids, or rosettes. · Primary function of calcium oxalate formation in plants is to regulate high-capacity calcium and protect against herbivory (Franceschi and Nakata 2005:41).	· Most abundant in plant leaves and roots (Patnaik 2003:765). · *Populus* (cottonwood), *Salix* (willow), *Agave*, *Yucca*, Cactaceae (cacti), *Nicotiana* (tobacco), *Datura*, all members of the Fabaceae or legume family, and various plants in the Chenopodiaceae such as *Atriplex* (saltbush), *Chenopodium*

Table A.2. Index Of Organic Compounds Noted In The Samples From Site 41bp595, Bastrop County, Texas		
Compound	**Description**	**Source**
	· Poisonous when ingested by animals, including humans.	(goosefoot); *Oxalis* and Araceae, and roots and leaves of rhubarb and buckwheat (Streitweiser 1976).

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APPENDIX B

MACROBOTANICAL ANALYSIS DATA

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Table B.1. Carbonized flotation material for possible AMS dating Site 41BP595

FS #	Unit	Feature	Level	Depth (cmbd)	Volume (cu. dm.)	Plant part (carbonized)	Identification	Common name	Number	Weight (g)
546	6	1			10.1	Nutshell	Carya sp., thick	Hickory	2	0.02
547	6	1			7.0	Nutshell	Carya sp., thick	Hickory	2	0.02
561	1	30	5	50-60	7.0	Nutshell	Carya sp., thick	Hickory	1	0.10
562	1	30	6	60-70	7.4	Nutshell	Carya sp., thick	Hickory	1	0.03
563	1	30	7	70-80	8.1	Nutshell	Carya sp., thick	Hickory	1	0.06
564	1	30	8	80-90	9.1	Nutshell	Carya sp., thick	Hickory	1	0.02
565	1	30	9	90-100	7.25	Nutshell	Carya sp., thick	Hickory	1	0.01
566	1	30	10	100-110	7.6	Nutshell	Juglandaceae	Hickory/walnut family	2	0.01
567	2	30	5	50-60	7.6	Nutshell	Carya sp., thick	Hickory	1	0.03
568	2	30	6	60-70	7.7	Nutshell	Carya sp., thick	Hickory	1	0.03
569	2	30	7	70-80	8.2	Nutshell	Carya sp., thick	Hickory	2	0.05
570	2	30	8	80-90	7.9	Nutshell	Carya sp., thick	Hickory	1	0.20
571	2	30	9	90-100	8.7	Nutshell	Carya sp., thick	Hickory	2	0.04

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Table B.2. Uncarbonized Plants from Site 41BP595

All plant parts are seeds unless otherwise noted **FS #**	546	547	635	602	636	649	650	638	665	669	671	673	675	678	610	615	617	620	622	561	562	563	564	565	566	567	568
Feature	**1**	**1**	**5**	**15**	**19**	**21**	**23**	**26**	**26**	**27**	**27**	**27**	**27**	**27**	**29**	**29**	**29**	**29**	**29**	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**
Level																				5	6	7	8	9	10	5	6
Depth (cmbd) or Portion						E 1/2	E 1/2		NW 1/2	SE 1/2	W 1/2	NW 1/2	SE 1/2	NW 1/2	W 1/2	E 1/2	E 1/2	E 1/2	W 1/2	50-60	60-70	70-80	80-90	90-100	100-110	50-60	60-70
Volume processed (cu. dm.)	10.10	7.00	4.45	5.15	4.25	5.15	6.90	5.20	6.50	9.60	6.70	7.10	7.35	7.20	6.70	5.65	6.65	6.50	5.20	7.00	7.40	8.10	9.10	7.25	7.60	7.60	7.70
Doveweed *(Croton* sp.)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Carpetweed *(Mollugo verticillata)*	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Flatsedge *(Cyperus* sp.)	X	X	X		X	X	X	X			X	X			X	X	X	X	X	X	X	X	X	X	X	X	
Evening primrose/Fluttermills *(Oenothera/Calyophus* sp.)	X	X	X		X	X			X	X		X			X	X	X	X	X	X		X	X			X	X
Panicoid grass (Panicodae)	X	X	X		X	X	X	X		X		X			X		X	X	X			X					
Purslane *(Portulaca oleracea)*			X			X		X			X						X	X	X	X	X		X			X	
Daisy family (Asteraceae)	X	X						X		X					X	X			X				X				
Grass family (Poaceae)					X	X	X	X		X	X	X	X						X	X							
Catchfy *(Silene* sp.)	X	X				X		X	X		X						X	X					X				X
Coneflower *(Rudbeckia/Echinacea* sp.)	X				X	X					X	X	X	X				X									
Clover *(Trifolium* sp.)		X					X			X			X	X							X						
Sunflower *(Helianthus* sp.)						X	X			X						X	X	X	X								
Milkwetch *(Astragalus* sp.)			X																	X	X			X		X	
Goosefoot *(Chenopodium* sp.)										X									X		X						
Legume pod (Fabaceae)					X		X								X												
Partridgepea *(Chamaecrista* sp.)		X			X																						
Unknown	X				X								X														
Knotweed *(Polygonum* sp., trigonous)					X			X																			
Live oak leaf *(Quercus fusiformis)*												X															
Copperleaf *(Acalypha* sp.)													X														
Rescuegrass *(Bromus* sp.)					X																						
Dayflower *(Commelina* sp.)			X																								
Juniper leaf scales *(Juniperus* sp.)	X																										
Mint famiy (Lamiaceae)																		X									
Pokeweed *(Phytolacca americana)*																				X							
Bulrush *(Scirpus* sp., trigonous)					X																						
Total taxa	10	9	8	1	13	10	8	9	4	9	7	8	7	4	7	6	8	10	10	8	7	5	7	4	3	6	4

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Table B.3. Carbonized Plants from Site 41BP595, by feature and lot

Raw counts

FS #	546	547	635	602	636	649	650	638	665	669	671	673	675	678	610	615	617	620	622	561	562	563	564	565	566	567	568	569	570	571	**Site**
Feature	**1**	**1**	**5**	**15**	**19**	**21**	**23**	**26**	**26**	**27**	**27**	**27**	**27**	**27**	**29**	**29**	**29**	**29**	**29**	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**Total**
Level																				5	6	7	8	9	10	5	6	7	8	9	
Depth (cmbd) or Portion						E 1/2	E 1/2		NW 1/2	SE 1/2	W 1/2	NW 1/2	SE 1/2	NW 1/2	W 1/2	E 1/2	E 1/2	E 1/2	W 1/2	50-60	60-70	70-80	80-90	90-100	100-110	50-60	60-70	70-80	80-90	90-100	
Volume processed (cu. dm.)	10.10	7.00	4.45	5.15	4.25	5.15	6.90	5.20	6.50	9.60	6.70	7.10	7.35	7.20	6.70	5.65	6.65	6.50	5.20	7.00	7.40	8.10	9.10	7.25	7.60	7.60	7.70	8.20	7.90	8.70	209.9
Wood																															
Oak *(Quercus* sp.)	4		6	2		1			3	2		2				1				2	3	4	3	5	1	6	8	8	2		63
White group oak *(Quercus* subg. *Quercus)*																			1		1			1		4	2	3			12
Plateau live oak (*Quercus fusiformis*)												1												1		1	1				4
Hickory *(Carya* sp.)		1	2			1				2		1								10	8	4	3	5				3	5	1	46
Hardwood	5	1	3	5	2	1	3	2	1	3	3		3	1	4			2	2	9	8	6	12	7	8	4	9	6	9	11	130
Not examined for species																	P				4						6	4			14
Total wood	9	2	11	7	2	3	3	2	4	7	3	4	3	1	4	1		2	3	21	24	14	18	19	9	15	26	24	16	12	269
Nutshell																															
Hickory *(Carya* sp.)	6	2		4														4		1	4	4	2	7		2	6	7	17	6	72
Hickory/walnut family (Juglandaceae)	2	1		3	1	1				1	1				1	2	2	1	2	2	4	10	1		4	3	4	2	5	1	54
Black walnut (*Juglans nigra*)						2																									2
Acorn *(Quercus* sp.)																								1				1		1	3
Total nutshell	8	3		7	1	3			1	1					1	2	2	5	2	3	8	14	3	8	4	5	10	10	22	8	131
Nut hull, hickory *(Carya* sp.)																							3								3
Seeds																															
Avens *(Geum* sp.)																										1					1
Indeterminable		2																		4	2										8
Panicoid grass (Panicodae)																							1								1
Grass family (Poaceae)																					1	2							2		5
Grape *(Vitis* sp.)																												3			3
Bulb scale, indeterminable																						1								1	2
Other																															
Indeterminable botanical	1	1	3	2								1	3	1						2	8	3	13	5		1	3	4	6	4	61
Gall																							1	1							2
Bark	1																														1

P=present, > 1.4 mm

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APPENDIX C

GEOARCHEOLOGICAL ANALYSIS DATA

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GEOARCHEOLOGICAL ANALYSIS DATA

Profile	Sample	Depth (cm)	Sand (%)	Silt (%)	Clay (%)	USDA Soil Texture Class	Mean (phi)	Median (phi)	Sorting (phi)	Skewness (phi)	Kurtosis (phi)	LOI (%)	Xlf $10^{-8}m^3kg^{-1}$	Xfd (%)
BT6-1	1	5	91.4	5.46	3.14	Sand	2.45	2.34	0.98	0.41	1.99	0.72	12.52	4.10
Edge of Feature 30	2	10	93.9	3.51	2.59	Sand	2.25	2.19	0.87	0.20	1.54	0.46	13.53	3.69
	3	15	91.7	4.24	4.06	Sand	2.34	2.25	1.12	0.36	2.26	0.43	10.82	5.42
	4	20	90.4	4.88	4.72	Sand	2.35	2.25	1.30	0.40	2.59	0.45	195.33	2.06
	5	25	91.4	4.49	4.11	Sand	2.29	2.22	1.19	0.33	2.32	0.35	12.94	9.19
	6	30	90	5.15	4.85	Sand	2.37	2.26	1.35	0.40	2.68	0.33	12.54	4.62
	7	35	90.2	5.08	4.72	Sand	2.38	2.27	1.30	0.41	2.63	0.50	13.80	12.95
	8	40	90.1	5.13	4.77	Sand	2.38	2.27	1.30	0.41	2.67	0.32	13.72	16.33
	9	45	89.2	5.45	5.35	Sand	2.46	2.33	1.36	0.45	2.80	0.33	15.08	15.64
	10	50	89.5	5.55	4.95	Sand	2.45	2.32	1.31	0.45	2.61	0.32	14.75	13.17
	11	55	88.2	5.9	5.9	Sand	2.57	2.41	1.36	0.52	2.83	0.31	13.23	5.73
	12	60	88.8	5.34	5.86	Sand	2.46	2.32	1.42	0.45	2.90	0.32	12.80	8.18
	13	65	90	5.3	4.7	Sand	2.47	2.34	1.21	0.47	2.62	0.29	17.33	4.07
	14	70	89.9	5.12	4.98	Sand	2.45	2.33	1.31	0.44	2.69	0.32	16.76	5.56
	15	75	89.4	5.45	5.15	Sand	2.43	2.30	1.37	0.43	2.71	0.29	13.24	7.27
	16	80	89.4	5.25	5.35	Sand	2.41	2.28	1.37	0.45	2.79	0.30	13.26	3.72
	17	85	87.4	6.23	6.37	Loamy Sand	2.51	2.33	1.51	0.48	2.85	0.27	16.66	2.14
	18	90	88.1	5.87	6.03	Sand	2.54	2.38	1.43	0.48	2.85	0.26	202.04	46.09
	19	95	87.6	6.09	6.31	Loamy Sand	2.54	2.37	1.50	0.48	2.90	0.27	14.40	7.36
	20	100	86.4	7.43	6.17	Loamy Sand	2.57	2.38	1.50	0.49	2.69	0.29	43.23	0.93
	21	105	70.5	11.3	18.2	Sandy Loam	4.13	2.63	2.78	0.75	1.11	0.29	8.80	3.74
	22	110	53.1	16	30.9	Sandy Clay Loam	5.08	3.61	3.08	0.62	0.61	1.21	7.49	7.91
	23	115	39.2	20.9	39.9	Sandy Clay Loam	5.95	5.69	3.07	0.15	0.56	2.91	8.50	3.05
	24	120	19.1	34.1	46.8	Clay	6.67	7.18	2.68	-0.21	0.81	2.83	8.48	10.19
BT6-2	1	5	91.8	4.73	3.47	Sand	2.42	2.32	0.99	0.34	1.91	0.64	9.19	3.13
Outside Feature 30	2	10	92.6	4.4	3	Sand	2.32	2.25	0.96	0.26	1.77	0.95	9.15	7.14
	3	15	92.9	4.25	2.85	Sand	2.21	2.18	1.01	0.19	1.71	1.07	8.69	7.25
	4	20	93.1	3.28	3.62	Sand	2.25	2.21	0.98	0.23	1.85	0.39	10.13	7.96

GEOARCHEOLOGICAL ANALYSIS DATA

Profile	Sample	Depth (cm)	Sand (%)	Silt (%)	Clay (%)	USDA Soil Texture Class	Mean (phi)	Median (phi)	Sorting (phi)	Skewness (phi)	Kurtosis (phi)	LOI (%)	Xlf $10^{-8}m^3kg^{-1}$	Xfd (%)
	5	25	91.6	4.29	4.11	Sand	2.31	2.24	1.15	0.34	2.23	0.45	9.86	9.59
	6	30	90.7	4.76	4.54	Sand	2.39	2.30	1.25	0.38	2.54	0.34	10.74	5.08
	7	35	90.4	4.81	4.79	Sand	2.45	2.33	1.27	0.43	2.72	0.32	11.35	4.94
	8	40	91	4.7	4.3	Sand	2.36	2.27	1.19	0.37	2.40	0.29	10.25	6.19
	9	45	90.6	4.78	4.62	Sand	2.34	2.26	1.30	0.36	2.58	0.29	11.85	8.26
	10	50	89.1	5.47	5.43	Sand	2.47	2.35	1.39	0.43	2.84	0.25	10.30	4.50
	11	55	89.5	5.41	5.09	Sand	2.45	2.33	1.36	0.42	2.72	0.24	9.82	4.17
	12	60	89.1	5.39	5.51	Sand	2.50	2.38	1.39	0.43	2.84	0.27	10.53	1.79
	13	65	89.2	5.18	5.62	Sand	2.45	2.33	1.41	0.43	2.89	0.26	10.62	0.43
	14	70	90.3	4.98	4.72	Sand	2.46	2.36	1.29	0.40	2.55	0.22	10.04	-1.40
	15	75	89.6	5.09	5.31	Sand	2.46	2.34	1.37	0.43	2.88	0.25	9.75	-3.81
	16	80	89.9	5.06	5.04	Sand	2.46	2.35	1.34	0.41	2.74	0.22	10.35	3.72
	17	85	90.1	4.94	4.96	Sand	2.42	2.31	1.33	0.41	2.71	0.24	10.75	2.59
	18	90	87.7	5.66	6.64	Loamy Sand	2.57	2.41	1.50	0.49	2.99	0.22	10.62	4.15
	19	95	87.7	5.86	6.44	Loamy Sand	2.52	2.36	1.49	0.47	2.92	0.29	10.65	0.00
	20	100	88.6	5.51	5.89	Sand	2.49	2.35	1.43	0.45	2.93	0.32	18.77	0.49
	21	105	85.1	7.17	7.73	Loamy Sand	2.71	2.46	1.50	0.58	2.77	0.27	10.11	6.67
	22	110	59.4	12	28.6	Sandy Clay Loam	4.77	3.03	2.94	0.77	0.62	1.16	8.32	7.31
	23	115	55.8	12	32.2	Sandy Clay Loam	5.00	3.35	3.07	0.69	0.59	1.79	7.48	8.33
BT7-1	1	5	94.6	2.77	2.63	Sand	2.31	2.25	0.77	0.19	1.51	0.44	8.35	4.79
Middle of Feature 30	2	10	94	2.8	3.2	Sand	2.37	2.31	0.82	0.21	1.59	0.36	8.69	6.91
	3	15	94.9	2.35	2.75	Sand	2.39	2.33	0.71	0.20	1.37	0.30	7.84	10.47
	4	20	94	2.92	3.08	Sand	2.37	2.31	0.80	0.24	1.54	0.34	9.59	10.05
	5	25	94.9	2.53	2.57	Sand	2.30	2.25	0.76	0.17	1.42	0.32	9.60	11.48
	6	30	94	3.05	2.95	Sand	2.37	2.31	0.80	0.23	1.54	0.30	10.45	12.83
	7	35	92.7	3.67	3.63	Sand	2.42	2.34	0.90	0.35	1.87	0.34	14.73	11.32
	8	40	90	5.34	4.66	Sand	2.48	2.35	1.24	0.45	2.64	0.53	12.92	14.13
	9	45	89.8	5.35	4.85	Sand	2.45	2.32	1.30	0.43	2.71	0.56	16.61	12.53

GEOARCHEOLOGICAL ANALYSIS DATA

Profile	Sample	Depth (cm)	Sand (%)	Silt (%)	Clay (%)	USDA Soil Texture Class	Mean (phi)	Median (phi)	Sorting (phi)	Skewness (phi)	Kurtosis (phi)	LOI (%)	Xlf $10^{-8}m^3kg^{-1}$	Xfd (%)
	10	50	89.7	5.29	5.01	Sand	2.45	2.32	1.31	0.45	2.74	0.46	14.43	12.90
	11	55	90.5	4.96	4.54	Sand	2.44	2.33	1.22	0.41	2.55	0.56	16.19	12.64
	12	60	89.8	5.21	4.99	Sand	2.44	2.32	1.32	0.43	2.76	0.55	16.83	13.90
	13	65	90.3	4.88	4.82	Sand	2.41	2.30	1.30	0.41	2.72	0.58	18.63	12.29
	14	70	89.7	5.04	5.26	Sand	2.47	2.34	1.33	0.46	2.87	0.56	15.99	9.70
	15	75	91.2	4.43	4.37	Sand	2.34	2.26	1.22	0.36	2.44	0.52	15.42	7.76
	16	80	90.6	4.71	4.69	Sand	2.38	2.28	1.29	0.39	2.61	0.89	15.68	9.88
	17	85	90.2	4.86	4.94	Sand	2.38	2.27	1.34	0.41	2.68	0.56	15.76	8.43
	18	90	90.4	4.86	4.74	Sand	2.43	2.32	1.29	0.41	2.63	0.42	13.93	1.73
	19	95	89.8	5.2	5	Sand	2.51	2.38	1.25	0.49	2.71	0.42	13.87	3.67
	20	100	90.7	4.81	4.49	Sand	2.45	2.34	1.20	0.42	2.55	0.34	12.16	-0.75
	21	105	90.7	4.85	4.45	Sand	2.44	2.33	1.19	0.43	2.51	0.30	11.11	-6.94
	22	110	91.1	4.42	4.48	Sand	2.38	2.28	1.20	0.41	2.54	0.34	15.99	3.74
	23	115	89.7	5.29	5.01	Sand	2.48	2.35	1.30	0.45	2.76	0.30	10.80	-0.44
	24	120	90.7	4.9	4.4	Sand	2.47	2.36	1.16	0.43	2.45	0.27	34.94	3.60
	25	125	90.6	5.05	4.35	Sand	2.45	2.34	1.18	0.42	2.47	0.30	10.32	-7.49
	26	130	89.7	5.31	4.99	Sand	2.46	2.34	1.31	0.43	2.76	0.31	10.73	-11.11
	27	135	88.4	5.79	5.81	Sand	2.51	2.36	1.41	0.48	2.91	0.32	11.32	-8.94
	28	140	75.4	8.8	15.8	Sandy Loam	3.70	2.31	2.84	0.73	1.69	2.26	15.01	-4.40
Fence Row	1	2	93.8	4.23	1.97	Sand	2.45	2.38	0.75	0.27	1.40	na	na	na
Dune 1	2	7	93.8	3.4	2.8	Sand	2.41	2.34	0.79	0.24	1.49	na	na	na
	3	12	95.5	2.65	1.85	Sand	2.31	2.26	0.69	0.19	1.31	na	na	na
	4	19	95.5	2.07	2.43	Sand	2.38	2.33	0.69	0.15	1.36	na	na	na
Fence Row	1	2	93	3.91	3.09	Sand	2.35	2.28	0.93	0.27	1.79	na	na	na
Dune 2	2	7	93.8	2.83	3.37	Sand	2.36	2.28	0.82	0.32	1.76	na	na	na
	3	12	94.8	2.26	2.94	Sand	2.32	2.26	0.74	0.21	1.47	na	na	na
	4	18	95.2	2.01	2.79	Sand	2.30	2.25	0.71	0.18	1.42	na	na	na
	5	23	96.4	1.3	2.3	Sand	2.24	2.20	0.62	0.14	1.29	na	na	na
Samples Across	0	na	na	na	na	na	na	na	na	na	na	0.48	12.10	5.34
Feature 30	1	na	na	na	na	na	na	na	na	na	na	0.40	26.49	3.85

GEOARCHEOLOGICAL ANALYSIS DATA

Profile	Sample	Depth (cm)	Sand (%)	Silt (%)	Clay (%)	USDA Soil Texture Class	Mean (phi)	Median (phi)	Sorting (phi)	Skewness (phi)	Kurtosis (phi)	LOI (%)	Xlf $10^{-8}m^3kg^{-1}$	Xfd (%)
	2	na	na	na	na	na	na	na	na	na	na	0.43	15.55	7.56
	3	na	na	na	na	na	na	na	na	na	na	0.55	16.61	7.87
	4	na	na	na	na	na	na	na	na	na	na	0.61	15.75	8.91
	5	na	na	na	na	na	na	na	na	na	na	0.59	16.74	9.12
	6	na	na	na	na	na	na	na	na	na	na	0.80	16.46	9.49
	7	na	na	na	na	na	na	na	na	na	na	0.77	19.38	8.73
	8	na	na	na	na	na	na	na	na	na	na	0.58	15.89	10.12
	9	na	na	na	na	na	na	na	na	na	na	0.68	17.43	11.76
	10	na	na	na	na	na	na	na	na	na	na	0.58	18.32	12.59
	11	na	na	na	na	na	na	na	na	na	na	0.56	15.56	7.76
	12	na	na	na	na	na	na	na	na	na	na	0.52	13.82	7.88
	13	na	na	na	na	na	na	na	na	na	na	0.50	13.83	9.33
	14	na	na	na	na	na	na	na	na	na	na	0.46	13.25	8.53
	15	na	na	na	na	na	na	na	na	na	na	0.42	12.22	10.37
	16	na	na	na	na	na	na	na	na	na	na	0.33	12.00	4.56
	17	na	na	na	na	na	na	na	na	na	na	0.27	10.48	4.55
	18	na	na	na	na	na	na	na	na	na	na	0.28	9.87	2.39