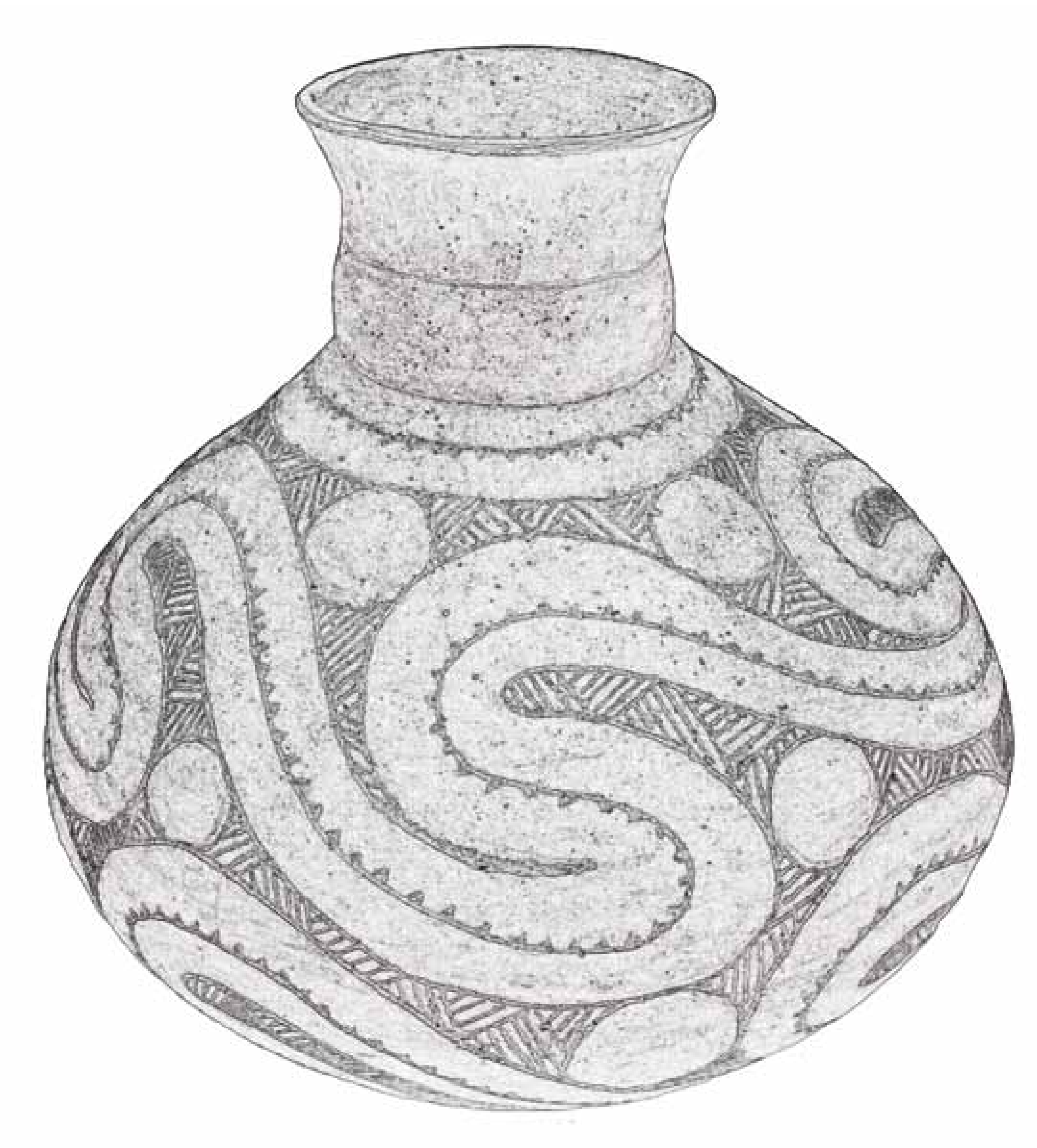
Caddo Archeology Journal



Volume 21 2011

Caddo Journal

ISSN 1522-0427

Stephen F. Austin State University Press
2011

Printed in the United States of America
at Hudson Printing in Longview, Texas

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Some Notes on Replicating Prehistoric Pottery

John Miller

Introduction

My interest in pottery replication began about 30 years ago. As an archeologist, I was often required to analyze collections of prehistoric pottery. My analytical techniques were limited but standard for the day and usually involved classifying pottery according to previously defined pottery types and varieties. While this type of classification helps archeologists develop chronologies and determine cultural affiliation, it provides little understanding of how pottery was actually made. I felt that I might be able to enhance my analytical skills and possibly glean a little more from the archeological record if I could learn more about how pottery was made. So in 1978, I gathered some alluvial clay from the Arkansas River floodplain and began my long journey. My primary objective has been to try and reproduce, as closely as possible, what I see in the archeological record in hopes that it might give me and others a better understanding of all the processes involved in the manufacture of prehistoric pottery. I sometimes find that I can't see what I am looking at in sufficient detail until I am faced with the task of having to draw or make it. Replication forces us to take a closer look at things and then allows us to see a little more clearly. Replication also connects you to the past and allows you to learn directly from the original artist. For me, it was simply not enough to just study pottery – I had to experience it.

During my journey, I have drawn information from a variety of resources. These include a careful analysis of prehistoric pottery, an extensive review of archeological and ethnographic documentation regarding Indian pottery manufacture in the Southeast, studying modern cultures that still use traditional pottery making techniques, consulting with Indian potters, archeologists other replicators and through trial and error coupled with careful observation and comparison (basic Experimental Archeology).

Most of my efforts have been focused on replicating pottery types that I am familiar with and that I have had the privilege to study first hand. These include types that are commonly found in Arkansas, many of which are attributed to highly skilled Caddo and Quapaw potters. While I have made replicas of Woodland period pottery, I mostly enjoy the challenge of the shell tempered wares from the Mississippi and Protohistoric periods. I like the diversity of vessel forms and designs that develop during these periods and have a deep appreciation of the incredible artistic talents of the original potters.

While I am not a purest, (that is I don't start my fires with a bow drill and I occasionally use modern tools) I usually try to stick with the processes and materials that would have been available to the Indian potters. My operating plan is loosely modeled after the ethnographic accounts of Natchez potters that were recorded by the French in the mid 18th century. Natchez pottery is technologically very similar to some of the Mississippi period pottery that occurs in Arkansas (especially Caddo and Quapaw pottery). Even though the historic accounts are somewhat vague, they are some of the best first hand records of pottery making in Southeast by a culture that was essentially still living in the Mississippian tradition.

The following outline documents the replication process that I have developed over the years that works best for me. The outline is based on a handout that I developed to distribute during presentations and is very general. It is largely pictorial because the process is difficult to convey with words alone. While we will never know for sure exactly how the Southeastern Indians made their pots, the process outlined below can result in pottery that is technologically very similar to some of what we see in the archeological record. While there is often more than one way to do things, I think the key to understanding many lost technologies can be boiled down to efficiency. Once you find the process that reaches the desired goal with the least amount of energy expended, you are probably getting close to recreating the process that was actually used. Give me another thousand years or so and I might catch up with the skilled Indian potters of the past!

Figure 1.

The first step in the process is to prepare the clay and tempering material. I have had the best results with gray backswamp clays (often called "gumbo" or "buckshot" clays) which occur along most stream systems throughout the State. These are very fine-grained clays that have a high shrink-swell ratio and generally contain lots of iron and other impurities that allow the clay to fire within the relatively low temperatures ranges produced in an open ground fire. While these clays are not suited for most modern ceramic applications, they appear to be the type of clay preferred by many of the Indian potters. I collect most of my clay from stream banks, road cuts or fields and have experimented with numerous samples from just about every corner of the State. The clay in the bowl on the left was collected from a backswamp deposit in the Ouachita River floodplain south of Arkadelphia. It is classified as Tuscumbia Silty Clay and it may be the same clay used by some of the Caddo potters who lived in the area in prehistoric/early historic times. It has been dried and crushed and any large inclusions (pebbles or vegetal material) have been removed. The tempering agent in the bowl on the right is crushed mussel shell which was preferred by many prehistoric potters after about 1000 A.D. The shells were collected along the White River, burned to facilitate crushing, crushed and screened to obtain the proper particle size.

Figure 2.

The clay and temper are thoroughly mixed together in a dry state (upper photo). Temper reduces the high shrinkage rate of the backswamp clay and allows the pottery to fire properly. It also has adverse affects as it decreases the clays plasticity and makes the pot weaker. Different clays require different amounts of temper to fire properly and it often takes a lot of experimentation to come up with the proper mix when new clay sources are used. Most prehistoric pottery has between 25% to 50% temper by volume. This mix is about half clay, half temper. Once the clay and temper have been thoroughly mixed, the mix is covered with water and allowed to sit over night so that all clay particles are thoroughly moistened. The excess water is then poured off and the mix is allowed to dry to a point where it can be kneaded. Kneading is done by hand and must be thorough enough to achieve a homogeneous mix. Once the clay is kneaded, it can be stored in loaves (lower photo) indefinitely as long as it is kept moist. Aging the mix for a few weeks sometimes improves the plasticity.

Figure 3.

These are a few of the tools that I use to make pots. They include a plaster bowl that I use as a press mold for the base of the pot, a Masonite board to roll out clay coils, old credit cards for smoothing the exterior of the pot, an elliptical wood scraper for smoothing the interior of the pot, an old corncob and a wooden paddle for rough shaping and several smooth stones for burnishing the surface as the pot dries. Complete potter's tool kits from archeological sites are relatively rare. The smooth polishing stones are often found on ceramic bearing sites but many of the other tools used may have been made of wood, bone, gourd rinds or other materials that tend to decay. Other tools may be somewhat ubiquitous and difficult to identify – for instance old pots, baskets or wooden bowls were probably used as press molds. Discarded mussel shells sometimes show wear along one edge and may have been used to smooth the interiors of pots. Cordmarked pottery found on some sites seems to indicate that cord wrapped wooden paddles were sometimes used in the shaping process.

Figure 4.

To start the forming process, I press mold the base of the pot using a shallow bowl or other form (in this case a plaster bowl). To do this I flatten out a lump of clay to the proper thickness and press it into the form. The form or mold serves as a support until the limp clay becomes dry and stiff enough to retain its shape. The mold also allows the work to be turned easier which facilitates keeping the pot symmetrical. Press molding is documented in the ethnographic record and indirect evidence of it can be observed in some of the prehistoric vessel shapes. Maintaining consistent thickness is important as it affects the drying and firing processes. Pottery from most archeological sites is much thinner than modern wheel thrown pottery and I generally try to make my pots as thin as possible (about 1/8 to 3/16's of an inch thick for most medium sized pots).

Figure 5.

The walls of the pots are built up by adding flattened coils to the base. I generally roll out the coils and flatten them to about the same thickness as the base. They are then attached to the base by pinching. The use of flattened coils is documented in the early photographs of southwestern Indian potters but most evidence from archeological sites here in Arkansas show the use of round coils about the diameter of one's little finger. I find it much easier to control the intended vessel shape and size using flattened coils.

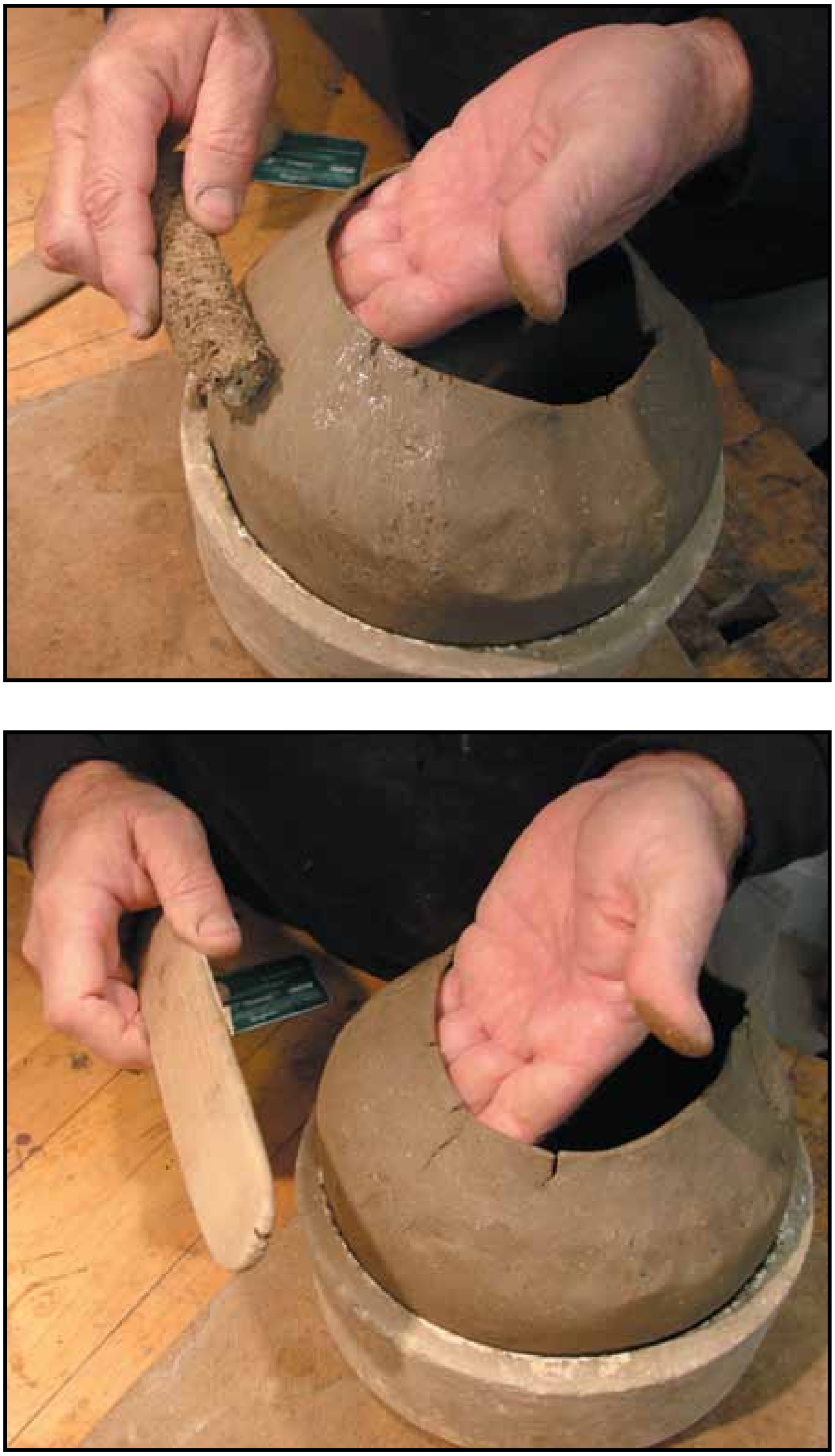

Figure 6.

A wet corncob and various scrapers are used to help weld the coils together and to even up the walls (upper photo). A wooden paddle is used to help adjust the shape of the pot and thin the walls (lower photo).

Figure 7.

When the body of the bottle is complete, the neck is added. In this case, I am making the neck with flattened clay coils. In some cases, I make the neck separately and attach it when both the body of the pot and the neck have dried to a leather-hard state. Archeological evidence shows both techniques were used. The lower left photo shows the pot after the addition of the first coil; the photo on the right shows the neck taken to its full height. It will be smoothed and trimmed as soon as it stiffens.

Figure 8.

The finished pot, after it has been decorated and dried, but not yet fired.

Figure 9.

Burnishing is a process that involves rubbing a smooth object (usually a polishing stone) over the surface of the pot beginning at the leather hard-state and continuing periodically until the pot is dry. Burnishing compacts the surface of the pot making it less porous and adds a shine that is sometimes mistaken for a glaze. Smooth, well-worn polishing stones are often found on ceramic bearing archeological sites.

Figure 10.

When decoration is applied by engraving, the pot is generally burnished and allowed to dry for several days. I generally pencil in the major design elements by eye. Engraving is done with a metal awl – in this case a sharpened nail. Engraving on prehistoric pottery was probably done with flint flakes. I have used these but they make the process a little more time consuming and difficult. Once the major design elements are engraved, the rest of the elements fall into place and are engraved by eye.

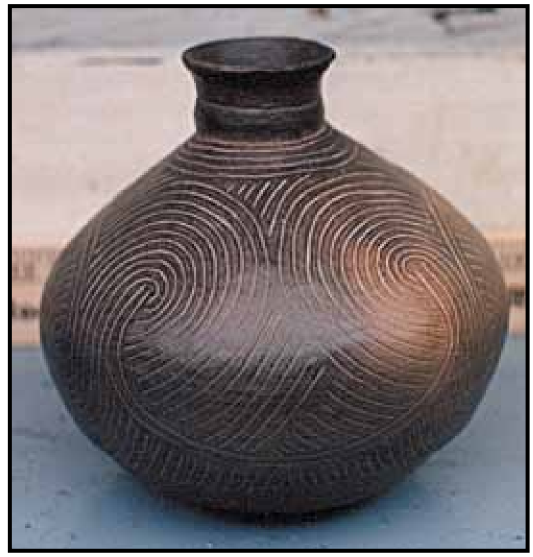

Figure 11.

Incised designs (upper photos) are applied when the pot has dried to a leather- hard state. For fine line incising, I use a smooth pebble (lower photo) but a variety of tools can be used. Incised designs are a little more difficult to produce than engraved designs because they cannot be drawn out on the surface of the still moist pot. You must have a good mental template of the design in your head and just go with the flow.

Figure 12.

Pots are generally allowed to dry for at least 2 or 3 days before firing. No archeological evidence of pottery kilns has ever been found at Indian sites in Arkansas. Ethnographic accounts and archeological evidence indicate that pottery was fired in relatively uncontrolled open ground fires. The first step in the firing process involves pre-heating the pots in order to remove the atmospheric water. This involves building a small fire and letting it burn down to coals, then raking out the center of the coal bed and adding the pots to allow them to slowly absorb heat. It's important not to let the pots come in direct contact with the coals, hence the reason I have elevated these pots on pieces of wood. The pots need to reach the boiling point (100C) to remove the atmospheric water. This process usually takes about 15 minutes. It is sometimes referred to as "water smoking" by some of the South American tribes since steam can often be seen rising from the pots as the atmospheric water vaporizes.

Figure 13.

Once the atmospheric water has been removed, fuel is placed over the pots and allowed to catch fire. It doesn't take much; I usually fire my pots down by the river using readily available driftwood as shown in the picture above.

Figure 14.

The fire is allowed to burn down and no additional fuel is added. The process takes about 20 minutes and generates enough heat to force a chemical change in the backswamp clays. Technically, the molecular water is driven off and the clay turns to pottery which will last for centuries. Refiring experiments on archeological ceramics indicate that most Indian pottery was relatively low-fired (somewhere between 500C and 700C). Getting this pottery too hot will cause problems with some types of tempering agents and the pots can actually begin to melt. These types of clays usually contain iron and other impurities that act as fluxes during the firing process. They are ideally suited for this type of technology but are avoided for modern ceramic applications.

Figure 15.

Once the fire has burned down, the pots can be removed from the fire and allowed to cool. Because of the high temper content, they are extremely resistant to thermal shock. I have taken pots out of the fire and tossed them directly into the river without any adverse effects. Once fired, the pots will hold water without dissolving back into clay and can be placed directly over open flames for cooking without pre-heating.

Figure 16.

When the proper temper/clay mix is not correct and the atmospheric water cannot escape slowly enough, spalling will occur. I probably lost my first 200 to 300 pots during the firing process before I finally reached the proper mixture necessary to withstand the rapid temperature rise that occurs during open ground firings. I now rarely lose any vessels in the firing process.

Figure 17.

A reducing firing atmosphere can be used to produce jet black pottery. A reducing fire is one in which there is a lot of carbon – or simply a very smoky fire. When I want to turn pots black, I simply smother the fire with leaves, grass or pine needles while the pots are very hot (upper photo). The pots will actually absorb some of the carbon produced by this process and turn black. This color will be permanent as shown in the two pots cooling on the log in the lower photo.

Figure 18.

Red and white pigments were commonly used for decoration. Analysis of archeological examples indicates that white pigments are most often kaolin clays – the same types of clays used by modern potters to make china and porcelain. The red pigments are usually clays that contain a lot of oxidized iron. These clays are generally found on older landsurfaces in the uplands and were rarely, if ever, used for actually making pots. These clays will retain their natural color when fired in an oxidizing atmosphere, unlike the backswamp clays which will change from gray to buff during firing. These clays were used for making slips that were applied to the pot at a leather hard state and were also rubbed into engraved and incised lines of pots after firing to highlight the decoration.

Figure 19.

Slip designs must be applied to the pot while it is leather hard otherwise they will not adhere to the surface. Slips are prepared by adding enough water to the slip clay to give the mix a cream-like consistency. Slips are not tempered and are applied to the pot by finger or brush in a very thin layer. If slips are intended to change the color of the vessel, they must be fired in an oxidizing fire – i.e. a very clean burning fire with a lot of oxygen present. These two pots show red and white slip designs and have been fired in an oxidizing fire. The slips have retained their natural color while the underlying backswamp clay used to make the pots has turned a buff color.

Figure 20.

The black color seen on polychrome pots may have been made using finely ground manganese concretions. I replicate this color by mixing ground manganese with water and applying the mixture to the pot before it is completely dry. It is then burnished into the surface of the pot producing a mechanical bond with the clay body. The pot is then fired in an oxidizing atmosphere (see Miller 2010:3-6 for more on this subject). Please note that manganese can be toxic if ingested or inhaled and must be handled carefully. This may be why the rarely occurring pottery type Avenue Polychrome occurs primarily as a mortuary offering and does not appear to have been used for food preparation or storage.

Figure 21.

After firing, red or white clays were often rubbed into engraved and incised lines to highlight the decoration. These are usually the same clays used for slip decoration.

Figure 22.

The pictures above show a few examples of the possible design combinations using different techniques: a. black bottle fired in a reducing atmosphere with red pigment rubbed into the engraved design; red slipped bottle fired in an oxidizing atmosphere with white pigment in the lines; b. bottle fired in a reducing atmosphere with white pigment in the engraved lines; c. bowl with red slipped interior fired in an oxidizing atmosphere and white pigment rubbed into the incised designs; d. red and white slipped bottle and a red slipped bottle with the underlying buff colored clay body showing; both fired in an oxidizing fire.

Suggested References

Dumont de Montigny, Louis Francois Benjamin

1753 *Memoires historiques sur la Louisiane.* Le Mascrier (ed.). Paris, vol. 1, p.154; vol. 2, pp.271 – 273.

Le Page du Pratz, Antoine S.

1758 *Histoire de la Louisiane.* Paris, vol. 1, pp. 124; 163-164; vol. 2, pp.178-179.

Miller, John

2010 The Other Color; Replicating the Black Stain on Avenue Polychrome Pottery. In *Newsletter of the Arkansas Archeological Society* 357:3-6. Fayetteville.

Mountain Fork Archaeology: A Preliminary Report on the Ramos Creek Site (34MC1030)

Elsbeth Linn Dowd

Introduction

In May-June of 2010, the University of Oklahoma and the Oklahoma Archeological Survey co-sponsored a field school at the Ramos Creek site (34MC1030) in southeastern Oklahoma. Ramos Creek is located in the Ouachita Mountains along the Mountain Fork, a tributary of the Little River. Recently identified by the U.S. Forest Service (USFS), this site is the northernmost known site with a Caddo component along this stream (Figure 1). The best-known Caddo sites identified for this drainage were tested during the Oklahoma River Basin Survey project of the 1960s and today are covered by the man-made Broken Bow Lake. Archaeological investigations along the Mountain Fork have been conducted by Wyckoff (1961, 1965, 1966, 1967a, 1967b, 1967c, 1968), Klinger and Cande (1987), Perttula et al. (1998), and Perttula and Nelson (2004). This past summer's work at Ramos Creek is part of a broader research program addressing several questions:

- What was the relationship of Ramos Creek to sites further downstream, including the multi-mound Woods Mound Group?
- How were the Caddo sites in this drainage organized politically and what social dynamics shaped their history? Is there a better way of understanding the socio-political organization of these communities than applying models used in other parts of the Caddo area and the wider Southeast?
- How were these communities related to those living in other parts of the Caddo archaeological area, including the rest of the Ouachita Mountains, the Little River Valley, the Red River Valley, and the Arkansas Valley?

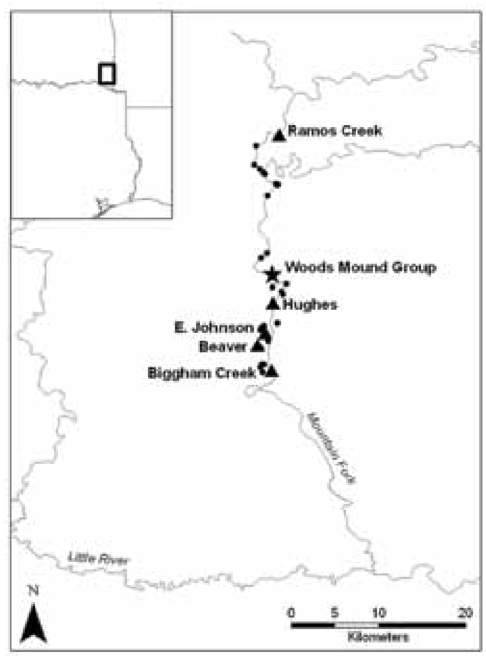

Figure 1. Ramos Creek site in relation to other Caddo sites along the Mountain Fork.

These questions form the basis of my dissertation research, which will examine the socio-political dynamics of communities living along the Mountain Fork during the late prehistoric period. This paper serves as a preliminary report on the field school at Ramos Creek.

Setting

The Ramos Creek site is located within the Ouachita National Forest in southeastern Oklahoma. It is within the Ouachita Mountains physiographic region, at the very eastern end of the Boktuklo Mountains where that range hooks south. The site is on a terrace along the Mountain Fork, which flows south out of the mountains into the Little River. Although the river valley is narrow downstream, it is wider from this point northward. The site is on a heavily forested pine plantation.

Excavations

During the initial site survey the USFS recovered a variety of artifacts from shovel tests, including dart points, pottery, and charred maize cobs. The stratigraphy and artifacts indicated that the site contained multiple components, including a late prehistoric component. In the summer of 2009, a 1x2 m unit was excavated where the maize cobs were recovered. At 20-25 cm below the surface a number of artifacts were observed, including charred wood, more charred maize, daub, and fire cracked rock. These materials were present to a depth of 35 cm below the surface. No features were detected, though. Based on the hypothesis that these deposits were associated with a structure, work was stopped until a broader area could be excavated.

Goals for the 2010 field school included constructing a topographic map of the site, conducting intensive shovel tests across the terrace, and opening test units near known artifact concentrations (Figure 2). 145 shovel tests were put in across the eastern and western portions of the landform; 104 were positive. Locations for excavation were determined based on artifact concentrations recovered during the USFS survey, the indications of a structure at the test unit, and the close-interval shovel testing conducted by the field school. Two sets of units (Blocks 1 and 2) were opened on the eastern side of the site near the potential structure and a third set of units (Block 3) was opened on the western side of the site. Each excavation unit was identified by the location of its southwest corner along an arbitrary grid. Blocks 1 and 2 contained features directly related to the Caddo component. Block 3 contained no Caddo features, although pottery was found in the upper levels. The lower levels of Block 3, however, revealed a burned rock cluster associated with three Dalton point fragments. This feature was an exciting discovery that will complement other investigations of Early Archaic sites in the Ouachita National Forest (Coleman et al. 2009:36-39; Coleman 2010).

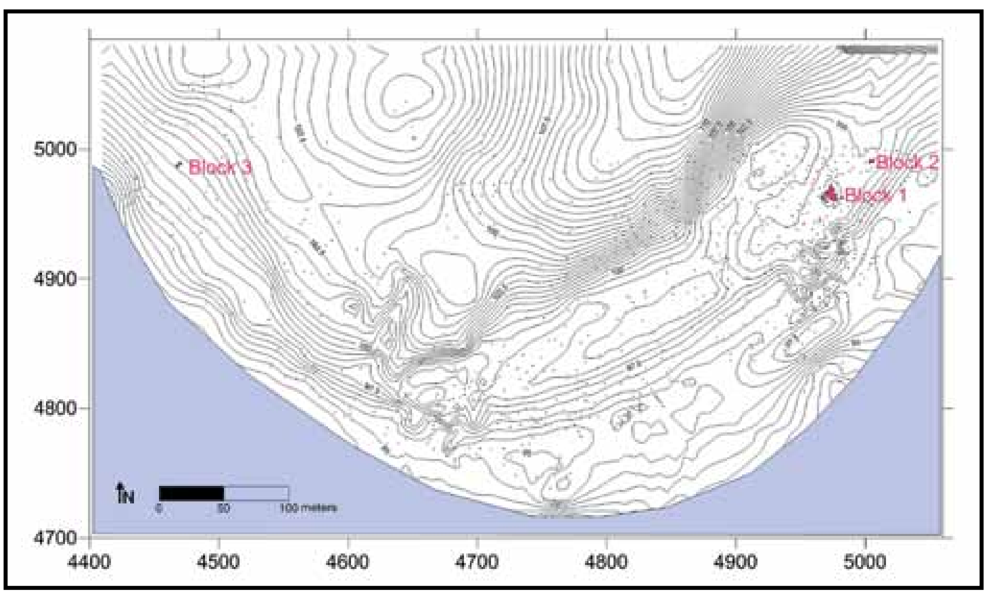

Figure 2. Map of Ramos Creek site, showing the distribution of shovel tests and excavations conducted by the field school.

Preservation of some organic materials at Ramos Creek was remarkably good for southeastern Oklahoma. Although no faunal remains were recovered, charred maize cobs were found in Block 1. Soil samples from the Caddo component are currently undergoing flotation to examine the subsistence practices of this community.

Block 1

Block 1 was located on the eastern end of the site, at the location where the charred maize cobs were found and the presence of a structure was hypothesized. The field school excavated 59 square meters, exposing most of a rectilinear structure (Figure 3). Because the site is heavily forested not all of the structure could be uncovered, but fortunately most of the large trees missed the floor area. Level depths were standardized across the excavation area in relation to the elevations measured by the total station, using the elevation of the southwest corner of each unit. Units were excavated in 10-cm levels to a depth of 99.85 (in the center of the structure this was 20 cm below datum) and thereafter in 5-cm levels to subsoil (45-50 cm below datum). Excavation in units outside of the structure did not continue all the way to subsoil because of time constraints.

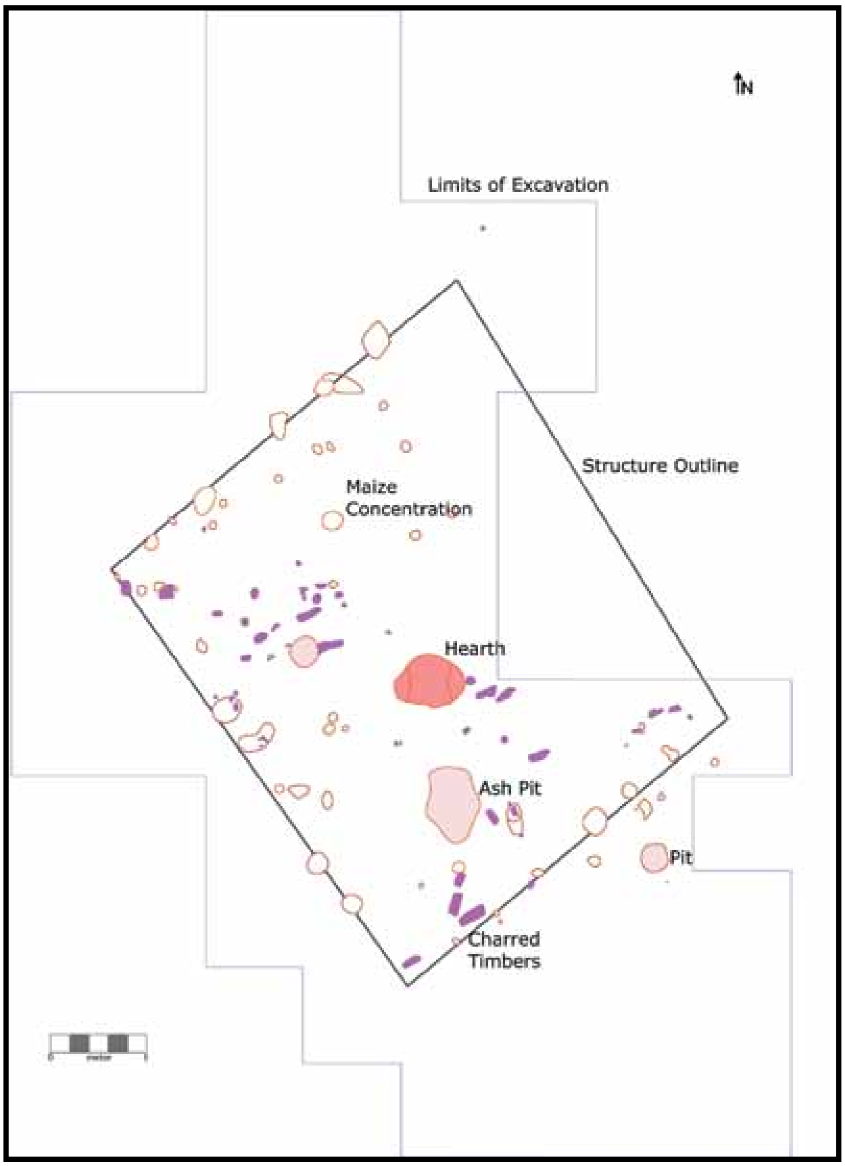

Figure 3. Outline of structure, features, and charred timbers in Block 1.

Sediments within the structure consisted of a dark brown to dark yellowish brown sandy silt A-horizon overlying a mottled dark brown to very dark grayish brown cultural horizon. A dark yellowish brown sandy silt C-horizon (subsoil) was beneath the cultural horizon within the structure and beneath the A-horizon outside the structure. No B-horizon development was apparent in Block 1. These sediments are part of the Ceda-Rubble alluvial complex (Soil Survey Staff).

The structure became visible approximately 25-35 cm below the surface, when a dark grayish brown to black outline and charred timbers appeared. The charred timbers were all located within the perimeter of the structure, suggesting that the structure was intentionally burned, pushed in on itself, and smothered. Features, including a central hearth, ash-filled pit, and post holes, became apparent at about 35-45 cm below the surface. The presence of these features and a number of larger artifacts lying horizontally at this level imply that the living surface of the structure was probably about 40 cm below the present ground surface. The structure was rectangular in plan, possibly with rounded corners, and measured about 5.5 by 4.5 meters. The long axis was oriented NW-SE (132 degrees east of true north). No entrance was detected, but a lower density of artifacts along the southwest side may imply that the entrance was located along this wall. This cannot be confirmed because trees prevented the excavation of the opposite wall.

Features associated with the structure include a central hearth, an ash-filled pit to the south of the hearth (F6), a cluster of charred maize cobs northwest of the hearth, a pit outside the southeast edge of the structure (F13), and post holes. A number of large flat rocks that may have functioned as cooking platforms or grinding surfaces were located near the hearth (Figure 4). One deep center post hole (F16) was located one meter west of the hearth. It measured 25 cm in diameter at the floor level and 8 cm in diameter at its base. This post hole extended 120 cm below the surface and 80 cm below the floor of the structure.

It was difficult to confirm whether certain soil stains were actually post holes, because of the large quantity of roots and leaching in this well-drained sandy pine forest soil. The high level of charcoal fragments and pieces of charred timber embedded within some of these stains and the relationship of the stains to the perimeter of the structure supported the interpretation that many were indeed post holes. The post holes around the perimeter of the structure tended to measure either 20-28 or 15 cm in diameter. Along the northwest wall, where the post holes were best-defined, they were regularly spaced about 70 cm apart. Other definite and probable post holes around the perimeter confirm this pattern. A series of smaller post holes inside the northwest wall measuring about 10 cm in diameter may indicate a rebuilding episode, the need for additional support, or the presence of a bench or other platform.

Concentrations of daub were present in small quantities throughout the structure, especially near the hearth and in the northwest section. The largest piece was no more than 5 cm long and most pieces were nickel-sized or smaller. None contained impressions of building materials.

Pottery sherds (n=471, including 93 diagnostic), lithic debitage (n=5012), and chipped- (n=36), ground- (n=7), and pecked-stone tools (n=4) were all found in Block 1 (Table 1). Artifact analysis is ongoing, but diagnostic sherds included red-slipped sherds from a carinated bowl, compound bowl, and bottle along with incised sherds with appliqué strips and ridge-pinched neck banding from jars (Figure 5). Point types included Reed, Fresno, and Scallorn. The points and debitage consist of local raw materials including Big Fork chert, John's Valley chert variants, novaculite, siltstone, and quartzite. The lithic tools were most densely concentrated near the hearth and in the southeast part of the structure. Pottery and lithic debitage were more evenly distributed across the structure, although a larger number of identifiable clusters of pottery sherds were located in the southeast part of the structure. This may indicate that this area was used for storage or food preparation. The presence of large rock slabs to the southeast of the hearth further supports this interpretation.

Figure 4. Central hearth from Block 1 structure and nearby rocks and ground stone, 40 cm below datum.

Quartz (n=196, weight=394.4 g) and fire-cracked rock (n=3304, weight=31,485 g) were also present in Block 1. It is likely that most of the quartz is natural, because quartz crystals were widely distributed across the site and large quartz veins occur nearby (Miser 1943). The quartz will be further examined for evidence of modification. The quantity of fire-cracked rock in the Block 1 structure was large, but not unexpected for a burned structure in a shale-rich alluvial soil. Interestingly, the distribution of fire-cracked rock within the structure mirrors the distribution of debitage. In both cases a much lower concentration occurred within the middle of the southwest wall, suggesting the potential presence of an entrance on this side (as discussed before).

Table 1. Artifacts from 2010 Excavations at Ramos Creek.

Provenience	Pottery		Lithic Debitage (n)	Chipped Stone Tools (n)	Ground Stone Tools (n)	Pecked Stone Tools (n)	Quartz		FCR	
	All Sherds (n)	Diagnostic Sherds (n)					n	weight (g)	n	weight (g)
Block 1 (structure)	471	93	5012	36	7	4	196	394.4	3304	31,485
Block 2	218	22	651	7	0	0	24	40.4	180	3,753
Block 3	115	16	1036	15	0	0	10	15.1	272	3,984
Shovel Tests	23	4	373	4	0	1	4	3.6	116	3,904
Total	*827*	*135*	*7217*	*64*	*7*	*5*	*234*	*453.5*	*3,872*	*43,126*

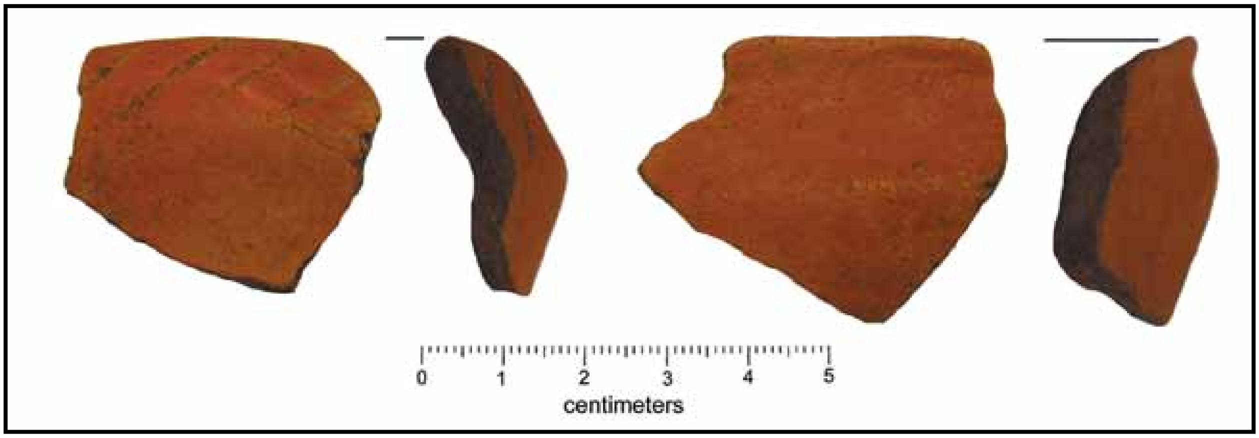

Figure 5. Two red-slipped pottery sherds from structure in Block 1.

Radiocarbon Dating

Twelve radiocarbon dates (3 AMS and 9 radiometric; Table 2) were obtained from charcoal samples from the Block 1 structure. The samples included charcoal from post holes and from charred timbers. At 2 sigma, the calibrated dates range from A.D. 1230 to 1630 (Figure 6). The pooled dates yielded a calibrated age of A.D. 1319-1350 or 1391-1412 (Buck et al. 1999; Figure 7). These date ranges compare well to calibrated dates from Woods Mound Group (34MC104) and place the Block 1 structure within the later part of the middle Caddo period (ca. A.D. 1200-1400).

Table 2. Radiocarbon dates from the Ramos Creek site (34MC1030).

Lab #	AMS or Radiometric	Measured Radiocarbon Age (BP)	13C/12C Ratio	Conventional Radiocarbon Age (BP)	2 Sigma Calibration (AD)	Intercept of radiocarbon age with cal curve (AD)	Catalog No.	Provenience
Beta-284398	Radiometric	410 ± 40	-25.7 o/oo	400 ± 40	1430-1530 and 1560-1630	1460	OUA10_20_385	N4964 E4974, 26-30 cmbd, charred timber
Beta-284390	AMS	520 ± 40	-27.9 o/oo	470 ± 40	1410-1460	1440	OUA10_20_159	N4966 E4972, 34 cmbd, post hole
Beta-284391	Radiometric	550 ± 50	27.1 o/oo	510 ± 50	1320-1350 and 1390-1450	1420	OUA10_20_234	N4964 E4970, charred timber
Beta-267780	AMS	530 ± 40	-25.8 o/oo	520 ± 40	1320-1350 and 1390-1440	1420	OUA10_20_449	N4966 E4972, 30-35 cmbd, charcoal
Beta-284396	Radiometric	560 ± 40	-26.3 o/oo	540 ± 40	1310-1360 and 1390-1440	1410	OUA10_20_355	N4964 E4972, 20-24 cmbd, charred timber
Beta-284392	AMS	590 ± 40	-26.8 o/oo	560 ± 40	1300-1370 and 1380-1430	1400	OUA10_20_266	N4966 E4972, 33 cmbd, post hole
Beta-284397	Radiometric	640 ± 50	-27.1 o/oo	610 ± 50	1280-1420	1320 and 1350 and 1390	OUA10_20_372	N4964 E4972, 20-25 cmbd, charred timber
Beta-284399	Radiometric	650 ± 50	-26.1 o/oo	630 ± 50	1280-1420	1310 and 1360 and 1380	OUA10_20_417	N4962 E4974, 33 cmbd, post hole (F12)
Beta-284393	Radiometric	650 ± 50	-25.6 o/oo	640 ± 50	1270-1410	1300 and 1370 and 1380	OUA10_20_268	N4962 E4974, 20-25 cmbd, charred timber
Beta-284394	Radiometric	690 ± 40	-25.6 o/oo	680 ± 40	1270-1320 and 1350-1390	1290	OUA10_20_353	N4964 E4972, 21-24 cmbd, charred timber
Beta-284400	Radiometric	710 ± 50	-26.2 o/oo	690 ± 50	1260-1330 and 1340-1400	1290	OUA10_20_422	N4972 E4972, 50 cmbd, post hole (F11)
Beta-284395	Radiometric	730 ± 50	-25.9 o/oo	710 ± 50	1230-1320 and 1350-1390	1280	OUA10_20_354	N4964 E4972, 20-24 cmbd, charred timber

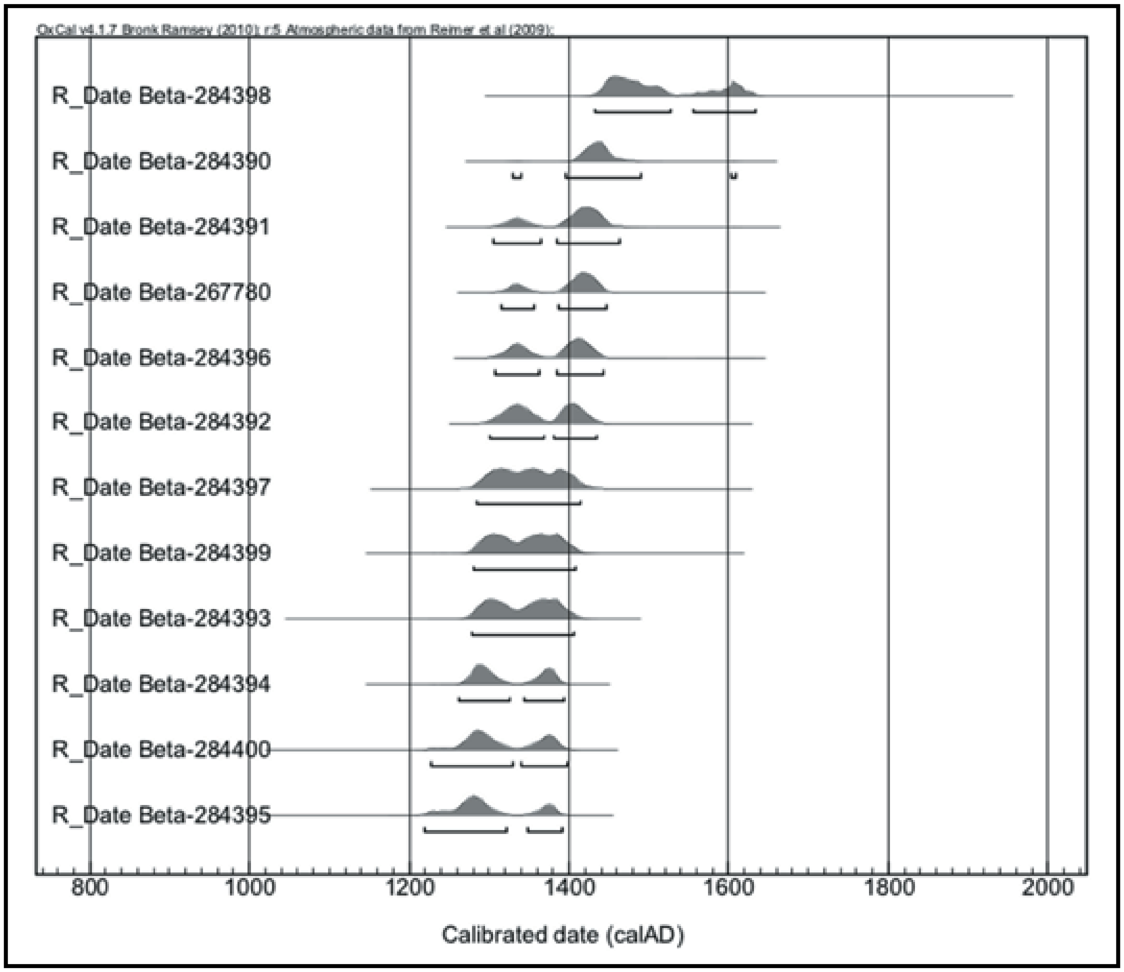

Figure 6. Ramos Creek dates from structure at Ramos Creek, calibrated using OxCal 4.1 with IntCal 09 curve.

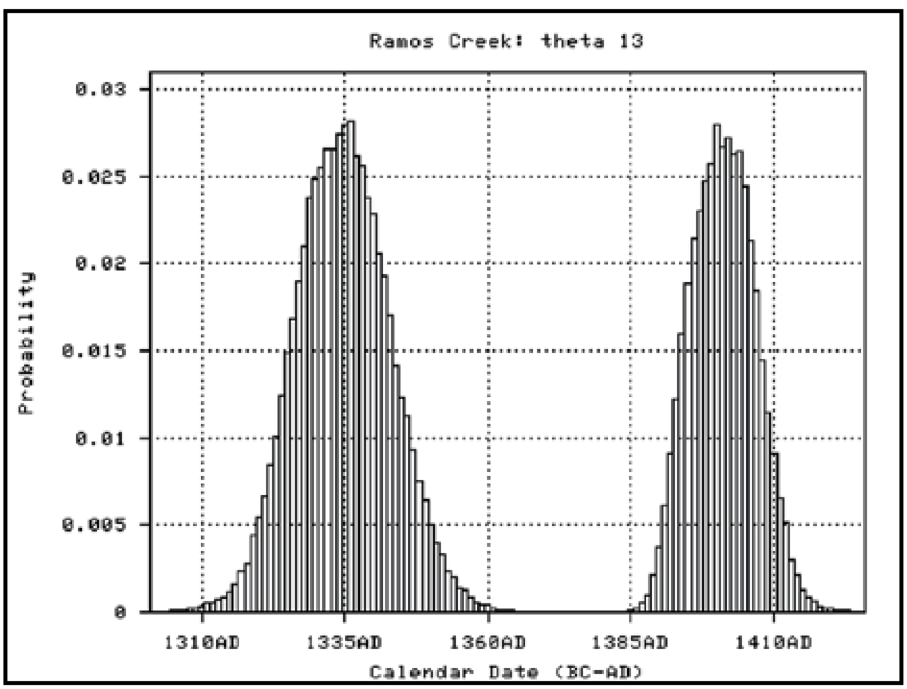

Figure 7. Pooled and calibrated radiocarbon dates from Caddo structure at Ramos Creek, using http://bcal.sheffield.ac.uk (Buck et al. 1999) with IntCal09.

Block 2

On the second day of the field school, a shovel test exposed part of an Archaic point. This shovel test was located about 35 meters northeast of Block 1, on the same terrace landform. Two contiguous 2x2 m units were opened next to the shovel test to examine the stratigraphy of the landform and to attempt to identify the Archaic component. We planned to excavate both units in 10-cm levels; however, a feature (F5) containing Caddo pottery was encountered 32 cm below the datum in the western unit.

Excavation of the western unit continued as planned. Nine 10-cm levels were excavated. The first four levels contained the vast majority of the artifacts, which included lithic debris and pottery sherds (Table 3). This artifact concentration co-occurred with a brown to dark brown silty sand A-horizon (Figure 8). Artifact density dropped off dramatically after 40 cmbd and no artifacts were found in Level 9. Between 40-50 cmbd a diffuse wavy boundary marked the transition to a yellowish-tan sandy silt C-horizon. At 60-70 cmbd a clear wavy boundary separated the first C-horizon from another C-horizon (2C), a dark yellowish brown to red sandy clay that grew increasingly hard. At 90 cmbd, a hand auger was used to take two cores, one in the north of the unit to 33 cm below the unit floor (123 cmbd) and one in the south of the unit to 35 cm below the unit floor (125 cmbd). No change in the sediment occurred nor did any artifacts appear, so excavation of this unit ceased.

Table 3. Block 2: Count of Pottery Sherds and Lithic Debitage by 10-cm level in Unit N4990 E5005.

Level	N4990 E5005 Pottery Sherds (n)	N4990 E5005 Lithic Debitage (n)
Level 1	1	25
Level 2	2	54
Level 3	4	73
Level 4	0	42
Level 5	0	0
Level 6	0	4
Level 7	2	4
Level 8	0	1
Level 9	0	0

A 1x1 meter unit was opened just south of the eastern unit of Block 2 to expose Feature 5, a pit feature containing a concentration of pottery sherds. The majority of pottery from Block 2 came from this feature, including 22 diagnostic sherds. These sherds included two rim sherds from a ridge-pinched neck-banded jar with appliqué pseudo-handles (Figure 9). One handle came off when the sherd was washed, illustrating that the pseudo-handle was originally applied after the entire neck had already been ridge-pinched.

Figure 8. Block 2 profile facing east, depth 90 cm below datum.

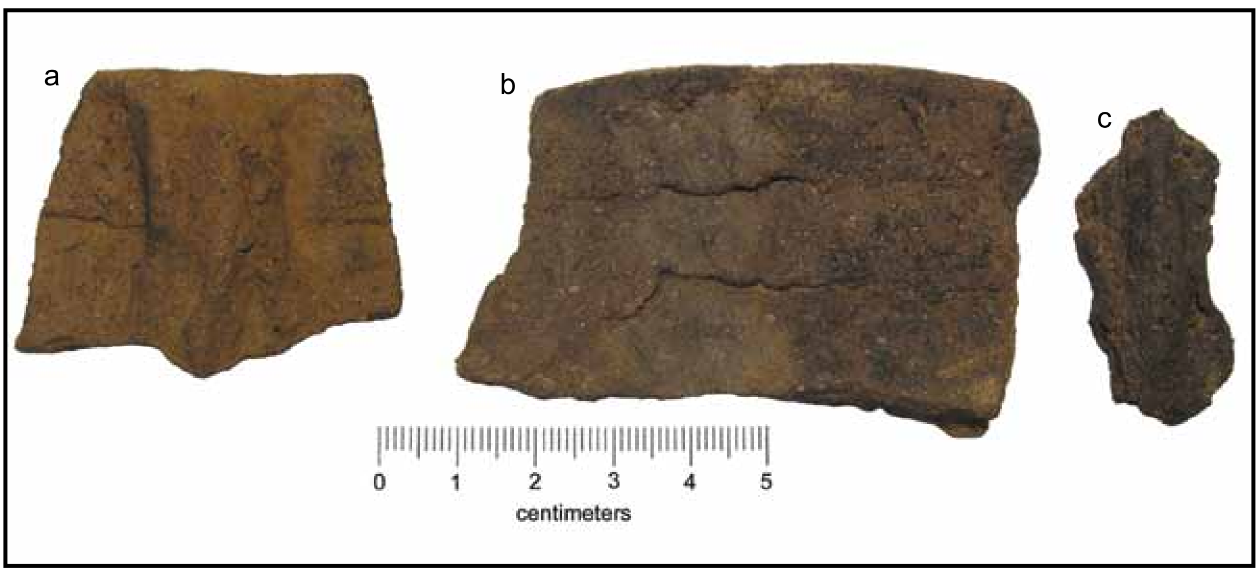

Figure 9. From Feature 5 in Block 2, a rim sherd of a ridge-pinched neck-banded jar with appliqué pseudo-handle (a). When a similar rim sherd was washed, the pseudo-handle came off, showing that the pseudo-handle was applied after the neck was ridge-pinched (b-c).

Given the presence of the pit feature, another Caddo structure was likely in close proximity to Block 2. The features in Blocks 1 and 2 in conjunction with the distribution of pottery sherds in the shovel tests (Figure 10) indicates that the Caddo-period settlement was likely dispersed across this landform.

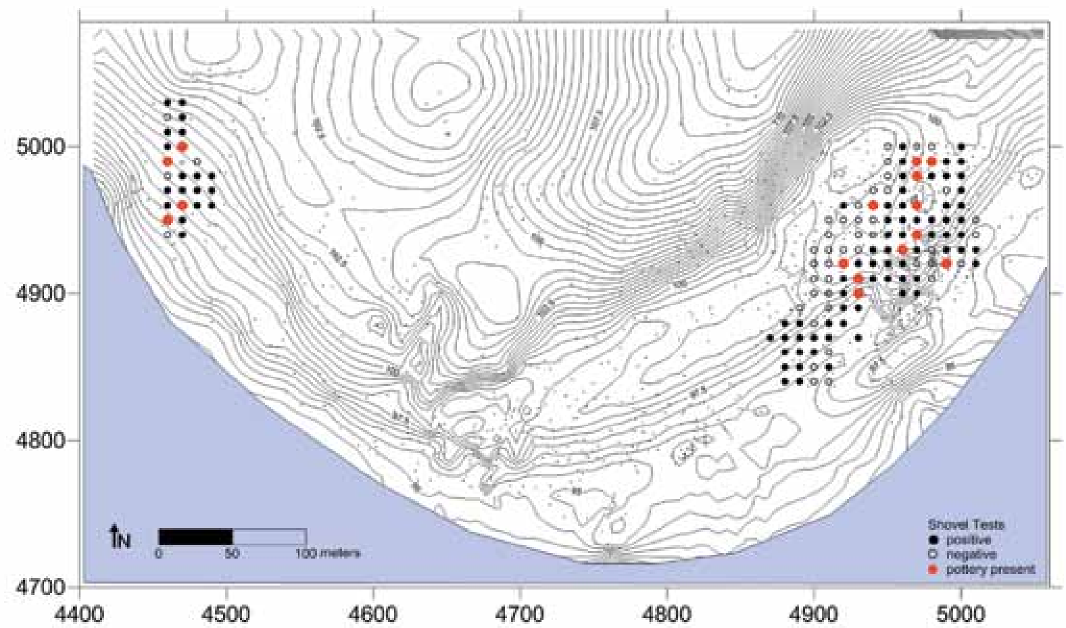

Figure 10. Map of Ramos Creek, showing the distribution of shovel tests in which pottery occurred.

Block 3

A third set of units was excavated on the west side of the site, near the location of another concentration of artifacts found during the USFS shovel tests. The sediments in this part of the site are part of the Sherwood-Zafra complex, which consists of weathered sediments from the bedrock sandstone and shale (Soil Survey Staff). Two 2x2 meter units were excavated in 10-cm levels. Pottery sherds were most heavily concentrated in the first three levels and disappeared entirely by Level 6 (Table 4). A gravel lens appeared at about 50 cm below datum, marking a boundary between the late prehistoric and Archaic components. A number of Archaic points and pieces of fire-cracked rock appeared between 50-60 cm below datum.

Table 4. Block 3: Counts of Pottery Sherds and Lithic Debitage by 10-cm level.

Level	N4986 E4467 Pottery Sherds (n)	N4988 E4469 Pottery Sherds (n)	N4986 E4467 Lithic Debitage (n)	N4988 E4469 Lithic Debitage (n)
Level 1	22	16	61	41
Level 2	18	25	98	89
Level 3	2	19	49	51
Level 4	2	7	66	74
Level 5	1	3	67	71
Level 6	0	0	59	31
Level 7	0	0	42	40
Level 8	0	0	25	40
Level 9	0	0	29	44
Level 10	0	0	9	16
Level 11	0	0	0	11

In the southwest unit a burned rock feature (F2) was encountered in level 7 and was fully uncovered by level 8 (Figure 11). This feature measured 120 cm east-west by 180 cm north-south. The feature extended beyond the unit and was pedestaled as the excavation continued to 110 cm below datum. Three Dalton point fragments were found near the feature 80-100 cm below datum (Figure 12). This feature may be revisited in the future.

Figure 11. Burned rock feature in Block 3, 80 cm below datum.

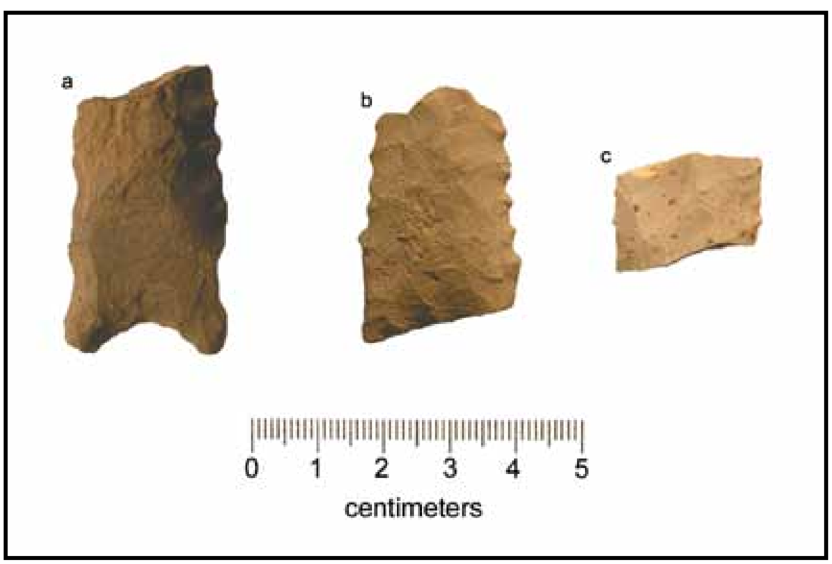

Figure 12. Dalton points from Block 3, 80-100 cm below datum.

Conclusion

Ramos Creek has the potential to contribute significantly to our understanding of both ancestral Caddo and Archaic peoples living in the Ouachita Mountains. This paper is only a preliminary report. In the coming months the artifact and paleobotanical analyses will be completed and examined in a regional context. The results will be published in my dissertation, which will examine the sociopolitical dynamics of the ancestral Caddo living along the Mountain Fork.

Acknowledgements

All of my thanks to Patrick Livingood, Amanda Regnier, Scott Hammerstedt, Don Wyckoff, the Caddo Nation, Bert Pelletier and the U.S. Forest Service, the University of Oklahoma, the Oklahoma Archeological Survey, the Sam Noble Oklahoma Museum of Natural History, Dawn Rutecki, Tim Dowd, Michael Carlock, Truet Hinson, Jo Harrington and her family, Sarah Hunt, Allison Douglas, Chelsea Reedy, and all of our field school students and volunteers. Partial funding for this project came from the National Science Foundation and the University of Oklahoma Graduate Student Senate. This material is based upon work supported by the National Science Foundation under Grant No. BCS-1024314.

References Cited

Buck, Caitlin E., J. Andrés Christen, and Gary N. James
1999 BCal: an on-line Bayesian radiocarbon calibration tool. *Internet Archaeology* 7 (http://intarch.ac.uk/journal/issue7/buck/).

Coleman, Roger E.
2010 Arkansas Dalton excavation hints at cane forest, weapon retooling. *Trowel Marks* 2(2):5.

Coleman, Roger E., Meeks Etchieson, Timothy K. Perttula, and Shawn Marceaux
2009 *Ouachita National Forest: An Archaeological Overview*. Ouachita National Forest, Hot Springs, Arkansas.

Klinger, Timothy C. and Robert C. Cande
1987 *Broken Bow Lake: Cultural Resource Survey at Broken Bow Lake, McCurtain County, Oklahoma*. Reports 87-7. Historic Preservation Associates, Fayetteville.

Miser, Hugh D.
1943 Quartz Veins in the Ouachita Mountains of Arkansas and Oklahoma (Their Relations to Structure, Metamorphism, and Metalliferous Deposits). *Economic Geology* 38(2):91-118.

Perttula, Timothy K. and Bo Nelson
2004 *Archeological Investigations at Five Prehistoric Sites at Broken Bow Reservoir, McCurtain County, Oklahoma*. Report of Investigations No. 49, Archeological and Environmental Consultants, LLC, Austin.

References Cited (cont.)

Perttula, Timothy K., Dan J. Prikryl, Bo Nelson, and Robert L. Cast

1998 *Archeological Survey of the Broken Bow Lake Shoreline and the Relocation and Evaluation of Nine Previously Recorded Sites, McCurtain County, Oklahoma*. Report of Investigations No. 7. Archeological and Environmental Consultants, LLC, Austin.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture

Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/ accessed 12/6/10.

Wyckoff, Don G.

1961 Report on Archaeological Survey of Broken Bow Lake: McCurtain County, Oklahoma. MS on file, Oklahoma Archeological Survey, Norman.

1965 *The Biggham Creek Site of McCurtain County, Oklahoma*. Archaeological Site Report No. 3. Oklahoma River Basin Survey Project, University of Oklahoma, Norman.

1966 *The Hughes, Lamas Branch, and Callaham Sites, McCurtain County, Oklahoma*. Archaeological Site Report No. 4. Oklahoma River Basin Survey Project, University of Oklahoma, Norman.

1967a *The Archaeological Sequence in the Broken Bow Lake Area, McCurtain County, Oklahoma*. Stovall Museum of Natural History, Oklahoma River Basin Survey Project, University of Oklahoma Research Institute, Norman.

1967b *The E. Johnson Site and Prehistory in Southeast Oklahoma*. Archaeological Site Report No. 6. Oklahoma River Basin Survey Project, University of Oklahoma, Norman.

1967a Woods Mound Group: A Prehistoric Mound Complex in McCurtain County, Oklahoma. *Bulletin of the Oklahoma Anthropological Society* 15:1-76.

1968 *The Beaver Site and the Archaeology of the Broken Bow Reservoir Area, McCurtain County, Oklahoma*. Archaeological Site Report No. 9. Oklahoma River Basin Survey Project, University of Oklahoma, Norman.

Reconstructing Ancient Foodways at the Jones Mill Site (3HS28), Hot Spring County, Arkansas

Mary Beth Trubitt, Kathryn Parker, and Lucretia Kelly

Abstract

Analyses of botanical and faunal samples and a new radiocarbon date provide a detailed picture of Indian foodways at the Jones Mill site on the Ouachita River in Arkansas. Hunting, plant processing, and fishing with nets is seen from Middle Archaic artifacts and features. Burned hickory nutshell found among clusters of fire-cracked rock shows the importance of nut masts as food between 6000-4300 B.C. By 1450 A.D., a more substantial community of people lived at Jones Mill. Refuse associated with traces of a Caddo period house provided direct evidence for the cultivation of maize and native Eastern Complex starchy seed crops and procurement of select wild plants and animals for food.

Background and Excavation Overview

Field excavations were conducted in 2007-2008 at Jones Mill (3HS28), a multicomponent site on the Ouachita River in west-central Arkansas (Figure 1). Trubitt directed Arkansas Archeological Survey/Society training programs at the site along with archaeological field schools held through University of Arkansas and Henderson State University. The research project is investigating the manufacture and trade of novaculite chipped stone tools particularly during the Middle Archaic period (*circa* 6000 – 3000 B.C.). Novaculite, now used for Arkansas whetstones, was an important raw material for local inhabitants (Trubitt *et al.* 2004). It was one of several rocks and minerals found in the Ouachita Mountains, specifically the Magnet Cove region, and transported down river to sites in Louisiana and Mississippi during the Archaic period (Brookes 1999; Gibson 1994, 1999; Jeter and Jackson 1994; Rolingson and Howard 1997; Webb 1977).

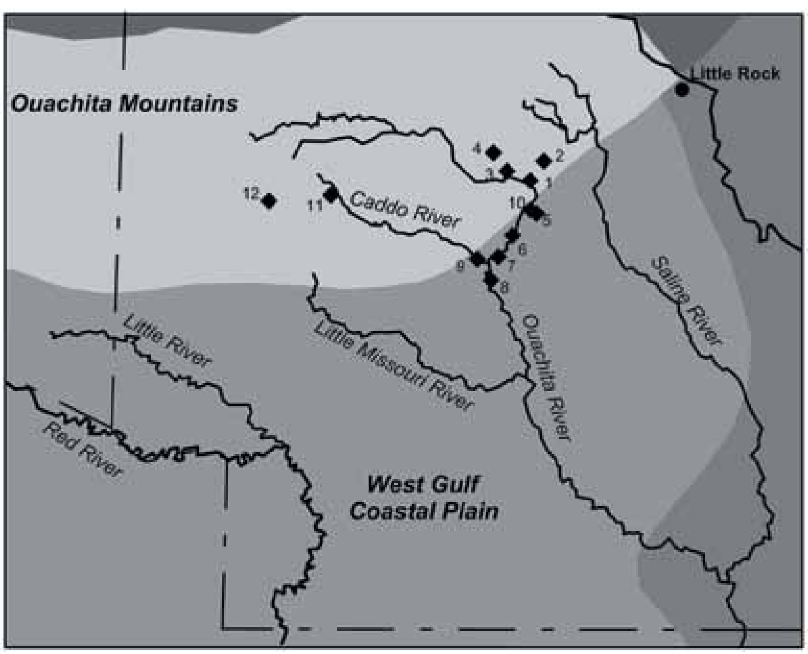

Figure 1. Regional map showing Jones Mill and other sites mentioned in text against major rivers and physiographic provinces in southwest Arkansas: (1) Jones Mill (3HS28), (2) 3GA48 quarry, (3) 3GA23/Lawrence, (4) 3GA22 quarry, (5) 3HS551, (6) Means, (7) Cooper, (8) Hardman, (9) Caddo Valley Md., (10) Helm, (11) Standridge, (12) Winding Stair.

The Jones Mill site is not a novaculite quarry itself, but lies about 7-10 km away from one of the largest quarry complexes in the Hot Springs area, the extensive Spanish Diggings quarries (3GA48/HS158/HS433) first described by Jenney (1891) and Holmes (1919), and more recently tested by Baker (1974) and mapped by Etchieson (1997). The situation of a large stratified site on the Ouachita River at the confluence of a creek that drains from a major ridgetop novaculite quarry is reminiscent of Harrington's (1920) "Deep Deposit" at the Lawrence site (3GA20/23/96/97) and the 3GA22 quarry in Hot Springs National Park (Holmes 1891, 1919; Trubitt 2005, 2007).

Previous field investigations at Jones Mill clearly showed the potential for uncovering deep and intact Archaic period deposits with cultural features. Excavations at the site were conducted in the early 1980s as part of cultural resource management testing by Archeological Assessments, Inc. (Bennett 1986). Using methods from surface collection and auger testing to hand excavation to backhoe trenching and mechanical stripping, that project confirmed 3HS28 as a large site with some vertical and horizontal separation of components. Most of the cultural features were identified in a block excavation on the site's north side, where archeologists found postmold patterns interpreted as three circular structures, as well as hearths, pits, and burials of four individuals (Bennett 1986:40-48). While no radiometric dates were obtained from that project, the artifact analyses indicated that a major Woodland period (Fourche Maline) component and a minor Caddo period occupation were represented by the midden and features. In excavation units further south, deposits with Middle and Late Archaic period diagnostics were uncovered to a depth of 1.2 m. The 1980s testing did not identify many floral and faunal remains, in part because soils in this region are generally acidic, but also perhaps because of the processing techniques used (for example, waterscreening soil prior to flotation, Bennett 1986:114).

Since that time, construction has been done on the less significant part of the site while the landowner has protected the denser area of 3HS28. The site was listed on the National Register of Historic Places in 1988. More recent site visits during other cultural resource management projects expanded the site boundaries and recorded additional sites in the vicinity (Chapman 2004), as well as show the continuing impact from local artifact collectors.

Our field work at the site comes out of the novaculite quarry research design developed several years ago (Trubitt *et al.* 2004) and an interest in studying the organization of Archaic period novaculite tool production and exchange. Excavations at 3HS28 were geared towards identifying and dating the residues of residential, subsistence, and tool manufacturing activities, evaluating whether the site was occupied seasonally or year-round, and analyzing the organization of novaculite tool production. Over the two field seasons on the Jones Mill site, we excavated a total of 47 m^3 in five trenches (Figure 2). In addition to public talks and presentations at professional conferences, several short articles have been published on the excavation results and radiocarbon dates (Brock 2009; Trubitt 2008, 2009a, 2009b, 2011). We are completing lab processing. The quantity of novaculite artifacts catalogued – over ½ million pieces, mostly chipping debris – makes it clear that tool production was a major activity of the former residents.

We placed three excavation trenches on the site's west side in an area that had relatively thin layers with Caddo and Woodland period materials and a thick deposit with Archaic period artifacts and features. Trenches 2, 3, and 4 showed a clear stratigraphy with cultural material found to a depth of about 1.5 m. Ceramic sherds, as well as magnetite cobbles, were limited to the upper 30-40 cm (Strata I-II, see Figure 3). Stratum III had artifacts diagnostic of the Middle Archaic period Tom's Brook and Crystal Mountain phases (Schambach 1998) such as Johnson and Big Sandy dart points and notched pebble net sinkers, as well as quantities of novaculite chipping debris, biface and tool fragments, occasional ground stone tools/fragments, and pieces of burned and unburned sandstone and igneous rock.

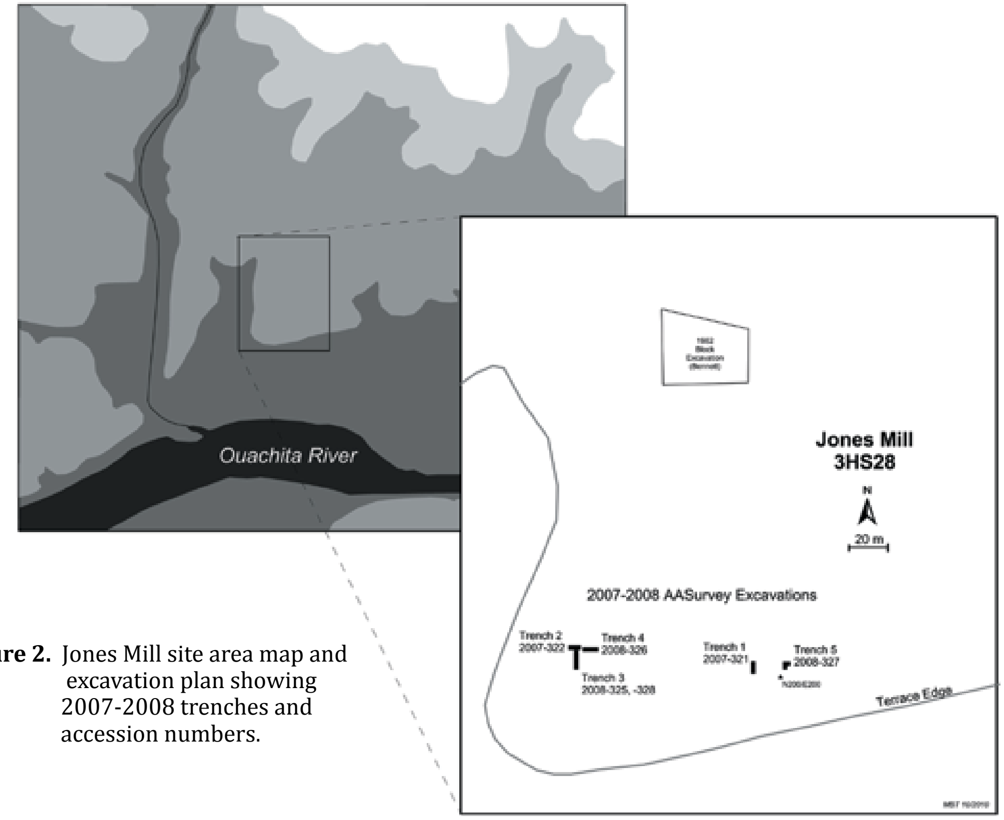

Figure 2. Jones Mill site area map and excavation plan showing 2007-2008 trenches and accession numbers.

Figure 3. Profile of Trench 3 excavation at Jones Mill, Unit N206 E95, view west, showing Stratum I, II, III, VI, and VII (Stratum IV and V were not present in this area; photo AAS/HSU D_T4006).

A discussion of dart points based on a sample from the 2008 excavations (Trubitt 2009a) highlighted metric differences and novaculite color preferences between the two general types (Johnson and Big Sandy or White River Side Notched). In a sample of 52 dart points, most (88%) were broken, and many of these (48%) showed distal impact fractures (Trubitt 2009a). Distal impact fractures are associated with use as projectiles (Johnson 1981; Titmus and Woods 1986). Many of these dart tips were broken through use— presumably in hunting—and refitted with new points at Jones Mill. This is indirect evidence for hunting. Other artifacts point to plant processing (fragments of sandstone grinding stones and pitted cobbles) and fishing or perhaps trapping small mammals or birds (notched pebble net weights or netsinkers). Currently, Dr. Melody Pope is examining a small sample of endscrapers from the site for microwear, and discussion of this evidence in terms of plant/animal/fish processing at the site will be covered in a future publication.

Many of the features found in the Middle Archaic Stratum III at Jones Mill were concentrations of rocks that included fire-cracked sandstone cobbles. These have been interpreted as refuse from hearths or fireplaces or from earth ovens or cooking pits. Especially in the millenia before the invention of pottery, people cooked with indirect heat, either heating rocks in a fire to use in "stone boiling" or using rock to hold the heat of the fire in earth ovens. These techniques resulted in quantities of burned and cracked rock discarded around cooking facilities, and explain the fire-cracked rock concentrations often found on Archaic period sites (see Hester 1991).

Radiocarbon dates have now been obtained on two of these burned rock features from Stratum III at Jones Mill, with funding from the Arkansas Archeological Society. The accelerator mass spectrometry technique was used to date small amounts of charred nutshell associated with these features from Trench 3. Feature 46, the deepest of these burned rock concentrations at about 1 m below ground surface, resulted in a conventional radiocarbon age of 7070±40 BP, which calibrates to 6020-5880 cal B.C. (2 sigma range, Beta-254393, Trubitt 2009b). Feature 43, a small burned rock cluster at about 50 cm below surface, returned a conventional radiocarbon age of 5450±40 BP, calibrated to 4350-4240 cal B.C. (2 sigma range, Beta-281374, Trubitt 2011). These dates give us an effective range for our Middle Archaic occupation of the Jones Mill site at 6000-4300 B.C.

Material associated with the features in Stratum III can give hints to their use. For example, Feature 46 had two notched pebble netsinkers as well as a Johnson type novaculite dart point. We are interested in learning whether cooking was done here and if so what was cooked. Dr. Mary Malainey has examined a small sample of fire-cracked rock fragments from the site for absorbed lipid residues. Her results and our interpretations of these features as Archaic cooking facilities will be the focus of a future publication. Charred plant remains from these features are also discussed later in this article.

The two trenches placed on the eastern side of the site uncovered better evidence of more recent occupations. Trench 1 and 5 had a thick dark brown organic midden deposit containing artifacts diagnostic of several time periods (Caddo, Woodland, Late and Middle Archaic). Several rock cluster features were excavated in Trench 1 in 2007 (Brock 2009). Features found in Trench 5 in 2008 included the bases of several postmolds (Figure 4). Based on analysis of materials incorporated into feature fill— especially the ceramics and botanical materials—as well as a new radiocarbon date, we can now interpret these as traces of a Caddo period building. If these posts are part of two opposite walls, it was a small building, since they are only about 3.5 m apart. Circular patterns of single-set posts between 4-16 m in diameter as well as square or rectangular patterns of posts with walls ranging from 3.8 to 8.8 m apart have been documented on Caddo period sites in west-central Arkansas (Trubitt 2009c).

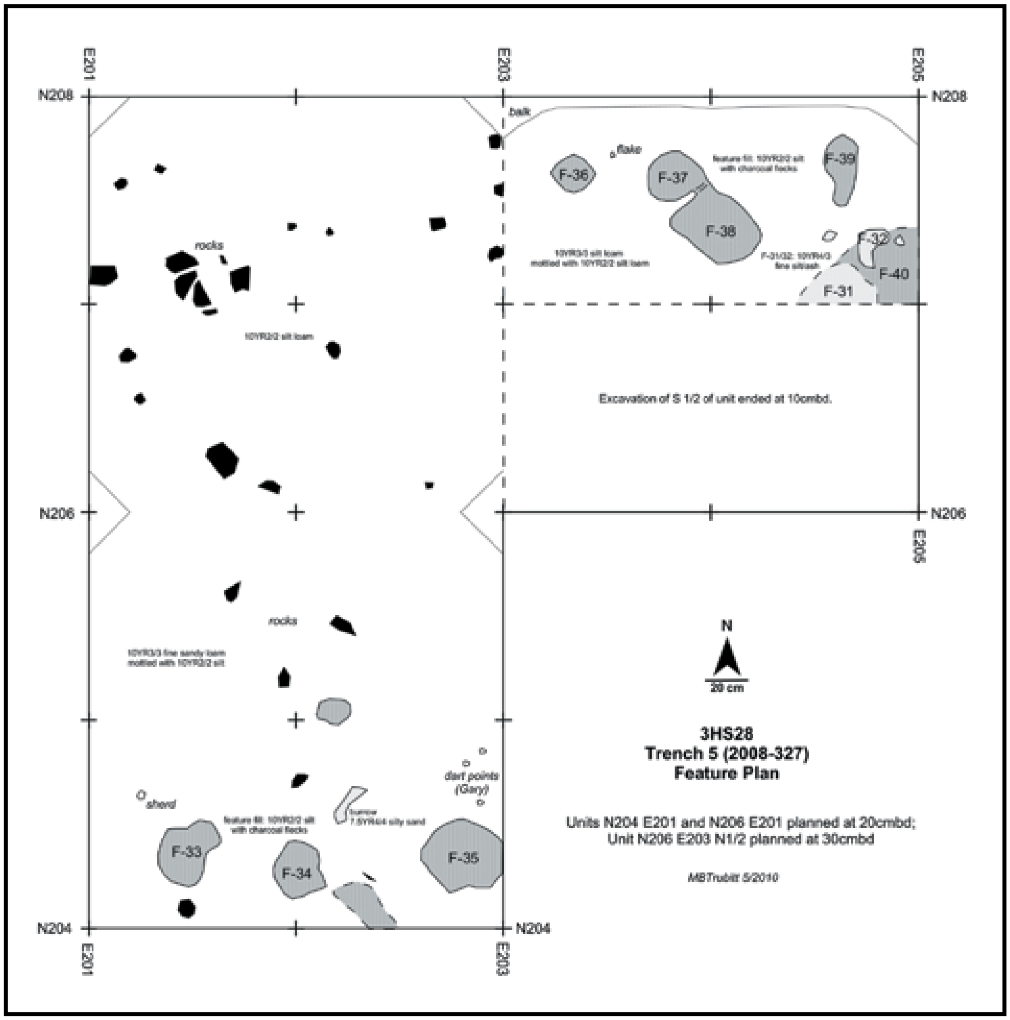

Figure 4. Feature plan for Trench 5 at Jones Mill.

With funds from the Arkansas Humanities Council, a new radiocarbon date was obtained from Jones Mill on a Trench 5 postmold (Feature 35) using the accelerator mass spectrometry technique. As discussed later in this paper, Parker identified maize from this feature, but the date was run on charred nutshell she identified as *Carya* (hickory). The AMS date returned a conventional radiocarbon age of 470±40 BP, calibrating to cal A.D. 1410-1460 (2 sigma range, Beta 282601, Table 1). Beta Analytic, Inc., reported an intercept of the radiocarbon age with the calibration curve (using INTCAL04) at cal A.D. 1440.

Table 1. New Radiocarbon Dating Results from Jones Mill (3HS28).

Sample ID and Provenience	*Measured Radiocarbon Age Before Present*	*13C/12C Ratio*	*Conventional Radiocarbon Age Before Present*	*Calibrated Age, 1 sigma range (68% probability)*	*Calibrated Age, 2 sigma range (95% probability)*
Beta-282601 2008-327-33-9, AMS charred nutshell from F-35	470 ± 40 BP	-24.9 o/oo	470 ± 40 BP	Cal AD 1420-1450	Cal AD 1410-1460

Trubitt's preliminary analysis of ceramic sherds from Trench 5 and the feature contexts found the majority tempered with grog or a grog-grit mixture, with shell, bone, and grit occurring in a minority of sherds. For Trench 5 as a whole (n=221), 73% of the analyzed sherds were tempered with grog or a mixture of grog and grit and/or bone, 14% were tempered with shell or shell and grog, and 13% were tempered with grit. For the Trench 5 features specifically (n=12), 83% were identified as grog or grog and grit tempered sherds and 17% were identified as shell and grog tempered sherds. Shell tempering appears in Middle Ouachita River region ceramics during the Mid-Ouachita phase and has been dated to the late 1300s-early 1400s A.D. (see Early 2002; Perttula *et al.* n.d.). The minority presence of shell-tempering in Trench 5 and its features fits with the early-to-mid 1400s A.D. date from Feature 35.

This article focuses on the results of specialized analyses by Parker (botanical materials) and Kelly (animal bone) to help interpret the foodways of the people who lived at Jones Mill. The key contexts to be discussed and contrasted here, therefore, are the Middle Archaic Stratum III in Trenches 2, 3, and 4 that includes burned rock features in Trench 3 dating to 6000-4300 B.C., and the Caddo period midden in Trench 5 that includes post features that were part of a building dating to A.D. 1440. The term 'foodways' refers to diet specifically, as well as to the ways social groups interacted with one another and with their environments to schedule food-getting activities throughout the year. Interpretation of site seasonality and duration of site occupation has repercussions for reconstructing the organization of novaculite tool production and access to nearby resources such as quarry sites.

Methods of Analysis

Archaeobotanical Analysis

Systematic flotation sampling of excavated cultural features provided essential baseline data about plant use patterns during prehistoric occupations at the Jones Mill site widely separated in time. All feature matrix samples from the site were processed by water flotation. A de-flocculent (baking soda) was typically added to facilitate dispersion of charred plant material from soil matrix (Pearsall 1989). In addition, the heavy fractions from two samples were reprocessed using a sugar water solution according to methodology suggested by Dr. Tristram Kidder (1997). Because sugar water has a higher specific gravity than water alone, charred plant remains are more prone to float rather than settle into heavy fractions. There was no discernable difference in botanical recovery from the two Middle Archaic samples tested, but the result may have been determined by the predominance of relatively dense nutshell, and absence or scarcity of all other classes of botanical material.

All processed and dried flotation samples received by Parker for analysis were sorted into two particle sizes with the aid of a No.10 geological sieve (2 mm mesh). Using a standard binocular microscope at low magnification (7-10x), all carbonized materials (wood, nutshell, seed, etc.) retained by the screen (>2 mm) were extracted, weighed and counted, and an attempt made to identify all plant materials other than wood. Nutshell and wood counts and weights are based on materials in this large size fraction only.

Identification of the first 20 randomly selected wood fragments was attempted (or all wood, if there were less than 20) for the large fraction of each sample. In this analysis, charred wood fragments examined but found to be unidentifiable at least to family were grouped into one of five categories: gymnosperm, ring porous hardwood, diffuse porous hardwood, bark or unidentifiable. Gymnosperm wood in this region of Arkansas could be from shortleaf pine (*Pinus echinata*) or Eastern red cedar (*Juniperus virginiana*). Ring porous woods may be from any one of several commonly occurring deciduous trees including various oaks (*Quercus* sp.), hickory (*Carya* sp.) and ash (*Fraxinus* sp.). Diffuse porous tree taxa include trees such as poplar/cottonwood (*Populus* sp.) and boxelder/maple (*Acer* sp.). Bark consists of small, thin, non-distinctive fragments. Wood fragments in which all distinctive morphological traits were distorted or destroyed during carbonization were classified as unidentifiable.

The small fraction (<2 mm) of each sample was examined carefully using a 10-30x binocular microscope in order to recover seeds, grass stems, maize (*Zea mays*) fragments and any other non-wood or nutshell items. Any of these items were extracted and identified if possible.

In addition to botanical remains from flotation, four water-screened samples from various levels of a single Trench 5 excavation unit were analyzed to provide a comparison between midden and features. Materials were sorted into the same categories (wood, nutshell, maize) used for flotation samples.

Seed, nut and wood identifications for both the flotation and water-screened remains were based on morphological characteristics, with reference to modern comparative specimens and standard pictorial guides (e.g. Martin and Barkley 1961; Hoadley 1990). All identifications were carried to the lowest possible taxon, usually to the genus level. Species identifications were attempted only when morphological comparisons ruled out other members of a genus (i.e. *Polygonum erectum*). Scientific nomenclature and general floristics information follows the USDA plants database (USDA 2010).

Zooarchaeological Analysis: All bone was processed in the Arkansas Archeological Survey's HSU Research Station lab before a sample was sent to Kelly for analysis. Bone was recovered using three methods: hand-collected (including ¼" screen) during general excavation, water-screened through 1/16" window mesh, and picked from the heavy fraction of processed flotation samples taken from features. All bone in this study was identified by direct comparison to modern osteological collections belonging either to Kelly or housed at the Illinois State Museum Records and Research Facility in Springfield, Illinois. Dr. Robert Warren of the Illinois State Museum very kindly identified the mussel shells. The faunal remains were analyzed and tabulated separately by recovery method. Flotation and water-screening facilitates the recovery of smaller bones and greater quantities of bone.

Identification of the faunal remains was made to the most specific taxonomic level possible, given the completeness and portion of the bone present. Nomenclature for mammals follows Hoffmeister (1989); for birds, Bohlen (1989); for fish, Pflieger (1975); for reptiles, Johnson (1992) and Cummings and Mayer (1992) for freshwater mussels. Taxonomic names, however, were verified through the Integrated Taxonomic Information System website (ITIS 2010) and in some cases were changed to the most up-to-date usage. Some elements from the same animal are more diagnostic than others (Driver 1992; Reitz and Wing 2008). Therefore, not all elements can be identified with equal certainty or specificity. If a bone could be only tentatively identified to a certain taxon, then the taxon was given a "cf." designation. Tentatively identified bones were combined with bones that could be more definitively identified as that taxon when listed in the summary tables. If there were no other bones that could be definitively identified, then the "cf." designation was retained in the tables.

As is common in zooarchaeology (Driver 1992; Reitz and Wing 2008; Uerpmann 1973), when a mammal or bird bone could not be identified to a taxon more specific than class, it was placed in a size category where possible. Table 2 provides the key to the animal size categories constructed. The categories of large, medium, and small are based on the size of the major bones in a skeleton. The intermediary categories of large-medium and medium-small in the summary tables are catch-all categories. For example, the category large-medium includes bone fragments that could belong to an animal of medium, medium to large, or large size. The bones are usually small fragments for which element cannot be determined. Placing bones in the intermediary categories is very subjective, therefore these categories do not have much analytic value beyond identifying indeterminate bone fragments within a class to a slightly finer level than simply "indeterminate."

Table 2. Faunal Size Classes.

Size Class	*Animals Falling within Size Class*
Large Mammal	Deer, Bear
Medium Mammal	Raccoon, Rabbit, Muskrat, Squirrel
Small Mammal	Mouse, Vole, Mole

For each bone identifiable to the level of class or to a more specific taxon, the following information, when applicable, was recorded: faunal catalogue number, complete provenience information, recovery technique (general excavation, flotation, or water-screen), taxonomic identification, element name, side, portion present, percent complete, epiphyseal fusion, tooth wear and eruption, modification, placement of modification, number of fragments, and weight. Additional information and observations were entered into a comments section, if necessary. Types of modifications recorded include weathering, gnaw marks, cut marks, staining, and burning. For the deer bone, locations of cut marks were recorded to possibly aid interpretation of butchery techniques.

Where possible for deer remains, epiphyseal fusion and tooth eruption and wear were recorded. Relative age of deer can be calculated from these characteristics (Gilbert 1990; Purdue 1983; Reitz and Wing 2008; Severinghaus 1949). Epiphyseal fusion and tooth wear do not give as accurate an age as tooth eruption, but general age categories can be constructed (Purdue 1983; Reitz and Wing 2008). All three aging methods are subject to individual variation in health, diet, and environment and—for fusion—the sex of the animal.

There has been much discussion over the years about the use of the basic quantification measures in zooarchaeology: NISP (number of identifiable specimens) vs. the use of MNI (minimum number of individuals) (for example, Chaplin 1971; Gautier 1984; Grayson 1984; Klein and Cruz-Uribe 1984; Marshall and Pilgram 1993). The use of either NISP or MNI has its drawbacks and can be affected by intensity of fragmentation and sample size. To partially offset the problems associated with these measures, both NISP and MNI, when applicable, are used here for the taxa identified. For NISP, if two or more fragments could be glued or fitted together, they were counted as one. This rule also applies to unfused epiphyses that could be refitted to their shafts.

MNI was figured by excavation trench (Trench 5 only) for each species by counting the most frequently occurring element after dividing it into lefts and rights (if applicable). Completeness, portion, age, and, in some cases, size were taken into consideration. MNI was also calculated for family and genus levels if no species within the family or genus had been identified for the unit. Or, if species were identified within a family or genus, MNI was calculated for that genus and/or family only after the MNI had been calculated for the species, and hence is exclusive of the species MNI count. MNI was not figured for the class or order levels.

Some weathering, carnivore and rodent gnawing, and staining have taken place indicating bones in some areas were exposed to the elements. A portion of the assemblage has been burned. In some cases, only singeing is evident and that may reflect a cooking method such as roasting, where only a small part of exposed bone was directly subjected to fire. More calcined bone than singed or charred bone was recovered (Table 3). This may indicate the bone was included in fire as part of trash disposal where it would have been subjected to high heat or prolonged exposure.

Table 3. Summary of Burning for Faunal Remains (NISP) from Jones Mill (3HS28).

	Trench 3 and 4 325+328, 326				*Trench 5 327*			
	calcined	*black*	*unburn*	*wt. g*	*calcined*	*black*	*unburn*	*wt. g*
mammals					84	22	366	353.6
birds							1	1.0
fish							20	0.5
reptiles					10	3	29	16.2
amphibians							2	0.1
indeterminate vertebrate	15			1.6	388	32	502	129.2
invertebrates			1	0.4		2	512	269.6
Total	15	0	1	2.0	482	59	1432	770.2

Middle Archaic Foodways

Archaeobotanical Analysis

Thirteen flotation samples totaling 174 liters of soil matrix collected from distinct cultural deposits in Trench 3, usually clusters of fire-cracked and natural rock and artifacts and charcoal defined as features, made up the Archaic sample. Carbonized macrobotanical remains in the Trench 3, Stratum III, flotation samples consisted of 670 nutshell and wood fragments having a combined weight of 8.9 g (Table 4). The resulting mean botanical density was 0.06 g/liter, low but also typical for an early prehistoric component. Nutshell from Feature 11, a cluster of magnetite cobbles at the top of Stratum II that post-dates the Middle Archaic component, was excluded from these calculations.

Nutshell was recovered from every sampled provenience in Trench 3, and was by far the dominant category of plant material, totaling 643 fragments (8.5 g). Thick-shelled hickory (*Carya* sp.) comprised 92% of all nutshells in this assemblage, the remaining 8% consisting of eroded, amorphous, thick pieces assignable only to the hickory/walnut family (Juglandaceae). A flotation sample from another Middle Archaic feature (F-4) in Trench 2, previously analyzed by Dr. Kitty Roberts, disclosed a similar combination of eroded hickory/walnut shell and hickory (Trubitt 2009a). Hickory/walnut fragments from the Archaic component are assumed to be entirely hickory rather than including black walnut or butternut, since no remains of these latter species have been present in any of the analyzed Jones Mill samples.

The Trench 3 wood assemblage was comprised of extremely small fragments that sometimes appeared twisted or torqued, with resulting morphology that was distorted and unidentifiable. Eight of thirteen flotation samples yielded wood fragments. In the 42 fragments recovered (total 0.6 g), only ten could be identified, representing four deciduous tree taxa including oak (both *Quercus* sp. and red oak subgroup, *Q*. sp., subgenus *Erythrobalanus*), Osage orange (*Maclura pomifera*), hickory (*Carya* sp.) and hackberry/sugarberry (*Celtis* sp.).

The combination of plant resources indicated in Jones Mill Archaic deposits, consisting of an abundant, edible and highly nutritious nut mast (hickory), and high quality fuel woods (oak, hickory, hackberry/sugarberry, and Osage orange) typifies Middle Archaic archaeobotanical recovery patterns in the Eastern Woodlands (cf. Asch and Asch 1985; Simon and Parker 2006; Stafford 1991). The Osage orange wood in the Middle Archaic sample may have been an import, if it was geographically restricted to an area of Blackland Prairie in East Texas between the end of the Pleistocene and initial European contact, as argued by Schambach (2003) (but see Early 2000) . The widespread and predictable high frequency of hickory nutshell recovered from Middle Archaic components suggests that harvest of mast resources was, even at this early time, a long and well-established focus of subsistence strategies.

Table 4. Trench 3 Botanical Identifications, Jones Mill (3HS28).

	Stratum II:			*Stratum III:*											
Provenience	F. 11, N1/2	F. 11, S1/2	*Stratum II Totals:*	F. 41	N208E95 (charcoal scatter)	F. 43	F. 44	N208E95 (charcoal scatter)	N208E95 (charcoal scatter)	F. 45, N1/2	N208E95 (rock scatter)	F. 46, S1/2	F. 46, N1/2	F. 46, N1/2	*Stratum III Totals:*
Sample Number (light & heavy fractions)	325-12, 325-13	325-15, 325-16		328-46, 328-47	328-61, 328-62	328-66, 328-67	328-68, 328-69	328-71, 328-72	328-82, 328-83	328-109, 328-110	328-118, 328-119	328-121, 328-122	328-124, 328-125	328-127, 328-128	
Sample Volume (liters)	18.5	4.0	22.5	4.0	8.0	19.0	0.5	11.0	36.0	15.0	34.0	8.0	8.0	8.0	151.5
Total Wood (N)	0	0	0	0	9	1	0	3	17	0	3	5	2	2	42
Total Wood Wt. (g)			0.00		0.22	0.01		0.01	0.31		0.01	0.04	0.02	0.03	0.65
Breakdown by taxon (N)															
Carya sp. (hickory)												1	1		2
Celtis sp. (hackberry/ sugarberry)														1	1
Maclura pomifera (Osage orange)					3										3
Quercus sp. (oak)								1	2						3
Q. sp., subgenus *Erythrobalanus* (red oak subgroup)								1							1
Gymnosperm												1			1
Diffuse porous						1									1
Ring porous					3				5		1	2			11
Unidentifiable					3			1	10		2	1	1	1	19
Total Nutshell (N)	8	7	15	2	16	36	3	1	33	37	34	440	17	9	628
Total Nutshell Wt. (g)	0.19	0.13	0.32	0.05	0.25	0.88	0.03	0.02	0.36	0.72	0.61	4.53	0.64	0.13	8.22
Breakdown by taxon (N and Wt.)															
Carya sp.	8	7	15			36	3	1		37	34	440	17	9	577
(hickory)	0.19	0.13	0.32			0.88	0.03	0.02		0.72	0.61	4.53	0.64	0.13	7.56
Juglandaceae				2	16				33						51
(hickory/walnut family)				0.05	0.25				0.36						0.66
Total Count (N):			15												670
Total Weight (g):			0.32												8.87
Weight/Sample Volume:			0.01												0.06

Zooarchaeological Analysis

Fragments of animal bone and shell collected from the Trench 3 and 4 excavations formed the Archaic sample examined from Jones Mill. Unfortunately, no faunal remains could be identified from these trenches (Table 5). The remains present consist of primarily small fragments of calcined bone that do not retain any distinguishing characteristics allowing for identification even to the class level. One small fragment of a freshwater mussel shell was recovered from Trench 3 (Accession 2008-328). It is therefore not possible to comment on the faunal subsistence of the Archaic inhabitants that could give insight into questions concerning the seasonality of occupation at the Jones Mill site or movement of Archaic populations at this time. Elsewhere in the area Archaic populations were hunters, gatherers, and fishers who exploited a variety of wild plants and animals for food (Jackson and Scott 2001).

Table 5. Summary of Faunal Remains (NISP) from Trenches 3 and 4, Jones Mill (3HS28).

	Trench 3				*Trench 4*		
	ws 325	*gen. ex. 328*	*ws 328*	*Total*	*gen. ex 326*	*ws 326*	*Total*
Indeterminate Vertebrate	4	3	5	12	1	2	3
Invertebrate (Unionidae)		1		1			0
Total	4	4	5	13	1	2	3

Caddo Foodways

Archaeobotanical Analysis

Charred macrobotanical remains from flotation sampling of eleven cultural features encountered in Trench 5 formed the Caddo period sample, and consisted primarily of nutshell, wood and maize (Table 6). Seeds were comparatively sparse but included Eastern Complex (EC) starchy cultigens. Four water-screened samples from 0 through 40 cm below surface in one unit contributed a similar range of botanical materials: hickory nutshell, wood and maize, but not seeds (Table 7). All of the features sampled are variously sized postmolds with plant remains that suggest domestic refuse from nearby processing or use activities. The 85 liters of soil in flotation samples produced 28.6 g of carbonized wood and nutshell (1676 fragments >2 mm in size), equivalent to a mean density of 0.34g / liter, or by fragment count 19.8 / liter. All analyzed samples contained identifiable nutshell and wood, but nutshell fragment counts were approximately twice those of wood. The presence of small amounts of maize in a majority of samples strongly suggested a post A.D. 850 Caddo affiliation for Trench 5 features (Perttula 2008). The AMS date that was run on Feature 35 confirmed the Caddo association.

At least eight tree taxa were represented in 109 wood fragments identified, out of 177 examined in a total of 503 fragments recovered (Table 8). Oak, including a few fragments from the red and white subgroups (*Q*. sp., subgenera *Erythrobalanus* and *Lepidobalanus*), together with hickory comprised nearly 70% of the identified wood, followed in descending order by shortleaf pine (*Pinus echinata*), Eastern red cedar (*Juniperus virginiana*), hackberry/sugarberry, sycamore (*Platanus occidentalis*), Osage orange and elm family (Ulmaceae). Oak and pine were each present in the majority of flotation samples, followed in ubiquity by hickory and red cedar. Several wood fragments in water-screened samples from levels 2 and 3 of Trench 5 were identifiable as hickory, pine and oak. Together the quantitative data suggest that four upland forest taxa: oak, hickory, pine and red cedar, provided most of the fuel used by Caddo residents at the site.

Table 6. Trench 5 Botanical Identifications, Jones Mill (3HS28).

Provenience	N204E201 (bone and shell conc)	F-31	F-32	F-33	F-34	F-35	F-36	F-37	F-38	F-39	F-40	*Trench 5 Total*
Sample Number (light & heavy fractions)	327-13, 327-14	327-21, 327-38	327-24, 327-39	327-25, 327-36	327-26, 327-31	327-27, 327-33	327-40, 327-41	327-48, 327-49	327-50, 327-51	327-42, 327-43	327-45, 327-46	
Sample Volume (liters)	10.0	5.5	1.0	17.0	7.0	14.25	1.25	5.0	8.00	0.75	15.0	84.8
Total Wood (N)	8	87	18	89	78	100	10	8	45	13	47	503
Total Wood Wt. (g)	0.2	0.79	0.2	0.95	1.31	0.96	0.06	0.08	0.63	0.12	0.41	5.71
Breakdown by taxon (N)												
Carya sp. (hickory)				10	20						5	35
Celtis sp. (hackberry/sugarberry)	4											4
Juniperus virginiana (Eastern red cedar)			2						4			6
Maclura pomifera (Osage orange)										1		1
Pinus echinata (shortleaf pine)		1		2		7		3	1	3	1	18
Platanus occidentalis (sycamore)		1				3						4
Quercus sp. (oak)	2	5		3		7	3	3	5	3	4	35
Q.sp., subgenus *Erythrobalanus* (red oak subgroup)		2	2									4
Q. sp., subgenus *Lepidobalanus* (white oak subgroup)						1						1
Ulmaceae (elm family)				1								1
Gymnosperm		3	2	1								6
Bark		2										2
Diffuse porous		1				2			2			5
Ring porous	1	3	5	1			1		2	1	2	16
Unidentifiable	1	2	7	2			6	2	6	5	8	39
Total Nutshell (N)	106	131	1	297	115	280	3	11	105	1	123	1173
Total Nutshell Wt. (g)	2.19	1.87	0.05	5.76	3.05	5.45	0.11	0.24	2.1	0.03	2.04	22.89
Breakdown by taxon (N and Wt.)												
Carya sp.	104	118		290	115	278	3	11	105		122	1146
(hickory)	2.18	1.82		5.69	3.05	5.44	0.11	0.24	2.1		1.99	22.62
C. illinoensis		1										1
(pecan)		0.01										0.01
Juglandaceae			1							1		2
(hickory/walnut family)			0.05							0.03		0.08
Quercus sp.	2	12		7		2					1	24
(acorn)	0.01	0.04		0.09		0.01					0.05	0.20

Table 6. Trench 5 Botanical Identifications, Jones Mill (3HS28) (cont.).

Provenience / *Sample Number (light & heavy fractions)*	N204E201 (bon e and shell conc) 327-13, 327-14	F-31 327-21, 327-38	F-32 327-24, 327-39	F-33 327-25, 327-36	F-34 327-26, 327-31	F-35 327-27, 327-33	F-36 327-40, 327-41	F-37 327-48, 327-49	F-38 327-50, 327-51	F-39 327-42, 327-43	F-40 327-45, 327-46	*Trench 5 Total*
Total Seeds (N)	0	3	0	1	2	6	3	1	1	0	2	19
Breakdown by taxon (N)												
Chenopodium sp. (chenopod/ lambs quarters))					1							1
Euphorbia maculata (nodding spurge)						1						1
Hordeum pusillum (little barley)							1					1
Labiateae (mint family)									1			1
Phalaris caroliniana (maygrass)					1							1
Polygonum sp. (smartweed/knotweed)								1				1
P. erectum (erect knotweed)						1						1
Sida spinosa (prickly sida)				1								1
Vitis sp. (grape)		1										1
Unidentifiable		2				4	2				2	10
Total Maize (*Zea mays*) (N)	16	38	0	30	5	34	0	1	3	0	3	130
Total Maize Weight (g)	0.32	0.16		0.24	0.07	0.12		0.04	0.01		0.01	0.97
kernel	15	14		17	3	1		1	1		1	53
cupule	1	21		12	2	30			1		2	69
glume		3		1		2			1			7
cob						1						1
Miscellaneous Materials	0	1	0	0	0	2	0	0	0	1	1	5
Fungus						1						1
Pedicel		1										1
Pine cone fragment						1						1
Monocot stem										1	1	2

Table 7. Listing of Identified Botanical Materials from Trench 5 Waterscreened Column.

Sample No.	*N206E201 Level*	*Type of Material Identified*	*Weight (g)*
2008-327-3	0-10 cm	6 hickory nutshell fragments	0.14
2008-327-9	10-20 cm	24 hickory nutshell fragments	0.60
		7 wood fragments (hickory, pine and indeterminate diffuse porous)	0.16
		2 maize cupules (1 measurable = 6.0 x 3.5 {LxW in mm}, 45 degree angle	0.03
2008-327-19	20-30 cm	21 hickory nutshell	0.63
		3 wood fragments (pine and oak)	0.02
		4 maize cupules and 1 cob fragment	0.06
2008-327-29	30-40 cm	23 hickory nutshell fragments	0.50
		1 maize cob fragment	0.01

** Note: Samples also included small pieces of bone.*

Table 8. Wood Identifications from Trench 5.

Wood Type	*Number of Fragments*	*Percentage*	*Feature Ubiquity*
Carya sp. (hickory)	35	32.11%	27.3%
Celtis sp. (hackberry/sugarberry)	4	3.67%	9.1%
Juniperus virginiana (Eastern red cedar)	6	5.50%	18.2%
Maclura pomifera (Osage orange)	1	0.92%	9.1%
Pinus echinata (shortleaf pine)	18	16.51%	63.6%
Platanus occidentalis (sycamore)	4	3.67%	18.2%
Quercus sp. (oak)	35	32.11%	81.8%
Q. sp., subgenus *Erythrobalanus* (red oak subgroup)	4	3.67%	18.2%
Q. sp., subgenus *Lepidobalanus* (white oak subgroup)	1	0.92%	9.1%
Ulmaceae (elm family)	1	0.92%	9.1%
Total	109	100.00%	

Similar to the botanical assemblage from Trench 3, flotation-derived nutshell was predominantly thick-shelled hickory, accounting for approximately 98% of all fragments. However, taxonomic diversity was slightly higher in this component, with small amounts of acorn (*Quercus* sp.), and traces (one or two fragments each) of pecan (*C. illinoensis*) and eroded amorphous hickory/walnut family. Several samples had fairly high nutshell counts numbering more than 100 hickory fragments, occasionally accompanied by a few pieces of acorn. In addition to thick nutshell processing refuse subsequently used as fuel, one fragmentary acorn cotyledon from Feature 40 represents an edible product that may have been lost in parching or some other form of pre-storage processing. All four water-screened samples had hickory nutshell but no other mast remains. While foraging strategies clearly targeted hickories, it is possible that acorn was more economically important than can be inferred from low nutshell frequency in Jones Mill and other prehistoric assemblages. When exposed to fire, thin acorn shells would often have been totally consumed, in comparison to the thick, dense shell of nuts in the Juglandaceae group, which are more likely to survive burning.

Among the 19 seeds recovered from Trench 5 samples, only nine could be identified, each representing a different plant taxon. Thus the assemblage is best described as diverse taxonomically, but also highly diffuse, meaning very low frequencies of any single seed type. Seeds of economic resources included one each of the EC starchy cultigens, little barley (*Hordeum pusillum*), erect knotweed (*Polygonum erectum*) and maygrass (*Phalaris caroliniana*). The erect knotweed specimen from Feature 35 typifies one of two recognized achene morphs, characterized by a slender, elongate form and a smooth, paper-thin pericarp. The second morph, not represented here, is squat and terete in form with thick punctate pericarps. Both types can occur on the same plant, but the proportion of elongate, thin pericarp morphs increases late in the harvest season. One partial chenopod (*Chenopodium* sp.) seed had a coating of soil that obscured surface morphology and seed margins. It is therefore unclear whether this specimen represents wild or cultivated *C. berlandieri*, or an entirely different species. In the context of Features 34, 35 and 36, which had seeds of three other EC starchy cultigens and/or maize, recovery of a *C. berlandieri* cultigen would not be unexpected, however.

A grape (*Vitis* sp.) seed from Feature 31 reflects availability of a wild edible fleshy fruit. Grape seeds are one of several sweet or sour fleshy fruits represented in prehistoric assemblages of all time periods from the Archaic onward and presumably universally harvested. Seeds of wild herbaceous plants that would have occurred naturally in the Jones Mill site vicinity included nodding spurge (*Euphorbia maculata*), mint family (Labiateae), smartweed/knotweed (*Polygonum* sp.) and prickly sida (*Sida spinosa*). Collectively, spurge, smartweed/knotweed and sida constitute a group of weedy taxa that would have found favorable growing conditions in fields, gardens and other areas disturbed by frequent human activity. Spurge and mint may have had medicinal uses (Williams 2000a).

Maize was recovered from 8 of 11 features (73%), a sample ubiquity typical of late prehistoric components in many areas of the Eastern Woodlands and Plains regions, including Caddo sites in the Ouachita River basin (Perttula 2008). The maize fragment count of 130 (1.0 g) from Trench 5 samples is low, however, equivalent to a mean of 1.5 fragments/ liter of processed sediment. Maize was similarly scant in water-screened samples, totaling seven cupule and cob fragments. Inedible parts of the ear including cupule, glume and cob fragments slightly outnumbered those of edible kernels, but both types of remains co-occurred in most samples with maize, suggesting harvest and use of a locally grown crop. One cupule recovered through water screening was sufficiently intact to measure, having width x height in mm of 6.0 x 3.5, and an angle of 45 degrees. Interpretations of row number based on single cupules are regarded as unreliable, but tentatively this specimen suggests an ear with 16 rows of kernels.

Items in the category of miscellaneous materials numbered five, subsuming monocot stem, fungal tissue, pedicel (flower stalk), and pine cone fragment. This limited array of materials is tentatively interpreted as kindling and/or incidental vegetation debris that fell or blew into space around posts.

Zooarchaeological Analysis

Animal bone and shell from Trench 5 excavations on the eastern side of the site made up the Caddo period sample. Trench 5 yielded a total of 1459 vertebrate and 514 invertebrate remains (Table 9). Most of the remains came from dry or water-screened samples from the midden; all the fauna recovered from features was from flotation samples (Table 10). While preservation was better on this side of the site, it still was not optimal. It is assumed the inhabitants utilized a larger range of animals than is indicated by the identified remains. Of the vertebrate remains 42% were calcined and another 4% were burned black or charred. Therefore the majority is unburned (Table 3). A large percent (63%) could not be identified to the class level, but this is substantially better than the 100% of the remains from Trenches 3 and 4 that were unidentifiable. Of the invertebrate remains, only 4% could be identified to more a specific taxon than freshwater mussel (Unionidae) or gastropod (Gastropoda). Three taxa of mammals, 1 of birds, 3 of fish, 3 of reptile, and 1 of amphibian were identified. Five taxa of freshwater mussel were identified. All but one of the 20 fish remains were recovered from flotation.

Deer remains were the most numerous in the mammalian class. Two other taxa were identified, tree squirrel (*Sciurus* sp.) and possible a skunk (*Mephitis mephitis*), but are represented by only 1 specimen each. The possible skunk is represented from a stained mandibular molar and is a very tentative identification. The archaeological specimen is larger than the comparative specimens available.

The deer remains are primarily specimens that are of higher density, and thus stood a better chance of survival. Table 11 lists the deer specimens recovered. Elements from the extremities were present in a higher percentage than what would be expected in a single deer. Axial elements, which are usually less dense, are present in a much lower percentage. Two individuals may be represented based on two complete mandibular 4th premolars. One is an adult tooth and the other is a deciduous tooth. Because the teeth are not in mandibles, it is possible they could be from a single individual that was in the process of shedding its deciduous dentition and the permanent premolar was erupting. The deciduous premolar, however, has no sign of wear and the adult premolar has moderate wear. This is the opposite of what would be expected in the scenario just given, therefore two individuals are identified. Because the teeth are not in mandibles it is more difficult to assign an age based on tooth eruption or even wear. Deer lose their deciduous dentition at around 1 ½ years of age. Therefore, one of the deer represented is over 1 ½ years and the other is younger (Schwartz and Schwartz 1981; Gilbert 1990).

Epiphyseal fusion was observable on only three bones, but supports the tooth eruption ages. An unfused distal tibia would come from an individual that was less than 17 months. The fused 1st phalanx and fused distal metapodial would come from an individual older than 17-29 months (Purdue 1983).

A first phalanx exhibits cut marks across its distal end. This was the only deer remain with cut marks. A couple of large and medium-large mammal fragments, which are quite possibly deer, also had cut marks.

Only one bird taxon, a turkey (cf. *Meleagris gallopavo*) could be identified and it is somewhat tenuous because of the fragmentary condition of the specimen. No other bone fragments could be identified to the Avian class level.

Three fish taxa were identified, all but one came from flotation of feature fill (Table 10). The lone fish remain from excavation was an Ictalurid (catfish family). From flotation the remains represent the sunfish (Centrarchidae) family with one more specifically identified to the sunfish genus (*Lepomis*). Without being able to identify the species of fish present, it is difficult to determine the aquatic habitat that was being exploited, however, it would most likely be the adjacent Ouachita River.

Turtles were exploited to some degree. Most remains are small indeterminate fragments of carapace or plastron. Softshell turtle (*Apalone* sp.) could be identified because of its distinctive textured shell. Box turtle (*Terrepene* sp.) was also identified. Two amphibian remains are present.

Table 9. Summary of Animal Taxa from Trench 5, Jones Mill (3HS28).

	Trench 5				
	gen. ex 327	*ws 327*	*flot. 327*	*Total NISP*	*Total MNI*
Mammals					
Sciurus sp.	1			1	1
cf. *Mephitis mephitis*			1	1	1
Odocoileus virginianus	36	7		43	2
large mammal	186	12		198	
medium-large mammal	228			228	
medium mammal	1			1	
sub-total mammal	452	19	1	472	
Birds					
cf. *Meleagris gallopavo*	1			1	1
Fish					
Ictaluridae	1			1	1
Centrarchidae			6	6	1
cf. *Lepomis* sp.			1	1	1
Indeterminate fish			12	12	
sub-total fish	1		19	20	
Reptile					
Testudines	25	7	4	36	
Terrepene sp.	4		1	5	1
Apalone sp.	1			1	1
sub-total reptile	30	7	5	42	
Amphibian					
Anura			2	2	1
Indeterminate Vertebrate	574	348		922	
Total Vertebrate	1058	374	27	1459	
Invertebrate					
Unionidae	498			498	
Amblema plicata	1			1	1
Fusconaia *sp.*	7			7	4
Elliptio dilatata	1			1	1
Ligumia recta	1			1	1
Actinonaias ligamentina	1			1	1
Gastropoda	5			5	4
Total Invertebrate	514			514	
Grand Total	1572	374	27	1973	

Table 10. Summary of Faunal Remains (NISP) from Features in Trench 5 (Flotation).

	Trench 5						
	F-31	*F-33*	*F-35*	*F-37*	*F-38*	*F-40*	*Total*
Mammals							
cf. *Mephitis mephitis*				1			1
sub-total mammal				1			1
Fish							
Centrarchidae	1	2	3				6
cf. *Lepomis* sp.					1		1
Indeterminate fish		2	6		2	2	12
sub-total fish	1	4	9		3	2	19
Reptile							
Testudines		2				2	4
Terrepene sp.				1			1
sub-total reptile		2		1		2	5
Amphibian							
Anura					2		2
Total Vertebrate	1	6	9	2	5	4	27

Table 11. List of Deer Elements (NISP) Recovered from Trench 5.

	Standard	*Trench 5*
Extemities		
Antler	2	1
Astragalus	2	2
Atlas	1	
Axis	1	
Calcaneum	2	1
Cuboid	2	1
Greater Cuneiform	2	2
Hyoid	2	
Lateral maleolus	2	
Lesser Cuneiform	2	
Lunate	2	
Magnum	2	1
Mandible	2	
Metacarpal	2	
Metacarpal, vestigial	4	
Metatarsal	2	2
Patella	2	
Phalanx 1	8	1
Phalanx 2	8	
Phalanx 3	8	
Phalanx, vestigial	24	
Pisiform	2	
Scaphoid	2	1
Skull	25	
Tooth	32	19
Triquetral	2	
Unciform	2	
Total	147	31
%	66.80%	79.50%

	Standard	*Trench 5*
Axial		
Innominate	2	
Rib	26	2
Sacrum	1	
Scapula	2	
Sternebra	7	
Vertebra, cervical	5	2
Vertebra, thoracic	13	1
Vertebra, lumbar	6	
Total	62	5
%	28.60%	12.80%
Appendicular		
Humerus	2	1
Radius	2	
Ulna	2	
Femur	2	
Tibia	2	2
Total	10	3
	4.60%	7.70%
Total	219	39
Not used		
Phalanx, unspecified		1
Metapodial		3

Invertebrates of freshwater mussel (Unionidae) and Gastropoda were represented in the assemblage (Table 9). Most were small fragments of shell that could not be further identified. Four of the five taxa of freshwater mussel were identified by Robert Warren of the Illinois State Museum. The most numerous is from the genus *Fusconaia,* but the species could not be determined. The most common *Fusconaia* species is the Wabash pigtoe (*Fusconaia flava*) that inhabits creeks to large rivers in mud, sand, or gravel substrates (Cummings and Mayer 1992). The other species identified include three ridge (*Amblema plicata*), spike (*Elliptio dilatata*), mucket (*Actinonaias ligamentina*), and black sandshell (*Ligumia recta*). The latter has the most specific habitat requirements of these in that it prefers medium to large rivers with a firm sand or gravel substrate and riffles (Cummings and Mayer 1992). All the valves that could be identified are small and would not have afforded much in the way of sustenance. It is possible the valves were being collected for other uses such as temper for pottery.

The valve identified as three ridge has been modified into a possible shell hoe (Figure 5). It was recovered from Level 3 in Unit N206E201 (Accession # 2008-327-20). The valve, however, is small in size measuring 65.4 mm in length and 56.5 mm in width. A small oval hole measuring 14.3 x 11.7 mm has been punched near the beak cavity. There is some chippage on the anterior end near the anterior retractor muscle scar that would have facilitated hafting and the posterior edge of the valve is somewhat squared off and shows wear from use. Hoe blades made from mussel shell valves were more commonly used in the Caddo area than were chipped stone hoes or bison scapulae. Harrington (1960: Plate V) illustrates a hoe from Salts Bluff (3BE18), one of the rockshelters in the northern Arkansas Ozarks, made from a mussel shell valve hafted onto a wooden handle. Perforated mussel shell valves have also been found at Hardman, Caddo Valley Mound, and Cedar Grove in southwest Arkansas (Kay 1984:190. 197-198; Reynolds 2007:53; Williams 1993:138-139).

Figure 5. Two views of perforated Amblema plicata valve from Trench 5 (2008-327-20, photo AAS/HSU D_4994, 4996).

Comparisons

From the Jones Mill testing in the 1980s, both the botanical and faunal assemblages were sparse, despite the number of features excavated (97, most in a block excavation area on the site's north side, see Figure 2). Most of the floral materials were fragments of wood; amaranth seeds were identified from three features, but hickory nutshell was only identified from one (Bennett 1986:114-115). Only mammal bone was identified, and the only bone identified to species was deer (Bennett 1986:115-117). The lack of identified plant and animal remains is surprising, especially since most of the features excavated were from the Woodland and Caddo period occupations at Jones Mill rather than the earlier Archaic period.

The recovery and analysis of floral and faunal samples as well as radiocarbon dates from modern excavations at Jones Mill was especially important since these were lacking in the earlier work at the site. The two spatially discrete excavation areas, Trenches 3 and 4 and Trench 5, reflect temporal and functional differences between occupations. Archaeological investigations at the site were limited to a relatively small area, however. Thus, the actual scope and magnitude of the Archaic and late prehistoric occupations remain to be more fully explored. Distinctions in diversity, ubiquity and density of macrobotanical and faunal remains between the two areas investigated were readily apparent. At the same time, there was also evidence for strong continuity in one aspect of plant-based foodways, a focus on harvest of seasonal nut masts. Periodic Middle Archaic visitors exploited local sources of novaculite and engaged in tool manufacture, while also purposefully targeting hickory nuts in nearby forests and processing them at the site. Remains of oak, hickory, Osage orange and hackberry wood were sparse in Middle Archaic flotation samples, partially due to preservation factors, although thick, dense nutshells also may have been used as fuel in place of wood. Unfortunately, the faunal assemblage from Jones Mill provides no information on the animal exploitation for the earlier Archaic residents. The faunal remains from the Archaic components consist of indeterminate, calcined fragments.

Foodways of late prehistoric Caddo residents at Jones Mill included a combination of agriculture and foraging for wild plant food resources. At least three taxa of native EC starchy cultigens—maygrass, little barley and erect knotweed—were represented in the seed assemblage, each by a single specimen. Given the presence of Fourche Maline diagnostics at the site, we hoped for some documentation of early domesticates, but the evidence for cultigens, including maize, reflects a later Caddo period occupation. The addition of maize to existing horticultural strategies previously based on indigenous starchy and oil seeds occurred in this region by approximately 1150 B.P. Over time, maize became a staple among the Caddo and gradually replaced traditional small seed crops, a process repeated in many areas of the Eastern Woodlands (cf. Fritz 1984; Perttula 2008; Simon and Parker 2006). In the Trench 5 flotation samples, maize fragments were ubiquitous and abundant in comparison to native cultivated seeds, suggesting that maize was the more important resource. The sample from this component was small and therefore may not be an accurate measure of relative economic significance, but a similar pattern is seen in the region more broadly.

Hickory nuts plainly were a targeted wild food for the Caddo based on all measures of nutshell in the plant assemblage (and hickory nut use continues in some Indian communities up to the present day, see Fritz *et al.* 2001). Several thin shell fragments and a partial cotyledon suggest that acorns were also harvested. Seasonal fleshy fruits and berries were represented only by a single grape seed, but probably were more valued than this sparse evidence suggests. Forests were the source of non-edible, but nonetheless critical fuel wood, including oak, shortleaf pine and hickory.

Most of the fauna identified from Trench 5 came from the midden and may be mixed contexts, although a few came from the bases of features that date to the Caddo occupation. It is a small assemblage that suffered from poor preservation although it was much better than the earlier occupations. The Caddo inhabitants of Jones Mill exploited nearby edge and aquatic habitats, the latter most likely being the Ouachita River. Deer would have provided the greatest amount of meat, but it appears fish, turtles, and possibly mussels would have also been an important source of animal protein. Birds do not appear to have been exploited to a great extent.

Beyond the Jones Mill site, there is little firm evidence for foodways from previous excavations in the Middle Ouachita River region for the Archaic period. A Middle Archaic date was obtained on charred nutshell identified by the excavators as hickory nut from a burned rock feature at 3HS551 (Klinger et al. 2001). One of the best discussions of the Archaic and Woodland period lifeways in this region is Schambach's (1998) analysis of WPA-era excavations at the Cooper and Means sites (3HS1, 3HS3), but in the 1930s and 1940s, animal bones and plant fragments were not systematically collected. A list of animals represented by bone and shell from Cooper (with its Middle Archaic to Woodland components) includes white-tailed deer, raccoon, opossum, turkey, rabbit, dog or fox, bobcat, beaver, quail, box turtle, fish, and 15 kinds of freshwater mussel. Fauna from Means (with Woodland and Caddo period components) included deer, raccoon, beaver, bison, turkey, box turtle, and freshwater mussels, and burned cane matting was found in the rectangular Mid-Ouachita phase structure (Schambach 1998:16, 79-80, 108).

More complete knowledge of plant and animal use comes from excavated and reported Caddo components in the Middle Ouachita River region. At Hardman (3CL418), maize was the most abundant plant food, beans and pepo squash are present, native cultigens are poorly represented (little barley and maygrass are present, and the amaranth and chenopod seeds are weedy or wild rather than domesticated). Nutshell from hickory, acorn, and pecan is relatively low, and there are some wild fruit seeds (persimmon, grape, blueberry, cherry, sumac, blackberry/raspberry) (Fritz 1993). White-tailed deer dominated and fish and mussels were abundant and diverse at Hardman, while small mammals, birds, reptiles, and amphibians were relatively sparse (Styles and White 1993). At Helm (3HS449), bone preservation was poor, and the faunal assemblage was not as diverse. Fish, birds, turtle, and frog/toad are present but the assemblage is dominated by deer and other mammals (Scott 2000). The botanical materials were fragmented, but were again dominated by maize, with nutshell (thick hickory, acorn), domesticated beans and pepo squash, maygrass, and wild or weedy types of chenopod, amaranth, knotweed, and sumpweed present, as well as several wild starchy seeded plants (ragweed, purslane, dropseed, dock) and wild fruits (nightshade, grape, persimmon, passionflower, and raspberry/blackberry) (Powell and Lopinot 2000). With the exception of the mussel shell, floral and faunal assemblages from the contemporaneous Caddo Valley Mound (3CL593) on the lower Caddo River have not yet been analyzed (Reynolds 2007). Ten species of freshwater mussel were identified there, including a perforated mussel shell valve (Scott 2007).

Further west in the Ouachita Mountains region, botanical materials from Standridge and Winding Stair have been analyzed but faunal remains were seldom recovered. A well-preserved and diverse botanical assemblage from Winding Stair (3MN496) was dominated by domesticated maize, followed by wild hickory nuts and acorns, chenopod that was wild or weedy rather than domesticated, and wild fruits (persimmons, grapes) (Williams 2000b). Maize likewise dominated the plant remains from Standridge (3MN53), with beans the only other cultigen identified. Persimmon seeds were also abundant, and a variety of nuts—hickory, black walnut, acorn, pignut, and shagbark hickory—were found (Early 1988).

Summary and Conclusions

While the recovery of flora and fauna from the Middle Archaic Trench 3 and 4 samples was disappointing, it is clear that hickory nut collecting and processing was an important part of the foodways during this time. These nuts are ready to harvest in the fall, and would provide a storable and nutritious food supply over the winter. An argument could be made for hunting, probably deer, during fall and winter too, but this is an inference based on the dart points with distal impact fractures. If Middle Archaic residents of Jones Mill were netfishing with the notched pebble netsinkers found at the site, they may have congregated here in the late spring/early summer to take advantage of fish spawning in the nearby Ouachita River, but again, this is conjecture.

The information from the Caddo period occupation based on Trench 5 is more complete. Deer and turkey would be in their prime in the late fall/early winter but could have been hunted year round. Nutshell such as hickory would be collected in the fall as well. Fish may indicate warmer months, as would turtles. Preparing fields for crops would be done in spring, with harvests in the summer. The food evidence, plus the remains of a house dating to AD 1450, shows a more substantial community of people farming, fishing, hunting, and living at Jones Mill throughout the year.

Limited archaeological excavations at the Jones Mill site has provided tantalizing insights into contrasting patterns of prehistoric plant and animal use at a single locality within the Ouachita River Valley from about 6000 BC to 1450 AD. Analysis of artifacts and features from the excavations is on-going, and further details of the lifeways of the ancient inhabitants of Jones Mill will be forthcoming.

Acknowledgments

This project is supported in part by a grant from the Arkansas Humanities Council and the Department of Arkansas Heritage. Additional support for research at the Jones Mill site comes from the Arkansas Archeological Society's Archeological Research Fund. Excavations at the site took place in 2007 and 2008 with crews of professionals, volunteers, and students from the Arkansas Archeological Survey, the Arkansas Archeological Society, and Henderson State University and University of Arkansas. Lab assistance was provided by Amanda Brock, Mary Ann Goodman, Florence Davis, Judy Thye, and Elizabeth Sorensen. The landowner, Entergy Arkansas, Inc., is appreciated both for extending permission for the excavations but also for continued protection of this important site.

References Cited

Asch, D. L. and N. B. Asch

1985 Archaeobotany of the Campbell Hollow Archaic Occupations. In *The Campbell Hollow Archaic Occupations: A Study of Intrasite Spatial Structure in the Lower Illinois Valley*, edited by C. Russell Stafford, pp. 82–107. Research Series, Vol. 4. Center for American Archeology, Kampsville, Illinois.

Baker, C. M.

1974 A Study of Aboriginal Novaculite Exploitation in the Ouachita Mountains of South-Central Arkansas. Unpubl. M. A. Thesis, Department of Anthropology, University of Arkansas, Fayetteville.

References Cited (cont.)

Bennett, W. J., Jr., with contributions from B. Burnett, C. Clark, A. F. Gettys, R. Hollaway, M. Marks, J. Miller, L. Smith, J. B. Sollberger, R. Stewart, and J. Watkins

1986 *Investigations at 3HS28, the Jones Mill Site*. Report No. 25, Archeological Assessments, Inc., Nashville, Arkansas.

Bohlen, H. D.

1989 *The Birds of Illinois*. Indiana University Press, Bloomington.

Brock, A.

2009 Field School Excavations at Jones Mill, 2007. *Field Notes* (Newsletter of the Arkansas Archeological Society) 350:3-4.

Brookes, S. O.

1999 Prehistoric Exchange in Mississippi, 10,000 B.C. - A.D. 1600. In *Raw Materials and Exchange in the Mid-South*, edited by E. Peacock and S. O. Brookes, pp. 86-94. Archaeological Report No. 29, Mississippi Department of Archives and History, Jackson, Mississippi.

Chaplin, R. E.

1971 *The Study of Animal Bones from Archaeological Sites*. Seminar Press, New York.

Chapman, J. S.

2004 *Cultural Resources Survey of Three Items in the Ouachita River, Hot Spring County, Arkansas, as Part of a Section 1135 Environmental Restoration Project*. Final Report, Panamerican Consultants, Inc., Memphis, Tennessee.

Cummings, K. S. and C. A. Mayer

1992 *Field Guide to Freshwater Mussels of the Midwest.* Illinois Natural History Survey, Manual 5, Champaign.

Driver, J. C.

1992 Identification, Classification and Zooarchaeology. *Circaea* 9(1):35-47.

Early, A. M.

1988 *Standridge: Caddoan Settlement in a Mountain Environment*. Research Series 29, Arkansas Archeological Survey, Fayetteville.

2000 The Caddo and the Forest. In *Forest Farmsteads: A Millennium of Human Occupation at Winding Stair in the Ouachita Mountains*, edited by A. M. Early, pp. 93-110. Research Series 57, Arkansas Archeological Survey, Fayetteville.

2002 The Mid-Ouachita Phase. *Field Notes* (Newsletter of the Arkansas Archeological Society) 305:10-13.

Etchieson, M.

1997 Prehistoric Novaculite Quarries in the Ouachita Mountains. Paper presented at the Annual Meeting of the Society for American Archaeology, Nashville, TN.

References Cited (cont.)

Fritz, G. J.

1984 Identification of Cultigen Amaranth and Chenopod from Rockshelter Sites Northwest Arkansas. *American Antiquity* 49(3):558-572.

1993 Archeobotanical Analysis. In *Caddoan Saltmakers in the Ouachita Valley: The Hardman Site*, edited by A. M. Early, pp. 159-168. Research Series 43, Arkansas Archeological Survey, Fayetteville.

Fritz, G. J., V. Drywater Whitekiller, and J. W. McIntosh

2001 Ethnobotany of Ku-Nu-Che: Cherokee Hickory Nut Soup. *Journal of Ethnobiology* 21(2):1-27.

Gardner, P. S.

1997 The Ecological Structure and Behavioral Implications of Mast Exploitation Strategies. In *People, Plants and Landscapes: Studies in Paleoethnobotany*, edited by Kristen J. Gremillion, pp. 161-178. The University of Alabama Press, Tuscaloosa.

Gautier, A.

1984 How Do We Count These Bones? Let Me Count the Ways. Problems of Archaeozoological Quantification. In *Animals and Archaeology*, Vol. 4, edited by C. Grigson and J. Clutton-Brock, pp. 237-251. BAR International Series 227, British Archaeological Reports, Oxford.

Gibson, J. L.

1994 Empirical Characterization of Exchange Systems in Lower Mississippi Valley Prehistory. In *Prehistoric Exchange Systems in North America*, edited by T. G. Baugh and J. E. Ericson, pp. 127-175. Plenum Press, New York.

1999 Swamp Exchange and the Walled Mart: Poverty Point's Rock Business. In *Raw Materials and Exchange in the Mid-South*, edited by E. Peacock and S. O. Brookes, pp. 57-63. Archaeological Report No. 29, Mississippi Department of Archives and History, Jackson, Mississippi.

Gilbert, B. M.

1990 *Mammalian Osteology.* Missouri Archaeological Society, Columbia, MO.

Grayson, D. K.

1984 *Quantitative Zooarchaeology: Topics in the Analysis of Archaeological Faunas*. Academic Press, New York.

Harrington, M. R.

1920 *Certain Caddo Sites in Arkansas*. Indian Notes and Monographs, Museum of the American Indian, Heye Foundation, New York.

1960 *The Ozark Bluff-Dwellers*. Indian Notes and Monographs, Vol. XII. Museum of the American Indian, Heye Foundation, New York.

Hester, T. R., editor

1991 *The Burned Rock Middens of Texas: An Archeological Symposium*. Studies in Archeology 13, Texas Archeological Research Laboratory, University of Texas, Austin.

Hoadley, R. B.

1990 *Identifying Wood: Accurate Results with Simple Tools*. The Taunton Press, Newtown, Connecticut.

References Cited (cont.)

Hoffmeister, D. F.

1989 *Mammals of Illinois*. University of Illinois Press, Urbana.

Holmes, W. H.

1891 Aboriginal Novaculite Quarries in Garland County, Arkansas. *American Anthropologist* 4 (old series):313-316.

1919 *Handbook of Aboriginal American Antiquities, Part I, Introductory, The Lithic Industries*. Smithsonian Institution, Bureau of American Ethnology Bulletin 60, Washington, D.C., reprinted 1974, Burt Franklin, New York, NY.

Integrated Taxonomic Information System

2010 Integrated Taxonomic Information System. Website http://www.itis.gov .

Jackson, H. E. and S. L. Scott

2001 Archaic Faunal Utilization in the Louisiana Bottomlands. *Southeastern Archaeology* 20(2):187-196.

Jeter, M. D. and H. E. Jackson

1994 Poverty Point Extraction and Exchange: The Arkansas Lithic Connections. In Exchange in the Lower Mississippi Valley and Contiguous Areas at 1100 B.C., edited by J. L. Gibson. *Louisiana Archaeology* 17(1990):133-206.

Jenney, W. P.

1891 Ancient Novaculite Mines near Magnet Cove, Hot Springs County, Arkansas. *American Anthropologist* 4 (old series):316-318.

Johnson, J. K.

1981 *Lithic Procurement and Utilization Trajectories: Analysis, Yellow Creek Nuclear Power Plant Site, Tishomingo County, Mississippi*, Volume II. Archaeological Papers of the Center for Archaeological Research No. 1, University of Mississippi, University.

Johnson, T. R.

1992 *The Amphibians and Reptiles of Missouri*. Missouri Department of Conservation, Jefferson City.

Kay, M.

1984 Late Caddo Subtractive Technology in the Red River Basin. In *Cedar Grove: An Interdisciplinary Investigation of a Late Caddo Farmstead in the Red River Valley*, edited by N. L. Trubowitz, pp. 174-206. Research Series No. 23, Arkansas Archeological Survey, Fayetteville.

Kidder, T. R.

1997 Sugar Reflotation: An Alternative Method for Sorting Flotation-Derived Heavy Fraction Samples. *Journal of Field Archaeology* 24(1):39-45.

Klein, R. G. and K. Cruz-Uribe

1984 *The Analysis of Animal Bones from Archaeological Sites*. University of Chicago Press, Chicago.

References Cited (cont.)

Klinger, T. C., J. A. Ross, D. R. Dickson, J. L. Gray, IV, and G. G. Dunn

2001 *Malvern Unit, Arkansas Department of Corrections Facility, Historic Properties Overview of a Proposed Prison Facility in the Ozark-Arkansas-Ouachita Region, Hot Spring County, Arkansas*. Historic Preservation Associates, Report #01-27, Fayetteville, Arkansas.

Marshall, F. and T. Pilgram

1993 NISP vs. MNI in Quantification of Body Part Representation. *American Antiquity* 58(2):261-269.

Martin, A. C. and W. D. Barkley

1961 *Seed Identification Manual.* University of California Press, Berkley.

Pearsall, D. M.

1989 *Paleoethnobotany: A Handbook of Procedures.* Academic Press, New York

Perttula, T. K.

2008 Caddo Agriculture on the Western Frontier of the Eastern Woodlands. *Plains Anthropologist* 53(205):79-105.

Perttula, T. K., M. B. Trubitt, and J. S. Girard

n.d. The Use of Shell-Tempered Pottery in the Caddo Area of the Southeastern U.S. Ms. under review for *Southeastern Archaeology*.

Pflieger, W. L.

1975 *The Fishes of Missouri.* Missouri Department of Conservation, Jefferson City.

Powell, G. S. and N. H. Lopinot

2000 Archeological Plant Remains from the Helm Site. In *Data Recovery at the Helm Site, 3HS449, Hot Spring County, Arkansas*, by R. H. Lafferty III, A. Early, M. C. Sierzchula, M. C. Hill, G. S. Powell and N. H. Lopinot, L. S. Cummings, S. L. Scott, S. K. Nash, and T. K. Perttula, pp. 187-229. MCRA Report 2000-1. Mid-Continental Research Associates, Inc., Lowell, Arkansas.

Purdue, J. A.

1983 Epiphyseal Closure in White-tailed Deer. *Journal of Wildlife Management* 47(4):1207-1213.

Reitz, E. J. and E. S. Wing

2008 *Zooarchaeology*. Cambridge University Press, Cambridge, United Kingdom.

Reynolds, M. D.

2007 *Preliminary Report on Salvage Excavations at 3CL593*. Limited distribution report, Arkansas Archeological Survey, HSU Research Station, Arkadelphia.

Rolingson, M. A. and J. M. Howard

1997 Igneous Lithics of Central Arkansas: Identification, Sources, and Artifact Distribution. *Southeastern Archaeology* 16(1):33-50.

References Cited (cont.)

Schambach, F. F.

1998 *Pre-Caddoan Cultures in the Trans-Mississippi South: A Beginning Sequence*. Research Series 53, Arkansas Archeological Survey, Fayetteville.

2003 Osage Orange Bows, Indian Horses, and the Blackland Prairie of Northeastern Texas. In *Blackland Prairies of the Gulf Coastal Plain: Nature, Culture, and Sustainability*, edited by E. Peacock and T. Schauwecker, pp. 212-236. University of Alabama Press, Tuscaloosa.

Schwartz, C. W. and E. R. Schwartz

1981 *The Wild Mammals of Missouri*. University of Missouri Press and Missouri Department of Conservation, Columbia.

Scott, R. J.

2007 Mussel Shell. In *Preliminary Report on Salvage Excavations at 3CL593*, by M. D. Reynolds, Appendix C. Limited distribution report, Arkansas Archeological Survey, HSU Research Station, Arkadelphia.

Scott, S. L.

2000 Vertebrate Faunal Remains from the Helm Site (3HS449). In *Data Recovery at the Helm Site, 3HS449, Hot Spring County, Arkansas*, by R. H. Lafferty III, A. Early, M. C. Sierzchula, M. C. Hill, G. S. Powell and N. H. Lopinot, L. S. Cummings, S. L. Scott, S. K. Nash, and T. K. Perttula, pp. 249-253. MCRA Report 2000-1. Mid-Continental Research Associates, Inc., Lowell, Arkansas.

Severinghaus, C. W.

1949 Tooth Development and Wear as Criteria of Age in White-tailed Deer. *Journal of Wildlife Management* 13:195-216.

Simon, M. L. and K. E. Parker

2006 Prehistoric Plant Use in the American Bottom: New Thoughts and Interpretations. *Southeastern Archaeology* 25(2):212-257.

Stafford, C. R.

1991 Archaic Period Logistical Foraging Strategies in West-Central Illinois. *Midcontinental Journal of Archaeology* 16(2):212-246.

Styles, B. W. and K. White

1993 Faunal Analysis. In *Caddoan Saltmakers in the Ouachita Valley: The Hardman Site*, edited by A. M. Early, pp. 145-158. Research Series 43, Arkansas Archeological Survey, Fayetteville.

Titmus, G. L. and J. C. Woods

1986 An Experimental Study of Projectile Point Fracture Patterns. *Journal of California and Great Basin Anthropology* 8(1):37-49.

References Cited (cont.)

Trubitt, M. B.

2005 Mapping a Novaculite Quarry in Hot Springs National Park. *Caddoan Archeology Journal* 14:17-33.

2007 The Organization of Novaculite Tool Production: Quarry-Workshop Debitage Comparisons. *Caddo Archeology Journal* 16:71-89.

2008 Something New on the Archaic: Highlights from the 2007-2008 Training Programs. *Field Notes* (Newsletter of the Arkansas Archeological Society) 345: 4-7.

2009a Investigating Middle Archaic at the Jones Mill Site. *The Arkansas Archeologist* (Bulletin of the Arkansas Archeological Society) 48:71-84.

2009b Putting an Age on the Archaic at Jones Mill. *Field Notes* (Newsletter of the Arkansas Archeological Society) 349: 3-7.

2009c Burning and Burying Buildings: Exploring Variation in Caddo Architecture in Southwest Arkansas. *Southeastern Archaeology* 28(2):233-247.

2011 Another Archaic Period Date from Jones Mill. *Field Notes* (Newsletter of the Arkansas Archeological Society). Forthcoming in next issue.

Trubitt, M. B., T. Green, and A. Early

2004 A Research Design for Investigating Novaculite Quarry Sites in the Ouachita Mountains. *The Arkansas Archeologist* (Bulletin of the Arkansas Archeological Society) 43:17-62.

Uerpmann, H.-P.

1973 Animal Bone Finds and Economic Archaeology: A Critical Study of 'Osteo-archaeological' Method. *World Archaeology* 4(3):

United States Department of Agriculture, Natural Resources Conservation Service

2010 *Fact Sheets and Plant Guides*. USDA, Natural Resources Conservation Service. Website http://www.plants.usda.gov/java/factSheet .

Webb, C. H.

1977 The Poverty Point Culture. *Geoscience and Man*, Volume XVII, School of Geoscience, Louisiana State University, Baton Rouge.

Williams, G. I., Jr.

1993 Lithic, Bone, Shell, and Historic Artifacts. In *Caddoan Saltmakers in the Ouachita Valley: The Hardman Site*, edited by A. M. Early, pp. 119-144. Research Series 43, Arkansas Archeological Survey, Fayetteville.

Williams, M. L.

2000a Evidence for Medicinal Plants in the Paloeethnobotanical Record of the Eastern United States during the Late Woodland through Mississippian Periods. Ph.D. dissertation, Department of Anthropology, Washington University, St. Louis.

2000b Ethnobotanical Analysis. In *Forest Farmsteads: A Millennium of Human Occupation at Winding Stair in the Ouachita Mountains*, edited by A. M. Early, pp. 111-122. Research Series 57, Arkansas Archeological Survey, Fayetteville.

Foster Trailed-Incised: A GIS-Based Analysis of Caddo Ceramic Distribution

Duncan P. McKinnon

Abstract

The use of a Geographic Information System (GIS) allows for dynamic visualizations in the analysis of spatial distributions and the modeling of data clusters and outliers. An on-going analysis of Foster Trailed-Incised vessels found within the Caddo Homeland seeks to construct a distributional framework that can be applied and compared to additional Caddo ceramic types and site location attributes using a GIS database. Preliminary results show high frequencies of Foster Trailed-Incised vessels along the Ouachita and Red River drainages as well as along the Saline, Arkansas, and Little Missouri rivers in Arkansas. Additional possible varieties of Foster Trailed-Incised have been identified in Caddo, Ouachita and Morehouse parishes in Louisiana and at Caddo sites in northeast Texas. While a full analysis of the distribution of Foster Trailed-Incised vessels (and relationships with other Caddo vessel types) is far from complete, initial conclusions are presented in this article.

Introduction

The use of a Geographic Information System (GIS) allows for dynamic visualizations in the analysis of spatial distributions and the modeling of data clusters and outliers. Furthermore, a GIS offers the ability for the user to generate visual models of the spatial distribution of archaeological features that can be compared with environmental datasets, such as elevation, hydrology, or soil data (Wheatley and Gillings 2002).

This article presents some initial findings and thoughts from an on-going GIS analysis of Caddo ceramic vessels recorded within the Caddo Homeland. This specific analysis uses a GIS to visualize the distribution of known Foster Trailed-Incised vessels, along with selected additional vessels that are similar in form and design to the Foster Trailed-Incised type. This analysis provides a distributional framework that can be applied and compared to additional Caddo ceramic types and site location attributes across the Caddo landscape. The majority of vessels discussed in this analysis is referred to as Foster Trailed-Incised and is included as a collective based on similarities in form and design, as discussed below.

The GIS database discussed here was created using Foster Trailed-Incised ceramic vessels primarily gathered from an "analog database" of data cards containing vessel photographs, site provenience (where known), and available attributes that have been documented by several contributors (mentioned in the acknowledgments) and are from collections throughout southwestern Arkansas. The photo cards were compiled and organized by Dr. Frank F. Schambach during his tenure as Station Archeologist at the Arkansas Archeological Survey station in Magnolia, Arkansas. Archaeological literature and site reports were also perused in search of additional recordings of Foster Trailed-Incised vessels found throughout the Caddo Homeland (see Brown 1996; Crook and Perttula 2008; Early 1988, 1993a; Hart 1982; Hemmings 1982; House 1991; Jackson et al. 2000; Kelley 1997; Kelley and Cox 1998; Kidder 1988; Krieger 1946; Lynott 1975a, 1975b;

Moore 1912; Moorehead 1931; Perino 1994, 1995; Perttula 2005, 2006; Perttula et al. 2009a, 2009b, 2009c, 2009d; Perttula and Nelson 2009; Rohbaugh 1982; Sundermeyer et al. 2008; Schambach 1981; Schambach et al. 1982; Schambach and Miller 1984; Suhm et al. 1954; Suhm and Jelks 1962; Trubowitz et al. 1982a; Walters 1997; Webb 1959; Webb and Dodd 1941; Weinstein et al. 2003).

A total of 360 whole or mostly whole vessels have been identified that contain various criteria (discussed below) to be considered Foster Trailed-Incised in type and variety (Figure 1a-b). Of the 360 vessels, 284 contain known site provenience (critical for a distribution analysis) and are included in this analysis. The 76 without site provenience are not included. Various sherds identified in the literature as possibly part of Foster Trailed-Incised vessels are also excluded because of known ambiguities associated with the assignment of decorated Caddo sherds to a type-variety system (see Early 1988, 1993a; Kelley 1997; Schambach 1981; Schambach and Miller 1984 for discussions on the Collegiate Classification System used in Arkansas and Louisiana ceramic analysis).

Attribute data were gleaned from notes associated with the Magnolia "analog database" and from tables within publications. At this time, none of the vessels have been analyzed (by me) apart from a review of the numerous images that have been gathered, scanned, and compiled. As a result, some data attributes about vessels are not included in this analysis and will require further exploration by examining the actual vessels (where available) and documentation forms (many of which are on file at various museums) as this project continues. Nonetheless, this preliminary review using the data that has been collected thus far sheds light on the efficacy of a GIS-based distributional analysis as it pertains to Caddo ceramic vessels.

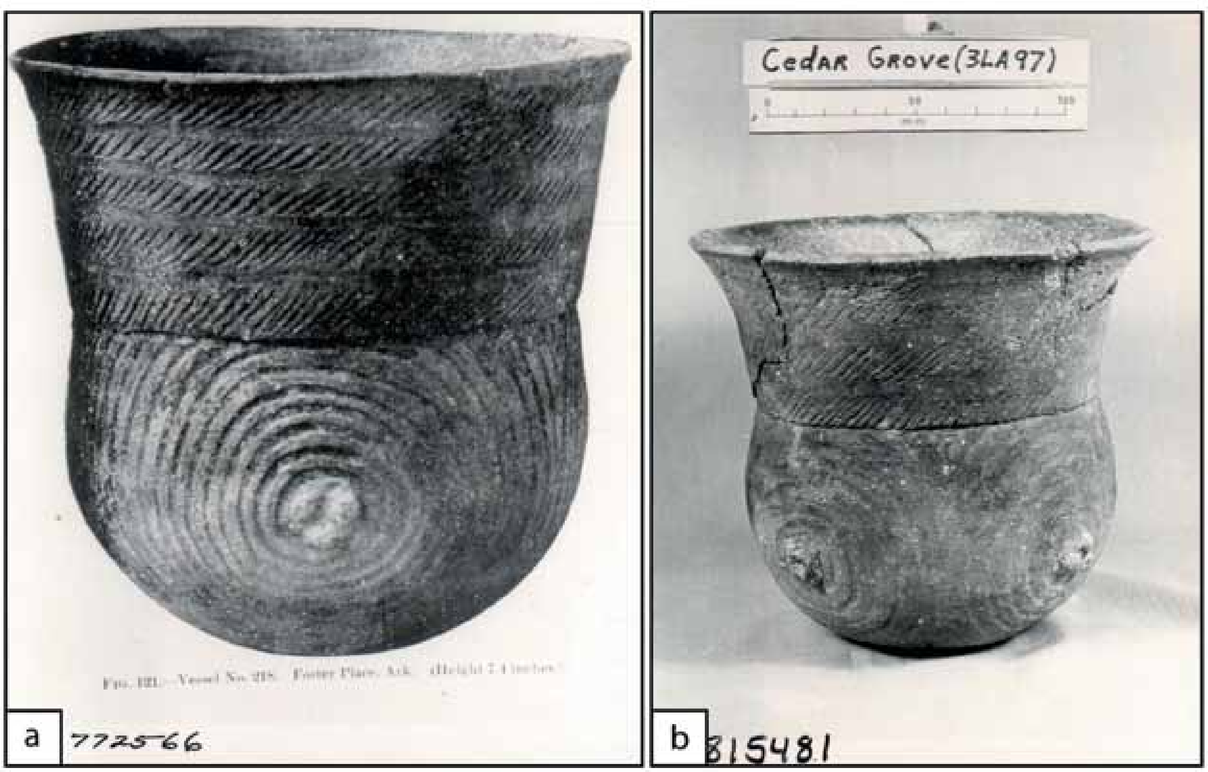

Figure 1. Examples of Foster Trailed-Incised vessels. (a) Foster Place site (3LA27) (AAS Neg. #772566; Moore 1912: Figure 121). (b) Cedar Grove site (3LA97) (AAS Neg. #815481; Schambach and Miller 1984: Figure 11-21a).

Foster Trailed-Incised: Temper, Form, and Treatment

Foster Trailed-Incised vessels are considered a Late Caddo (A.D. 1400-1680) type predominately associated with Caddo occupations in the Ouachita and Red River drainages (Suhm et al. 1954; Suhm and Jelks 1962) with additional distributions along the Saline, Arkansas, and Little Missouri rivers. Additionally, varieties of Foster Trailed-Incised have been identified in Ouachita and Morehouse parishes in northeast Louisiana (Kidder 1988) and at Caddo sites in northeast Texas (Crook and Perttula 2008; Perttula 2005; Sundermeyer et al. 2008; Walters 1997).

Vessel Temper

Webb and Dodd (1941) are the first to describe construction and decorative criteria associated with Foster Trailed-Incised vessels, although several others have elaborated (or contested) vessel characteristics (see Krieger 1946; Suhm et al. 1954; Suhm and Jelks 1962; Webb 1959; Schambach and Miller 1984; Early 1988, 1993a; Kelley 1997). Webb and Dodd describe vessel construction as clay tempered with occasional shell. Webb (1959:131) further elaborates by stating that temper is "preponderantly clay-tempered" with "occasional sand or tuff, presumably accidental" and shell or bone temper is considered rare. Krieger (1946), Suhm et al. (1954) and Suhm and Jelks (1962) classify Foster Trailed-Incised vessels as having clay grit or finely pulverized shell temper. A single vessel located by Early (1988:74) at the Standridge site (3MN53) is described as containing "liberal quantities of finely pulverized shell".

Variations in the dominant temper used are likely related to the distribution of localized resources and regional adherence to cultural "rules" associated with vessel construction. This is not to imply an absence of a resource, but rather the suggestion of regional approaches in the utilization of particular resources. Of the Foster Trailed-Incised vessel images that are included in the database thus far (n=284), temper is recorded in 22.89% (n=65) of the vessels. Of these, shell temper occurs in 75.38% (n=49) and grog temper in 24.62% (n=16).

Vessel Form

Regarding vessel form, Webb and Dodd (1941) include vases, conical bowls, modified globular pots and cups, modified jars, and bottles as possible vessel forms. Suhm et al. (1954) and Suhm and Jelks (1962) include only small jars or globular bowls with a base that is "usually convex so vessel does not stand up well; sometimes flat." Webb (1959:132) identifies the lip as rounded and unmodified with a base that is described as "usually flat." Schambach and Miller (1984:121) consider an evolution of vessel forms that range from a tall flared-rim to possible short-rim jars. Of the Foster Trailed-Incised vessel images that have been reviewed (n=284), and using simplified categories of tall-rim and short-rim jars, tall rims occur in 80.63% (n=229), and short-rimmed jars occur in 13.38% (n=38) of the vessels. Approximately 6.0% (n=17) either have no rims or rims have been broken and are missing.

Vessel Treatment

Webb and Dodd (1941:96) describe decorative treatment as trailed and heavily incised decorations with deep U-shaped incisions and shallower, wider trailed lines on the vessel body that form concentric circles. The concentric circle motif is the principal body design associated with this type. Small "teat-like" nodes in groups of three are located in the center of concentric circles on some vessels. Single nodes, or non-decorated centers are also well documented. Rims often contain lightly incised lines or punctates on tall rims. Suhm et al. (1954:272) and Suhm and Jelks (1962:43) describe the decorative treatment as containing "incising, trailing (incising with a broad, round-tipped tool), punctating, and appliqué."

At the Cedar Grove site (3LA97) along the Red River in southwest Arkansas, Schambach and Miller (1984:121 and Figure 11-10) present an evolution of Foster Trailed-Incised vessels that are divided into seven varieties based on differences in design and decorative treatment. Those varieties are *Foster, Dobson, Red Lake, Dixon, Moore, Shaw, and Finley*.

The Cedar Grove seriation begins with Foster Trailed-Incised *var. Foster*, which contains a concentric circle motif on the body and multiple bands of zoned diagonal lines on a tall rim (see Figure 1b). This design motif evolves through a series of varieties, each containing variations of the motifs found on the *var. Foster*. The Foster Trailed-Incised seriation ends with varieties *Shaw* and *Finley*, each containing vertically oriented interlocking scroll designs on the body with unzoned punctates on the tall rim of *var. Shaw* and a single row of diagonal incised lines on the short rim of *var. Finley*. Although a candidate for "one of the best, and most sensitive time indicators in the Great Bend region" (Schambach and Miller 1984:121), the Cedar Grove Foster Trailed-Incised seriation has yet to be tested at other sites or regions.

Similar Vessel Types

Several Caddo vessels are similar in either form or design, which adds a significant level of complexity when attempting to assign a particular type in the standard type-variety typology. Similar forms and designs likely represent a cultural "over-lap" between regional groups of populations and the implementation of various characteristics in vessel construction and design. By including vessel types that likely represent a cultural "over-lap" in a GIS database, it is hoped that areas of differential vessel type densities can be discerned, clusters in distributions recognized, and spatial patterns analyzed.

Some types similar in either form or design treatment to Foster Trailed-Incised include Cowhide Stamped (Suhm et al. 1954: Plate 13; Suhm and Jelks 1962: Plate 15), Keno Trailed (Suhm et al. 1954: Plate 39; Suhm and Jelks 1962: Plate 44), Killough Pinched (Suhm et al. 1954: Plate 41; Suhm and Jelks: Plate 46), and Military Road Incised (Suhm et al. 1954: Plate 48; Suhm and Jelks 1962: Plate 54). As part of this preliminary analysis of Foster Trailed-Incised, a small representation of the most similar Cowhide Stamped (n=36) and Keno Trailed (n=7, notably *var. Scotts Lake*) vessel type varieties are included.

Some Cowhide Stamped vessel forms are similar to Foster Trailed-Incised (Figure 2). Some body decorations on Cowhide Stamped vessels have similar (if not identical) concentric circle designs as those on Foster Trailed-Incised vessels. For example, two short rim vessels from sites (3HS100 and 3HS33) in Hot Spring County contain concentric design similar to Foster Trailed-Incised (Figure 2a-b). A Cowhide Stamped vessel, from the Battle Mound site (3LA1), demonstrates the similar concentric circle design motif on the body but with scroll bands of stamping rather than incising and containing a short rim (Figure 2c). Additionally, several Cowhide Stamped vessels documented at the Belcher Site (16CD13) along the Red River in northwest Louisiana have concentric circle body motifs similar to Foster Trailed-Incised vessels (Webb 1959:Figure 109).

Keno Trailed vessels exhibit a similar trailing scroll design on the body with "combinations of straight and curved parallel lines fitted close together to cover nearly the entire body" (Suhm et al. 1954:310; Suhm and Jelks 1964:87). However, the vessel shape is more globular with only a short out-flaring rim. Central nodes are often absent. Two Keno Trailed *var. Scotts Lake* (Schambach and Miller 1984:123) vessels from the Battle Mound site (3LA1) (Moore 1912:Figure 61; Perttula et al. 2009:Figure 14d) nicely demonstrate the similarity in the scrolling design motif on the body (Figure 3a-b).

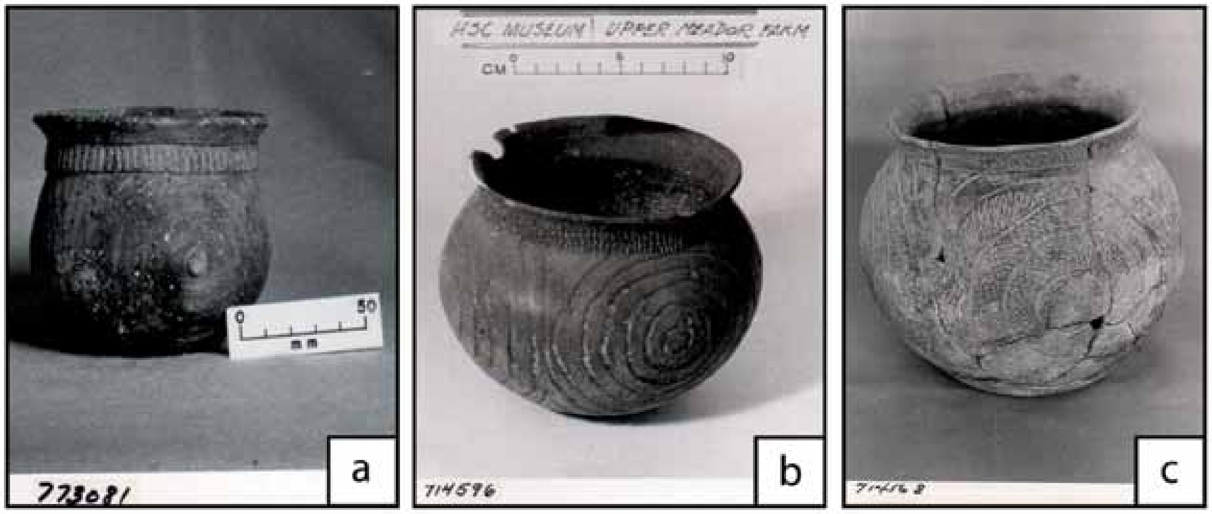

Figure 2. Examples of Cowhide Stamped vessels. (a) McDonald Cole Field (3HS100) (AAS Neg. #773081). (b) Upper Meador Farm (3HS33) (AAS Neg. #714596). (c) Battle Mound site (3LA1) (AAS Neg. #714168).

Figure 3. Examples of Keno Trailed vessels. (a) Battle Mound site (3LA1) (Moore 1912: Figure 61). (b) Battle Mound site (3LA1) (AAS Neg. #694003).

Foster Trailed-Incised Distribution in a GIS

The current database contains a total of 284 whole and mostly whole vessels that meet some if not all of the criteria (largely based on form and design) to be considered a Foster Trailed-Incised vessel and variety of the type. The vessels were found at 82 known sites and spread across 22 counties in Arkansas and Texas and three parishes in Louisiana (Figure 4).

Foster Trailed-Incised vessels have yet to be identified at sites in Oklahoma, although Moorehead (1931:43, Figure 20) illustrates a vessel that is similar in design and form to Foster Trailed-Incised vessels. The vessel is listed in the caption as being from “eastern Oklahoma”. Since specific site provenience is not known, it is not included in this analysis.

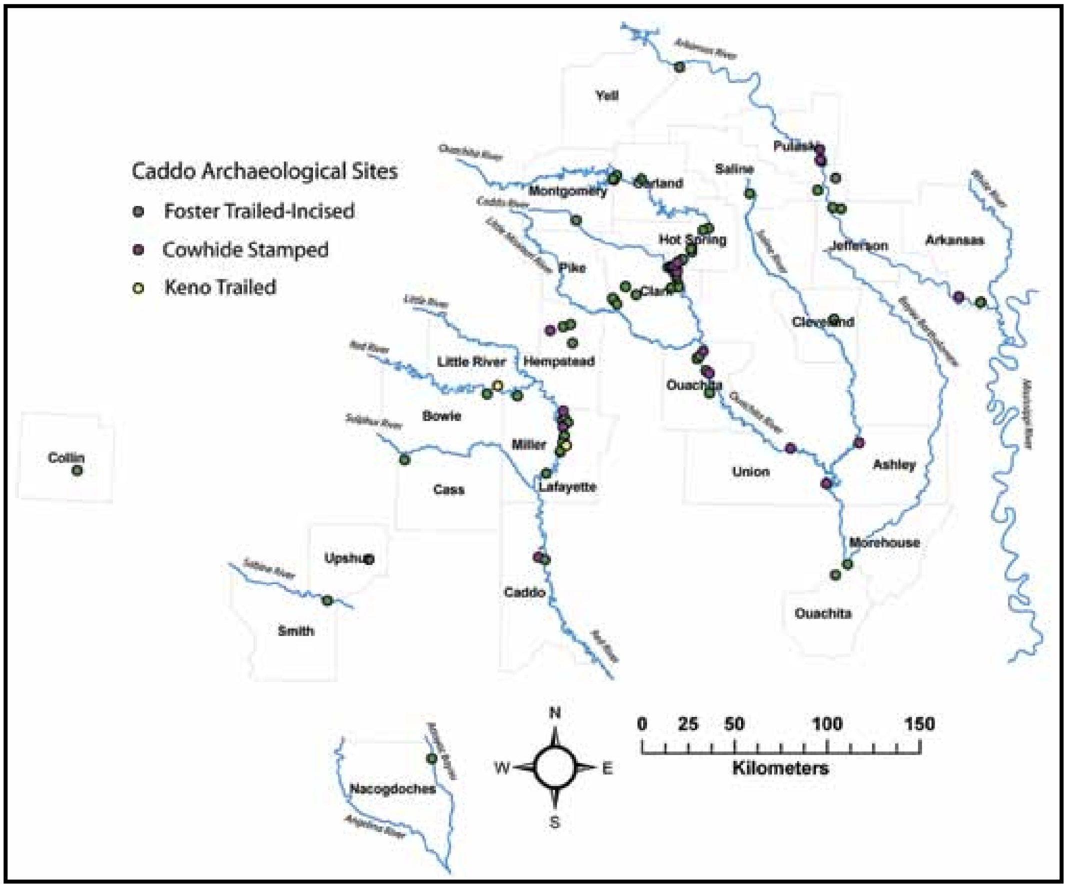

Figure 4. A distribution map of Foster Trailed-Incised, select Cowhide Stamped, and select Keno Trailed vessels in Arkansas, Louisiana, and Texas.

Arkansas has the largest representation in Arkansas (n=2), Clark (n=50), Cleveland (n=2), Garland (n=10), Hempstead (n=10), Hot Springs (n=46), Jefferson (n=9), Lafayette (n=84), Little Rock (n=2), Miller (n=3), Montgomery (n=5), Ouachita (n=16), Pike (n=1), Pulaski (n=18), Saline (n=3), and Yell (n=1) counties. In Texas, sites in Bowie (n=1), Collin (n=1), Cass (n=1), Nacogdoches (n=1), Smith (n=1), and Upshur (n=1) counties are represented. In Louisiana, sites in Caddo (n=12), Ouachita (n=3), and Morehouse (n=1) parishes are represented.

Additionally, and a product for further analysis, this general distribution shows occurrences of Cowhide Stamped vessels primarily situated along of the Ouachita River (with some examples along the Red River) and as far north as the Arkansas River, whereas Keno Trailed *var. Scotts Lake* vessels are situated south of the Ouachita River primarily on the Red River (see Figure 4). Current data gathering shows sites with Cowhide Stamped (those most closely resembling Foster Trailed-Incised in form and design) are situated in Arkansas (n=1), Ashley (n=1), Clark (n=2), Hempstead (n=1), Hot Spring (n=3), Lafayette (n=6), Ouachita (n=2), Pulaski (n=4), and Union (n=3) counties in Arkansas and Caddo Parish (n=13) in Louisiana. Keno Trailed *var. Scotts Lake* vessels (those most closely resembling Foster Trailed-Incised in form and design) are situated in Lafayette (n=6) and Little River (n=1) counties in Arkansas.

The Universal Transverse Mercator (UTM) coordinates for each site were acquired from the Arkansas Archeological Survey AMASDA site database, the Texas Historical Commission Historic Sites Atlas, and the Louisiana Division of Archaeology Cultural Resources Map. Site databases in Oklahoma were not consulted, given the lack of Foster Trailed-Incised vessels identified in the literature directly associated with Oklahoma sites.

GIS Distribution: Quantity, Temper and Form

While preliminary, several distribution maps have been created using attributes associated with quantity, temper, and form, thus allowing for further questions and subsequent analyses to be derived.

Quantity

A distribution map of quantities of vessels at each site (taking into consideration potential biases in site selection and collection methods) shows clustering of Foster Trailed-Incised vessels along the Red, Ouachita, and Arkansas River drainages (Figure 5). Vessels, in lesser quantities (or lesser discovered quantities), are also distributed along the Caddo and Little Missouri rivers in Arkansas, in Ouachita and Morehouse parishes in northeast Louisiana along Bayou Bartholomew, and in northeast Texas.

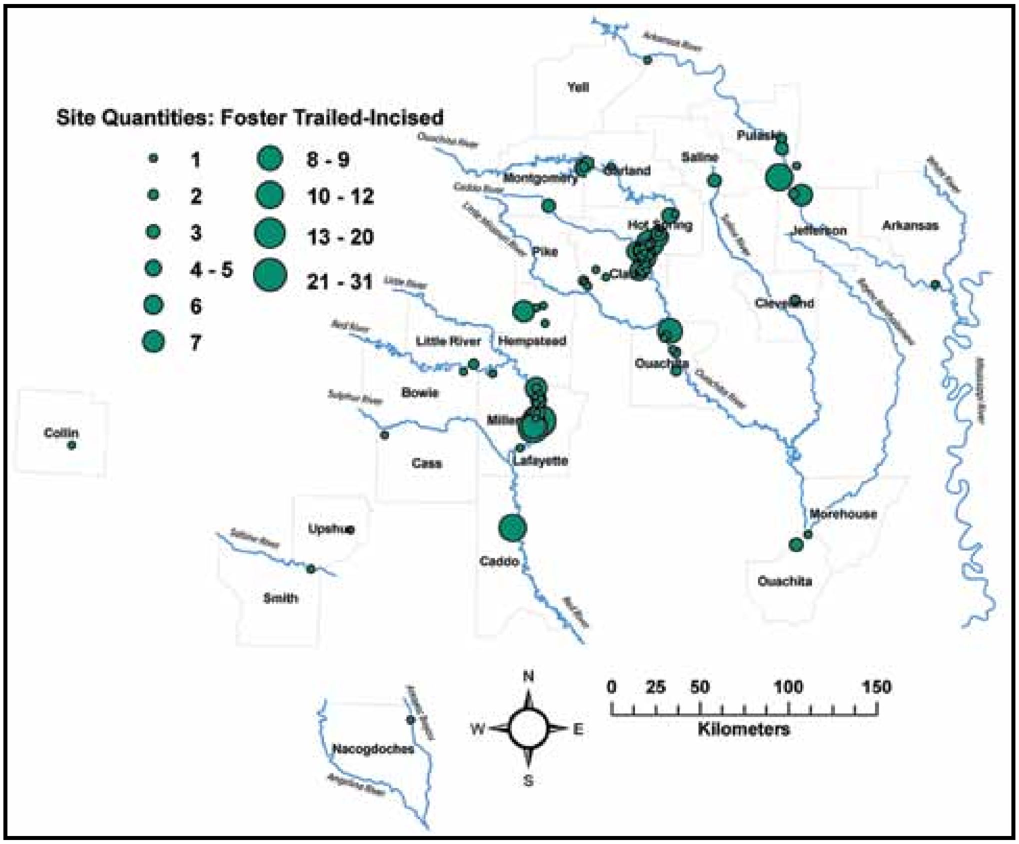

Figure 5. A distribution map of quantities of Foster Trailed-Incised vessels at individual sites.

The largest site quantity occurs at Battle Mound (3LA1), a heavily collected Middle and Late Caddo mound site on the Red River, with 31 Foster Trailed-Incised vessels. Second, with 20 vessels, is the Lester Place (3LA38), a later Caddo non-mound site, inundated by the natural processes of the Red River meander and likely a part of a series of farmsteads. The Kuykendall Brake site (3PU111), a multi-component site located on a former channel of the Arkansas River in Pulaski County, contains 12 Foster Trailed-Incised vessels (the most frequently occurring vessel type recorded at that site). The Belcher site (16CD13) along the Red River in northwest Louisiana also contains 12 Foster Trailed-Incised vessels. Next on the list is the Bob Fisher Mound (3HS22) in Hot Spring County, Arkansas with 11 recorded Foster Trailed-Incised vessels. Additional sites with high Foster Trailed-Incised occurrences are situated along the Ouachita River in Hot Spring and Clark counties and along the Red River in Lafayette and Miller counties. Vessel numbers at these sites average between 6 and 8 vessels. While this distribution has inherent biases based on a number of collection factors, three areas of higher occurrences can be identified along the Red, Ouachita, and Arkansas Rivers (see Figure 5).

Temper

Although temper is not yet a part of the documentation of the many of the Foster Trailed-Incised vessels included in this database (being in various public and private collections and yet to be reviewed by the author), a preliminary distribution map does reveal some insights worthy of further exploration (Figure 6). As already mentioned, shell temper is the most prevalent temper where temper has been recorded or noted (n=65; 22.89%). A distribution map of temper reveals that shell temper is fairly equally distributed across the study area with clusters in the Red, Ouachita, and Arkansas River drainages. Interestingly, grog temper is primarily located along the Red River drainage and at sites further west into east Texas.

This distribution alludes to a connection between the type of temper used and the distribution of localized clay and temper resources as well as regional adherence to cultural "rules" associated with vessel construction. It also offers an avenue of analysis as correlations are explored between temper type and ecological and geological data layers.

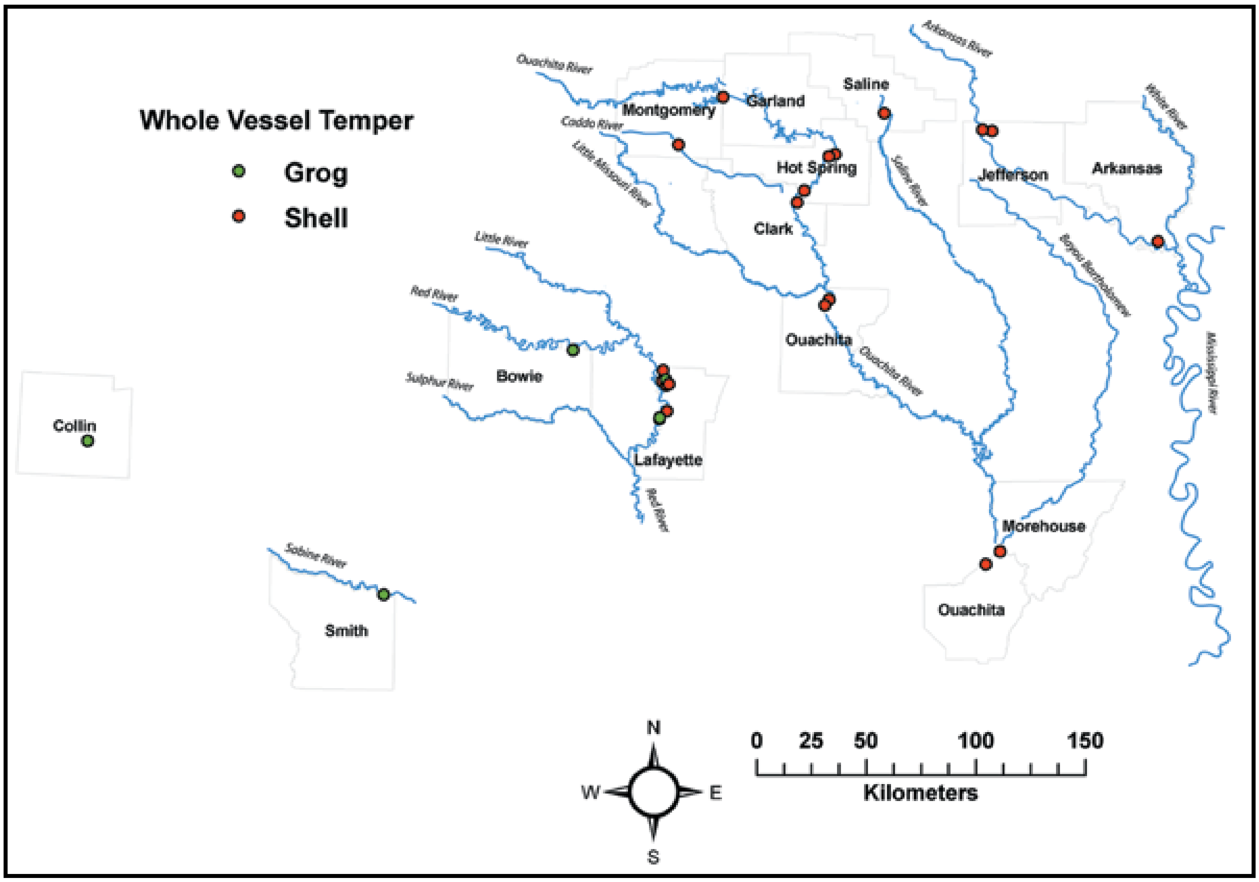

Figure 6. A distribution map of whole vessel temper associated with Foster Trailed-Incised vessels.

Form

Experimenting with distribution of vessel form, three generalized categories of tall, short, or none/missing rim were assigned to the Foster Trailed-Incised vessels in the database. The resulting distribution map shows the different rim types spread out across the entire study area (Figure 7). More categories of rim type (that is, more precise observations and measurements of rim characteristics) or other vessel form attributes are likely to reveal more interpretable results. In spite of this, two locations that show interesting distribution clusters to be further explored are along the Arkansas River in Pulaski and Jefferson counties and along the Ouachita River in Hot Spring and Clark counties. Tall rim vessels are mostly absent in the area along the Arkansas River, whereas short rim vessels are mostly absent along the Ouachita River.

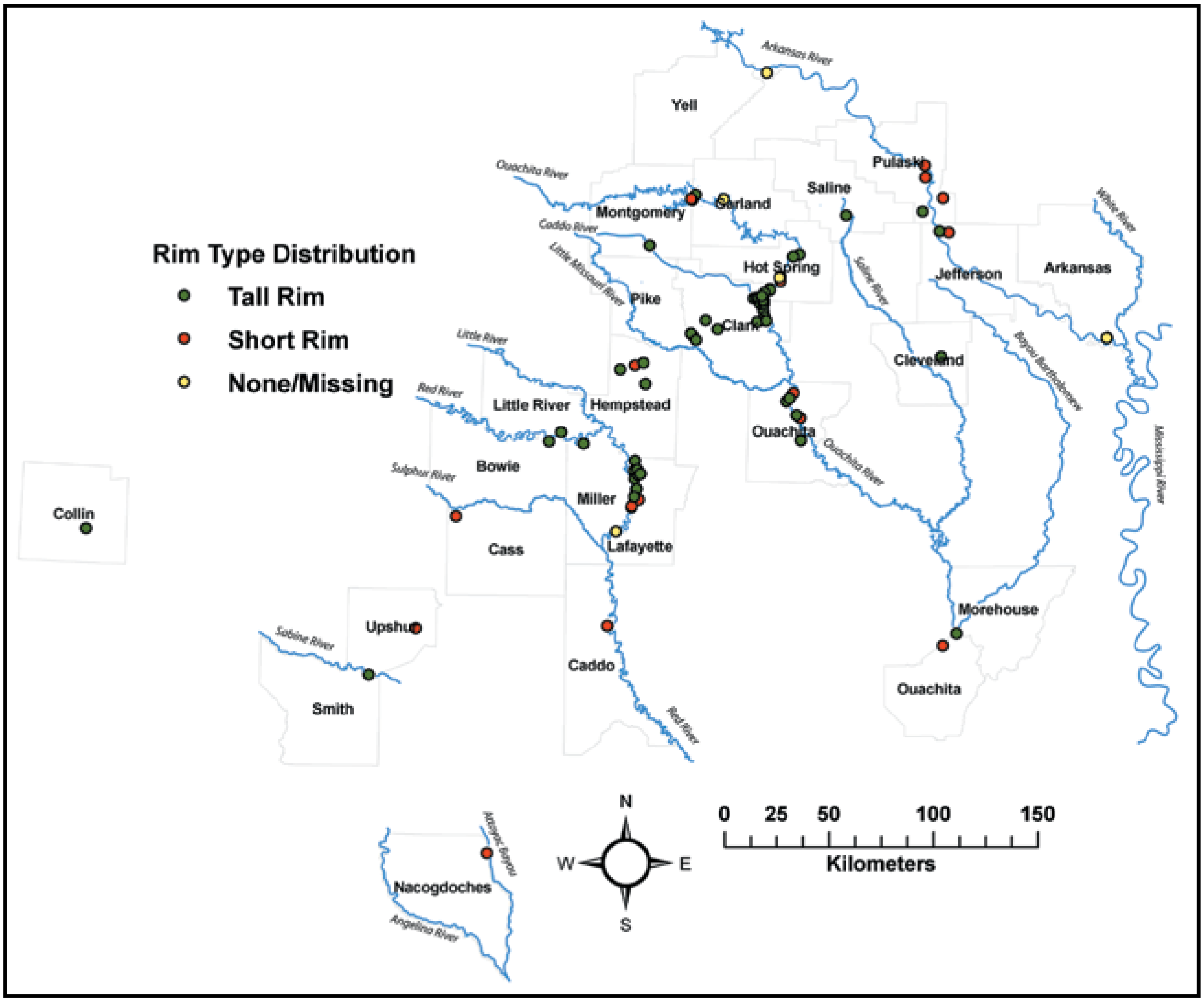

Figure 7. A distribution map of rim type associated with Foster Trailed-Incised vessels.

Distance Loci Analysis

A simple Standard Distance algorithm reveals that the locus of the Foster Trailed-Incised vessel distribution is situated in the Ouachita River area around Clark and Hot Spring counties in Arkansas (Figure 8). A 2-standard deviation distance analysis reveals a distributional radial distance of approximately 150 km that includes most of the sites along the Ouachita, Red, and Arkansas River areas. Of course, with any statistical analysis more data (more identified Foster Trailed-Incised vessels) will allow for additional confidence in the results. However, this preliminary analysis reveals a few sites along the southern portion of Bayou Bartholomew in Louisiana (although on the border), in north-central and east Texas, and along the southern most portions of the Arkansas River in Arkansas County that are not within the 2-standard deviation distance and are considered, for this analysis, as outliers.

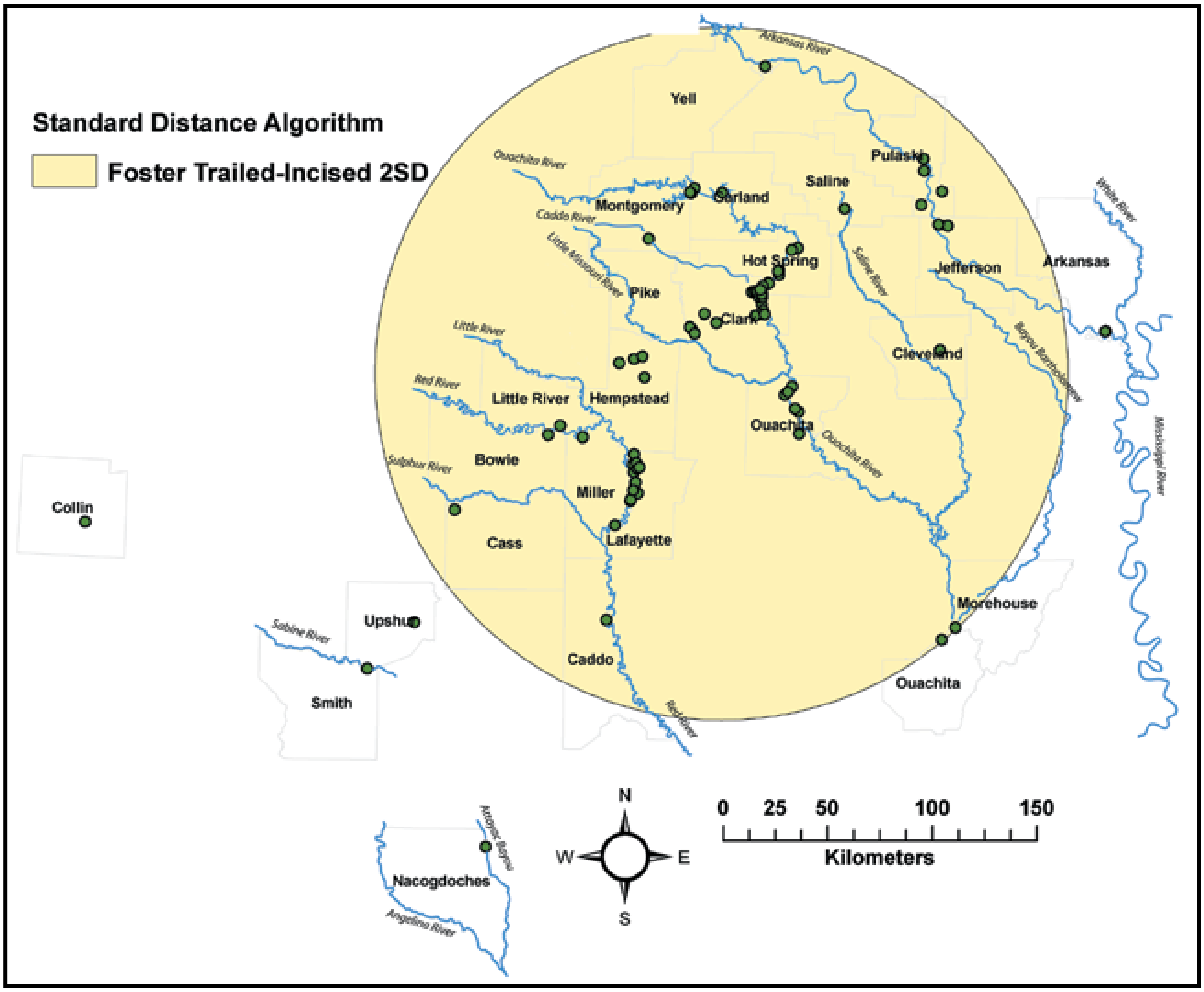

Figure 8. A 2-standard deviation distance analysis of the total distribution of Foster Trailed-Incised vessels.

Distance Outliers

Examples of outliers are found at a few sites, including the Joe Little, Henry Williams (41UR318), and Langford (41SM197) sites in east Texas, the Sister Grove Creek site (41COL36) in north-central Texas, the Wallace site (3AR25) in eastern Arkansas, and the Glendora (16OU32) and Keno (16OU31) sites in northeast Louisiana (see Figure 8).

Joe Little site

The Joe Little site is located along the Attoyac Bayou in northeast Nacogdoches County, Texas. Dr. Herndon Burr excavated minimally in the 1960s at the site and a single Foster Trailed-Incised vessel was located (Tom Middlebrook, personal communication 2009). Although Dr. Tom Middlebook has searched extensively for the site location, the site has not been identified and recorded. Consensus is that the site was likely destroyed and put in the fill of the nearby Farm to Market road.

The vessel from the Joe Little site is globular in form with a short out-flaring rim (Figure 9a). The body is decorated with incised scrolling designs and appliqué nodes are present. The rim design consists of annular punctuates. Following the seriation outlined by Schambach and Miller (1984:121), the vessel most resembles the Late Caddo *var. Moore* or *var. Shaw*, but does contain differences in body incised scrolling designs.

Interestingly, the vessel from the Joe Little site resembles a vessel from the Lymon Moore site (34LF31), in the vicinity of Spiro in the Arkansas Valley, which is classified as Braden Punctated (Rohrbaugh 1982:461, Figure 20). The body design on the Joe Little vessel is also similar to a vessel found at the Los Adaes site (16NA16) near Natchitoches, Louisiana that is classified as Emory Punctated-Incised (Gregory, 1973:121, Figure 13f).

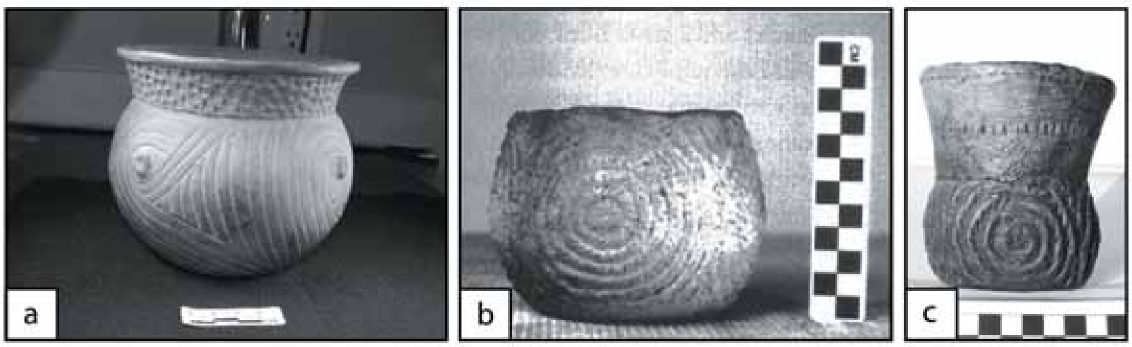

Figure 9. Outlier vessels containing Foster Trailed-Incised characteristics. (a) Joe Little site (image courtesy of Tom Middlebrook) (b) Henry Williams site (41UR318) (Perttula 2006) (c) Langford site (41SM197) (Walters 1997).

Henry Williams site (41UR318)

Little is known about the Henry Williams site apart from it being one of many excavated by Buddy Jones in the 1950s and 1960s in Upshur County, Texas (Perttula 2006:2). The site likely contains Middle to Late Caddo (A.D. 1200-1680) occupations, based on the presence of a Pease Brushed-Incised vessel.

A pinched bowl from the Henry Williams site contains a design motif on the body similar to those that represent Foster Trailed-Incised (Figure 9b). Additionally, the vessel is globular in form but without a rim. The design on the body is comprised of concentric circles and is included in this distribution analysis based simply on design similarities to Foster Trailed-Incised. Although pinching is not an essential criterion of Foster Trailed-Incised varieties found at sites further east of the Henry Williams site, the pinched decoration technique is fairly typical in east Texas and slightly resembles Harleton Appliquéd vessels (Suhm et al. 1954: Plate 28; Suhm and Jelks 1962: Plate 33) or even Killough Pinched (Suhm et al. 1954: 41; Suhm and Jelks 1962: Plate 46).

Langford site (41SM197)

The Langford Site in Smith County, Texas, was excavated by the Walters family in 1960 and contained a house, several middens, and a small cemetery. The site is considered a single component Middle Caddo (A.D. 1200-1400) occupation site based on "several red slipped bowls, a brushed-punctated vessel, the occurrence of engraved ladders and panels on bottles and bowls, and a vessel with engraved snake designs" (Walters 1997:39).

At the site, an interesting vessel that resembles Foster Trailed-Incised in both form and design has been recorded (Figure 9c). The body has broad concentric circles and two rows of punctations on the rim divide sets of narrow and interlocking incised lines, similar to Foster Trailed-Incised. However, the design treatment on the body is pinching and more similar to vessels classified as Killough Pinched (Suhm et al.1954: Plate 41; Suhm and Jelks 1962: Plate 46). The vessel is unlike those located at sites within the Red River valley (see Schambach and Miller 1984) or the Ouachita River valley (see Early 1993a).

Walters (1997:38) suggests this vessel might be an earlier variety of Foster Trailed-Incised or a local undefined variety. In contrast, Perttula et al. (2009) describe additional details of the vessel and assign it to the type Washington Square Paneled (Hart 1982) based on the horizontal interlocking scrolls of punctuates on the rim and the consideration that the Langford site has been identified as Middle Caddo (A.D. 1200-1400) in age.

Sister Grove Creek (41COL36)

By far the most interesting Foster Trailed-Incised outlier is the vessel found at the Sister Grove Creek site in Collin County, Texas (Crook and Perttula 2008). The Sister Grove Creek site is a Late Prehistoric site located on the East Fork of the Trinity River in north-central Texas where an 85% complete reconstructed Foster Trailed-Incised vessel was identified (Figure 10a). The Foster Trailed-Incised vessel was located after a strong rainstorm and in close proximity to a previously identified large pit feature (see Lynott 1975a, 1975b). The vessel represents the first known occurrence of this vessel type along the East Fork of the Trinity River (Crook and Perttula 2008). The form is globular with an out-flaring rim. The rim design contains four horizontal panels of diagonal lines. The designs on the body are trailed concentric semi-circles, although it is missing the appliqué nodes.

The lack of other Foster Trailed-Incised vessels in the East Fork of the Trinity River region implies that this vessel was likely traded from a Caddo group along the Red River in southwestern Arkansas. Radiocarbon dates (A.D. 1469-1614) from the site indicate that the later occupation at the site is contemporaneous with the Late Caddo period in the Red River (Lynott 1975a).

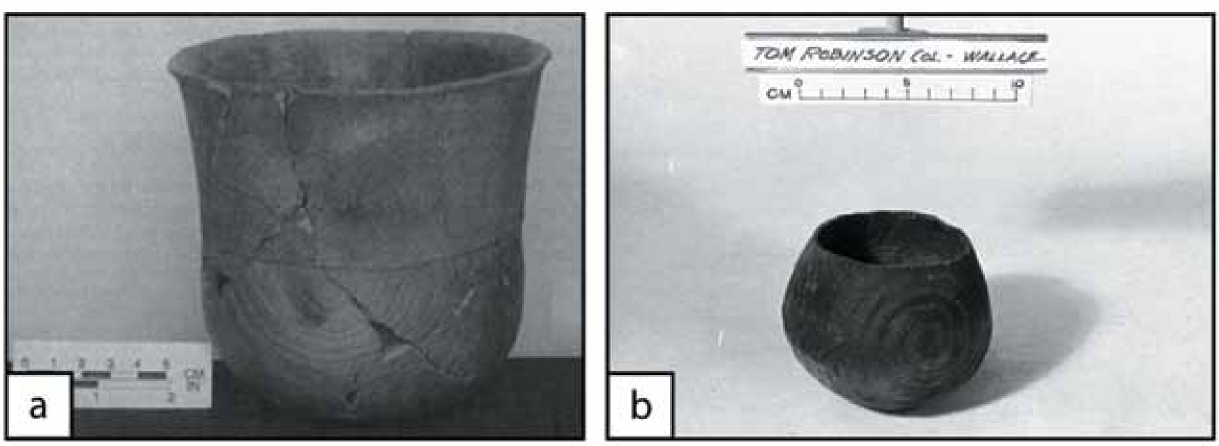

Figure 10. Outlier vessels containing Foster Trailed-Incised characteristics. (a) Sister Grove Creek site (41COL36) (Crook and Perttula 2008) (b) Wallace site (3AR25) (AAS Neg. #714964).

Wallace (3AR25)

The Wallace site is a mound and village site located in Arkansas County, Arkansas on the west bank of Locust Bayou, a former active Arkansas River channel. The vessel found there is globular in form and the rim is missing (Figure 10b). From the image alone, it is impossible to discern if the missing rim is deliberate or has been broken. The body resembles Foster Trailed-Incised vessels with a series of concentric circles. A centralized node is present but it is difficult to determine from the image if it is appliquéd.

Glendora site (16OU32) and Keno site (16MO31)

The Glendora and Keno sites are located along Bayou Bartholomew in northeast Louisiana (Kidder 1988). The Glendora site is located near the confluence of Bayou Bartholomew and the Ouachita River. A large assemblage of Late to Historic Caddo ceramic types from the Glendora site is identified as types found in the Lower Ouachita Basin (Kidder 1988:368-371). The ceramic assemblage at the Keno site is similar to that discovered at Glendora in that it contained Late and Historic Caddo ceramic types.

At Glendora and Keno, Kidder (1988:Figure 51) classifies three vessels as being Foster Trailed-Incised (Figure 11). A vessel from the Keno site is assigned to *var. Finley* (Figure 11i), a single vessel from the Glendora site is assigned to *var. Shaw* (not pictured), and two additional vessels from the Glendora site are assigned as *var. unspecified* (Figure 11g-h).

One of the vessels from Glendora (Figure 11g) most resembles the form and design of Foster Trailed-Incised vessels located in the Ouachita River drainage. It contains a series of concentric circles with appliqué nodes on the vessel body. The primary rim design consists of rows of punctates with two incised lines above the rim-body juncture. The identification of *var. Finley* and *var. Shaw* at the Glendora and Keno sites suggests contact with Late Caddo groups along the Red River in southwest Arkansas (see Schambach and Miller 1984:121). Additionally, similarities in form and design (see Figure 11g) to vessels in the Ouachita River drainage suggest contact with Caddo groups to the north along the Ouachita River, possibly associated with interregional salt trading networks (see Early 1993b). Interestingly, one of the vessels from Glendora (see Figure 11h), classified as *var. unspecified*, resembles in form and design specific vessels from the Joe Little site, the Lymon Moore site (34LF31) and the Los Adaes site (16NA16) that have already been mentioned.

Figure 11. Foster Trailed-Incised vessels from Glendora (16OU32) and Keno (16MO31) sites. (g) var. unspecified, (h) var. unspecified, (i) var. Finley (Kidder 1988).

Conclusions and Directions

A Geographic Information System (GIS) is an informative visual tool for demonstrating patterns of spatial distributions. The preliminary distribution analysis presented in this article exemplifies some of the difficulties inherent with ceramic typologies when viewed across space, but also demonstrates the efficacy of a spatial analysis in order to begin to understand cultural relationships. The seven outlier sites and their corresponding ceramic vessels all reveal characteristics and similarities to emblematic Foster Trailed-Incised vessels located in the Red and Ouachita River valleys.

A single Foster Trailed-Incised vessel from the Joe Little site (see Figure 9a), most resembles Late Caddo *var. Moore* or *var. Shaw*, but does contain differences in body incised scrolling designs. A single vessel from the Henry Williams site (see Figure 9b) contains concentric circles on the body, similar in design to Foster Trailed-Incised, although the treatment is with pinched rather than incised lines. A single vessel from the Langford site (see Figure 9c) resembles a Foster Trailed-Incised vessel based on form and overall design but is unlike those located at sites within the Red River valley or the Ouachita valley. It has been considered as a possible earlier variety of Foster Trailed-Incised or a different local type, such as Washington Square Paneled (Hart 1982). A single vessel from the Sister Grove Creek site (see Figure 10a) represents the first known occurrence of this vessel type along the East Fork of the Trinity River (Crook and Perttula 2008) and implies long distance trade with groups along the Red River in southwestern Arkansas. A vessel from the Wallace site (see Figure 10b) resembles Foster Trailed-Incised vessels with a series of concentric circles and a centralized node. The Foster Trailed-Incised vessels from the Glendora site (see Figure 11) resemble Late Caddo Foster Trailed-Incised vessels found in the Red River and Ouachita River valleys suggesting contact with Caddo groups throughout southwest Arkansas and possibly farther afield.

Future directions for this analysis are primarily focused around achieving a higher resolution of data attributes (such as temper, form, and treatment), acquiring additional examples of Foster Trailed-Incised vessels, adding ecological and geological data, and the inclusion of other Caddo ceramic types.

Higher resolution can be achieved by further identification of temper used, and by the development of additional categories of form and treatment, such as those used in the Collegiate Classification System (see Early 1988, 1993a; Kelley 1997; Schambach 1981; Schambach and Miller 1984). Additional examples of Foster Trailed-Incised vessels will help with statistical analyses, while the inclusion of ecological and geological datasets will allow for the exploration of correlates between environment and vessel attributes. Lastly, the inclusion of additional Caddo pottery types with similar formal and decorative characteristics to those that define the Foster Trailed-Incised type will allow for overlaps between ceramic types to be realized spatially and statistically and relationships between cultural groups to be explored.

Acknowledgements

Many thanks to the contribution of many individuals, including Dr. Ann Early, her students and employees from Henderson State University, including (the now) Drs. Mary Kay Sandford and David B. Kelley, Arkansas Archeological Survey photographer Dan Printup, University of Arkansas Museum photographer Mary McGimsey, Dr. Frank Schambach, and many others for taking all the photographs of vessels that became the "analog database", compiled and organized by Dr. Schambach during his tenure in Magnolia, Arkansas. Having much of the ceramic data easily accessible allowed for the fairly seamless (although time consuming) compiling of the "digital database". Many thanks go to several individuals who referred me to literature and reports, including Drs. Jamie Brandon, Ann Early, John House, Tom Middlebrook, Tim Perttula, George Sabo III, and Frank Schambach. Drs. Early, Perttula, Sabo, and Schambach all read earlier versions of this article and provided valuable comments and suggestions related to both content and future directions. Lela Donat, registrar at the Arkansas Archeological Survey, was especially helpful in locating Arkansas related documents and photos. Mark Walters provided much help with identifying sites in east Texas. As always, thanks to the Caddo people for allowing others to learn and explore their cultural heritage. An original version of this article was presented at the 52nd Caddo Archeological Conference held in Tyler, Texas.

References Cited

Brown, James A.

1996 *The Spiro Ceremonial Center: The Archaeology of Arkansas Valley Caddoan Culture in Eastern Oklahoma.* Memoirs of the Museum of Anthropology, University of Michigan, No. 29. Ann Arbor: Museum of Anthropology, University of Michigan.

Crook, Wilson W., III, and Timothy K. Perttula

2008 A Foster Trailed-Incised Vessel from the Sister Grove Creek Site (41COL36), Collin County, Texas. *Caddo Archeology Journal* 18:22-25.

Early, Ann M.

1988 Ceramics. In *Standridge: Caddoan Settlement in a Mountain Environment,* by Ann M. Early, pp. 61-104. Arkansas Archeological Survey Research Series 29, Fayetteville.

1993a Ceramics. In *Caddoan Saltmakers in the Ouachita Valley: The Hardman Site,* edited by Ann M. Early, pp. 63-118. Arkansas Archeological Survey Research Series 43, Fayetteville.

1993b Hardman and Caddoan Saltmaking. In *Caddoan Saltmakers in the Ouachita Valley.* pp. 223-234. Arkansas Archeological Survey Research Series 43. Fayetteville.

Gregory, Hiram F.

1973 *Eighteenth-Century Caddoan Archaeology: A Study in Models and Interpretation.* Southern Methodist University, Ph.D, Anthropology. Ann Arbor, University Microfilms.

Hart, John P.

1982 *An Analysis of the Aboriginal Ceramics from the Washington Square Mound Site, Nacogdoches County, Texas.* Master's Thesis, Department of Anthropology, Northeast Louisiana University, Monroe.

Hemmings, E. Thomas

1982 Spirit Lake (3LA83): Test Excavations in a Late Caddo Site on the Red River. In *Contributions to the Archeology of the Great Bend Region,* edited by Frank F. Schambach and Frank Rackerby, pp. 55-89. Research Series 22, Arkansas Archeological Survey, Fayetteville.

House, John H.

1991 The Mississippian Sequence in the Menard Locality, Eastern Arkansas. In *Arkansas before the Americans,* edited by Hester A. Davis, pp. 6-39. Arkansas Archeological Survey Research Series 40, Fayetteville.

Jackson, A.T., Marcus S. Goldstein, and Alex D. Krieger
2000 *The 1931 Excavations at the Sanders Site Lamar County, Texas.* Archival Series 2, Texas Archeological Research Laboratory, University of Texas.

Kelley, David B.
1997 Ceramic Analysis. In *Two Caddoan Farmsteads in the Red River Valley: The Archeology of the McLelland and Joe Clark sites,* edited by David B. Kelley, pp. 37-60. Arkansas Archeological Survey Research Series 51. Fayetteville.

Kelley, David B. and Carey L. Cox
1998 *Cultural Resources Survey of Levee Rehabilitation/Restoration Areas Along the Red River Between Fulton, Arkansas and the Louisiana State Line: Items 4, 5, and 9.* Report submitted by Coastal Environments, Inc., to the U.S. Army Corps of Engineers, Vicksburg, Mississippi.

Kidder, Tristram R.
1988 *Protohistoric and Early Historic Culture Dynamics in Southeast Arkansas and Northeast Louisiana A.D. 1542-1730.* Ph.D. Dissertation, Department of Anthropology, Harvard University.

Krieger, Alex D.
1946 *Culture Complexes and Chronology in Northern Texas, with Extensions of Puebloan Dating to the Mississippi Valley.* Publication No. 4640. The University of Texas, Austin.

Lynott, Mark J.
1975a *Archeological Investigations at Lake Lavon, 1974.* Contributions in Anthropology 16. Archaeology Research Program, Southern Methodist University, Dallas.
1975b Wylie Focus Pits in Light of Recent Investigations. *The Record, Dallas Archeological Society,* Vol. 31, No. 2, pp. 1-4.

Moore, Clarence B.
1912 Some Aboriginal Sites on the Red River. *Journal of Academy of Natural Sciences of Philadelphia* 14:481-638.

Moorehead, Warren K.
1931 *The Archaeology of the Arkansas River Valley.* Andover Press, Andover, Massachusetts.

Perino, Gregory
1994 Archaeological Research at the Rowland Clark Site (41RR77), Red River County, Texas. *Journal of Northeast Texas Archaeology* 4:3-42.
1995 The Dan Holdeman Site (41RR11), Red River County, Texas. *Journal of Northeast Texas Archaeology* 6:3-65.

Perttula, Timothy K.
2005 1938-1939 WPA Excavations at the Hatchel Site (41BW3) on the Red River in Bowie, County, Texas. *Southeastern Archaeology* 24: 180-198.
2006 *A Study of the Buddy Calvin Jones Collection from Northeast Texas Caddo Sites.* Friends of Northeast Texas Archaeology. Special Publication No. 6, Austin and Pittsburg.

References Cited (cont.)

Perttula, Timothy K., Bo Nelson, Mark Walters, Robert Cast, and Bobby Gonzalez

2009a *Documentation of Caddo Funerary Objects in the Gilcrease Museum Collections.* Special Publication No. 12. Friends of Northeast Texas Archaeology, Austin and Pittsburg.

Perttula, Timothy K., Robert Cast, Bobby Gonzalez, and Bo Nelson

2009b *Documentation of Unassociated and Culturally Unidentifiable Funerary Objects In the U.S. Army Corps of Engineers, Fort Worth District Collection Housed at the Texas Archeological Research Laboratory at the University of Texas at Austin.* Friends of Northeast Texas Archaeology. Special Publication No. 13.

Perttula, Timothy K., Mark Walters, Shawn Marceaux, and Bo Nelson

2009c *Caddo Pottery Vessels and Pipes From Sites in the Middle and Upper Neches River Basins, Smith and Wood Counties.* Friends of Northeast Texas Archaeology. Special Publication No. 7, Austin and Pittsburg.

Perttula, Timothy K., Mark Walters, and Bo Nelson

2009d *Documentation of the Native American Ceramic Vessels from Northeast Texas, Southern Arkansas, and Eastern Oklahoma in the Boyce Smith Museum in Troup, Texas.* Friends of Northeast Texas Archaeology. Special Publication No. 8.

Perttula, Timothy K., and Bo Nelson

2009 *Prehistoric Artifact Assemblages from Sites along Hickory Creek in the Davy Crockett National Forest, Houston, County, Texas.* Friends of Northeast Texas Archaeology. Special Publication No. 14.

Rohbaugh, Charles L.

1982 *Spiro and Fort Coffee Phases: Changing Cultural Complexes of the Caddoan Area.* Ph.D. Dissertation, The University of Wisconsin-Madison.

Schambach, Frank F.

1981 A Description and Analysis of the Ceramics. In *The Shallow Lake Site (3UN9/52) and its Place in Regional History,* edited by W. Frederick Limp, pp. 101-176. Research Series 12. Arkansas Archeological Survey, Fayetteville.

Schambach, Frank F. and John E. Miller

1984 A Description and Analysis of the Ceramics. In *Cedar Grove: An Interdisciplinary Investigation of a Late Caddo Farmstead in the Red River Valley,* edited by W. Frederick Limp, pp. 109-170. Research Series 23. Arkansas Archeological Survey, Fayetteville.

Schambach, Frank F., Neal L. Trubowitz, Frank Rackerby, E. Thomas Hemmings, W. Frederick Limp, and John E. Miller III

1982 *Test Excavations at the Cedar Grove Site (3LA97): A Late Caddo Farmstead in the Great Bend Region. In Contributions to the Archeology of the Great Bend Region,* edited by Frank F. Schambach and Frank Rackerby, pp. 90-130. Research Series 22, Arkansas Archeological Survey, Fayetteville.

References Cited (cont.)

Suhm Dee Ann and Edward B Jelks (editors)

1962 *Handbook of Texas Archeology: Type Descriptions.* The Texas Archeological Society Special Publication No. 1 and Bulletin No. 4, The Texas Memorial Museum, Austin.

Suhm, Dee Ann, Alex D. Krieger, and Edward B. Jelks

1954 An Introductory Handbook of Texas Archeology. *Bulletin of the Texas Archeological Society* 25:1-562.

Sundermeyer, Scott A., John T. Penman, and Timothy K. Perttula

2008 *Integrated Cultural Resources Investigations for the Bowie County Levee Realignment Project, Bowie County, Texas and Little River County, Arkansas.* Miscellaneous Reports, Report of Investigations No. 29. Lopez Garcia Group, Dallas.

Trubowitz, Neal L., Frank F. Schambach, and John E. Miller III

1982 Test Excavations at 3LA128: An Early Caddo Occupation on the Red River. In *Contributions to the Archeology of the Great Bend Region,* edited by Frank F. Schambach and Frank Rackerby, pp. 39-54. Research Series 22, Arkansas Archeological Survey, Fayetteville.

Walters, Mark

1997 The Langford Site (41SM197), Smith County, Texas. *Journal of Northeast Texas Archaeology* 9:38-41.

Webb, Clarence H.

1959 *The Belcher Mound: A Stratified Caddoan Site in Caddo Parish, Louisiana.* Memoir 16. Society for American Archaeology, Salt Lake City.

Webb, Clarence H. and Monroe Dodd, Jr.

1941 Pottery Types from the Belcher Mound Site. *Bulletin of the Texas Archeological and Paleontological Society* 13:88-116.

Weinstein, R.A., David B. Kelley, and Joe W. Saunders (editors)

2003 *The Louisiana and Arkansas Expeditions of Clarence Bloomfield Moore.* University of Alabama Press, Tuscaloosa.

Wheatley, David and Mark Gillings

2002 *Spatial Technology and Archaeology: The Archaeological Applications of GIS.* Taylor and Francis, London.

Sourcing Red River Jasper: An Archaeological and Geological Investigation of a Gravel Chert in the Red River Drainage

Elsbeth Linn Dowd

Abstract

Red River Jasper, a lithic material found in the Red River drainage, is an understudied chert that was widely used by prehistoric populations in this region from the Archaic to late prehistoric (Caddo) periods. Despite its common occurrence at sites along the Red River, this tabular chert has received little attention compared to other raw materials on the eastern margin of the Southern Plains. Although the material is macroscopically diverse, ranging in color from brown to yellow to red, microscopic analysis indicates that the material is relatively homogeneous and likely came from a limited set of sources. The archaeological distribution of Red River Jasper, geological evidence, and a stream survey of gravels demonstrate that the primary bedrock source was located in the Johns Valley Formation of the Ouachita Mountains and was carried downstream by the Kiamichi River into the Red River.

Introduction

Archaeologists have long recognized that a lithic material known as Red River Jasper was widely used by populations living along the Red River drainage in Oklahoma, Arkansas, Texas, and Louisiana. Various people manufactured lithic tools from Red River Jasper as early as San Patrice times (10,400 to 9,000 B.P.) (Jennings 2006) through the late prehistoric period (Figure 1). This tan to reddish brown chert occurs naturally as tabular pebbles in the gravels of the river. Archaeologists have commonly characterized this material as a local chert that was acquired opportunistically from gravel bars along the Red River. The material is more widespread archaeologically, though, occurring frequently at sites along the Little and Kiamichi Rivers that drain the Ouachita Mountains in Oklahoma. This paper examines the character and distribution of Red River Jasper in order to understand where it originates and how its natural range corresponds to its archaeological distribution. Although the archaeological implications regarding the origins of stream-deposited gravel are less profound than those for a quarried material, defining the natural range of any lithic material allows archaeologists to address the processes surrounding procurement, mobility, and trade, which are essential for understanding the technological, social, and cultural practices of prehistoric groups.

This paper begins with a description of the material and the parameters of its variation, both macroscopic and microscopic. Despite variability in color, a microscopic examination of structure and mineralogy through electron microprobe analysis indicates that Red River Jasper is a relatively homogenous material that may have come from a restricted set of sources. Next, the archaeological and natural distributions of the material are examined through artifact analysis and a survey of stream gravels along the Kiamichi River (Figure 2). Based on those distributions, several localities that cross-cut the John's Valley formation in the Ouachita Mountains are identified as potential sources for Red River Jasper.

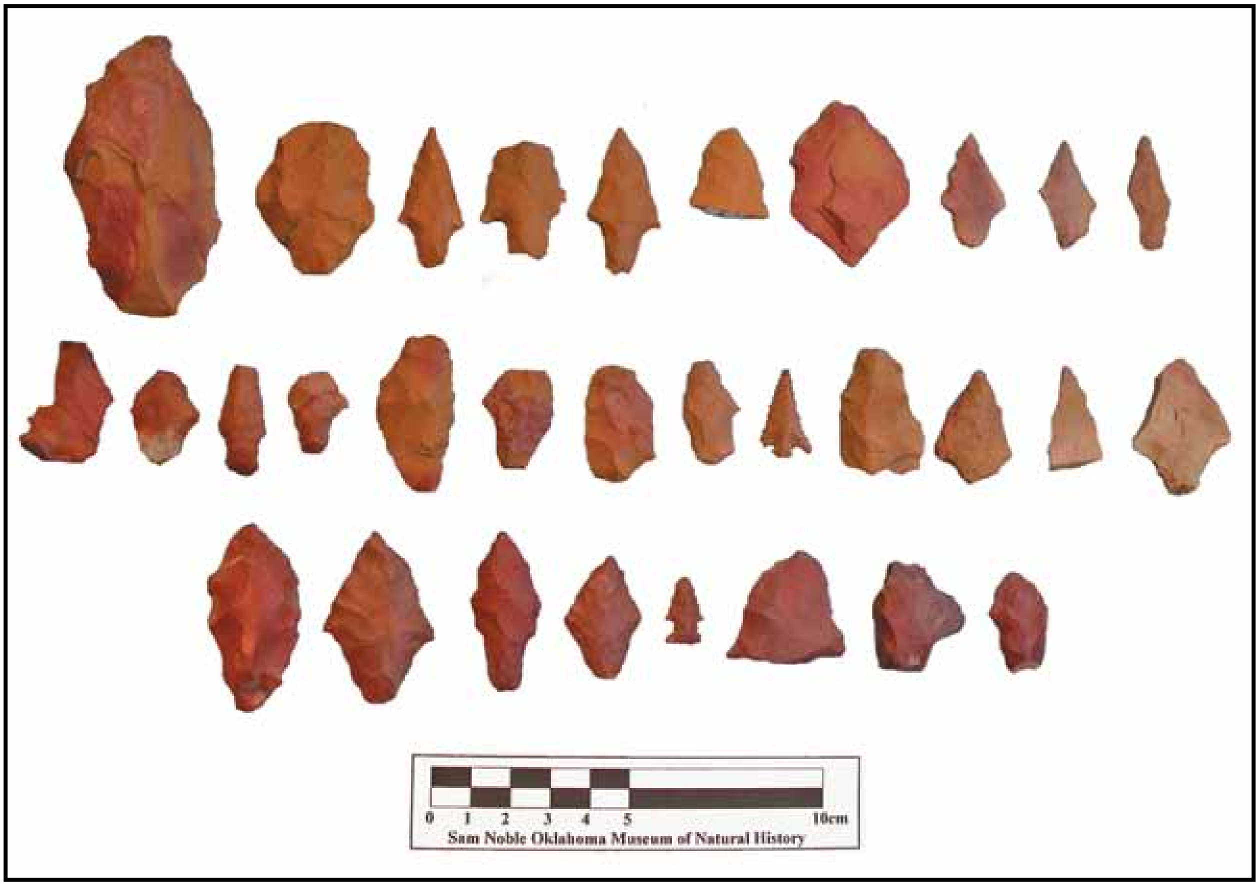

Figure 1. Red River Jasper artifacts from the A.W. Davis site (34MC6) in McCurtain County, Oklahoma.

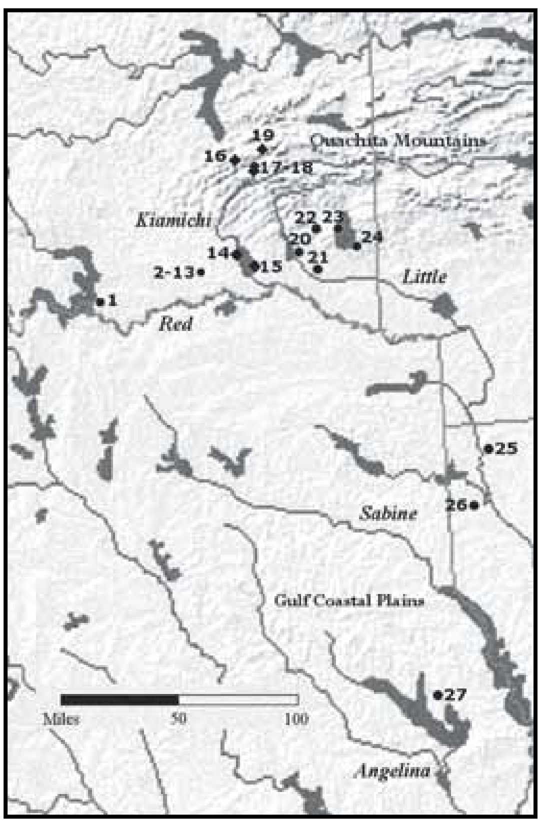

Figure 2. Sites and localities discussed in paper.
(1) James site, 34BR11;
(2-13) 34AT105 – 34AT117;
(14) Montgomery site, 34CH70;
(15) Mahaffey site, 34CH1;
(16) Natural Lake site, 34PU71;
(17) Blessingame site, 34PU74;
(18) Arrowhead Hill site, 34PU105;
(19) Buffalo Bend site, 34PU111;
(20) Bell site, 34MC76;
(21) A.W. Davis site, 34MC6;
(22) Pine Creek Mound Group site, 34MC146;
(23) Bill Hughes site, 34MC21;
(24) Biggham Creek site, 34MC105;
(25) Willow Chute Bayou locality, Bossier Parish, LA;
(26) John Pearce site, 16CD56;
(27) Wolfshead site, 41SA117.

Material Analysis: Macroscopic Variation, Microscopic Homogeneity

Macroscopic Description

While Red River Jasper is easily recognizable in its classic form, it encompasses a relatively large amount of macroscopic variation, particularly in color (Figure 3). As defined by Leudtke (1992:151), jasper is "a variety of chert containing iron oxide impurities that generally result in a characteristic gold, brown, or red color." The *Glossary of Geology* published by the American Geological Institute concords with that definition, but adds that while jasper is "characteristically red … yellow, green, grayish-blue, brown, and black cherts have also been called jasper" (Bates and Jackson 1980:2). Most commonly the cortex of Red River Jasper can be described as brown to strong brown (7.5YR5/4 to 7.5YR5/6), but it also occurs in other shades including light brown (7.5YR6/4), yellowish brown (10YR5/4), reddish yellow (7.5YR6/8), weak red (10R4/3), dusky red (10R3/3), and pink (7.5YR8/4). Likewise, the interior is most regularly brown to strong brown, but also occurs in the above-mentioned shades. The interior frequently displays a combination of these colors, with a banded, mottled, or transitional structure. Often the material grades from yellowish brown in the middle to red near the cortex, although in some instances the opposite pattern occurs. In certain cases, particularly in the upper reaches of the Kiamichi, the interior includes shades of gray and light olive brown (2.5YR5/3). Here, these darker shades usually are located in the interior of the material and grade to red or yellowish brown near the cortex. These patterns will be discussed later in relation to the formation of this material and subsequent chemical weathering.

Figure 3. Transitional zones of gray and yellowish brown present within Red River Jasper artifacts from the Arrowhead Hill site (34PU105) along the upper Kiamichi River, Pushmataha County, Oklahoma.

All Red River Jasper has a smooth water-worn cortex, evidence of alluvial transport (Figure 4). The interior has a fine texture. The material is generally dull, but some fine-grained pieces are lustrous. It is not translucent. It commonly contains mineral inclusions that appear as white or dark brown specks.

Figure 4. Two Red River Jasper cores, illustrating stream-rolled cortex, from sites 34CH70 and 34PU74 respectively in Choctaw and Pushmataha counties, Oklahoma.

The average dimensions of Red River Jasper gravels can be estimated from the measurement of cores, which are artifacts that have had flakes removed but are at a very early stage in the reduction sequence. Measurements of maximum length and maximum thickness for Red River Jasper cores were taken from a sample of 77 cores from seven sites along the Kiamichi and Little River drainages (Table 1). Measurements of maximum length form a normal distribution, with a mean of 5.64 cm, whereas measurements of maximum thickness are positively skewed, with a mean of 1.97 cm (Figures 3 and 4). The positive skew indicates that most cores are relatively thin. Overall, these dimensions demonstrate the small size of the initial gravels that the knappers had to work with. This should be kept in mind when considering the final size and degree of cortex on the finished tools.

The shape of these cores was determined by dividing the maximum length of each core by its maximum thickness. This ratio indicates whether a core is more round (closer to a 1:1 ratio) or more tabular (greater than a 1:1 ratio). The distribution of the ratios for this sample of cores is positively skewed, with a mean of 3.13 cm (Figure 5). The positive skew indicates that most of the cores are relatively tabular and that some are very tabular. Using small, tabular cobbles, a knapper most likely would have reduced the cobble directly to make a tool, rather than working a flake blank. This size and proportion also explain why a number of tools made from this material retain some cortex (Figure 6 and Table 2).

Table 1. Dimensions of Red River Jasper cores (n=77) from study sites.

Measurement	Range (cm)	Mean (cm)	Standard Deviation
Maximum Length	2.69 – 8.71	5.64	1.22
Maximum Thickness	0.82 – 4.31	1.97	0.66
Length:Thickness	1.22 – 6.62	3.13	1.14

Table 2. Number and percent of artifacts with cortex, grouped by reduction stage, from all Red River Jasper assemblages.

Reduction Stage	n Total	n with Cortex	% with Cortex
Core	77	77	100
Early Stage Biface	18	18	100
Late Stage Biface	44	18	41
Preform	41	12	29
Finished Tool	90	9	10

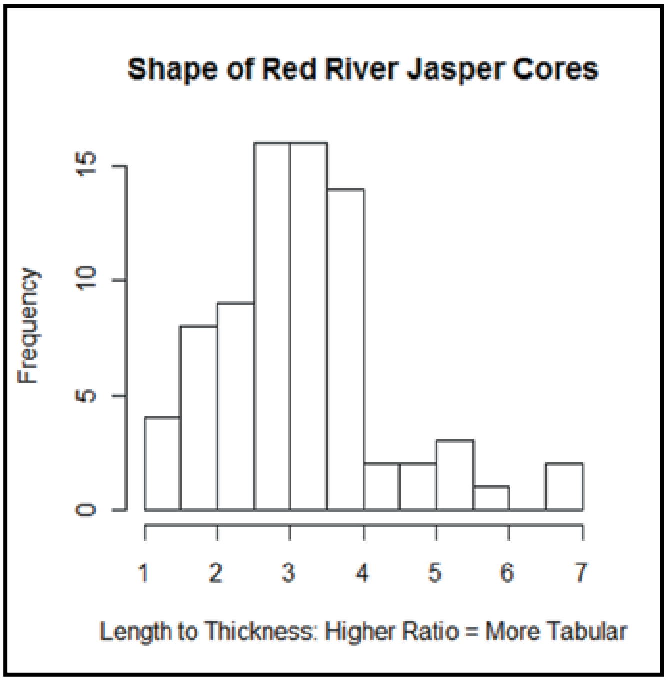

Figure 5. Shape of Red River Jasper cores (n=77) from study sites, based on ratio of maximum length to maximum thickness. The higher the ratio, the more tabular the core (and likely the more tabular the original cobble). Most of these cores are tabular; they are at least 2-4 times longer than they are thick.

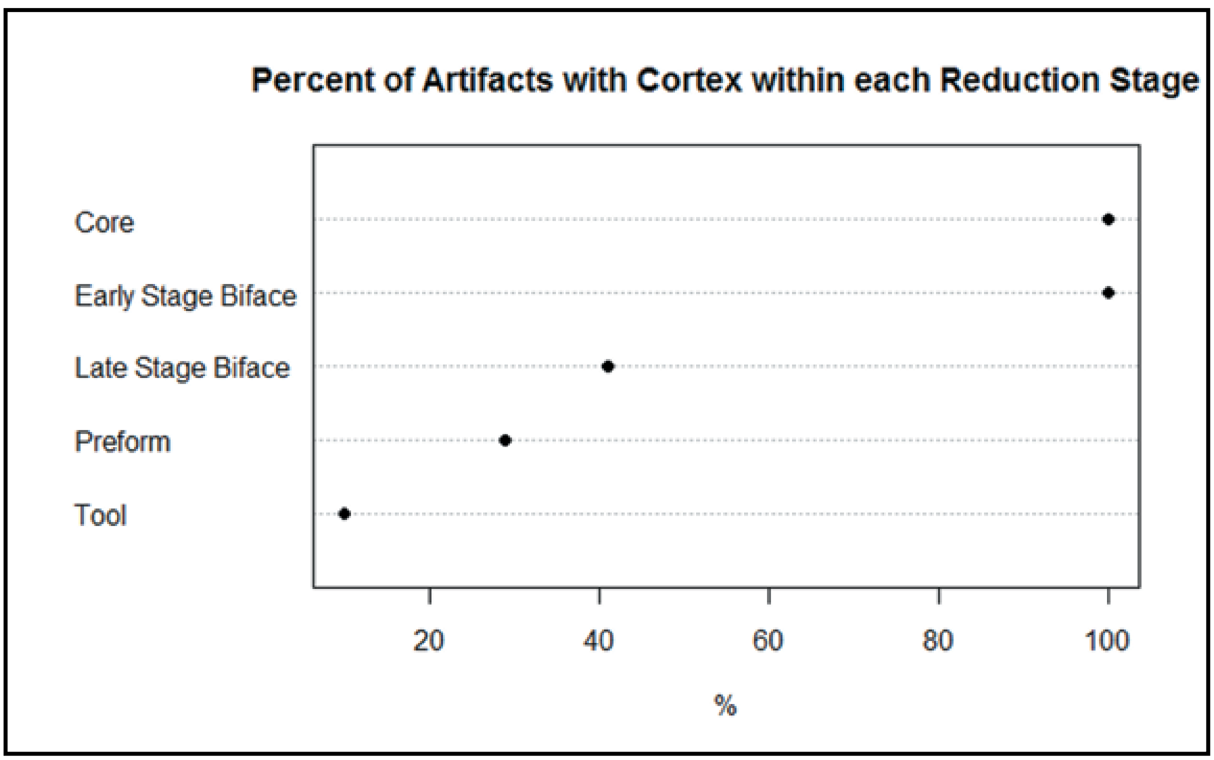

Figure 6. Within each assemblage of Red River Jasper, artifacts were classified by reduction stage as debitage, cores, early stage bifaces, late stage bifaces, performs, or tools. This graph shows the total percentage of artifacts with cortex within each reduction stage. As expected, flint-knappers removed more cortex as they reduced the material. A number of finished tools, however, still have cortex on them, because it was sometimes difficult to remove all cortex from the small tabular cores. The size and shape of the cores also helps explain the red tips and ears on some points.

The small size and tabular shape of the cobbles additionally accounts for a particular pattern of color variation exhibited by a number of projectile points. As noted by Jennings (2006:13), some San Patrice points that are mainly yellowish brown have red tips and ears. These include points from the John Pearce site (Webb et al. 1971). Later points from sites along the Kiamichi and Little River drainages also display this pattern (Figure 7). Jennings questioned whether this reddening was a result of heat treatment (either associated with hafting or prior to knapping) or whether it was due to the natural composition of the gravel. The appearance, size, and shape of the cobbles in this study suggest that these red tips and ears on points were directly related to the natural condition of the Red River Jasper gravels.

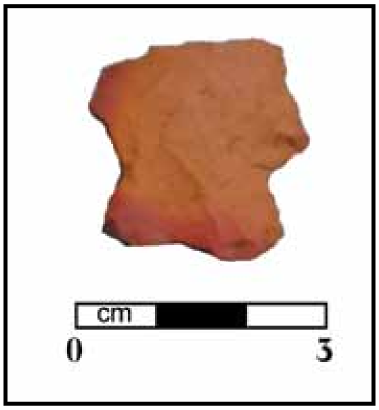

Figure 7. Broken point from the Blessingame site (34PU74) illustrating red color at the edges of the point.

Microscopic Structure

Macroscopic variation in Red River Jasper falls mainly in the realm of color, which grades from red to yellowish brown to gray. These color differences most likely exist because of differences in the type and concentration of various iron oxides within the material. The concentration of iron oxides in jasper is often attributed to its formation in hydrothermal fluid, which is groundwater that has been heated by magma or metamorphism (Lovering 1972; Luedtke 1992:45-46, 51). In such cases, the hydrothermal fluid flows through the forming chert, carrying dissolved chemicals that contribute to the formation process. It is also possible, however, for chert to undergo post-diagenic (post-formation) chemical weathering, particularly in a warm and humid climate, which could involve the process of oxidation (Hurst and Kelly 1961:253; Luedtke 1992:44, 108). Because chert is somewhat porous, water can seep slowly through it, enabling oxidation and other chemical and physical weathering processes to occur. Iron compounds in a chert might slowly undergo oxidation, weathering chemically into iron oxides that would give the chert a red to yellowish brown color. This process would form a weathered rind, or a zone of chemical alternation extending from the exterior towards the interior of the chert nodule (Gordon and Dorn 2004:853).

This process of post-diagenic chemical weathering is the most likely explanation for the color variation present in Red River Jasper, given the distribution of that variation from the cortex to the interior of the cores. When chert nodules from the primary (bedrock) context—which was likely originally gray and contained iron compounds—eroded into a stream, they began to undergo chemical weathering. Although the timing of chemical weathering is complicated (Luedtke 1992:107), it is probable that the longer the chert was exposed to water, the more weathering occurred. As the nodule traveled downstream, it generally weathered more red or yellowish brown and less gray, starting first with the cortex and moving progressively into the interior. This process would not occur uniformly in all chert nodules from the parent formation, given the chemical variability that exists throughout most formations and even within small sections of nodules (Luedtke 1992:57-59). The process of oxidation through chemical weathering fits well with the distributional evidence for the source of this material, as discussed later in this paper.

In order to further understand the structure and composition of Red River Jasper, particularly the zones of color transition, six samples were selected for microscopic examination using electron microprobe analysis (EMPA). EMPA, which is similar to scanning electron microscopy (SEM), is most useful for examining the structure and mineralogy of solid materials. Samples were selected to encompass a range of macroscopic variation. Samples were taken from five cores from three sites along the Kiamichi River and one sample was taken from a pebble from a locality on the Red River floodplain in Bossier Parish, Louisiana (Figure 8). Sample selection was biased towards sites along the lower Kiamichi River because these sites contained the largest array of cores from which to select samples illustrating variation in color.

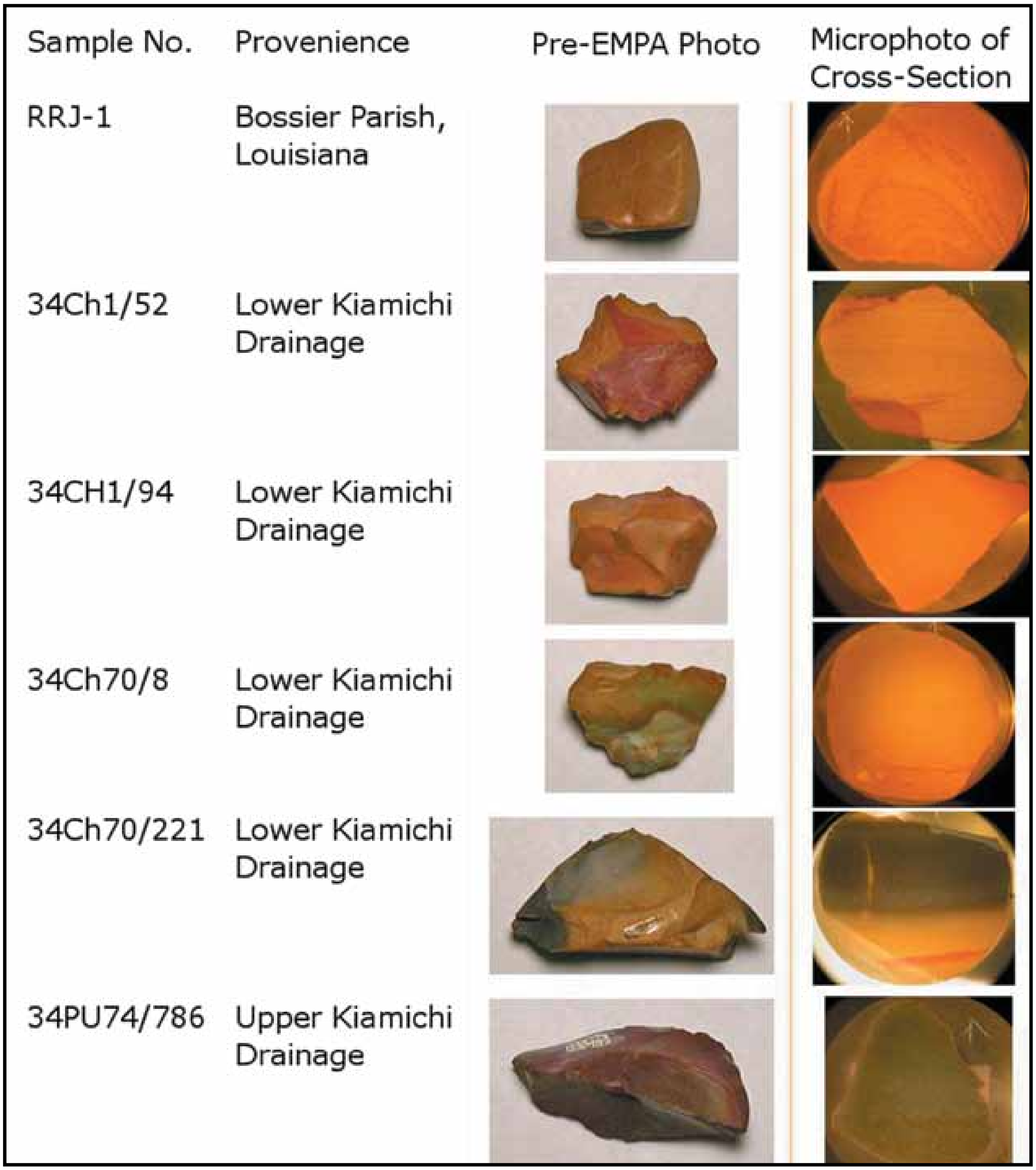

Figure 8. Samples of Red River Jasper used for electron microprobe analysis. The photos on the left were taken before analysis. The photos on the right show a cross-section of each piece embedded in epoxy resin.

The samples were prepared for analysis as thick sections embedded in epoxy. A microphotograph was taken of each sample to examine structure under relatively low magnification. This was helpful for selecting portions of the sample that cut across macroscopic bands of variation for closer analysis through the acquisition of backscattered electron images and cathodoluminescence (CL) images. In several cases the cross-sectional microphotographs also revealed structural aspects of the cores that were not visible prior to creating a cross-section. The exterior of core 34PU74/766 was entirely red, even where flakes had been removed, so it was expected that the inner material would also be red. In cross-section, however, it became apparent that only the exterior was red, whereas the interior was actually gray with some olive gray bands. This indicates that the artifact must have weathered *in situ*, following flake removal, highlighting the weathering capability of this material and supporting post-diagenic chemical weathering as the likeliest explanation for variation in color. Cross-sections of the pebble from Louisiana and two of the cores from sites along the Kiamichi (34CH1/52 and 34CH70/221) illustrate the internal banding that seems to be common to this material. These bands were targeted in the microprobe analysis as potential localities of structural or chemical variation.

Backscattered electron imaging (BSEI) and CL were the two primary analytic methods used for this microprobe study (under the direction of Dr. George Morgan at the University of Oklahoma) to acquire structural, mineralogical, and chemical information on a set of materials classified as Red River Jasper based on their macroscopic characteristics.

Two images acquired through BSEI are illustrated here, from samples RRJ-1 and 34PU74/766 (Figure 9). These images are representative of all six samples. Each shows that the samples have a high level of mineralogical homogeneity, with minerals distributed relatively evenly within each sample regardless of macroscopic banding. The dark gray portions of the image represent quartz (SiO_2), with some larger quartz particles present within the matrix. Most of the white parts of the images represent iron oxides, which give this material its yellow, brown, or red color. The macroscopic lighter and darker yellowish-brown banding present in RRJ-1 is not readily discernable in the BSE image. A slight change in the quantity of iron oxides is detectable between the red and gray zones of 34PU74/766, however. The larger (approximately 23 to 58 μm) white particles in the RRJ-1 BSE image represent minerals common to sedimentary systems, including Iron Aluminum Phosphate and Barium Sulfate. The black portions in each of the BSE images represent holes filled with epoxy, where mineral particles popped out of the sample during polishing.

BSEI demonstrates that Red River Jasper is generally a mineralogically and structurally homogeneous material. Its primary content is quartz, followed by a series of iron oxides. For the most part, the iron oxides are evenly distributed within each sample. Some samples also contain small quantities of other minerals that are common to sedimentary systems. The main source of variation within certain samples is associated with the differential distribution of iron oxides in yellow or red zones vs. gray or black zones. While these macroscopically different zones all contain some amount of iron oxides, the yellow or red zones contain considerably more of these minerals. Iron oxides are also distributed variably between the samples, explaining the overall variation of color. Color variability may also be related to differences in the properties of the iron oxides. Those portions of the samples containing more iron oxides have undergone a greater degree of chemical weathering than those containing fewer iron oxides.

Very little variability in the CL signal was detected within the samples. This was not unexpected as cherts are often unresponsive to CL (Morgan, personal communication 2009). Other archaeologists studying cherts and quartzites have suggested that instrumental neutron activation analysis (INAA), X-ray florescence (XRF), and inductively coupled plasma mass spectrometry (AD- or LA-ICP-MS) are more useful techniques for the detection of trace elements and isotopic signatures (King et al. 1997:796; Malyk-Selivanova et al. 1998; Pitblado et al. 2008). However, these authors and others (Frahm 2007; Luedtke 1992:57-60) have also noted that any given chert formation may encompass a large amount of chemical variability. When used for sourcing, trace element analyses require a large number of samples, both archaeological and from the hypothesized formation to gain any sort of statistical validity. This was outside the scope of this study, which instead focused more on the physical structure and distribution of Red River Jasper.

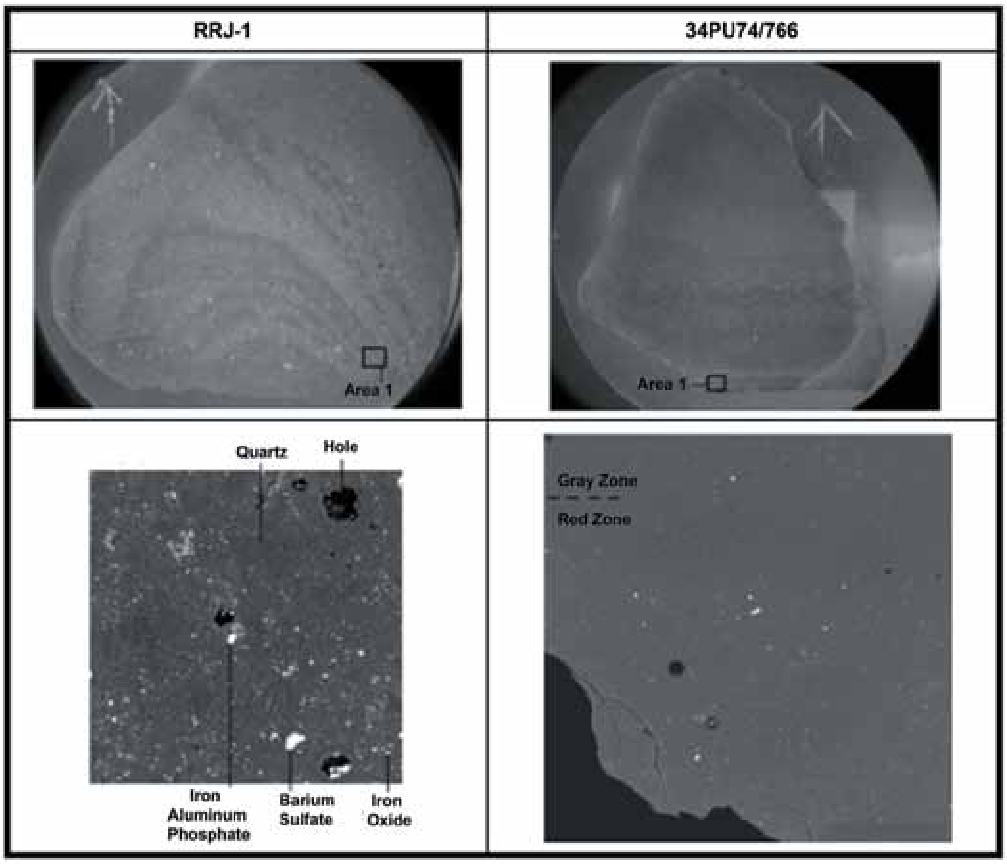

Figure 9. Microphotographs (top) of two samples, RRJ-1 from Louisiana and 34PU74/766 from the upper Kiamichi drainage, showing the location of backscattered electron (BSE) images (bottom). The BSE images illustrate the mineralogy and structure of the material. Both samples are composed primary of quartz with small quantities of iron oxides and other minerals common to sedimentary systems. Little variation is present except for the distribution of iron oxides, which explains macroscopic variation.

Sourcing Red River Jasper: Archaeological Distribution and Geological Sources

Archaeological Distribution

In order to investigate the potential source of Red River Jasper, a series of lithic assemblages were examined (Table 3). Based on prior observations, Wyckoff (personal communication 2008) hypothesized that the material was coming out of the Ouachita Mountains of Oklahoma, probably from a formation within the Kiamichi River drainage. The Ouachita Mountains are comprised of deeply folded and faulted ranges generally running east to west situated between the Arkansas Valley to the north and the Gulf Coastal Plain to the south (Banks 1990:33; Hart 1963:11; Johnson 1998:3; Thornbury 1965:279-281). The Ouachita Mountains are approximately 402 km (250 mi) long and average 80 km (50 mi) in width, ranging from Atoka, Oklahoma to near Little Rock, Arkansas. The rocks of the Ouachitas are all sedimentary, primarily sandstones and shales with smaller amounts of chert, quartzite, and novaculite (Johnson 1998:3). The mountain belts are mostly composed of resistant sandstone and cherts, whereas the valleys formed within the shales.

Lithic assemblages from eleven sites along the major drainages of the Ouachitas, including the Kiamichi, Little, Glover, and Mountain Fork rivers, were chosen for this study. Twelve additional sites along the Muddy Boggy River, which runs through the western-most extension of the Ouachitas, were inspected. No Red River Jasper was found in these assemblages. One site along the Red River upstream (west) of its confluence with the Kiamichi was also examined, because Red River Jasper was known to occur within the assemblage of that site. Artifacts from these sites range in age from the Archaic to late prehistoric period.

Table 3. Assemblages examined for Red River Jasper. Sites listed geographically by drainage from west to east.

Map #	Site Name	Site #	Drainage	Red River Jasper Present?	Site Reference(s)
1	James	34BR11	Red/Washita	Y	--
2	George	34AT105	Muddy Boggy	N	McGuff 1980
3	Green Snake	34AT106	Muddy Boggy	N	McGuff 1980
4	Firecracker	34AT107	Muddy Boggy	N	McGuff 1980
5	Velt	34AT108	Muddy Boggy	N	McGuff 1980
6	Hurry Up	34AT109	Muddy Boggy	N	McGuff 1980
7	Loads	34AT111	Muddy Boggy	N	McGuff 1980
8	Pittance	34AT112	Muddy Boggy	N	McGuff 1980
9	Funny Feature	34AT113	Muddy Boggy	N	McGuff 1980
10	--	34AT114	Muddy Boggy	N	McGuff 1980
11	Texas Hole	34AT115	Muddy Boggy	N	McGuff 1980
12	Sappho	34AT116	Muddy Boggy	N	McGuff 1980
13	Will o the Wisp	34AT117	Muddy Boggy	N	McGuff 1980
14	Montgomery	34CH70	Lower Kiamichi	Y	Rohrbaugh 1971, 1972
15	Mahaffey	34CH1	Lower Kiamichi	Y	Rohrbaugh et al. 1971; Rohrbaugh 1972
16	Natural Lake	34PU71	Upper Kiamichi (Jackfork Creek)	N	Lintz 1979a
17	Blessingame	34PU74	Upper Kiamichi (Buffalo Creek)	Y	Lintz 1979b
18	Arrrowhead Hill	34PU105	Upper Kiamichi (Buffalo Creek)	Y	Vehik 1979
19	Buffalo Bend	34PU111	Upper Kiamichi (Buffalo Creek)	Y	Flynn et al. 1979
20	Bell	34MC76	Little	Y	Wyckoff 1968a
21	A.W. Davis	34MC6	Little/Glover	Y	Wilson 1962
22	Pine Creek Mound Group	34MC146	Glover	Y	Gettys 1975
23	Bill Hughes	34MC21	Mountain Fork	N	Wyckoff 1968b
24	Biggham Creek	34MC105	Mountain Fork	Y	Wyckoff 1965

Within each assemblage, all cores, bifaces, and bifacial tools were examined for Red River Jasper. Attributes and variables were recorded for all artifacts made from this material. These included reduction stage, any diagnostic attributes, whether or not cortex was present, maximum length, maximum thickness, texture, cortex color, matrix color, inclusions, and notes on color transitions within the material (mottled, banded, transitional, or red tips on finished tools).

Of the assemblages along the drainages coming out of the Ouachita Mountains, nine contained cores, bifaces, and/or bifacial tools made of Red River Jasper. The relative proportion of cores, early stage bifaces, and artifacts with cortex within each Red River Jasper assemblage was determined to identify what stages of the reduction process were practiced at different sites (Table 4). A higher proportion of cores, early stage bifaces, and artifacts with cortex demonstrates that the material went through the initial stages of reduction at that site. This suggests that the material was acquired locally. A lower proportion of cores, conversely, implies that more of the material was initially worked elsewhere and was brought to the site in the form of late stage bifaces and finished tools.

Table 4. Sites with Red River Jasper artifacts. Total number of artifacts and number and percent of cores, early stage bifaces, and artifacts with cortex within each assemblage. Sites listed geographically by drainage from west to east.

Site	Drainage	n RRJ Artifacts	Cores		Early Stage Bifaces		Artifacts with Cortex	
			n	%	n	%	n	%
34BR11	Red/ Wichita	30	0	0	0	0	10	33
34CH1	**Lower Kiamichi**	79	35	**44**	1	1	50	**64**
34CH70	**Lower Kiamichi**	53	24	**45**	2	4	27	**51**
34PU74	**Upper Kiamichi**	29	9	**31**	6	21	19	**66**
34PU105	**Upper Kiamichi**	12	4	**33**	4	25	8	**67**
34PU111	**Upper Kiamichi**	5	3	**60**	2	40	5	**100**
34MC76	Little	57	1	2	2	4	14	25
34MC6	Little/ Glover	31	0	0	2	6	9	29
34MC146	Glover	3	0	0	0	0	0	0
34MC105	Mountain Fork	14	0	0	0	0	1	7

By far the highest percentages of Red River Jasper cores occur within the assemblages of sites along the upper and lower reaches of the Kiamichi River (Figure 10). This strongly suggests that people living at these sites acquired this material locally, whereas the people living in distant drainages transported it in an already reduced form. Sites with the highest proportions of early stage bifaces include all of those along the upper Kiamichi. Sites along the lower Kiamichi, however, have a much lower proportion of early stage bifaces, equal or less than the proportion of early stage bifaces at sites along the Little River. It is possible that fewer early stage bifaces are present at the sites along the lower Kiamichi because the material was traded out in this form. This might explain the presence of a relatively equal proportion of early stage bifaces at the Little River sites. People living along the Little River, which is the next major drainage east of the Kiamichi, did not have far to travel to reach the lower Kiamichi sites, reducing the potential difficulty of carrying the material from one river to the next. Red River Jasper cores were small to begin with, though, and carrying bifaces in the early stages of the reduction process may not have imposed any particular difficulty. One of the sites under consideration along the lower Kiamichi (34CH1) and both sites along the Little River (34MC76 and 34MC6) included late prehistoric Caddo components. The Caddo people living at these sites may have been connected to each other within a trade network. It is also possible that the residents along the Little River traveled to the Kiamichi River independently, acquired Red River Jasper cobbles purposefully or circumstantially, partially reduced them, and taken them to their sites for further reduction.

The proportions of artifacts with cortex in the Red River Jasper assemblages represent a wider range of variation. Nonetheless, sites along the Kiamichi still exhibit the highest proportions, supporting the idea that the material originates within that drainage.

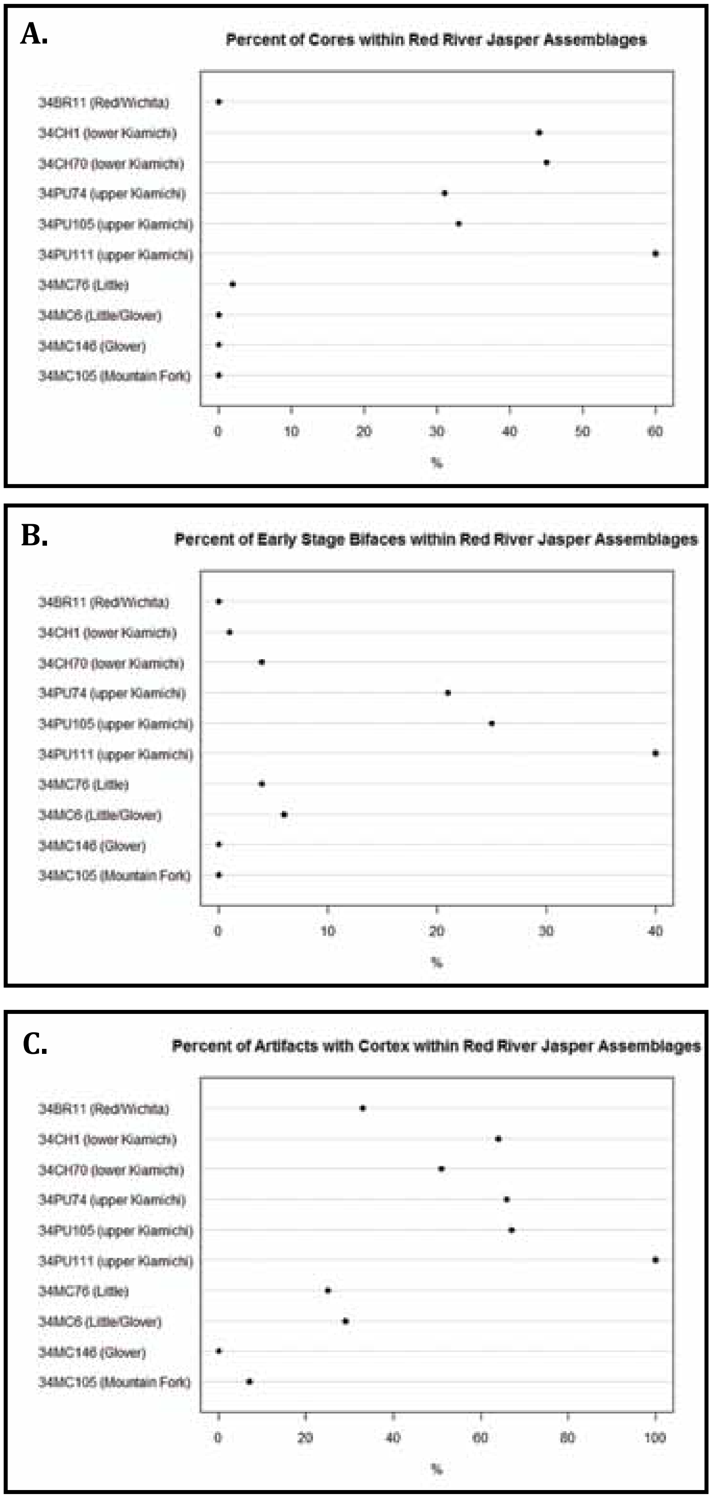

Figure 10. Proportion of cores, early stage bifaces, and artifacts with cortex present within assemblages of Red River Jasper. The assemblages with the highest percentages of cores, early stage bifaces, and artifacts with cortex are all from the Kiamichi drainage, indicating that these people had the most immediate access to the raw material. This supports the hypothesis that the Kiamichi River was a primary source within the Ouachita Mountains for Red River Jasper.

Stream Survey and Geological Origins

The proportions of cores, early stage bifaces, and artifacts with cortex from these assemblages all point to the Kiamichi River as the most likely source for Red River Jasper gravels. Based on the high proportion of cores and early stage bifaces at sites along the upper reaches of the Kiamichi, this portion of the drainage is the most likely location of the formation(s) from which these gravels are eroding. Narrowing down the potential location (or locations) and the composition of this formation(s) involved two approaches. First, a survey was conducted at locations sequentially farther upstream along the Kiamichi to determine how far upstream the Red River Jasper gravels occur. This aided in the identification of streams feeding the Kiamichi that may cut across the contributing formation(s). Second, potential chert-bearing formations within this range were examined. Through consultation with the Oklahoma Geological Survey, the Johns Valley Formation was identified as the most likely source material for Red River Jasper. Outcrops of the Johns Valley Formation are present in the Winding Stair Range of the Ouachita Mountains north of the Kiamichi River. Together, the archaeological, survey-based, and geological evidence point to a limited number of potential outcrops of the Johns Valley Formation cross-cut by streams draining into the Kiamichi River from which Red River Jasper may be originating (Figure 11).

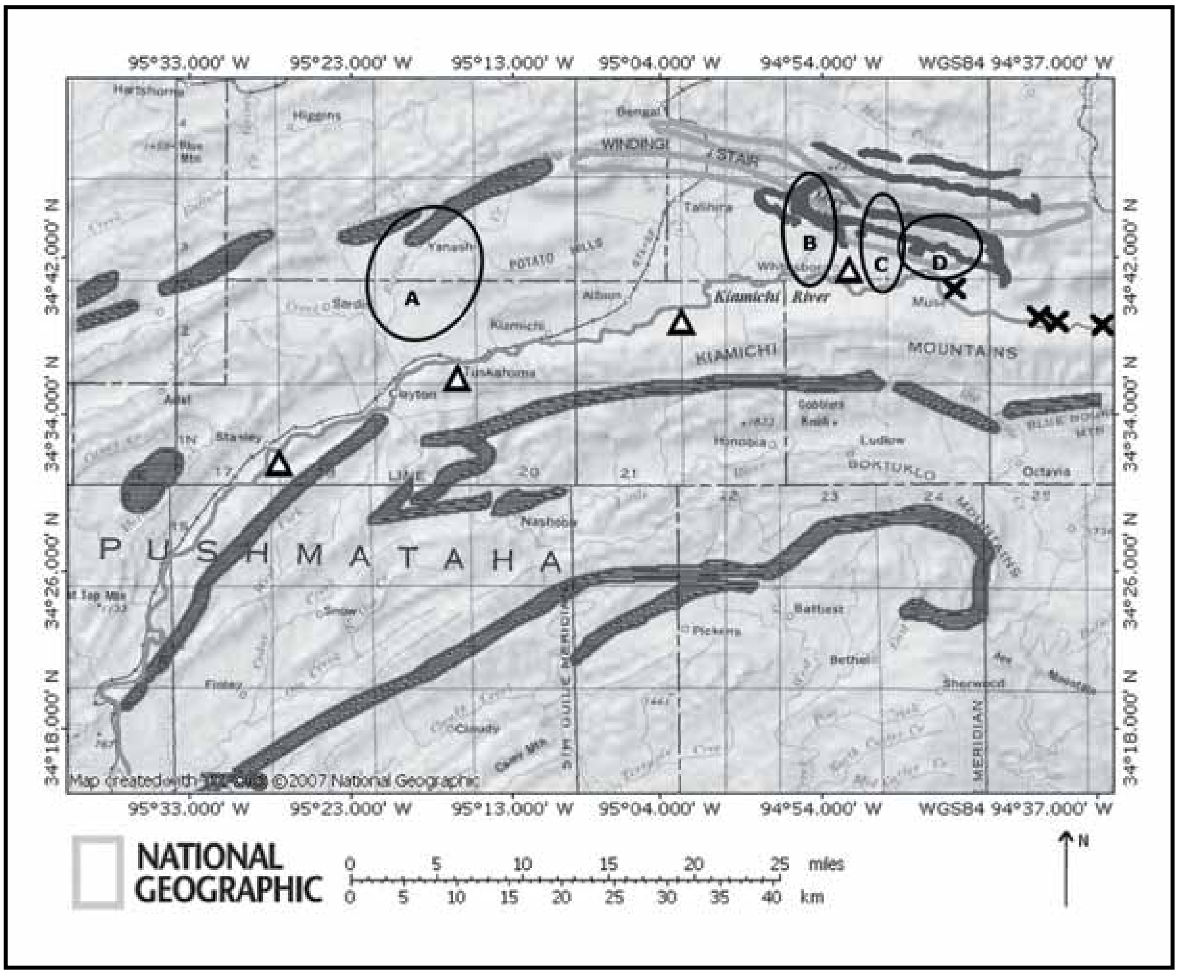

Figure 11. Distribution of the Johns Valley Formation in the Ouachita Mountains, Oklahoma, in relation to a survey of gravels along the banks of the Kiamichi River for Red River Jasper. The shaded areas indicate outcrops of the Johns Valley Formation (dark shaded areas adapted from Banks 1990:Figure 1.20 and light shaded areas adapted from Hart 1963:Plate I). Δ indicates the presence of Red River Jasper during the gravel survey along the Kiamichi River; X indicates its absence. Localities A through D indicate potential sources for Red River Jasper or for its antecedent, outcrops of iron-rich John's Valley chert. Base map courtesy of National Geographic TOPO! Software.

Most major rivers draining the Ouachitas flow south where they join the eastward-flowing Little River, which eventually joins the Red River in Arkansas. The Kiamichi River flows westward—paralleling the mountains—until it turns south near Clayton and eventually joins the Red River. The portion of the Kiamichi River under discussion is situated in a broad alluvial valley in the central part of the Ouachita Mountains known as the Fourche-Kiamichi Belt (Thornbury 1965:283). This part of the river valley is bounded by the Potato Hills and the Winding Stair Range to the north and the Kiamichi Mountains to the south.

Based on the physical characteristics of Red River Jasper, its known distribution, and the geological history of the region, Neil Sunerson (personal communication 2008) of the Oklahoma Geological Survey has suggested that it comes from the Johns Valley Formation. The Johns Valley Formation was first named by Ulrich (1927:21-22) and chert in the formation has been discussed by Banks (1984:91, 1990:46) and Hart (1963:30-40). This formation is composed primarily of shale but also contains exotic chert cobbles and boulders. Some debate exists over the origin of these chert clasts. Hart (1963:36-40) argued that they became embedded in the shale following a violent faulting episode, in which the boulders were transported through underwater turbidity flows and gravity slides down the muddy northern slope of the Ouachita trough. This may have occurred sometime during the Upper Mississippian to Lower Pennsylvanian period (328.3 ±1.6 to 311.7 ±1.1 mya) of the Paleozoic era (Gradstein et al. 2004; Hart 1963:40; Ogg et al. 2008).

The type location for the Johns Valley Formation is located in Johns Valley, northwest of the Kiamichi River. Other outcrops of the Johns Valley Formation occur in linear bands along the Winding Stair Range and Kiamichi Mountains, respectively north and south of the Kiamichi River in the section of interest (Banks 1990:Fig. 1.20; Miser 1959:Fig. 3). Because the streams that enter the Kiamichi River from the south are considerably smaller than those from the north, it is more likely that the source for Red River Jasper lies in the linear outcrop to the north of the river.

A detailed geological map of the Winding Stair Range near the surveyed portion of the Kiamichi River is presented by Hart (1963). All of the major streams that feed the Kiamichi from the Winding Stair Range in this area cut across a Johns Valley Formation outcrop. This outcrop pinches out and ends just past the last place where Red River Jasper was found along the Kiamichi, providing further support for a Red River Jasper origin within this range. A broader-scale map of chert-bearing formations by Banks (1990:Fig. 1.20) suggests several other potential localities for Johns Valley source material within the study area. Further work would be required to determine whether Red River Jasper is coming from one or multiple sources, but at least one source must include the outcrop cross-cut by streams between the towns of Whitesboro and Muse in the Kiamichi Valley.

The exotic boulders of the Johns Valley Formation include Arkansas Novaculite along with Woodford, Pinetop, and Big Fork cherts and quartzites (Banks 1984:91). Of these, Woodford Chert most resembles the less-weathered gray to black specimens of the Red River Jasper gravels. Woodford Chert that is not embedded within the Johns Valley Formation outcrops near belts of Johns Valley Shale at isolated localities along the crest of the Winding Stair Range (Banks 1990:40). Like Red River Jasper, the material is opaque, and Banks (1990:41) has noted that iron pyrite and iron-oxide staining is common along fractures. The chert from which Red River Jasper originates could be a variant of Woodford Chert or it could be an as-of-yet unidentified chert, in either case situated within the Johns Valley Shale. This chert was apparently particularly susceptible to chemical weathering, perhaps because it was more porous than other cherts or lengthy exposure to water in its small tabular form. As it entered the Kiamichi drainage, it gradually transformed into Red River Jasper, in some cases changing color throughout by the time it was acquired and used to make tools.

Banks (1995:13) mentioned a green chert that occurs in fractured beds in the Potato Hills and at Black Knob Ridge east of Atoka. He traced gravels of this material in the Kiamichi River south of the Potato Hills and found that it weathered to shades of brown and yellow. It is possible that this represents another variety of what has been called Red River Jasper, one with a different parent formation. Of the cores from the archaeological assemblages, a few have portions that were light olive brown. It is possible that Red River Jasper, particularly once it works its way downstream, is actually composed of multiple materials that chemically weather to a similar appearance.

Conclusion

Archaeologists base many of their interpretations on lithic artifacts, the best-preserved and most abundant artifacts at sites spanning most of human history. Because of this, understanding the character and natural distribution of lithic raw materials is essential for interpreting the archaeological record (Wyckoff 2006). Whereas many raw materials on the Southern Plains are well-documented, this paper represents the first serious report of the characteristics and distribution of Red River Jasper. It is evident that many of these tabular brown chert gravels that occur in the Red River drainage come out of the Ouachita Mountains via the Kiamichi River. The most likely source for these gravels is the Johns Valley Formation, which is cross-cut by a number of feeder streams to the Kiamichi within the Winding Stair Range. As the gravels erode from the Johns Valley Formation, they undergo chemical weathering that gives them their yellow-brown to red colors. Future survey along Buffalo Creek, Rock Creek, and other streams draining the Winding Stair Range may narrow down the location of the source or sources of the gravels within the Johns Valley Formation. It is possible that other sources for materials classified as Red River Jasper may also exist.

Knowing the natural range of Red River Jasper helps us to understand which people acquired the material locally and who had to travel or trade in order to obtain it. The identification of Red River Jasper at sites outside of its natural range, though, can be complicated by its sometimes macroscopic similarity to other local gravels, such as those from the Antlers Formation. While these gravels are easily distinguishable in core form, they are more difficult to differentiate further on in the reduction sequence. Microscopic and trace-element analyses comparing some of these cherts may help archaeologists to more accurately distinguish between them, but too much variation may exist within each material to tell them apart. However, archaeologists can productively focus on the macroscopic suites of attributes that differentiate these cherts and on identifying Red River Jasper cores, which are easily distinguishable. Understanding the characteristics and natural range of Red River Jasper may help archaeologists in understanding the potential processes underlying its cultural distribution.

Acknowledgements

First and foremost, all of my thanks to Don Wyckoff for encouraging me to embark on this project, for making me appreciate the importance of understanding lithic materials, and for funding my travels through southeastern Oklahoma. Thank you to the Sam Noble Oklahoma Museum of Natural History, George Morgan at the University of Oklahoma electron microprobe lab, Neil Sunerson at the Oklahoma Geological Survey, Jeffrey Girard at Northwestern State University of Louisiana, and the United States Army Corps of Engineers Tulsa District, in particular Michelle Horn and Ken Shingleton. A big thanks to my husband, Tim, for traversing the Kiamichi with me in search of gravels and carting chert through the Ouachitas. Finally, my thanks to my reviewers, Charlie Cobb, and George Avery.

References Cited

Banks, Larry D.

1984 Lithic Resources and Quarries. In *Prehistory of Oklahoma*, edited by R. E. Bell, pp. 65-95. Academic Press, Orlando.

1990 *From Mountain Peaks to Alligator Stomachs: a Review of Lithic Sources in the Trans-Mississippian South, the Southern Plains, and Adjacent Southwest*. Oklahoma Anthropological Society, Memoir 4. Norman.

1995 Appendix B. Classification and Identification of Lithic Artifacts and their Geologic Sources of Origin for Texas Archeological Site 41BW422, Bowie County, Texas. In *Archaic Lifeways in the Northern Part of the West Gulf Coastal Plain: results of Excavations at Site 41BW422, Bowie County Texas*, by Gordon C. Tucker Jr. Prepared for Texas State Department of Highways and Public Transportation. Austin, Texas.

Bates, Robert L. and Julia A. Jackson (editors)

1980 *Glossary of Geology*. 2rd ed. American Geological Institute, Falls Church, Virginia.

Flynn, Peggy, Marjorie Hammett Earman, and Rain Vehik

1979 Test Excavations at the Buffalo Bend Site (34Pu-111). In *The Prehistory of the Proposed Clayton Lake Area, Southeast Oklahoma: Phase I Investigations*, edited by Rain Vehik and Jerry R. Galm, pp. 452-487. Archaeological Research and Management Center, Research Series 6. University of Oklahoma, Norman.

Frahm, Ellery

2007 Electron Microprobe Analysis in Archaeology. Example: Examining the Microstructure of Flint and Chert. Electronic document, http://web.mac.com/elleryfrahm/iWeb/Microprobe/Electron%20Microprbe%20Analysis%20in%20Archaeology/F75D2AC4-3FB1-4F39-A941-DDB9B523A2EF.html, accessed April 24, 2009.

Gettys, Marshall

1975 Preliminary Report on Archaeological Investigations at Lukfata Reservoir, Southeastern Oklahoma. Oklahoma River Basin Survey Project, General Survey Report No. 14. University of Oklahoma, Norman.

Gordon, S. and R.I. Dorn

2004 Rind, Weathering. In *Encyclopedia of Geomorphology*, edited by A.S. Goudie, pp. 853-855. Routledge, London.

Gradstein, F. M., J. G. Ogg, A. G. Smith, et al.

2004 *A Geologic Time Scale 2004*. Cambridge University Press.

Hart, Orville Dorwin

1963 *Geology of Eastern Winding Stair Range Le Flore County*. Oklahoma Geological Survey, Bulletin 103. University of Oklahoma, Norman.

Hurst, V. J. and A. R. Kelly

1961 Patination of cultural flints. *Science* 134:251-256.

Jennings, Thomas A.

2006 San Patrice Technology and Mobility Across the Plains-Woodland Border. Master's Thesis, submitted to the University of Oklahoma.

References Cited (cont.)

Johnson, Kenneth S.

1998 Mountains, Streams, and Lakes of Oklahoma. Oklahoma Geological Survey, Information Series #1. Reprinted from Oklahoma Geology Notes (1993), vol. 53, no. 5, pp. 180-188.

King, Adam, James W. Hatch, and Barry E. Scheetz

1997 The Chemical Composition of Jasper Artefacts from New England and the Middle Atlantic: Implications for the Prehistoric Exchange of "Pennsylvania Jasper". *Journal of Archaeological Science* 24:793-812.

Lintz, Christopher

1979a The Natural Lake Site (34Pu-71). In *The Prehistory of the Proposed Clayton Lake Area, Southeast Oklahoma: Phase I Investigations*, edited by Rain Vehik and Jerry R. Galm, pp. 125-168. Archaeological Research and Management Center, Research Series 6. University of Oklahoma, Norman.

1979b The Blessingame Site (34Pu-74). In *The Prehistory of the Proposed Clayton Lake Area, Southeast Oklahoma: Phase I Investigations*, edited by Rain Vehik and Jerry R. Galm, pp. 244-362. Archaeological Research and Management Center, Research Series 6. University of Oklahoma, Norman.

Lovering, T. G.

1972 Jasperoid in the United States: its characteristics, origin, and economic significance. *United States Geological Society Professional Paper* 710:1-164.

Luedtke, Barbara A.

1992 *An Archaeologist's Guide to Chert and Flint*. Archaeological Research Tool 7. Institute of Archaeology, University of California, Los Angeles.

Malyk-Selivanova, Natalia, Gail M. Ashley, Robert Gal, Michael D. Glascock, and Hector Neff

1998 Geological-Geochemical Approach to "Sourcing" of Prehistoric Chert Artifacts, Northwestern Alaska. *Geoarchaeology* 13(7):673-708.

McGuff, Paul

1980 *Cultural Resource Survey and Testing at the McGee Creek Project, Oklahoma*. Prepared for the United States Department of the Interior Bureau of Reclamation, Southwest Region, Amarillo, Texas. Environmental Assessments, Inc., Pauls Valley, Oklahoma.

Miser, Hugh D.

1959 Structure and Vein Quartz of the Ouachita Mountains of Oklahoma and Arkansas. In *The Geology of the Ouachita Mountains: A Symposium*, edited by Lewis M. Cline, William J. Hilseweck, and Dan E. Feray, pp. 30-43. Dallas Geological Society and Ardmore Geological Society, Dallas.

Ogg, J. G., G. Ogg, and F. M. Gradstein

2008 *The Concise Geologic Time Scale.*

Pitblado, Bonnie L., Carol Dehler, Hector Neff, and Stephen T. Nelson

2008 Pilot Study Experiments Sourcing Quartzite, Gunnison Basin, Colorado. Geoarchaeology 23(6):742-778.

References Cited (cont.)

Rohrbaugh, Charles L.
1972 *Hugo Reservoir II: A Discussion of the Development of the Archaic Cultures in Hugo Reservoir into the Pre-Formative and Formative Tradition and Including the Descriptions of Three Archaic Sites Dug During the 1970 Field Season: Ch-89, The McKensie Site; Pu-58, The Hill Site, and Ch-113A, The Pat Boyd Place, Area A*. Oklahoma River Basin Survey, Archaeological Site Report 23. University of Oklahoma Research Institute, Norman.

Rohrbaugh, Charles L., Robert J. Burton, Susan Sasse Burton, and Lura Joseph Rosewitz
1971 *Hugo Reservoir 1: The Description of the Archaeological Sites Excavated Ruing the 1970 Field Season Including Ch-1, Ch-43, Ch-70, Ch-75, Pu-82 and Ch-90*. Oklahoma River Basin Survey, Archaeological Site Report 22. University of Oklahoma Research Institute, Norman.

Thornbury, William D.
1965 *Regional Geomorphology of the United States*. John Wiley & Sons, New York.

Ulrich, E. O.
1927 *Fossiliferous boulders in the Ouachita "Caney" shale and the age of the shale containing them*. Oklahoma Geological Survey Bulletin 45. Norman.

University of Oklahoma
2009 Electron Microprobe Laboratory. Electronic document, http://research.ou.edu/microprobe/OUEMPLhome.asp, accessed April 24, 2009.

Vehik, Rain
1979 Phase I Excavations at the Arrowhead Hill Site (34Pu-105). In *The Prehistory of the Proposed Clayton Lake Area, Southeast Oklahoma: Phase I Investigations*, edited by Rain Vehik and Jerry R. Galm, pp. 394-451. Archaeological Research and Management Center, Research Series 6. University of Oklahoma, Norman.

Webb, Clarence H., Joel L. Shiner, and E. Wayne Roberts
1971 The John Pearce Site (16CD56): A San Patrice Site in Caddo Parish, Louisiana. *Bulletin of the Texas Archaeological Society* 42:1-49.

Wilson, Rex
1962 The A.W. Davis Site, Mc-6, of McCurtain County, Oklahoma. *Bulletin of the Oklahoma Anthropological Society* 10:103-152.

Wyckoff, Don G.
1965 *Biggham Creek Site, McCurtain County, Oklahoma*. Oklahoma River Basin Survey, General Survey Report 3. University of Oklahoma, Norman.
1968a The *Bell and Gregory Sites: Archaeological Chronicles of Prehistory in the Pine Creek Reservoir Area, Southeast Oklahoma*. Oklahoma River Basin Survey, Archaeological Site Report 11. University of Oklahoma, Norman.
1968b *The Beaver Site and Archaeology of the Broken Bow Reservoir Area, McCurtain County, Oklahoma*. Oklahoma River Basin Survey, Archaeological Site Report 9. University of Oklahoma, Norman.
2006 Recent Lithic Technological Studies on the Southern Plains and Adjacent Regions Part I: Identifying and Sourcing Raw Materials. *Lithic Technology* 30(2):89-106.

A Case for Dehahuit's Village, Part II

Jim Tiller

Abstract

In this, the second of a two part series on Dehahuit's village, we will use period materials to further establish a circumstantial case for the location of the village of this historic figure on Paw Paw Bayou in eastern Harrison County, Texas. In our discussion we will make use of selected distances and directions noted in the archival record and present a time and distance problem based on the journals of the Freeman and Custis expedition. We conclude with an analysis of Father José Puelles' 1807 map of Texas and William Darby's 1816 map of Louisiana.

Introduction

As discussed in *A Case for Dehahuit's Village, Part I*,[1] Brooks' District Court statement and Sibley's comment regarding the Caddo living on a bayou named Sodo, when combined with the 1837 Caddo memorial, strongly suggest that the settlement of this historic figure has been mistakenly associated with the site on Jim's Bayou, referred to in recent years as Timber Hill.

In this the second and more speculative of the two articles in this series, the author will offer additional archival evidence and alternative interpretations of the record to buttress the circumstantial case for the location of Dehahuit's village on Paw Paw Bayou. We begin with a discussion of distances and directions from known points to the main or principal Caddo village (and thus the probable home of the great *caddi*) found in period records. We will next develop a time and distance problem related to Dehahuit's settlement as suggested in the journals of the 1806 Freeman-Custis expedition. We conclude with a consideration of the Sodo Lakes region Caddo village sites depicted on Father José Puelles' 1807 map of Texas and William Darby's 1816 map of Louisiana.

Distance and Direction

In the historical record, there are at least eight pieces of evidence (hereafter referred to as "items") related to distance and direction suggesting that the primary Caddo village during the early 1800s was located south of Caddo Lake (Figure 1). These would include the following

(1) In 1840, Jehiel Brooks, answering the memorial of Samuel Norris in the matter of the Grappe claim, made the following statement

> The Indian south boundary as expressed in the treaty made by your respondent he believes cannot be questioned with any greater propriety. The Head Chief of the Caddo nation named Dehahuit or Dehahut resided at what has always been known by the name of "the Key Village" from the time of the first council ever held by this Government with that functionary in May 1805 to the time of his death in March 1833 which village is situated within a short distance of said Boundary and about ninety miles from the town of Natchitoches.[2]

(2) Indian Agent John Sibley, in his 1805 *Historical Sketches*, reported that the Yatasi tribe lived

> on Bayou river (or Stony Creek) [the period name for today's Buffalo Bayou] which falls into Red river, western division, about fifty miles above Natchitoches. Their village is in a large prairie, about half way between the Caddoques and Natchitoches surrounded by a settlement of French families. The Spanish Government, at present, exercises jurisdiction over this settlement, where they keep a guard of a non-commissioned officer and eight soldiers.[3]

(3) In an 1809 report of the Barr and Davenport trading company of Nacogdoches, it was noted that

> The old tribe of the Nacogdoches had its Rancheria about five leagues [13 miles] above the city of the same name … On the Sabine, two leagues [5 miles] above the village of the Nacogdochitos was the pueblo of the Nadacos … The Cadodachos were also on the east bank of the Sabine, some nineteen or twenty leagues [50-53 miles] above the pueblo of the Nadacos.[4]

(4) On entering the Red River above the Great Raft south of present-day Benton, Louisiana, Thomas Freeman (of the Freeman-Custis expedition) made the following journal entry

> Beyond this Prairie [reference is to Caddo Prairie which extends north of Shreveport along the west side of the Red River] there is a large lake [Lake Sodo], on the west of which, and nearly 30 miles from Red River, lies the principal Village of the Caddos.[5]

(5) Once the Freeman-Custis expedition had arrived at the Coushatta village, Peter Custis made the following entry in his journal

> The Caddoes reside about 50 miles from this according to some accounts & not so far according to others, on a small Creek emptying into a lake which communicates with the River a little above the Raft.[6]

(6) Trader Anthony Glass, writing from the Coushatta village at Cedar Bluff in 1808, observed that

> [The Coushattas] are friendly with the Caddoes who own the Country & who used to occupy the same spot; But now live about thirty Miles South West on the Lake. The Caddoes left the place on account of having lost many of their people by the small poxe, it being a custom to abandon a village where many have died. This place is nearly north latitude 32, 50, and distant from Nackitosh by the usual road about 120 miles in a rich beautiful place.[7]

(7) In his 1805 *Historical Sketches*, John Sibley wrote that the

> Caddos Live about thirty five miles west of the main branch of Red river, on a bayou or creek, called, by them, Sodo, which is navigable for pirogues only, within about six miles of their village, and that only in the rainy season. They are distant from Natchitoches about 120 miles, the nearest route by land, and in nearly a northwest direction.[8]

(8) In 1840, 53 year old Joseph Valentin testified that over the years he had frequently accompanied the Caddo during their winter hunts and that when not hunting, the Caddo

> resided for the most part at their villages at the *head* [author's emphasis] of Cos Lake[9]

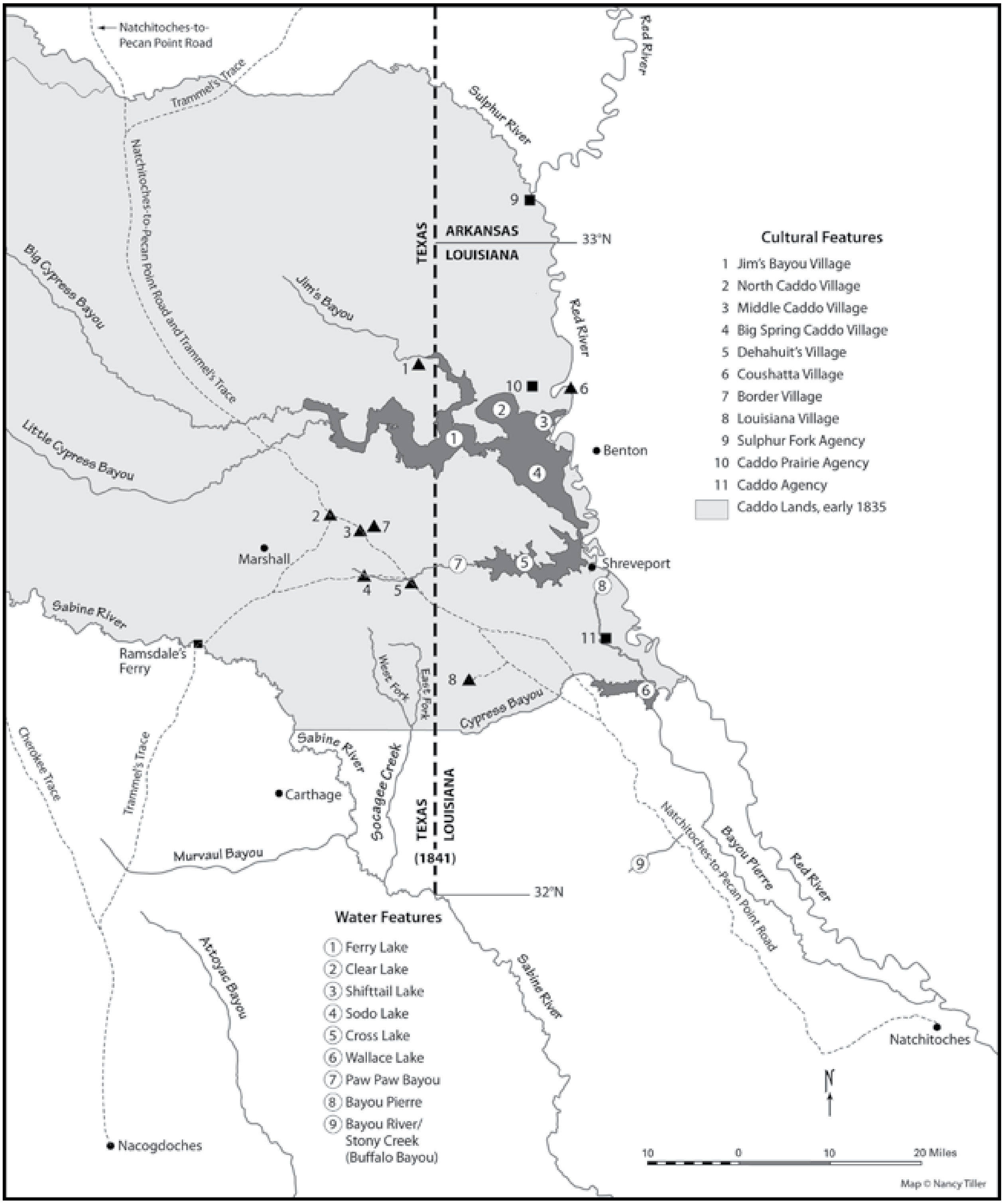

Figure 1. The Sodo Lakes Region, 1838. Marshall, Carthage and Benton are provided as reference points.

As discussed at some length in Part I of this series, the most significant evidence related to distance is the statement of Brooks who noted that the village of Dehahuit was located near the south boundary of the Caddo lands and some 90 miles from Natchitoches (item 1).[10] When combined with Sibley's 1805 statement regarding the location of the Caddo relative to the Yatasi tribe and the town of Natchitoches (item 2), the primary Caddo village appears to have been situated approximately 90 to 100 miles above Natchitoches at a point on what would later be known as the Natchitoches-to-Pecan Point Road. As calculated on later American survey plats (in 1805, what would in time become known as the Natchitoches-to-Pecan Point Road only extended from Natchitoches to the Bayou Pierre settlements), Dehahuit's village was located south of Ferry Lake approximately 87 miles from Natchitoches. From a slightly different perspective, the report of Barr and Davenport (item 3) places the Caddo approximately 70 miles (27 leagues) above Nacogdoches, possibly in the general area of Cross Lake. Valentin, in noting the Caddo lived in villages at the *head* of Cross Lake when not out of the area, certainly suggests that the region west of Cross Lake was the center of the Caddo culture in the Sodo Lakes region, and, by inference, makes it very likely that one of these Cross Lake villages was the home of Dehahuit. It is difficult to see how proponents of the Jim's Bayou site as the home village of Dehahuit can square these statements with a location north of the lakes (Figure 2).[11]

In the journals of the Freeman-Custis expedition (as interpreted by Flores), the party, after a journey east around the Great Raft, re-entered the Red River below Benton, Louisiana near Willow Chute (item 4).[12] The 30-mile distance referenced by Freeman was almost surely measured in a straight line from a point near Willow Chute to the principal Caddo village. Considering the wording of the journal entry ("beyond this Prairie ... large lake") it does not appear Freeman was suggesting a land route around Shifttail and Clear Lakes and the Jim's Bayou arm of Ferry Lake to the primary Caddo village. Clearly, the implication is that from expedition's river location the principal Caddo village was situated beyond Caddo Prairie and to the west of a large lake (probably Lake Sodo). If the reference was to the Jim's Bayou site, this was indeed an odd way to describe the location. At the very least one would have expected the word "beyond" to have been amended by Freeman to read "northwest of."

Regardless of whether one considers the distance to be the 30 miles of Freeman (item 4) or 50 miles (or a little less) of Custis (item 5), 30 miles according to Glass (item 6) – and observe that both Custis and Glass are providing distances as measured from the same point, the Coushatta village – or the 35 miles as estimated by Sibley (item 7), it appears the village being referenced was *not* the Jim's Bayou site, it being only 17 straight-line miles from the Coushatta village. In addition, note the direction provided by Glass to the Caddo villages – to the southwest. In fact, the Jim's Bayou site lies slightly to the north of a point due west of the Coushatta village. While items 2-6 would suggest a location to the south of the Sodo Lakes complex, Brooks' comments in item 1 and Valentin's in item 8 leave no doubt that the primary Caddo village and, thus the probable home of Dehahuit, lay a considerable distance south of Ferry Lake.

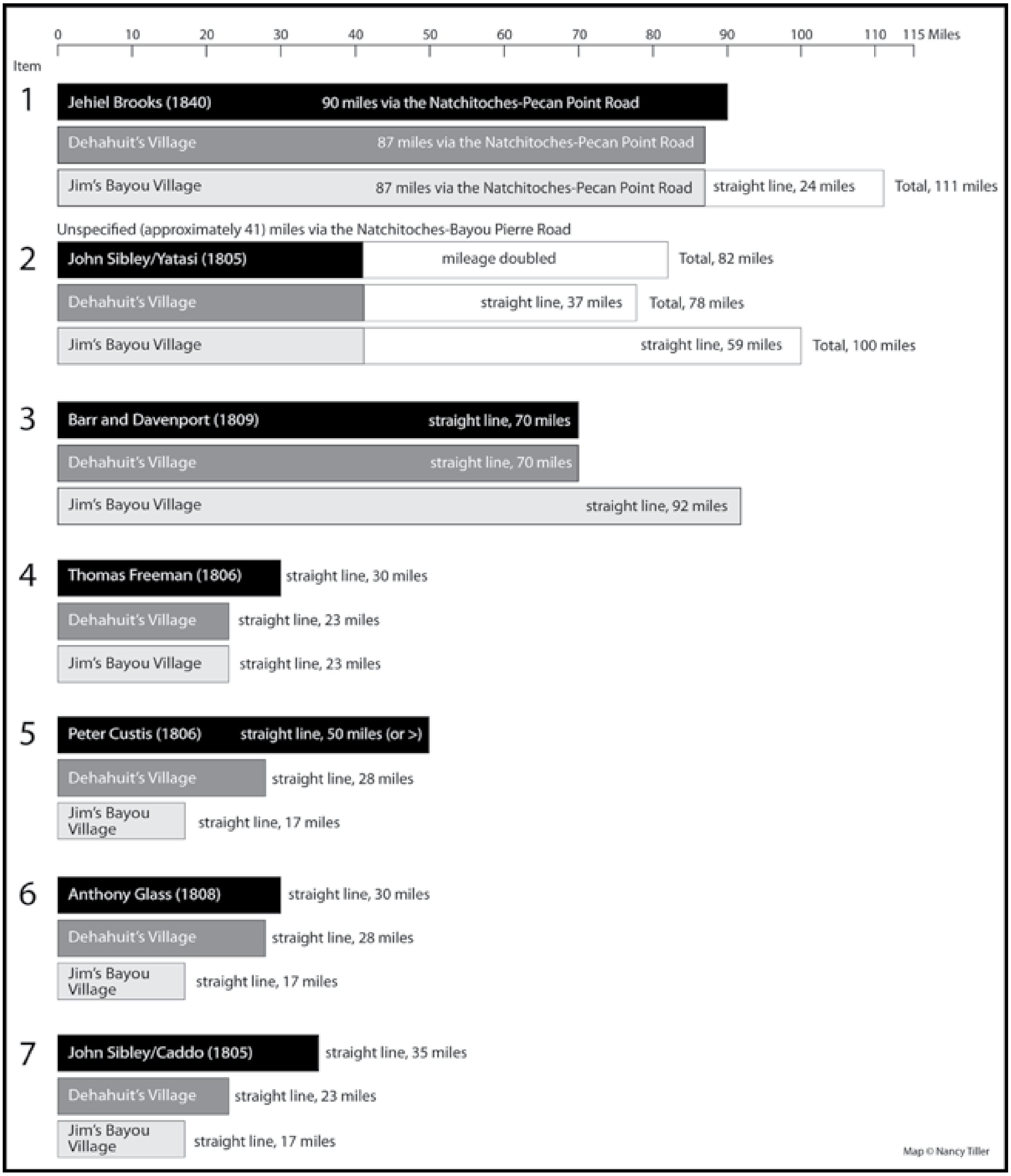

Figure 2. A Comparison of Distances Between Selected Locations[39]

Interestingly both Glass (item 6) and Sibley (item 7) reference a 120 mile distance from Natchitoches – Glass noting this as the distance to the Coushatta village via the "usual road," and Sibley's 120 mile estimate to the Caddo villages as "the nearest route by land." From his journal, there is little question the route travelled by Glass lay up the *east* side of Red River. This route probably very closely followed the road through "Tulin's Vaucherie" and around Lakes Bistineau and Bodcau to the Coushatta village depicted on William Darby's 1816 map of Louisiana (Figure 3). As this was the "usual road" between Natchitoches and the Coushatta village during the early 1800s (and it seems reasonable to assume that Sibley would have been well aware of the approximate 120 mile distance between these two points), and since we know the Jim's Bayou site is found some 17 straight-line miles *west* of the Coushatta village, it is doubtful that Sibley was describing the Jim's Bayou site (nor Sodo Bayou) in his *Historical Sketches* as being 120 miles from Natchitoches as measured up the *east* side of the Red River along the "usual road."

Nor does it seem likely that Sibley's 120 mile distance between Natchitoches and the Caddo villages related to a route up the *west* side of Red River. While a distance of 120 miles via the Natchitoches-to-Pecan Point Road and then around Caddo Lake would in fact put one in the general area of the Jim's Bayou village site, what is often overlooked in this 1805 statement is that Sibley indicated the distance was "the nearest route by land." In 1805, not only was there no Natchitoches-to-Pecan Point Road, it is doubtful (see comments of William Darby below in the section on Darby's Caddo village) that a commonly accepted route aside from hunting/trading paths to the northwest even existed on the west side of the Red River above the Bayou Pierre settlements.

Is it not possible that Sibley's route followed, at least in part, the route travelled by Glass and depicted by Darby? Note on Darby's map the second fork in the road north of Toulin's vaucherie. What reason could possibly justify the presence of a *ferry* across Lake Bistineau at the point? The ferry crossing is not at the lake's narrowest point assuming one is intent on continuing northward along the road indicated. Even more important, for what reason does this ferry crossing exist in this sparsely populated area if one is only to rejoin the original road to the north? The distance saved by such a route would have been minimal and likely would not have justified the expense of the ferry. It seems clear to the author that while Darby did not indicate the presence of another road/path west of Lake Bistineau, one surely must have existed. That road/path in all probability extended west from the ferry crossing to the Raft, thence to Cross Bayou (hence a possible origin of the name of the bayou and lake), then west along the old Indian trail to the Caddo villages. In later years this route west out of Shreveport (US Highway 80) would follow the watershed divide which separates streams flowing north into Cross Lake from those flowing south into Boggy Bayou/Wallace Lake. A route such as described would have fallen within Sibley's 120 mile "the nearest route by land" estimate.

Of course, one cannot be certain Sibley was in fact referencing a route up the east side of the Red River; however, considering Darby's comments regarding how little was known of the region north of the Bayou Pierre settlements were made several years after the writings of Sibley and Glass, it is not unreasonable to suggest that Sibley was in fact alluding to the most commonly used route into Indian country south of the Sodo Lakes complex in the years immediately following the 1803 Louisiana Purchase.

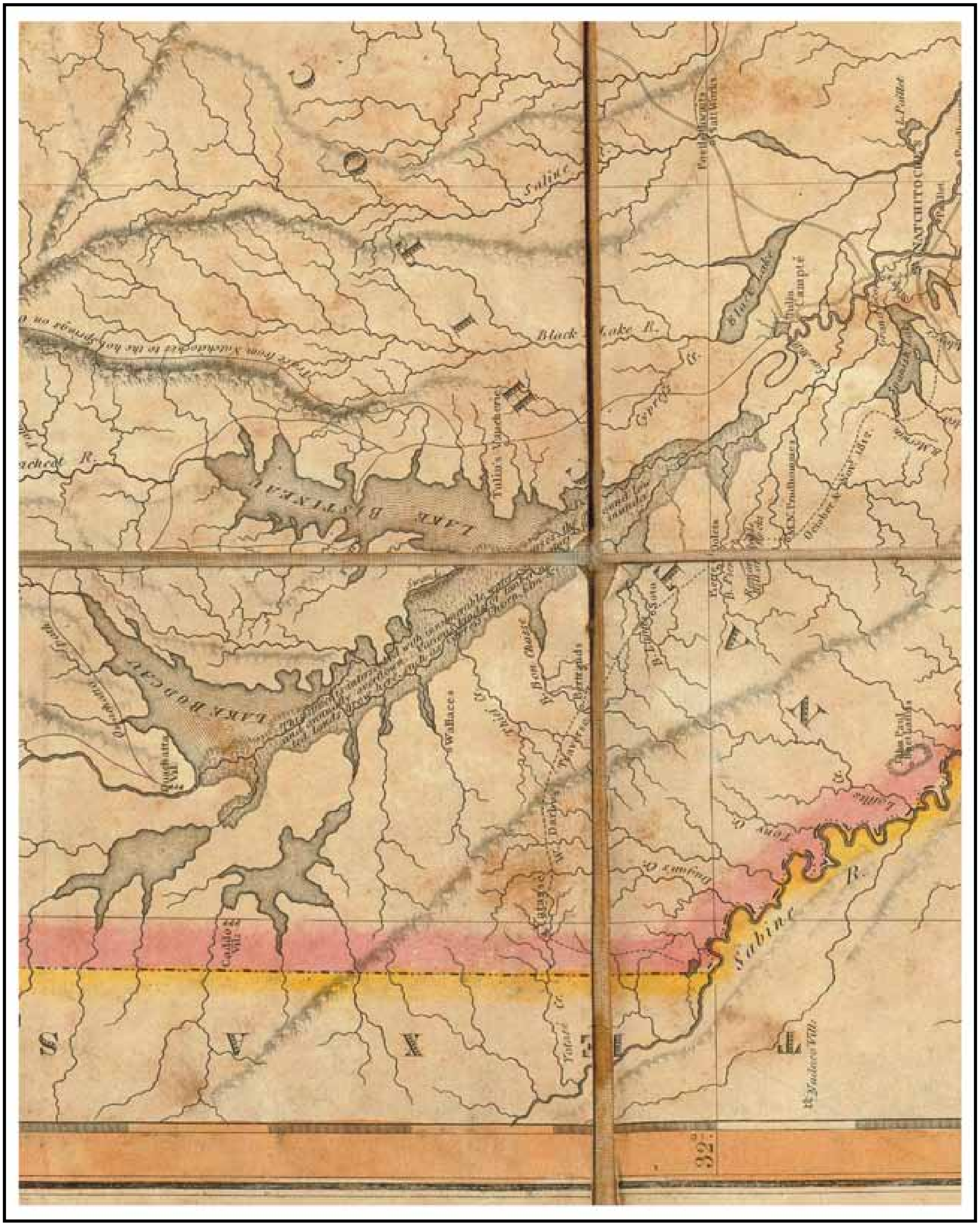

Figure 3. The Sodo Lakes Region as Depicted on William Darby's *Map of Louisiana* (1816)[40]

Time and Distance

Interestingly, we have in the journals of Freeman and Custis a number of references related to time and distance (Figure 4). Consider the following

(9) As the expedition party began to ascend the river (they had only gone about one mile), they were met by a messenger. He brought them word that

> About 300 Spanish Dragoons, with 4 or 500 Horses and Mules were encamped a few miles back of the Caddo Village … After delivering this message, the Indian [the messenger originally sent by the Caddo Chief, Dehahuit] said the Caddo Chief requested Mr. Touline [aka François Grappe] to go to him immediately on our arrival at the Coashutta Village, as he wished very much to see him; but if M. Touline could not go to the Caddo Village, the Chief would meet him at the Coashutta's, and expected the Spanish officer would wish to accompany him.[13]

(10) The messenger was then

> dispatched immediately [on June 24th], with a request that the Caddo Chief should meet M. Touline alone, at the Coashutta Village.[14]

(11) After a period of several days at the Coushatta village

> The Caddo Chief not arriving on the 30th as was expected, Mr. Touline dispatched a favorite Indian, the same one who had piloted the party through the swamp, to the Caddo Nation to learn the cause of his delay; with instructions to return almost immediately. The next morning a runner arrived at the camp, with intelligence that the Chief and 40 of his young men and warriors were on their way from the Caddo Village, and would arrive about noon. At the time expected, they made their appearance on the south side of the river, about a quarter of a mile above the camp.[15]

The expedition re-entered the Red River on June 24. At that point, they were approximately 19 miles from the Coushatta village. As they began to move upstream, they had gone approximately one mile when they were met by a messenger from Dehahuit who informed them of the presence of Spanish troops near his village and delivered the request for Touline to come to him once the expedition had arrived at the Coushatta village (item 9). Touline declined and instead, as suggested by the chief, told the messenger he would meet him at the Coushatta village (item 10).

It was anticipated that Dehahuit would come to the Coushatta village on the 30th, but he did not arrive as expected (item 11). A runner (Touline's "favorite Indian") was sent to determine the cause of the delay. The next morning (July 1), a runner arrived at the Coushatta village with the message that Dehahuit and his party would arrive about noon. It is not clear if this runner was the same one dispatched by Touline the day before – he possibly having met the Caddo party in route and returned to the Coushatta village with word of Dehahuit's location, or if this was a runner sent ahead by the Caddo chief to alert the Coushatta and members of the expedition of his imminent arrival. The fact the journal entry notes that "a" runner was dispatched on the 30th and "a," and not "the" runner came back/returned on July 1 suggests that the runners were not the same individual.

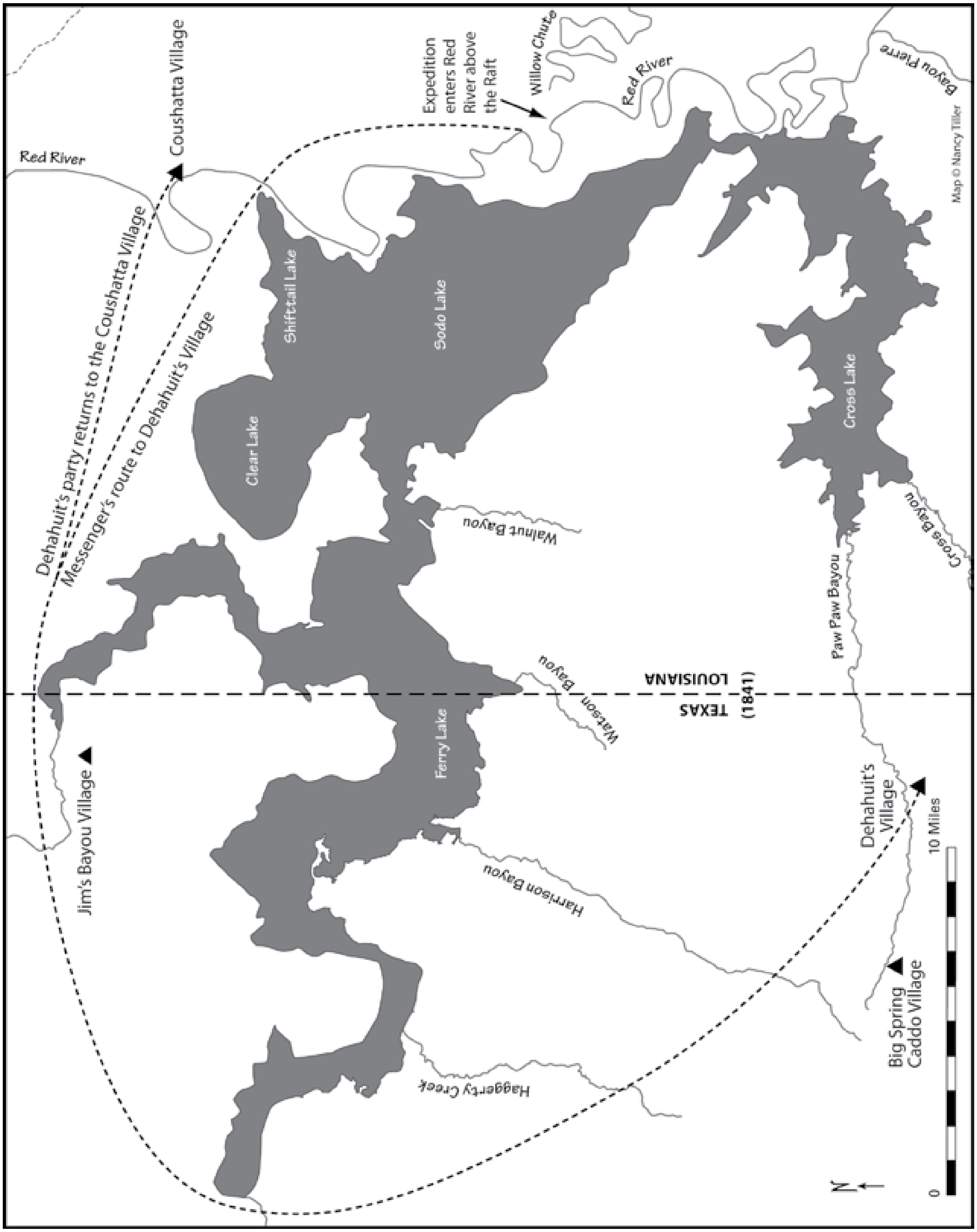

Figure 4. June 24-July 1, 1806.

Notice seven days elapsed between when the initial messenger was sent to the Caddo chief and the arrival of Dehahuit at the Coushatta village. He was expected on the 30th – six days after the messenger was dispatched from a location near Willow Chute. Why such a timeframe? The answer is suggested in the expedition journals.

The original messenger which met the expedition party at Willow Chute was ordered by the Caddo chief to return to him with word of whether or not Touline would be coming to the Caddo village. Touline declined to go and this information was sent back to Dehahuit with the return messenger on June 24th (item 10). Since Touline would not come to the Caddo village, Dehahuit (who was asked not to bring a Spanish officer – he was to come "alone") came to the Coushatta village. Central to our discussion of the location of Dehahuit's village is the probable route taken by the messenger who returned to the Caddo village from Willow Chute, and, upon having received the message, the path most likely taken by Dehahuit to the Coushatta village.

There are no maps available that show an early 1800 road network in the area under discussion, thus the author proposes two of the most likely routes that could have been used by the Indian messenger as he moved from the expedition on the Red River to Dehahuit's village. The most probable path would have involved moving north then west around the western end of the Sodo Lakes complex.

The second route, improbable as it may initially appear, could have involved a journey "across" Sodo Lake. Having been first formed in the spring of 1800,[16] it is very likely that by 1806 the lakes had not taken on the general configuration they exhibited in the 1838 American surveys (see Figure 1). Certainly there are many period maps that suggest the size and shape of the lakes complex varied widely depending upon the year and season viewed. Because the lakes took a number of years to stabilize, it seems very likely that in the years immediately following their creation shallower portions of the lakes dried up in the sense that portions of a lake disappeared leaving only the central stream (Big Cypress-Twelvemile Bayou or Paw Paw-Cross Bayou).[17] No longer an impassible barrier, local inhabitants took advantage of the situation and returned to the use of paths that had existed prior to the creation of the lakes. One such route doubtless would have connected the Caddo villages south of Sodo and Cross Lakes with the Caddo Prairie-Coushatta village region north of present-day Shreveport.

Based on the journal entry of Freeman, it is doubtful any use was made of an across-Sodo Lake route in the summer of 1806. Freeman tells us that guide and interpreter Talapoon had been previously sent from Natchitoches around the Raft with a request for the Caddo chief to meet the expedition at the Coushatta village.[18] Upon receiving this message, Dehahuit sent a return messenger (doubtless accompanied by Talapoon) via the Coushatta village to Touline (item 9), who Custis described as "a worthy and respectable old French gentleman, whose friendship for the Americans induced him to accompany us this far."[19] It seems reasonable to suggest that Talapoon, in going "round from Natchitoches," had in fact gone up the *west* side of the Red River directly to the Caddo village At this point, he joined the Indian messenger who was to deliver Dehahuit's message to Touline. Had the more direct Sodo Lake option been open to them, it seems likely that these two (probably) physically vigorous individuals would have taken it rather than the much longer route around the western end of the lakes complex. In fact, they did not. Freeman tells us that the expedition met the two as they were coming *downstream* in a canoe, presumably from the Coushatta village.[20] Too, note that Dehahuit in his message requested Touline come to him (at his village) *immediately upon his* [Touline's] *arrival at the Coushatta village* (item 9). Had a Sodo Lake-Twelvemile Bayou route been open, it seems very unlikely that Dehahuit would have requested the highly respected, old and presumably less than agile Touline to go out of his way to the Coushatta settlement, then around the lakes to his village. It is the belief of the author, based on the journals of Freeman and Custis, that in the summer of 1806 the lake waters were of sufficient height to make a journey directly from the Red River to the Caddo village area south of present-day Caddo Lake too difficult for even the most physically vigorous.[21]

The author estimates that a trip *on foot* from the Willow Chute area north and west around the Sodo Lakes complex to the proposed Dehahuit's village area at the western end of Cross Lake would have been approximately 55 to 60 miles (a hard two days – with the messenger assumed to be *on foot* as no mention is made of horses in the expedition journals. The return trip *by horseback* from Dehahuit's village to the Coushatta settlement would have been approximately 50 miles (a long one day or possibly a day and a half journey). Freeman tells us that the Caddo chief was *not expected* to arrive at the Coushatta village until June 30 (item 10) – a full *six days* after the Indian messenger left the expedition on Red River to return to Dehahuit's village. It is the belief of the author that the six day period was required to provide time for the messenger to leave the expedition, return to the Caddo village, inform the chief of Touline's decision, have the chief prepare for the journey, and then make the trip north and then west around the lakes to the Coushatta village. Had Dehahuit lived at Jim's Bayou, some 25 miles from the point the Indian messenger encountered the expedition, and less than 20 miles from the Coushatta village, it seems doubtful, especially considering the expressed desire of Dehahuit to seek the advice of Touline *as soon as possible*, that he would have spent three or four days (after receiving Touline's answer) getting prepared for a half-day journey.

It should also be noted that there is *absolutely no basis* in the expedition *texts* for believing that the chief's party, which arrived by noon on July 1 (six or seven days after the messenger left the expedition at Willow Chute), departed the village on Jim's Bayou on the morning of that same day.[22] In fact, they had almost surely been on the road for at least one full day and possibly a part of a second day.

Finally, it is important to consider item 12. The chief, Dehahuit

> said he was sorry his village was so far … He hoped we would excuse him for taking with him so many men to trouble us, as most of them were young men who had never been so far as the Post and had a great curiosity to see their new friends.[23]

This statement suggests to the author, especially in view of the totality of the material discussed in this series of articles, that the village of the Caddo chief was a considerable distance from the Coushatta village – so far in fact that many of the 40 young Caddo warriors who accompanied him had never been to the village. It seems improbable that young Caddo warriors would not, at some point, have made the trip to the Red River Coushatta settlement had their village been located on Jim's Bayou, less than 20 miles distant (maybe a half-day's ride – there and back in one long day). On the other hand, it seems more than reasonable to suggest that young warriors would have been less inclined to travel around the western end of Ferry Lake to the Coushatta village, a one-way distance of approximately 50 miles, and a journey that would have required, at a minimum, an overnight stay.

The author believes the material presented in the journals of Freeman and Custis and discussed above provide additional circumstantial evidence that the village of Dehahuit was in fact located south of Ferry Lake and at a considerable distance from the Coushatta village.

Sodo Lakes Caddo Villages and the Maps of Father José Puelles and William Darby

Any discussion involving the use of early 1800s-era maps to locate one point relative to another requires careful analysis; and this is especially true when the discussion relates to maps of northwestern Louisiana and adjacent eastern Texas. Few persons possessing the necessary equipment for taking even semi-accurate geographical readings had visited the region prior to the 1820s. As a result, no cartographer really had a firm grasp of the subtleties of the physical landscape. In fact, many of the maps of the period simply, rightly or wrongly, recycled earlier findings. An immensely complicating factor all cartographers had to contend with was the presence of the Great Raft of the Red River. The Raft, the river and its floodplain were comprised of an ever-changing maze of bayous, lakes, wetlands and woodlands – and as the Raft slowly made its way upstream, what one year was a dry prairie could the next year be a lake or vast swamp. Cartographers typically depicted the Raft on period maps as simple interconnected streams with little effort being given to precisely locating specific waterbodies within the larger region.

The Sodo Lakes complex offers an especially interesting situation. Largely situated *above* the Raft, the region presented travelers with a series of lakes that changed their size and shape each year depending upon the configuration of the terrain and amount of water available from the Red River and its tributary streams. Although first formed in the spring of 1800, it probably took a number of years for the lakes to assume some semblance of permanence. While there is no question the lakes were present on the landscape after 1800, they were doubtless subject to wide fluctuations in both size and shape, and they rarely appear on maps of the region prior to the 1820s.[24] As late as 1834, Burr's map of the area depicted only a single lake in the region, that one lying to the *east* of the Red River.[25] In the paragraphs to follow, we will examine the relative location of the Sodo Lakes area Caddo villages found on Father José Puelles' 1807 map of Texas and William Darby's 1816 map of Louisiana.

The Caddo Village on the 1807 Map of Father José Puelles

As noted previously, in 1806 President Thomas Jefferson sent Thomas Freeman and Peter Custis up the Red River to explore the southwestern boundary area of the recently acquired Louisiana Purchase. As Spain claimed the lands bordering the river in its middle and upper course, troops were dispatched to intercept the American party once it left Natchitoches. In time, Spanish soldiers would make their way to a point just west of the Caddo village described in the Freeman-Custis journals. In July 1806, after choosing not to attempt to stop the Americans in the area of the Coushatta village, Spanish forces left their position behind Dehahuit's settlement and moved northwest around the Sodo Lake complex, then north to the Red River where they intercepted and turned back the expedition near Spanish Bluff.

Interestingly, the route taken by the Spanish from Nacogdoches to Spanish Bluff is traced on Father Puelles 1807 *Mapa Geographica de las Provincias Septentrionales de esta Nueva Espana.*[26] Early nineteenth-century maps of Texas produced by this cartographer-priest, who typically made extensive use of information gathered from soldiers and others who actually visited the areas mapped, are widely recognized both for their detail and accuracy. Many, such as Stephen F. Austin who prepared maps of Texas during the early 1820s, were heavily influenced by the work of Puelles.[27] In the paragraphs to follow, we will examine that portion of the Puelles map depicting northeast Texas and adjacent Louisiana, giving special attention to the relative location of the Caddo village.

While it is not possible to precisely establish the latitude of the Caddo village on Puelles' map, Father José Pichardo in his 1812 *Treatise on the Limits of Louisiana and Texas* indicated that the village was located on the Puelles map at 32º 26'N.[28] Pichardo, who was tasked with providing the Spanish government with arguments relative to Spanish and American claims along their common border, had wide access to Spanish archival materials, and doubtless the village grid point was taken from these files. Jackson tells us that due to sickness then raging through Nacogdoches, Puelles was "kept out of the saddle" and thus did not accompany Francisco Viana to the Spanish encampment behind the Caddo village. Jackson suggests that Puelles most likely obtained the coordinate of Dehahuit's village from Viana, although he notes that Elizabeth A.H. John speculates that rather than Puelles, the young cartographer John Peter Walker, a skilled surveyor and an individual very familiar with taking astronomical readings, may have actually accompanied the Spanish troops to the Caddo settlement and was thus the source of the grid location.[29] While the exact source for the latitudinal coordinate of the Caddo village is unknown, it seems likely that it was probably provided to Puelles from the papers of either Viana or Walker, both certainly capable of providing a relatively accurate latitudinal reading. The Pichardo-Puelles-Walker grid point of 32° 26'N would place the Caddo village depicted on Puelles map only three miles south of the modern-day coordinate of Dehahuit's village as proposed (32° 29'N).

Note on Figure 5 the path over which the Spanish forces moved once they left Nacogdoches. It is the contention of the author that the initial leg of the route taken out of Nacogdoches closely coincided with that of modern-day US Highway 59. The early 1800s Nadaco village on the Puelles map probably lay in very close proximity to present day Mt. Enterprise. The large hill from which the community takes its name was doubtless a major landmark to period travelers. In fact, both the Cherokee Trace and Trammel's Trace of later years converged on the northwest side of this prominence. Upon reaching the hill, the Spanish troops veered northeast passing just north of the headwaters of Attoyac Bayou. Closely following the route of modern-day State Highway 315, they likely passed near modern-day Carthage then along US Highway 79 to the general area of De Berry where they turned north. Moving along the west side of the west fork of Socagee Creek, and taking advantage of the region's many large springs, the soldiers ultimately took up a position some six miles west of Dehahuit's village on Paw Paw Bayou at a location or near what would later be known as the site of the Big Spring Caddo village (see again item 9).

Figure 5. The Route of Spanish Troops from Nacogdoches to Spanish Bluff, Summer 1806[41]

Figure 6 is a base map of the region with selected historic and modern-day features provided for reference. A semi-transparent version of Puelles' map, resized to overlay his representations of the Nadaco-Mt. Enterprise and Dehahuit's village locations, suggests (the scale nothwithstanding) that the route proposed above does in fact closely parallel that depicted by Puelles. When combined with the latitudinal location of the Caddo village as noted by Pichardo; the fact that the Sodo Lakes complex was not encountered by the Spanish in route to the Caddo village; and the northwesterly route taken out of the Caddo village and around the Sodo Lakes complex (probably a segment of this path was later to become known as the Natchitoches-to-Pecan Point Road) strongly suggests that the village depicted on the Puelles map lay south of modern-day Caddo Lake.

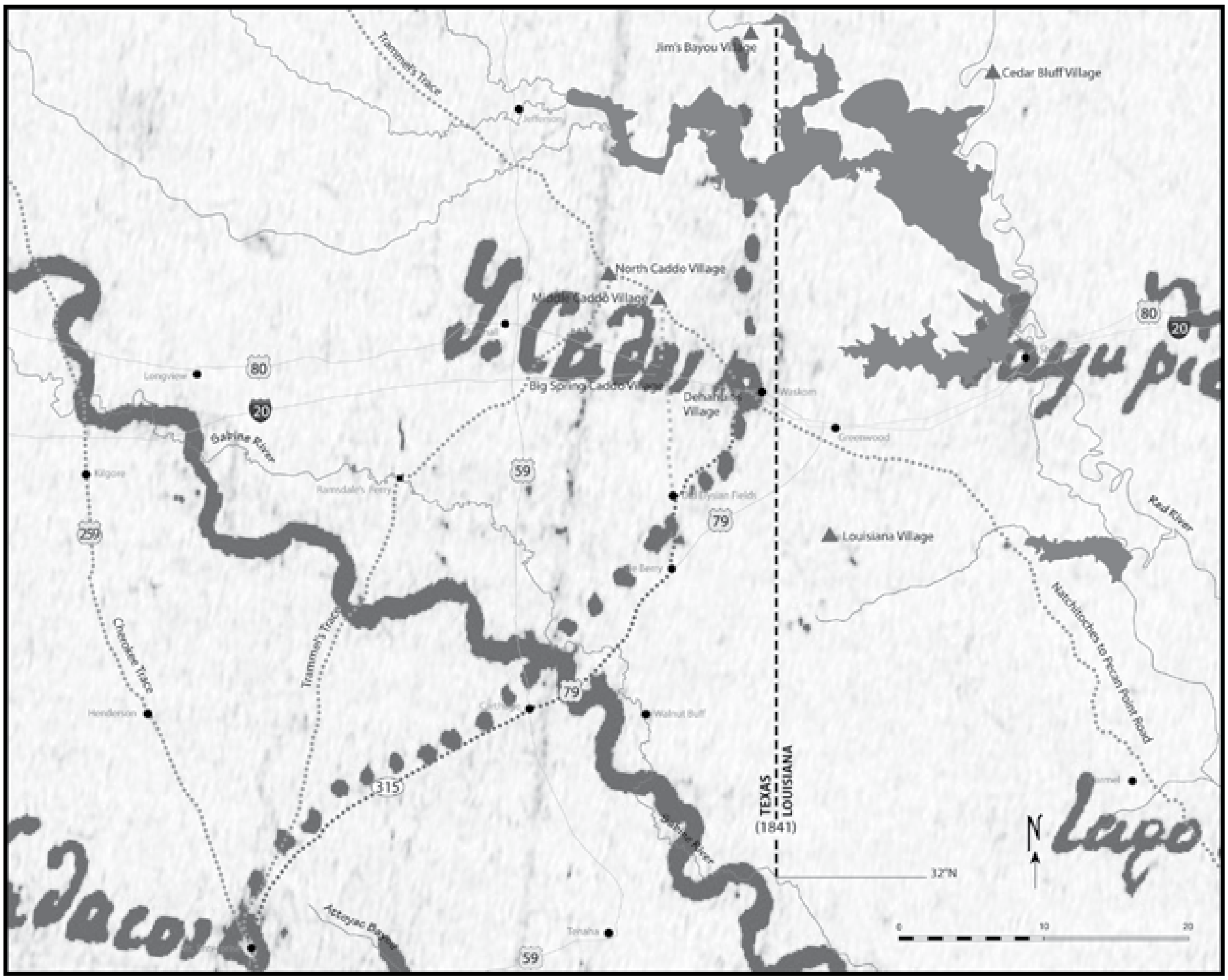

Figure 6. An Overlay of the Nadaco/Mt. Enterprise-Dehahuit Village Sites on a Modern Map of the Region South of Caddo Lake[42]

The Caddo Village on William Darby's 1816 Map of Louisiana

The northwest Louisiana Caddo village depicted on William Darby's 1816 map of that state is often identified as the village of Dehahuit (see Figure 3). Based on a geographical analysis of the map and the material presented in this series of articles, there is little period evidence that supports such a conclusion. Darby's Caddo settlement more likely represents a substantial, and as yet to be discovered, Caddo site.

We begin our discussion of Darby's map with a few comments regarding what Darby actually knew about northwestern Louisiana. While we know he travelled over much of the state prior to the publication of his map, there is no evidence Darby ever personally explored the region west of the Red River and north of his 1812 traverse. As he tells us in his 1818 *Emigrant's Guide to the Western and Southwestern States and Territories*

> The author commenced a traverse at the town of Natchitoches on Red river, and measured the several courses between the latter and Sabine. From a wish to include the then vaguely known settlement of Bayou Pierre, the traverse was extended northwest along the overflown lands [the Raft] of Red river, as high as 32º 10' 21" N lat., and then curved to the Sabine. By this means the creeks, lakes, and settlements, N.W. of Natchitoches were delineated upon Darby's large map of Louisiana.[30]

The reader will note that Darby's travels left him some 50 miles short of the 33rd parallel (the northern border of Louisiana); or put another way, his route to the Sabine took him barely 10 miles north of the 32nd parallel. His knowledge of the physical and cultural features north of his October-November 1812 traverse, including the relative location of the Caddo village, was probably acquired second-hand from local residents, and most likely from his guide on his 1812 trip, "my hunter, a man of the name of Wallace."[31] Wallace belonged to one of the area's pioneer families. His settlement on Cypress Bayou was a well-known frontier landmark in northwestern Louisiana west of the Red River.

The question is "Which Caddo village is depicted on Darby's map?" Caddo scholars tend to associate the settlement with the site on Jim's Bayou, however, situated as it is to the southwest of the Coushatta (Quachatta) village, and knowing what we now know about the location of Dehahuit's village, it would seem just as reasonable to conclude what is being portrayed is Dehahuit's settlement south of Paw Paw Bayou at the western end of Cross Lake. Based on an analysis of Darby's map, the author is inclined to believe the village depicted is likely neither, and instead is probably an as yet to be discovered Caddo settlement site near, or possibly even under, the western end of modern-day Caddo Lake. See again Figure 3 and consider the following

> *The stream sequence above Wallace's*. While it is certainly possible that Wallace did not provide Darby with the names and relative location of *all* right bank streams entering the Raft above his home, it seems reasonable to assume that the larger streams, and in particular those closest to his settlement on Cypress Bayou, would have been identified. It appears that the streams shown, moving in sequence north from Wallace's, are as follows: Cypress Bayou (Wallace's settlement is located to the south of this watercourse), Cross Bayou (there is no Cross Lake depicted), and modern-day Twelvemile Bayou which drains the elongated northwest to southeast Sodo Lakes complex *less* the Cross Lake component. The reader will note that the lake complex on Darby's map, as is occasionally depicted on early 1800s maps, is tilted in a slightly northwest to southeast direction.[32]
>
> *The configuration of the southern lake on Darby's map and the location of the village upon that lake*. Granted it requires some imagination, but note the lake appendages as one moves in a counterclockwise direction from the southeast (Sodo Lake/Twelvemile Bayou) – Shifttail-Clear Lake and the distinctive elbow-like arm of Jim's Bayou. Interestingly, Darby has depicted the lake extending up Jim's Bayou beyond the Jim's Bayou village as discussed at some length in Part I of this series of articles. To the west is a much smaller (at least from its 1838 configuration) Ferry Lake with the Caddo village located to the south of Big Cypress Bayou. A modern topographic map suggests that the western end of old Ferry Lake north of Karnack could have exhibited a bulbous configuration similar to that shown on Darby's map. Across the western/southern end of the lake are, in sequence from the Caddo village, Harrison Bayou, Watson's Bayou (which is situated almost directly south of the Jim's Bayou arm of the lake, and even

today still exhibits a semi-triangular-shaped bay where it enters Caddo Lake),[33] and finally what may have been Walnut Bayou which enters Caddo Lake just east of modern-day Mooringsport.

The configuration and relative location of the large lake to the west of the Coushatta village. To those who believe Dehahuit's village was in fact located at the western end of Cross Lake, it might be tempting to suggest that the large waterbody to the west of the Coushatta village was the Ferry-Clear-Shifttail-Sodo Lakes segment of the lakes complex. However, the 1838-1839 United States surveys of the region clearly show a large cypress brake associated with Black Bayou lying generally northwest of the Coushatta village site. The configuration of the brake depicted on these survey plats is remarkably similar to that of Darby's northern lake.[34]

Darby's depiction of latitudinal location. As might be expected, Darby's latitudinal locations are relatively accurate across those portions of Louisiana he actually traversed. For instance, Natchitoches was located by Darby at 31° 45'N (it is found at 31° 45'N – he placed the settlement at its actual location). He located Gaines Ferry on the Sabine at approximately 31° 29'N (it is actually found at 31° 28'N – Darby placed the ferry less than one mile north of its actual location). He located Wallace's settlement at approximately 32° 17'N (it is actually at 32° 18'N – Darby placed the site approximately 1 mile south of its actual location). The reader will note that while Darby did not actually visit this settlement, Wallace was Darby's guide. Too, the fact Wallace lived less than 10 miles north of Darby's route through the Bayou Pierre region doubtless aided Darby in the relatively accurate placement of his homesite on the map.

Once Darby began to rely on others for the position of more distant geographic points of interest, his locations became less reliable. For instance, he located the Coushatta village at approximately 32° 37'N (it is actually found at 32° 47'N – Darby placed the village approximately 10 miles south of its actual location). He located the confluence of the Sulfur Fork and Red Rivers at 32° 53'N (it is actually found in Arkansas at 33° 5'N – Darby located the confluence some 12 miles south of its true location). Above his 1812 route to the Sabine, save for Wallace's settlement, Darby's latitudinal points appear to have been in error an average of approximately 11 miles *south* their actual locations. The Caddo village was located by Darby at approximately 32° 33'N. If we assume the site depicted was actually some 11 miles north of this point, the settlement would be located at approximately 32° 44'N. Modern latitudinal measurements place the Jim's Bayou site at 32° 50'N. Dehahuit's village is located at 32° 29'N. Jefferson, Texas, west of modern-day Caddo Lake, is located at 32° 46'N.

Darby's longitudinal location of the Caddo village. The international boundary north of the Sabine on Darby's map is found approximately 5.5 miles west of the present Texas Louisiana border.[35] His map places the Caddo village approximately 1.5 miles west of the *modern* Texas-Louisiana boundary. Considering the relative difficulty of locating longitudinal points in the early 1800s, and based upon just mileage alone, it is certainly possible that either Dehahuit's settlement on Paw Paw Bayou (2.5 miles from the current border) or the Jim's Bayou site (2 miles from the current border) could have been the village depicted on Darby's map. However, due to the several factors discussed in this and the previous article on these two sites, it is the view of the author that neither of these settlements is likely to be the Caddo village depicted on Darby's map. More likely there is an undiscovered (and probably submerged and/or silted over) Caddo village site near the western end of modern-day Caddo Lake.

While Wallace almost surely had knowledge of a number of Caddo settlements in the region, it appears he did not provide Darby with the location of Dehahuit's village on Cross Lake which we know from the 1840 statement of Brooks in the Grappe matter was at the time the home of the Caddo chief. Perhaps the reason for this lies in the fact that in 1812 Dehahuit had only been chief, and the Paw Paw Bayou site had only been occupied by the Caddo, for some 10-15 years. Wallace, whose family had a long history of trade with the Caddo, would probably have assigned much greater importance to the largest and most centrally located Caddo village in the area.[36] The village of the chief, especially if it were located on the periphery of the Caddo settlement region as it was, would have held less significance for him. Certainly Wallace would not have been the only period informant to fail to mention the village of Dehahuit. George Gray, Indian Agent during much of the 1820s, and an individual who had first-hand knowledge of Dehahuit's settlement, never made a specific reference to either Dehahuit or his village, and at most made only two passing references to Caddo settlements south of the Sodo Lakes complex.[37]

It is not possible to say with certainty whether Darby's Caddo village is the Jim's Bayou settlement, as many believe, or an as yet to be discovered Caddo site. What does seem probable is that the Caddo settlement depicted on Darby's map is not the village of Dehahuit.

Summary and Conclusions

The case for the village of the great *caddi* Dehahuit lying south of the Sodo Lakes complex on Paw Paw Bayou as presented by the author in this and a previous article in this journal is based on a geographical analysis of a variety of period documents. It cannot be said with certainty that the location of Dehahuit's village has been definitively established, however, the author believes that, above all other known period Caddo sites in the region, the settlement on Paw Paw Bayou most closely matches the archival record as being the home of this historic figure. While one could conceivably argue that another of the south-of-the-lakes villages may have been the home of Dehahuit, it is difficult to see how, based on the historical record, Caddo scholars can continue to claim that this individual lived on Jim's Bayou and that this site was the location of the last Caddo village in the traditional northwest Louisiana/East Texas Caddo homeland.[38]

Endnotes

1. Tiller, Jim. A Case for Dehahuit's Village, Part I. *Caddo Archeology Journal*. Vol. 20, 2010 (see URL, http://digital.library.shsu.edu/u?/p15061coll3,3). pp. 1-30.

2. Brooks, Jehiel. *The Answer of Jehiel Brooks to the Memorial of Samuel Norris, January 30, 1840.* Box 1, Folder 12, Item 8, The Brooks-Queen Family Collection. The American Catholic History Research Center and University Archives. The Catholic University of America. Washington, D.C. (see URL, www.aladin.wrlc.org/gsdl/collect/brooks/brooks.shtml).

3. Sibley, John. "Historical Sketches of the Several Indian Tribes in Louisiana, South of the Arkansas River, and Between the Mississippi and River Grande." *American State Papers. Indian Affairs*. Vol. I. p. 721. In *Discoveries made in exploring the Missouri, Red River, and Washita, by Captains Lewis and Clark, Doctor Sibley, and William Dunbar, Esq.* [microform] *with a statistical account of the countries adjacent with an appendix by Mr. Dunbar.* Early American Imprints, Series 2, No 10326. p. 66, "Bayou river (Stony creek)" appears as "Bayau Pierre (Stony Creek)."

4. Castañeda, Carlos E. (James P. Gibbons, editor). *Our Catholic Heritage in Texas, 1519-1936.*Vol. V, The Mission Era: The End of the Spanish Regime, 1780-1810. Austin, TX: von-Boeckmann-Jones Company, 1942. p. 405.

5. Flores, Dan (editor). *Jefferson and Southwestern Exploration: The Freeman & Custis Accounts of the Red River Expedition of 1806*. Norman, OK: University of Oklahoma Press, 1984. p. 145.

Endnotes (cont.)

6. Flores, Dan (editor). *Jefferson and Southwestern Exploration: The Freeman & Custis Accounts of the Red River Expedition of 1806*. Norman, OK: University of Oklahoma Press, 1984. p. 168.

7. Glass, Anthony. (Dan L. Flores, editor). *Journal of an Indian Trader: Anthony Glass and the Texas Trading Frontier, 1790-1810*. Texas A&M Southwestern Studies, No. 4. College Station, TX: Texas A&M University Press, 1985. p. 39.

8. Sibley, John. "Historical Sketches of the Several Indian Tribes in Louisiana, South of the Arkansas River, and Between the Mississippi and River Grande." *American State Papers. Indian Affairs*. Vol. I. p. 721.

9. 27th Cong., 2nd sess. *House Report 1035*. p. 28. The reader will remember that Cos Lake is an old name for Cass or modern-day Cross Lake.

10. Tiller, Jim. A Case for Dehahuit's Village, Part I. *Caddo Archeology Journal*. Vol. 20, March 2010 (see URL, http://digital.library.shsu.edu/u?/p15061coll3,3). pp. 2-4.

11. Parsons, Mark L., James E. Bruseth, Jaques Bagur, S. Eileen Goldborer and Claude McCrocklin. *Finding Sha'chahdinnih (Timber Hill): The Last Village of the Kadohadacho in the Caddo Homeland*. Archeological Reports Series, No. 3. Austin, TX: Texas Historical Commission, 2002. pp. 1-15. It appears that the material in this work is based on comments of a number of earlier writers. See Flores, Dan (editor). *Jefferson and Southwestern Exploration: The Freeman & Custis Accounts of the Red River Expedition of 1806*. Norman, OK: University of Oklahoma Press, 1984. pp. 161-162, footnote 4 for a summary statement of sources.

12. Flores, Dan (editor). *Jefferson and Southwestern Exploration: The Freeman & Custis Accounts of the Red River Expedition of 1806*. Norman, OK: University of Oklahoma Press, 1984. p. 143 (note 32).

13. Flores, Dan (editor). *Jefferson and Southwestern Exploration: The Freeman & Custis Accounts of the Red River Expedition of 1806*. Norman, OK: University of Oklahoma Press, 1984. p. 146.

14. Flores, Dan (editor). *Jefferson and Southwestern Exploration: The Freeman & Custis Accounts of the Red River Expedition of 1806*. Norman, OK: University of Oklahoma Press, 1984. p. 146.

15. Flores, Dan (editor). *Jefferson and Southwestern Exploration: The Freeman & Custis Accounts of the Red River Expedition of 1806*. Norman, OK: University of Oklahoma Press, 1984. pp. 160-161.

16. Sibley, John. Letter to William Eustis, Secretary of War. November 28, 1812. National Archives and Records Administration. *Letters Received by the Secretary of War, main series, 1801-1870*. Record Group 107, M221, Reel 57. Material courtesy the University of Southern Mississippi. Hattiesburg, MS. See also Bagur, Jacques. *A History of Navigation on Cypress Bayou and the Lakes*. Denton, TX: University of North Texas Press, 2001. pp. 11-13; Garrett, Julia Kathryn. "Dr. John Sibley and the Louisiana-Texas Frontier, 1803-1814." *Southwestern Historical Quarterly*. Vol. 49, No. 3 (January 1946). pp. 417-418.

17. *A Map of the State of Louisiana with Part Of The Mississippi Territory, from Actual Survey By Wm. Darby*. 1816. William Darby, surveyor. Philadelphia, PA: John Melish. The David Rumsey Map Collection (see URL, www.davidrumsey.com); Austin, Stephen F. *Mapa Original de Texas*. Scale, none given. Note on map: "Presented to his Excellency the President, by the author in 1829." Map Number 0917, Map Collection. Archives and Information Services Division. Texas State Library and Archives Commission. Austin, Texas.

18. Flores, Dan (editor). *Jefferson and Southwestern Exploration: The Freeman & Custis Accounts of the Red River Expedition of 1806*. Norman, OK: University of Oklahoma Press, 1984. p. 146.

19. Flores, Dan (editor). *Jefferson and Southwestern Exploration: The Freeman & Custis Accounts of the Red River Expedition of 1806*. Norman, OK: University of Oklahoma Press, 1984. pp. 147-148.

Endnotes (cont.)

20. Flores, Dan (editor). *Jefferson and Southwestern Exploration: The Freeman & Custis Accounts of the Red River Expedition of 1806*. Norman, OK: University of Oklahoma Press, 1984. pp. 145-146.

21. While there are hints in the journals themselves, see references in Flores' *Jefferson and Southwestern Exploration* to a "very rapid" current (p. 134), "against a current, running at the rapid rate of three miles an hour" (p. 136), and "a rise in the water, which we observed was taking place" (p. 140), the comment about swimming the horses of the Caddo party across the Red River at a time (late June-early July) when it would normally have been possible for a person to have walked across the river in a number of places (p. 161), perhaps the most compelling information regarding the probable level of the Sodo Lakes complex in the summer of 1806 can be found in Appendix Three ("Meteorological observations made on Red River, 1806" (pp. 336- 339)). An analysis of these tables clearly shows at least three cyclonic frontal passages (typically characterized by periods of widespread and extended precipitation) were experienced in the area between May 2 and June 15. Of the 30 days of record in May, fully 15 experienced rainfall; seven of the first 15 days in June experienced rainfall. Notes accompanying the tables make use of such adjectives as "great rain" (May 12), "violent thunderstorm" (May 13), "excessive rain" (May 15), "much rain" (May 17), and "heavy shower" (May 23). Many of the rainfall periods are associated with thunder and lightning, and also include a number of days with gentle showers in the morning, rains beginning at night and stretching through the next day, and extended period of cloudy weather – all characteristics of the presence of cyclonic fronts. Such fronts, which typically impact broad geographic areas, almost surely brought sustained and widespread rainfall throughout the watershed of the Red River in the late spring of 1806. Based on materials found in the Freeman and Custis journals, it is very likely that area streams and lakes, following upon what were typically the wet spring months, would have been unusually high for early summer.

    Interestingly, a 1987 paper by Quinn and others in the *Journal of Geophysical Research* suggests that a moderate El Niño was experienced along coastal Peru in 1806. Peruvian El Niño incidents are typically associated with periods of increased rainfall across the southern United States (see Quinn, W. H., V. T. Neal, and S. E. Antunez de Mayolo. El Niño Occurrences Over the Past Four and a Half Centuries. *Journal of Geophysical Research*. Vol. 92 (C13), 1987. pp. 14449- 14461).

22. Flores, Dan (editor). *Jefferson and Southwestern Exploration: The Freeman & Custis Accounts of the River Expedition of 1806*. Norman, OK: University of Oklahoma Press, 1984. pp. 160-161; Parsons, Mark L., James E. Bruseth, Jaques Bagur, S. Eileen Goldborer and Claude McCrocklin. *Finding Sha'chahdinnih (Timber Hill): The Last Village of the Kadohadacho in the Caddo Homeland*. Archeological Reports Series, No. 3. Austin, TX: Texas Historical Commission, 2002. p. 15.

23. Flores, Dan (editor). *Jefferson and Southwestern Exploration: The Freeman & Custis Accounts of the Red River Expedition of 1806*. Norman, OK: University of Oklahoma Press, 1984. p. 165.

24. See for instance *Mapa Geographica de la Provincia Tehas*. 1822. Stephen F. Austin. Document di_02881, Stephen Austin Map Collection. Dolph Briscoe Center for American History, The University of Texas at Austin. Austin, Texas; Bradford, Thomas G. Texas. *An Illustrated Atlas, Geographical, Statistical, and Historical, of the United States and Adjacent Countries*. Scale, 1.75 inches is 80 miles. 1838. Map Number 0033, Map Collection. Archives and Information Services Division. Texas State Library and Archives Commission. Austin, Texas

25. 1834. David H. Burr, draftsman. New York, NY: J.H. Colton and Company. Document 79292, Digital Collection. Professional Services Program Area, Surveying Division. Texas General Land Office. Austin, Texas.

26. *Mapa Geographica de las Provincias Septentrionales de esta Nueva Espana*. 1807? Father José Maria Puelles. Document di_04655, Texas Cartography Collection. Dolph Briscoe Center for American History, The University of Texas at Austin. Austin, Texas.

27. Jackson, Jack. *Shooting the Sun: Cartographic Results of Military Activities in Texas, 1689-1829*. Vol. 2. The Book Club of Texas, 1998. p. 316.

Endnotes (cont.)

28. Pichardo, Father José Antonio (Charles Wilson Hackett, editor). *Pichardo's Treatise on the Limits of Louisiana and Texas: An Argumentative Historical Treatise with Reference to the Verification of the True Limits of the Provinces of Louisiana and Texas: Written by Father José Antonio Pichardo, of the Congregation of the Oratory of San Felipe Neri, to Disprove the Claim of the United States That Texas Was Included in the Louisiana Purchase of 1803*. Vol. 4. Austin, TX: The University of Texas Press, 1946. p. 421.

29. Jackson, Jack. *Shooting the Sun: Cartographic Results of Military Activities in Texas, 1689-1829*. Vol. 2. The Book Club of Texas, 1998. p. 329.

30. Darby, William. *Emigrant's Guide to the Western and Southwestern States and Territories*. New York, NY: Kirk and Mercein, 1818. pp. 84-85.

31. Darby, William. Letter to the Editor. *Daily National Intelligencer*. May 13, 1836.

32. Texas General Land Office. Digital Collection. Tanner, Henry S. *Map of Texas with Parts of the Adjoining States*. Scale, 1 inch is 25 miles. Philadelphia, PA: Henry S. Tanner. 1839. GLO Map Image 88995. Archives and Records Division, Austin, Texas; Texas General Land Office. State Collection. Groves, H. *Republic of Texas*. Scale, 1 inch is 25 miles. 1837. GLO Image 476. Archives and Records Division, Austin, Texas.

33. Silting has filled in much of today's Buzzard Bay at the point where Watson's Bayou enters Caddo Lake. The May 1838 American survey plat of T19N, R16W much more clearly delineates the distinctive triangular shape seen on Darby's map. See United States Department of the Interior, Bureau of Land Management. *Louisiana, North and West District. Survey Plat Map* for *T19N, R16W* (1838). Available from the Bureau of Land Management, Springfield, Virginia. Paper copies (18" X 24") may be acquired from the Bureau of Land Management in Springfield, Virginia. Also available online at http://www.glorecords.blm.gov/ (see Search Surveys).

34. United States Department of the Interior, Bureau of Land Management. *Louisiana, North and West District. Survey Plat Maps and Field Notes* for *T22N, R15W* (1839), *T22N, R16W (1839) and 23N, 16W* (1839). Available from the Bureau of Land Management, Springfield, Virginia. Paper copies (18" X 24") may be acquired from the Bureau of Land Management in Springfield, Virginia. Also available online at http://www.glorecords.blm.gov/ (see Search Surveys).

35. Tiller, Jim. *Before the Line*. Vol. I, An Annotated Atlas of International Boundaries and Republic of Texas Administrative Units. Huntsville, TX: The START Group, 2010 (see URL, http://digital.library.shsu.edu/u?/p15061coll3,0). pp. 7-16.

36. Brooks, Jehiel. *The Answer of Jehiel Brooks to the Memorial of Samuel Norris, January 30, 1840.* Box 1, Folder 12, Item 8, The Brooks-Queen Family Collection. The American Catholic History Research Center and University Archives. The Catholic University of America. Washington, D.C. (see URL, www.aladin.wrlc.org/gsdl/collect/brooks/brooks.shtml); Flores, Dan (editor). *Jefferson and Southwestern Exploration: The Freeman & Custis Accounts of the Red River Expedition of 1806*. Norman, OK: University of Oklahoma Press, 1984. See footnote 3, pp. 160-161; Perttula, Timothy K. *The Caddo Nation*. Austin, TX: The University of Texas Press, 1992. pp. 40-41; 27th Cong. 2nd sess. *House Report 1035*. pp. 24-25, 33, 86.

37. National Archives and Records Administration. *Letters Received by the Office of Indian Affairs, 1824-1881, Red River Agency*. M234, Roll 727. Letter from George Gray, Agent to Thomas McKinney, Superintendent of Indian Affairs, October 1, 1824; letter from George Gray, Agent to James Barbour, Secretary of War, December 4, 1825. See also Tiller, Jim. *Before the Line*. Vol. II, Letters from the Red River, 1809-1842. Huntsville, TX: The START Group, 2011 (see URL, http://digital.library.shsu.edu/u?/p15061coll3,8). Items 301, 323.

Endnotes (cont.)

38. Parsons, Mark L., James E. Bruseth, Jaques Bagur, S. Eileen Goldborer and Claude McCrocklin. *Finding Sha'chahdinnih (Timber Hill): The Last Village of the Kadohadacho in the Caddo Homeland*. Archeological Reports Series, No. 3. Austin, TX: Texas Historical Commission, 2002. pp. 1-15. See Tiller, Jim. Was Timber Hill the Last Caddo Village in the Caddo Homeland? *Caddo Archeology Journal*. Vol. 18, 2008 (see URL, http://digital.library.shsu.edu/u?/p15061coll3,2). pp. 11-21 for a rebuttal of the case for the Jim's Bayou site (erroneously designated in the article as Timber Hill by the author) being the last Caddo village in the northwestern Louisiana-East Texas region.

39. Figure 2. Items 1-7 correspond to the first seven items listed under the section entitled "Distance and Direction." Except for item 2, each item was developed as follows: (1) the top (black) bar represents the distance referenced by the individual/company indicated. For instance, in item 1 Brooks estimated the distance from Natchitoches to Dehahuit's village to be 90 miles; (2) the dark gray bar (Dehahuit's Village) depicts the actual distance (either via straight line or by a specified road) from the initial point referenced (Natchitoches) to Dehahuit's village. When determining straight line mileage, distances were calculated without regard to physical features (lakes, swamps, etc.). The presence of such features would, of course, add mileage to the calculated total. In the case of item 1, Dehahuit's village is located 87 miles north of Natchitoches via the Natchitoches-to-Pecan Point Road as depicted on 1830s-era United States survey plat maps; (3) the light gray bar represents Jim's Bayou village. In item 1, Jim's Bayou is located 110 miles from Natchitoches (87 miles to Dehahuit's village as measured along the Natchitoches-to-Pecan Point Road plus 24 miles as measured on a straight line from Dehahuit's village to the Jim's Bayou village).

    The mileages shown in item 2 were calculated as follows: (1) Sibley estimated that the Yatasi tribe was centered on modern-day Buffalo Bayou, 50 miles above Natchitoches. The distance as calculated along the old Natchitoches-to-Pecan Point Road was determined to actually be 41 miles. The distance from the old Natchitoches-to-Pecan Point Road-Buffalo Bayou intersection to Dehahuit's village, as measured on a straight line, was determined to be 37 miles, the total (78 miles) being very close to the double the "halfway" distance suggested by Sibley. To compare, the Jim's Bayou site, as measured on a straight line, was calculated to be some 59 miles above the intersection of the old Natchitoches-to-Pecan Point Road and Buffalo Bayou, or a total of 100 miles above Natchitoches.

40. Figure 3. Source: *A Map of the State of Louisiana with Part Of The Mississippi Territory, from Actual Survey By Wm. Darby*. 1816. William Darby, surveyor. Philadelphia, PA: John Melish. The David Rumsey Map Collection (see URL, www. davidrumsey.com).

41. Figure 5. Source: adapted from *Mapa Geographica de las Provincias Septentrionales de esta Nueva Espana*. 1807? Father José Maria Puelles. Document di_04655, Texas Cartography Collection. Dolph Briscoe Center for American History, The University of Texas at Austin. Austin, Texas.

42. Figure 6. Source: adapted from *Mapa Geographica de las Provincias Septentrionales de esta Nueva Espana*. 1807? Father José Maria Puelles. Document di_04655, Texas Cartography Collection. Dolph Briscoe Center for American History, The University of Texas at Austin. Austin, Texas.

Digital Preservation and Spatial Representation at the Washington Square Mound Site (41NA49), Nacogdoches County, Texas

Robert Z. Selden Jr.

Abstract

Thirty-one years of excavations at the Washington Square Mound site (41NA49) have produced a large number of artifacts, excavation records, field notes, photographs, slides, maps, excavation profiles, and plan view maps. This article is the product of an effort to synthesize the aforementioned information for the initial field school which occurred in the summer of 1979. Through the use of geographic information systems (GIS), a digital grid was constructed atop aerial photography to house the digitized information within a spatial representation of the provenience from which it was recovered. This allows a query of the artifact catalog to produce the spatial distribution of artifact categories across the site, and provides access to all associated information.

Introduction

The Washington Square Mound site (41NA49) is a multi-component archaeological site centrally located in Nacogdoches, Texas. The site is a Middle Caddo period (A.D. 1200-1400) mound center, as well as home to Nacogdoches University (1845-1895), and now serves as a part of the Nacogdoches Independent School District.

This article serves as a prototypical demonstration of how repositories may organize digital collections to stimulate further research from segments of their collections that remain unanalyzed. I will (1) examine whether a geospatial methodology can be developed to serve as a site-specific digital repository, and (2) assess the ability to query the resulting digital repository for artifact distributions.

The method discussed in this article provides for a relationship with the original data that is much less intrusive, effectively extending the lifespan of the original data by reserving physical contact for those instances when absolutely necessary. The categorically-specific nature of the georelational database allows researchers to access information relating to a single excavation unit, including historic documentation and photography alongside the artifact catalog and aerial photography of the landscape.

The utility of this approach will increase as intact analytical units (those locations discovered to hold undisturbed cultural deposits) are identified at the Washington Square Mound site, allowing for a more thorough discussion of the recovered artifacts, and ultimately adding to what might be inferred about the prehistoric and historic inhabitants of the site.

This fundamental digital modification can assist repositories in maintaining the integrity of their collections while affording researchers the capacity to query and rapidly produce spatial representations of artifacts based upon specific morphological characteristics atop an escalating number of free or inexpensively accessed online remote sensing resources. This grants researchers the ability to quickly produce a usable product that is easily employed within the framework of technical reports, presentations, and publications.

Site Location and Description

Washington Square is located within the small urban center of Nacogdoches, Texas. The excavated portion of the site is situated near the center of the town, although it is believed that the site once ranged throughout the whole of the interfluve of Banita and La Nana creeks, tributaries to the Angelina River (Figure 1) (Corbin 1982a:1). The site is listed on the National Register of Historic Places (National Park Service 1992), and is a State Archeological Landmark in the State of Texas (Texas Antiquities Committee 1984).

Figure 1. Location of Washington Square atop the interfluve of Banita and La Nana creeks (Selden 2010).

Archaeological Investigations

The Washington Square Mound site was first excavated by Stephen F. Austin State University (SFASU) in a series of field schools from 1979-1982 (Figure 2) (Brown 1985; Corbin 1980, 1982a, 1982b, 1983, 1984, 1985a, 1985b; Curb 1980; Hart 1980, 1982; Kisling 1983; McDonald 1982; Oakes 1980). These excavations totaled approximately five months of concentrated effort (Corbin 1984:14), and produced evidence of a prehistoric Caddo occupation that had been capped by fill during the more recent historic period (Corbin 1984; Corbin and Hart 1998; Perttula et al. 2009, Selden 2010).

The original decision to use the Washington Square Mound site as the focus of the 1979 SFASU field school was due to the fact that a "gas shortage would prohibit the field school from working very far away from the university" (Corbin 1980:2). At the time, Washington Square was believed to have been highly impacted during the early 1900s due to construction, but associated cultural materials were found to rest within an undisturbed context (Corbin 1980:2-3). It was during the course of this initial investigation that Dr. James E. Corbin discovered the lack of a plow zone atop the site and that much of Washington Square was capped by at least 30-40 cm of overburden (Corbin 1980:2), and in some places as much as 80 cm (Corbin 1984:6; Corbin and Hart 1998:50).

In sum, the SFASU field school efforts conducted at Washington Square consisted of 92 m^2 of hand-excavation and 25 m^2 of machine-excavated trenches in 1979; 23 m^2 of hand-excavation in 1980; 18 m^2 of hand-excavation in 1981; and 48 m^2 of hand-excavation and 23.25 m^2 of machine-excavated trenches in 1984. The TAS field school completed 101 m^2 of hand-excavation in 1985, intermittent compliance-based projects after 1985 have totaled 4 m^2 of hand-excavation, and Fabulous Fridays led to 4 m^2 of hand-excavation (Corbin and Hart 1998:59-60). Thus, over the course of the archaeological investigations at the Washington Square mound site, a minimum of 348.25 m^2 have been excavated in addition to the more recent compliance-based projects.

Having the information obtained from these investigations housed in a repository near the site is ideal, particularly since compliance-based fieldwork at the site is ongoing. As those assemblages are analyzed and added to the larger collections, that information can assist in augmenting archaeological knowledge regarding the prehistoric use of the site. The majority of material recovered from the Washington Square Mound site was recovered with the aid of a sophisticated archaeological toolkit. As that toolkit increases in size, and as technology develops that can be used in archaeological research, it will provide additional methods for the interpretation of data that can result in a renewed discussion regarding the prehistoric development and use of the Washington Square Mound site.

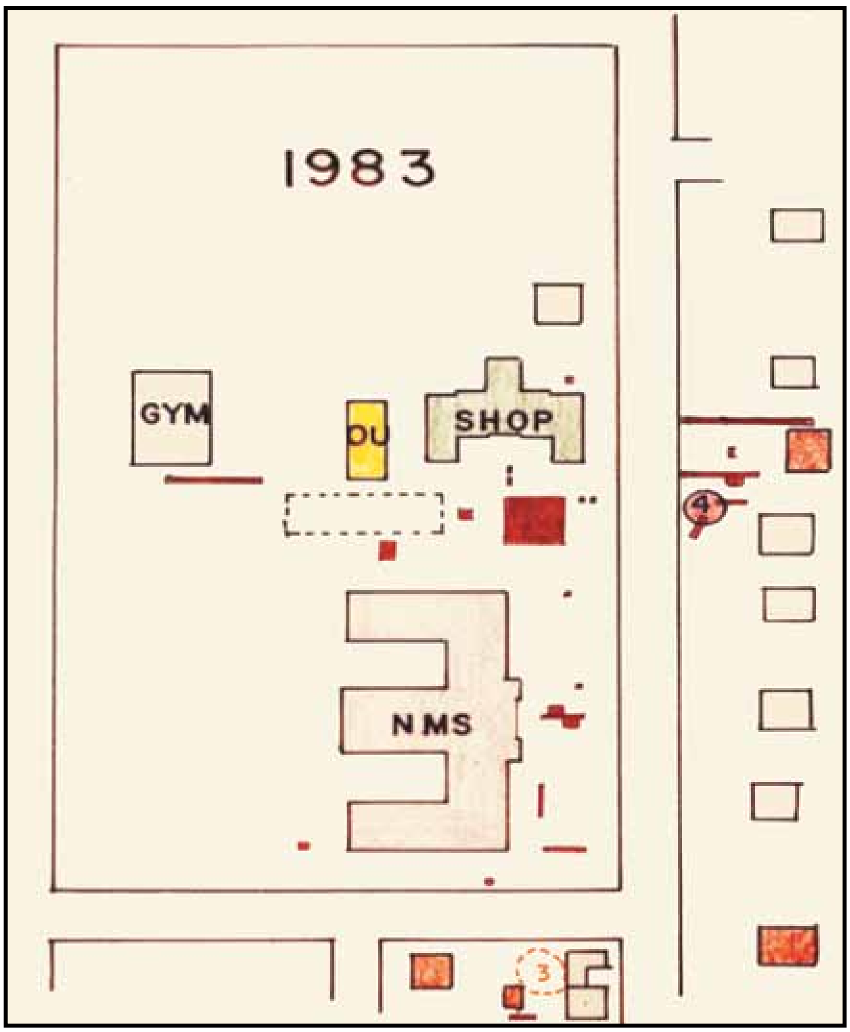

Figure 2. Map of the 1979-1982 field school excavations. OU, Original University Building; NMS, Nacogdoches Middle School, Gym, Shop (Collections of the Anthropology and Archaeology Laboratory, SFASU, Accession No. SFA2009.2).

Methods

The composition of methods for this project consists of three autonomous components that contribute to the final representation of the Washington Square Mound archaeological data. These include the artifact catalog (1979 artifacts), the lexicon (catalog of analytical terminologies), and the geodatabase (digital filing cabinet for the spatial data). To produce a representation of queried artifacts and associated data the user must relate the artifact catalog and the lexicon to produce an exportable table for use within ArcGIS®. The provenience (north and west coordinates for the digitally-constructed grid) for the artifact catalog and the grid can be joined to produce a spatial representation of the queried data. This process will enable users to view the spatial distribution of artifacts, and related data, in order to clearly convey that information for a discussion of a specific artifact category.

The Artifact Catalog

Illustrations

Several large illustrations of plan views, excavation profiles, and features were available within SFASU's Anthropology and Archaeology Laboratory's archives for the Washington Square Mound site. These images were scanned at the Columbia Regional Geospatial Service Center in both .tiff and .jpg formats, and renamed to reflect the appropriate provenience. The illustrations supplemented numerous excavation profiles, plan views, and feature illustrations within the excavation records, and were cataloged digitally. The larger illustrations were of more objective elements (excavation plans, etc.), and as such, were assigned to a reference provenience.

Images

The images from Washington Square consist of 107 black and white negatives, 267 slides, and an increasing number of digital photographs. The slides and negatives were scanned using a Nikon® Coolscan™ V ED, and were renamed according to provenience. When the provenience was not listed, the image was relocated to the appropriate reference provenience. Digital reproductions of scanned color slides were saved at 4,000 dpi (60.7MB/ea).

Artifacts

The artifacts from the 1979 excavation were sorted, counted, and entered into an Excel® spreadsheet. The specific categories captured in this process were lot_no (a specific assigned lot number), spec_no (specimen numbers encountered in the catalog), unit (designation for units not assigned a specific northing and westing coordinate), level (level number), quad (relevant quadrant attribute within a unit), depth (specimen depth), north (provenience), west (provenience), feature (relevant feature designation), elev_range (when available, the applicable elevation data for the lot), designation (specific typological reference recorded in the catalog), count (numerical representation of how many instances were discovered), and date opened (date that this unit was opened as specified in the artifact catalog).

Field Records

The field records from the 1979 field season were scanned and saved as .pad files prior to being reorganized by provenience (e.g., n240_w100_field_notes). Once digitized, those representations were assigned to the digital grid by provenience. These files may be opened externally from the geodatabase in Adobe® Reader®, and are able to be saved and printed.

Sanborn Fire Insurance Maps

Numerous structures were found to have been destroyed or relocated from the grounds of Washington Square during the 19th and 20th centuries. In order to create a georeferenced representation of the historic landscape, the Sanborn Fire Insurance Maps from 1900, 1906, 1912, 1921, 1922, 1929, and 1929-1946 were overlaid (Environmental Data Resources, Inc. 2008) and georeferenced within ArcGIS®.

Hyperlinks

Hyperlinks containing photographs of historic structures were assigned to their respective digital location within the grid. This allows access to hyperlinked slides, photographs, and documentation within their recorded provenience.

Grid

The 1 x 1 m digital grid atop the site was constructed utilizing Hawthe's Tools™. This freeware produced an individual polygon for each 1 x 1 m unit within the site. For Washington Square, this meant the construction of 83,432 unique polygons, each with a unique provenience. From the grid, archaeological data may be accessed, viewed, and manipulated according to the needs of the user.

Lexicon

Much like a dictionary is a lexicon of the English language; the lexicon developed for this project was a dictionary of artifact typologies, or a catalog of terminology used within analyses that will allow users to assign a specific name to a type of recovered artifact. Lexicons have been utilized as catalogs for language (Bender 1984:410; Shaul and Hill 1998:392), boundaries (Parker 2006:80), color (Pollnac 1975:94), depictions of scenes on vessels (Osborne 2001:277), music (Seeger 1969:239), plant names (Hays 1976:491), occasions (Faris 1968:116), and symbols, images, and meanings (Gregg 1998:125). The lexicon developed for this project organizes artifact typologies from a variety of sources including field guides (Finsley 1999; Turner and Hester 2002), handbooks (Suhm and Krieger 1954; Suhm and Jelks 1962) and one website (Florida Museum of Natural History 2010), to create a product capable of managing the data from a wide range of archaeological sites in East Texas. The categories of artifacts selected for the lexicon are prehistoric ceramics, lithics, fossils, samples, mineral-imported stone, historic artifacts, and fauna. Each contained a catalog of commonly occurring typologies from the East Texas region.

Geodatabase

A geodatabase serves as one part of the data repository and contained the spatial information from the site. This is a key feature setting geodatabases apart from other database formats because it can store and manage spatial and non-spatial data within a framework specifically designed to work in conjunction with ArcGIS®.

Data were then combined to produce a comprehensive representation of the landscape at Washington Square that enables users to employ the digital grid to view these data within their recovered spatial context. When the lexicon is related to the grid, the diverse categories of artifacts can be queried for each provenience, and the remainder of the unit information (photographs, profiles, plan views, and excavation records) are available via hyperlink. This enables researchers to incorporate as much or as little information from the geodatabase as needed to examine the data relevant to their research question(s).

Reference Provenience

The reference provenience was created to house information without a spatial reference, and was made available to the left of the digital grid in the form of three circles. The photography reference provenience houses miscellaneous images of the landscape, in addition to general images from events like the 1985 TAS field school. The cartography reference provenience houses the digital scans of large-scale profiles, plan views, and excavation plans for the site that include numerous proveniences. Since these provide a view of the site encompassing a general view of the landscape, they are filed separately from their provenience(s). The text reference provenience includes information from the site having no specific spatial reference. Many of the mapping records, daily logs, and site reports are made available within this location.

Data Query

Users can tailor specific queries to aid in answering research questions within a platform from which attributes discovered during analyses might be further illustrated. This expedites the writing process by enabling authors to obtain illustrations of specific instances in which the data in question occur.

Employing the filter feature of Microsoft® Excel™ is as easy as clicking an icon. This will open drop down menus for each column, and will enable researchers to choose which items to display. Each column of the spreadsheet provides a menu of the terms listed, giving users the ability to be as conservative or liberal as necessary when manipulating data sets for a particular class of artifacts (i.e., lumpers and splitters).

After categories of interest are located, a check mark can be placed in the desired categories and "OK" selected. This decreases the number of entries within the table, highlighting only those meeting the researcher's criteria. The selected artifacts are then highlighted, defined, and saved prior to incorporation in ArcGIS®. Using the formulas tab in Excel™, users then define the table. This allows users to create unique queries within the artifact catalog, and to apply them individually or collectively within the digital grid.

Single or multiple definitions can be created for incorporation depending upon the needs of the user. This would give the users the capacity to query multiple spreadsheets for the matching artifact descriptions or to add the entire collection to a single contiguous file where it can be queried as the composite catalog.

Since field records, photographs, and images were hyperlinked by spatial location, they can be accessed regardless of artifact query. This feature adds context to a discussion of specific artifact category, allowing users to incorporate new imagery, topographic representations, and data into the geodatabase, tailoring it to match subjective research goals. This can then be overlaid atop historic images to create a greater depth of information within the study area.

Results

Locating the grid coordinates for the datum utilized to anchor the imagery to the site grid proved to be a challenge. No existing mapping records for the site provided these coordinates, and the additional datum located to the north of the Thomas J. Rusk building was destroyed when a handicap ramp was installed pursuant to the Americans with Disabilities Act of 1990. The grid was eventually georeferenced using Corbin's 1979 excavation map atop the grid and aerial photography. Once recovered, the proveniences were cross-referenced with excavation records and photographs. Those resulting coordinates were utilized to populate the remainder of the grid, enabling the application to produce a spatial display of the queried artifact data.

In order to capitalize on previously collected data from the Washington Square Mound site, GPS points from the 2009 excavation were used to construct a map of the terrain. Through a process referred to as spatial interpolation (which estimated the elevation value between the collected points), a triangulated irregular network (TIN) was created from those GPS points to display the topography.

This digital elevation model (DEM) was used in conjunction with the TIN to create the interpolated points. This displays the site within its actual context, while enlarging the view to include the surrounding landscape. The resulting data can be displayed three-dimensionally (Figure 3), enabling users to simultaneously view the site, the surrounding area, and the collected data. A number of additional elements (aerial photography, topography, etc) may be added to enrich the user's view of the information as needed.

Figure 3. Washington Square TIN atop TIN created with 30 m DEM (Texas Natural Resources Information System 2010, Selden 2010).

Searches can be conducted by feature, provenience, artifact category, lexicon key, description, elevation range, level, and lot number, which can be viewed atop the three-dimensional representation of the site. This task is completed by filtering results in the artifact catalog, and defining the result that is joined with the spatial information from the site.

The filter provides a method for users to refine their searches for specific information. For example, in filtering the description category, users can choose one specific type of brushed sherd (i.e., brushed-punctated body sherds), or every kind of brushed sherd in the brushed category (there are 25 categories of brushed sherds in the artifact catalog for 1979). The artifact catalog's ability to adapt to the requirements of the user decreases the effort needed to produce a spatial representation of collected information, while granting the full spectrum of functionality associated with the ArcGIS® software. The capacity to query and rapidly produce a spatial representation of artifacts based upon specific morphological characteristics, atop an escalating amount of free or inexpensively accessed online remote sensing data, gives this application a usable value that could be easily employed in reports, presentations, and publications.

Through the incorporation of the three parts of this prototype (lexicon, artifact catalog, geodatabase), researchers can view the historic occupation separately from the prehistoric occupation. Evidence for both occupations can be seen when viewing the first three levels of recovered artifacts from the site (Figures 4, 5, 6). The first level (0-10 cm below surface) showed a wide distribution of historic and prehistoric artifacts that are mixed in the level, which was mirrored in the second level. The third level displays only a single unit of mixed historic and prehistoric artifacts, and was the terminal level for the excavations within this area.

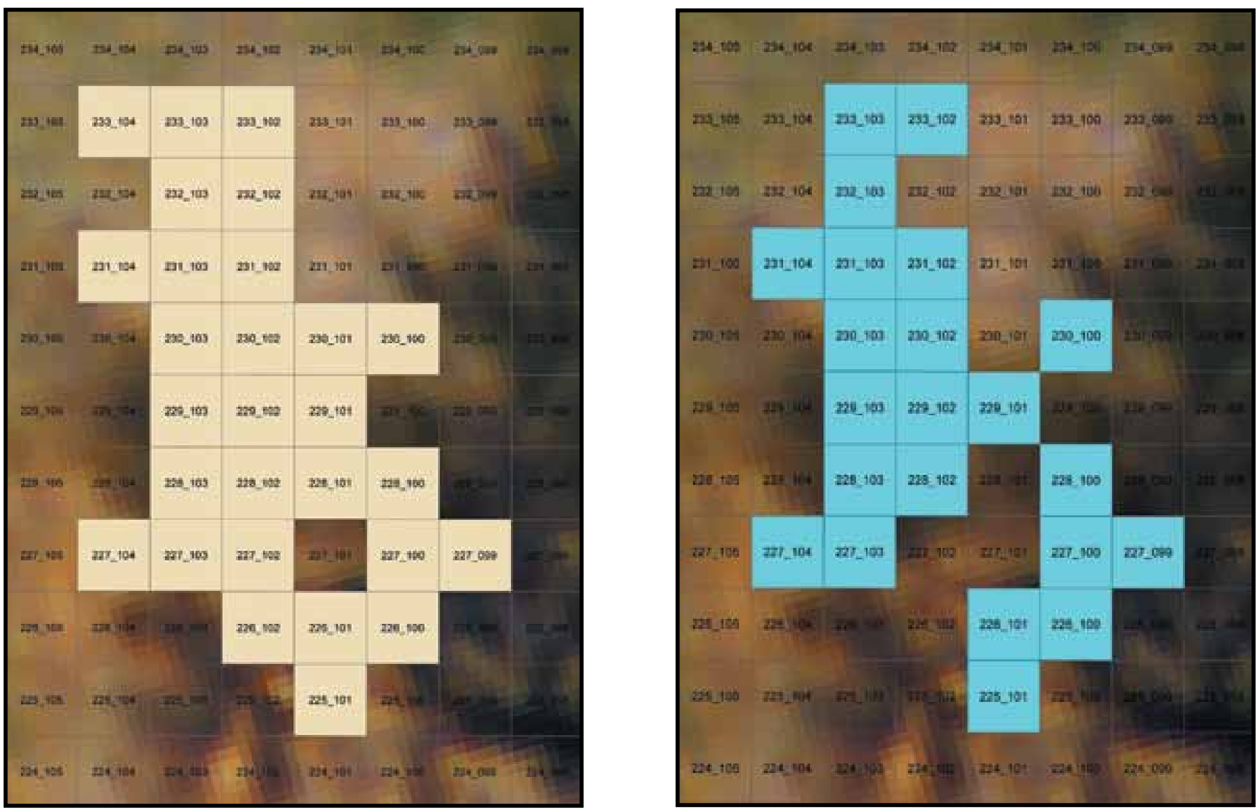

Figure 4. Distribution of artifacts from Level 1; prehistoric ceramics (left), and lithics (right) (Selden 2010).

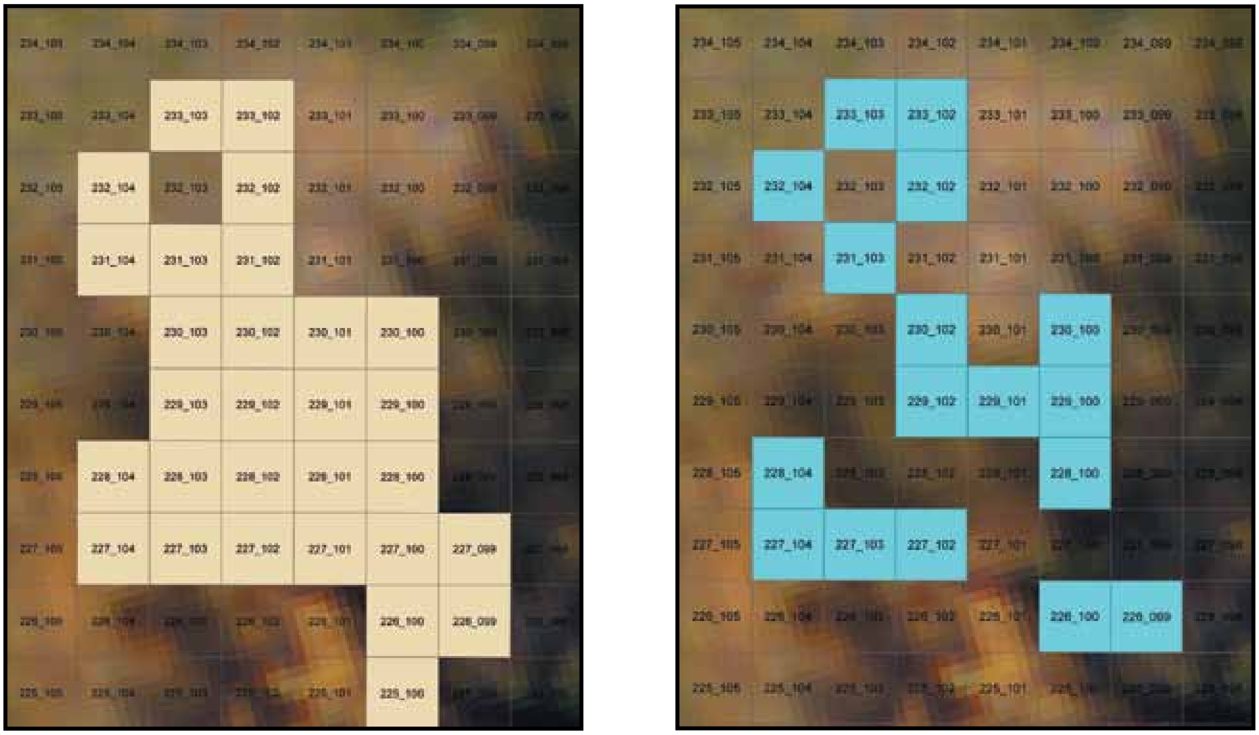

Figure 5. Distribution of artifacts from Level 2; prehistoric ceramics (left), and lithics (right) (Selden 2010).

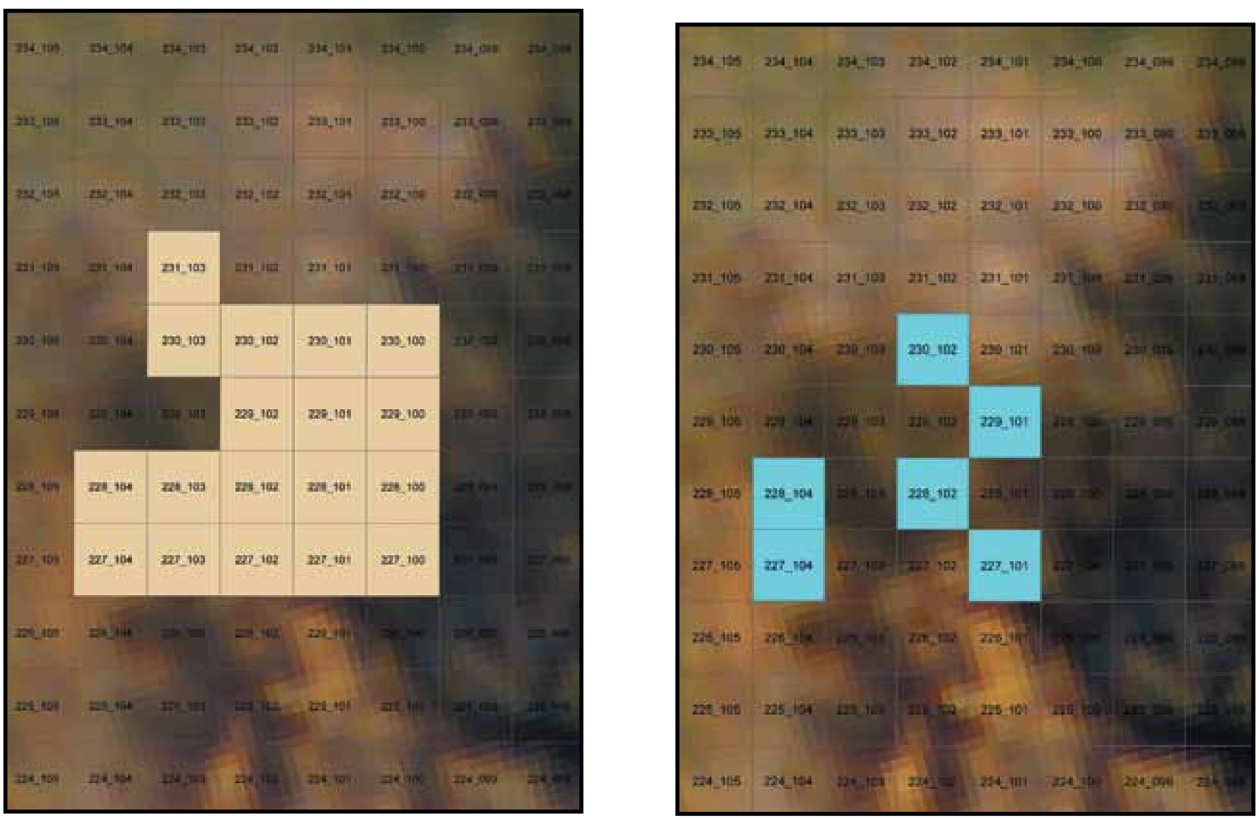

Figure 6. Distribution of artifacts from Level 3; prehistoric ceramics (left), and lithics (right) (Selden 2010).

This information will allow the user to view the depth and distribution of the historic and prehistoric occupations of the Washington Square Mound site. Revealing the location and depth of levels with a mixture of prehistoric and historic artifacts will allow the researcher to locate proveniences with unmixed prehistoric deposits. This will enable the user to focus their attention on historic and/or prehistoric artifacts relevant to their research.

Suppose a researcher wants to view the distribution of prehistoric artifacts within a specific area. Prehistoric ceramic and lithic artifacts can be utilized to produce this distribution. In this instance, the first level containing prehistoric artifacts not mixed with historic artifacts occurs in level three of the northern excavations, the last level excavated during the 1979 investigation. The only intrusion from the historic occupation in this area occurred in N228/W102.

During the 1979 excavations, a number of prehistoric features were identified at the Washington Square Mound site, and their provenience can be displayed using this same method (Figure 7). This produced a view of those features located within an undisturbed prehistoric, or a mixed prehistoric-historic, occupational deposit. The records for these units are hyperlinked, making all of the associated material associated with those features (plan views, profiles, images, illustrations, and field records) available by clicking on the unit associated with the feature.

Figure 7. Location of prehistoric features 9, 15, and 18 at the Washington Square Mound site (Selden 2010).

Discussion

To facilitate the realization of the goals for this article, a prototype of the geodatabase model was developed, producing a product where one can view the geographic distribution of queried artifacts alongside the associated data from a specific provenience; to view that information atop available free imagery; to easily incorporate information collected by users and to develop an evolving lexicon of local typologies. This allows users to view the prehistoric and historic occupations, and the features discovered at the Washington Square Mound site, atop a wide variety of imagery.

For future archaeological projects conducted on private land, the archive of photographs, excavation profiles, plan view maps, and field notes can be manipulated to disseminate the collected data online for public viewing. This can reinvigorate an interest in local history and provide an outlet for county-based historical commissions or avocational efforts as they progress. Due to the amount of private land in Texas, this can give archaeologists a window into many of the large private collections in the region (with the land owner's permission, of course), lending more context to professional efforts within the area.

This method can also assist in complementing the Council of Texas Archeologists' guideline that existing information from previous archaeological investigations be incorporated and cited within the context of an investigation. The application houses information for an archaeological site within a portable system (i.e., reference provenience –text), giving investigators access to large quantities of data from a field or laboratory setting. It can provide a foundation for the development of research questions, while serving as a supporting component of the analyses themselves.

The information within the prototype's reference provenience provides the ideal platform for interaction with the public in a format that is easily updated. For that reason, engaging the public to contribute digital representations of personal holdings can make valuable resources available which might have been previously unknown. If manuscripts, photographs, communication records, or blueprints from personal collections are obtainable for incorporation within the prototype, it will increase the amount of extractable information from historic sites. Since the prototype for this article serves as a spatial repository for those data, it will house the information within its spatial location atop a digital representation of the area of interest.

The incorporation of this method into archaeological projects can contribute much to future investigations by providing an objective view of any previous excavations, and by assisting in the formulation of a management plan which seeks to reduce impact to areas of a site that remains unexplored. The prototype can assist future archaeologists and site managers at the Washington Square Mound site specifically by providing the information necessary to design responsible mitigation plans to address archaeological concerns as they arise.

This prototype can contribute to future archaeological research by providing digital representations of data, assisting with the preservation of paper records by reducing the amount of physical contact with the artifacts by keeping them as hands-off as possible until the actual analyses are to be done. There is no doubt that instances will arise in the future in which an investigator will need physical access to the records, but this should occur at a much lower frequency due to their ability to be viewed and printed directly from the interface. Should a closer examination of particular images be required, that slide may be made available. This process ensures minimum contact, thus preserving slides in the most stable state possible.

The method of interaction with the data will reduce the workload involved in viewing large quantities of information from the entire site, or a unique artifact recovered from a queried provenience. The method was designed to produce a new way to search for both disparities and similarities within the collection of artifacts through the incorporation of a number of spatial analysis tools, and the functionality of ArcGIS®.

The Center for Regional Heritage Research is currently taking steps to establish satellite stations throughout the region to collect culturally-relevant information from citizens within East Texas. If relevant information is submitted for Washington Square from the community (photographs, oral histories, or manuscripts), that could be added to the prototype, creating a type of usable history for the community at large. If this manner of dialogue is successful, it would greatly increase the scope of knowledge collected for these sites, possibly leading to more accurate interpretations at the Washington Square Mound site in the future.

The lexicon from this project can be employed within a conversation about architecture if needed, by adding the applicable terminology in order to facilitate a final product that addresses the user's needs. Having all of the local typological resources stored within the lexicon not only assists in data consistence, but can also help to standardize the search terms needed to query the information in the future.

If users want to search for areas of interest, this method allows them to do so. Through employing the use of the artifact catalog, lexicon, and geodatabase, the distribution of prehistoric ceramics from the 1979 excavations can be viewed. This information can be broken down further to display the frequency and distribution of the prehistoric ceramics by level and by feature. The frequency and distribution of these artifacts can be utilized alongside the information that demarcates mixed and intact prehistoric proveniences at the site to produce an accurate representation of those artifacts recovered from intact deposits, and indicate an area of undisturbed prehistoric Caddo activity within the site.

The distributions can be utilized within a conversion of other artifact categories. Level 1 consisted of a mixture of historic and prehistoric artifacts. While one unit from Level 1 (230_102) produced only prehistoric artifacts, Level 2 from that same unit was mixed with historic artifacts. In Level 2, ceramics were recovered in 29 units, and lithics were recovered from 58% (n=17) of those units, leaving 12 units in Level 2 where ceramics were recovered and lithics were not. Of the surviving intact deposits located in this area of the site, ceramics were found to have been recovered from seven units, and lithics came from three units. Only one unit excavated to Level 3 had a mixture of historic and prehistoric artifacts (228_102). Outside of this unit, ceramics were recovered from 17 other units, and lithics from 35% (n=6) of those, leaving 12 units where only ceramics were recovered. All of these units have hyperlinks to the excavation records, field notes, photographs, images, and slides to add further context to a discussion of what was recovered from the Washington Square Mound site.

The representations for Levels 1, 2 and 3 can be altered to display the number of artifacts that were recovered from each unit and level, and different symbols and colors can be used to indicate areas of higher occurrence within each unit level to display the frequency of artifacts.

Summary and Conclusions

The objective of this research was to test: (1) whether a geospatial methodology can be developed to serve as a site-specific digital repository, and (2) to assess the ability to query the resulting digital repository for artifact distributions. When new imagery, photographs, and documentation become available in the future, it can be made available within the current system with ease. This is ideal for the Washington Square Mound site and other similar sites due to the fact that the investigations are ongoing.

Aside from producing geographically accurate frequency and distribution representations, many research resources reside within the reference provenience. For this project, representations included the recorded information from the 1979 excavations, relevant unpublished material, photography of the Washington Square landscape, and excavation maps created at the site.

One benefit of this format is its ability to provide investigators with the artifact catalog, and the site's holdings. Should a user need to view a selection of artifacts, the catalog could be filtered to provide a listing of those artifacts that contribute to the research effort. If a user needed to view the actual artifacts, a list of those specific artifacts could be forwarded to the host repository. This would allow the repository to extract the necessary artifacts prior to the arrival of the investigator, decreasing contact with irrelevant artifacts, and making the process more efficient.

If additional excavations at the Washington Square Mound site were to occur in the near future, like that of the compliance-based efforts that took place in May 2010, this application could assist the Principal Investigator (PI) by providing a large amount of data from the site within a format that can be electronically transferred to that person's computer or digital storage device (i.e., external hard drive). The user would have access to a spatial representation of the previous excavations at the site, as well as the site boundaries, the boundaries of the area defined as a State Archaeological Landmark, and the boundaries of the Washington Square National Register District. The GPS coordinates of proposed surface-disturbing activities can be plotted, giving the PI a spatial representation of the project area atop a map of the previous excavations, disturbances, developments, and site boundaries. Prior to the excavation, the PI could choose to view the artifacts recovered from areas adjacent to the proposed project area, revealing the variety of artifacts located within that part of the site. Based upon that information and the information contained within the reference provenience (Washington Square Mound site reports, conference presentations, analyses, photographs, and cartography), the PI might be able to hypothesize what resources might be impacted, and at what depth.

As future analyses are completed for the Washington Square Mound site artifacts, new data fields (columns) can be added within the artifact catalog that allow it to capture artifact-specific information. This could include, among other things, artifact weight, measurements, and hyperlinks to photographs of the artifact (as warranted). As analyses of artifacts proceed, the lexicon could be employed and amended as necessary. Since new types of ceramics were previously defined at the Washington Square Mound site (Hart 1982), it is possible that more might exist. In that case, the new typological assignment could be added to the lexicon alongside morphological characteristics, a description, and hyperlinked photographs.

Depending on the research questions, an investigator could employ a number of geospatial tools to aid their efforts to reconstruct the physical environment. For instance, if a user investigated the pathways between known Caddo sites in the area, they might employ the use of least-cost analysis, which also could be utilized to calculate pathways from Washington Square to known resources in the area like water, clay, cane breaks, and agricultural areas. It could also be employed to research possible routes between known Caddo sites.

With the results from the least-cost analysis, the information could be overlaid atop infrared photography, viewshed, hillshade, and aspect representations to search for further clues that might support the interpretation of human behavior at the site. The geodatabase can evolve to include much more information, and as more work is completed, that data can be integrated within the grid, alongside the reports from future investigations**.** Should any patterns arise within that data, researchers will have the ability to view the geographic distribution of the queried data, and have clickable access to those data associated with the queried units. Access to these data simplifies the process necessary to view the site's holdings from a single computer screen.

The contribution of this method to the field of archaeology does not rest within a single autonomous division of its construct, but within the whole. By employing the artifact catalog, lexicon of local typology, and the geodatabase in a combined effort, users can capitalize on the availability of information from a single computer screen. Perhaps if this method was adopted on a larger scale, it could serve as the basis for a cross-comparison of archaeological sites within project reports from cultural resources management firms, adding to a conversation regarding the relationships between known archaeological assets.

Acknowledgements

The original concept for this article began within the context of a conversation with Dr. George E. Avery on the topic of possible new ways to relate the artifacts recovered from the Washington Square Mound site to the people that created them, and developed into a master's thesis by Robert Z. Selden Jr.

My express appreciation is extended to Dr. Timothy K. Perttula, Dr. Darrel L. McDonald, Dr. George Avery, Dr. Leslie G. Cecil, Dr. Perky Beisel, and Dr. Charles F. Abel for the many edits and recommendations throughout the development of this project.

This article was made possible with the aid of Stephen F. Austin State University's College of Liberal and Applied Arts, Department of Social and Cultural Analysis, Center for Regional Heritage Research, Columbia Regional Geospatial Service Center, and the Anthropology and Archaeology Laboratory.

My highest regards to the Anthropology and Archaeology Laboratory and their staff for granting me access to the collections from the Washington Square Mound site, and for the use of their numerous resources.

References Cited

Antiquities Code of Texas

1977 Antiquities Code of Texas. Electronic document, http://www.thc.state.tx.us/rulesregs/RulesRegsPDF/AntiqCode.pdf, accessed April 2, 2010.

Bender, M. Lionel

1984 Distant Genetic Relationship and the Use of Basic Lexicon. *American Anthropologist* 86(2):410.

Brown, Heather

1985 Excavations at Washington Square Mound Site, 1984. Manuscript on file, Anthropology and Archaeology Laboratory, Stephen F. Austin State University, Nacogdoches, Texas.

Corbin, James E.

1980 Excavations at Washington Square Mound Site 1979. Paper presented at the 1980 Caddo Conference, Texarkana.

1982a Excavations at Washington Square Mound Site. Paper presented at the Annual Meeting of the Texas Archaeological Society, College Station.

1982b The Washington Square Mound Site 1981: A Lesson in Humility. Paper Presented at the 1982 Caddo Conference, Fayetteville.

1983 One, Two, Three, or More; How Many Mounds at Washington Square? Paper presented at the 1983 Caddo Conference, Natchitoches.

1984 An Archaeological Assessment of a Portion of the Washington Square Mound Site (41NA49), Nacogdoches County, Texas. Electronic document, http://www.projectpast.org/caddo/topic3/corbin1984.pdf, accessed January 20, 2010.

1985a Washington Square Mound. *Texas Archeology* 29(3):7-8.

1985b A Short History of the Washington Square Mound Site or How We Know Some of What We Know without Actually Digging. *Texas Archeology* 29(4):7-8.

Corbin, James E., and John P. Hart

1998 The Washington Square Mound Site: A Middle Caddo Mound Complex in South Central East Texas. *Bulletin of the Texas Archaeological Society* 69:49-78.

Curb, Charles

1980 Excavations in the Reaveley-House Mound Washington Square Mound Site 1979. Paper presented at the 1980 Caddo Conference, Texarkana. Manuscript on file, Anthropology and Archaeology Laboratory, Stephen F. Austin State University, Nacogdoches.

Environmental Data Resources, Inc.

2008 Digital Sanborn Maps. Electronic resource, http://sanborn.umi.com/, accessed April 2, 2010.

Faris, James C.

1968 Validation in Ethnographical Description: The Lexicon of 'Occasions' in Cat Harbour. *Man* 3(1):112-124.

Finsley, Charles E.

1999 *A Field Guide to Fossils of Texas*. Gulf Publishing, Lanham, Maryland.

References Cited (cont.)

Florida Museum of Natural History

2010 Historical Archaeology at the Florida Museum of Natural History. Electronic resource, http://www.flmnh.ufl.edu/histarch/gallery_types/how-to.asp, accessed April 2, 2010.

Gregg, Gary S.

1998 Culture, Personality, and the Multiplicity of Identity: Evidence from North African Life Narratives. *Ethos* 26(2):120-152.

Hart, John P.

1980 Cultural Features: Washington Square Mound site, 1979. Paper presented at the 1980 Caddo Conference, Texarkana. Manuscript on file, Anthropology and Archaeology Laboratory, Stephen F. Austin State University, Nacogdoches.

1982 An Analysis of the Aboriginal Ceramics from the Washington Square Mound Site Nacogdoches, Texas. Master's thesis, Department of Anthropology, Northeast Louisiana University, Monroe.

Hays, Terence E.

1976 An Empirical Method for the Identification of Covert Categories in Ethnobiology. *American Ethnologist* 3(3):489-507.

Kisling, Deborah C.

1983 1982 Excavations at Washington Square Mound Site. Paper presented at the 1983 Caddo Conference, Natchitoches. Manuscript on file, Anthropology and Archaeology Laboratory, Stephen F. Austin State University, Nacogdoches.

McDonald, Jeanine

1982 Archaeological Investigations at the Reavely-House Mound. Paper presented at the 1982 Caddo Conference, Fayetteville. Manuscript on file, Anthropology and Archaeology Laboratory, Stephen F. Austin State University, Nacogdoches.

National Park Service

1992 *National Register of Historic Places Registration Form: Washington Square Historic District*. United States Department of the Interior, Washington, D.C.

Oakes, Sharon

1980 Summary of Test Pit Excavations. Manuscript on file, Anthropology and Archaeology Laboratory, Stephen F. Austin State University, Nacogdoches.

Osborne, Robin

2001 Why Did Athenian Pots Appeal to the Etruscans? *World Archaeology* 33(2):277-295.

Parker, Bradley J.

2006 Toward an Understanding of Borderland Processes. *American Antiquity* 71(1):77-100.

References Cited (cont.)

Perttula, Timothy K., with contributions by Bo Nelson and Mark Walters

2009 Caddo Ceramic and Lithic Artifacts from the Washington Square Mound Site (41NA49) in Nacogdoches County, Texas: 1985 Texas Archeological Field School Investigations. *Bulletin of the Texas Archeological Society* 80:145-193.

Pollnac, Richard B.

1975 Intra-Cultural Variability in the Structure of the Subjective Color Lexicon in Buganda. *American Ethnologist* 2(1):89-109.

Seeger, Charles

1969 On the Formational Apparatus of the Music Compositional Process. *Ethnomusicology* 13(2):230-247.

Selden Jr., Robert Z.

2010 Toward a Unique Understanding of Washington Square: Digitization and Spatial Representation of a Caddo Mound Site. M.I.S. Thesis, Department of Social and Cultural Analysis, Stephen F. Austin State University.

Shaul, David Leedom, and Jane H. Hill

1998 Tepimans, Yumans, and Other Hohokam. *American Antiquity* 63(3):375-396.

Suhm, Dee Ann, and Edward B. Jelks (editors)

1962 *Handbook of Texas Archaeology: Type Descriptions.* Texas Archaeological Society, 2009 Reprint. Gustav's Library, Davenport.

Suhm, Dee Ann, and Alex D. Krieger, with contributions by Edward B. Jelks

1954 *An Introductory Handbook of Texas Archaeology*. Texas Archaeological Society, 2009 Reprint. Gustav's Library, Davenport.

Texas Antiquities Committee

1984 *SAL Designation of the Washington Square Mound Site (41NA49).*Texas Antiquities Committee, Austin.

Texas Natural Resources Information System

2010 Data Search and Download. Electronic resource, http://www.tnris.state.tx.us/datadownload/download.jsp, accessed April 2, 2010.

Turner, Ellen Sue, and Thomas R. Hester

2002 *A Field Guide to Stone Artifacts of Texas*. Gulf Publishing, Lanham, Maryland.

A Radiocarbon Date from a Middle Caddo period Habitation Site on Hickory Creek, Houston County, Texas

Timothy K. Perttula

Introduction

The National Forests and Grasslands (U.S.D.A. Forest Service) in Texas (NFGT) conducted Passports in Time (PIT) projects in 2006 and 2007 on Hickory Creek in the Davy Crockett National Forest, Houston County, Texas. The work took place at four prehistoric archeological sites: 41HO13, HC-1, Hickory Creek #2 (HC-2), and HC-3, with the majority of the work occurring at the Hickory Creek #2 site. Following discussions with the NFGT, the NFGT agreed to turn over the collections and available notes/records to me for the purposes of completing a volunteer analysis of these collections and preparing a report on the analytical findings (Perttula and Nelson 2009).

During the course of the analysis, I learned that a radiocarbon sample of animal bone had been submitted to Beta Analytic, Inc. by the NFGT in 2007, but the dating specifics of that sample were not available until after Perttula and Nelson (2009) completed their report on the Hickory Creek collections. The purpose of this article is to provide the results of the radiocarbon analysis of this one sample, and consider its chronological and cultural implications for prehistoric Caddo sites in this area of East Texas.

Context of the Radiocarbon Sample

The Hickory Creek #2 site is located on an alluvial rise (ca. 230 feet amsl) next to an old channel of Hickory Creek. Hickory Creek is an eastward-flowing tributary of the Neches River in the East Texas Pineywoods (Diggs et al. 2006). Hickory Creek merges with the Neches River about 12 km below the southernmost *El Camino Real de los Tejas* crossing of the river, and the mouth of the creek is approximately 14 km from the early Caddo (ca. A.D. 850-1300) mound center at the George C. Davis site (41CE19) (Story 2000; Newell and Krieger 2000). The Hickory Creek sites are about 8 km upstream from its confluence with the Neches River.

PIT project archeological investigations in 2006 at the Hickory Creek #2 site included the removal and screening of the fill and back dirt from four looter pits (#3, 4, 5, and 8). In 2007, seven excavation units (Unit 1-7) of varying sizes were hand-excavated to a maximum depth of 90 cm bs in the archeological deposits at the site. The units ranged from 2 x 2 m in size (Unit 2, 4, and 7) to 3 x 3 m in size (Units 1, 3, 5, and 6). Based on placement of units across the landform, Units 1-4 are part of Area A at the site, while Units 5-7 are in Area B (Figure 1). During the excavations, no obvious features were encountered in the archeological deposits, but a concentration of ceramic sherds, animal bones, and other domestic refuse was noted between 30-40 cm bs that may represent an occupational surface or the unprepared floor to a prehistoric Caddo house structure. A sample of unburned animal bones from Unit 3 (29-35 cm bs) in Area A was submitted to Beta Analytic, Inc., for radiocarbon dating. Unit 3, as with other excavation units (Table 1), contained an abundance of lithic debris, chipped stone tools, plain and decorated ceramic sherds, burned clay/daub, and animal bones (n=334, Perttula and Nelson 2009:Table 18).

At the Hickory Creek #2 site, there are high densities of prehistoric archeological materials across the landform, particularly in Units 1, 3-6 and Looter Pit 8. In the western part of the site, the highest density of arrow points is in Unit 3. This same unit has the highest densities per m^2 in plain sherds, decorated sherds, and burned clay/daub. Furthermore, the western area of the site, along with Unit 4, have the highest densities of sherds in the archeological deposits, ranging from 5.4-26.5 sherds per m^2, compared to only 0.1-3.6 sherds per m^2 in Area B at the eastern end of the site (see Figure 1).

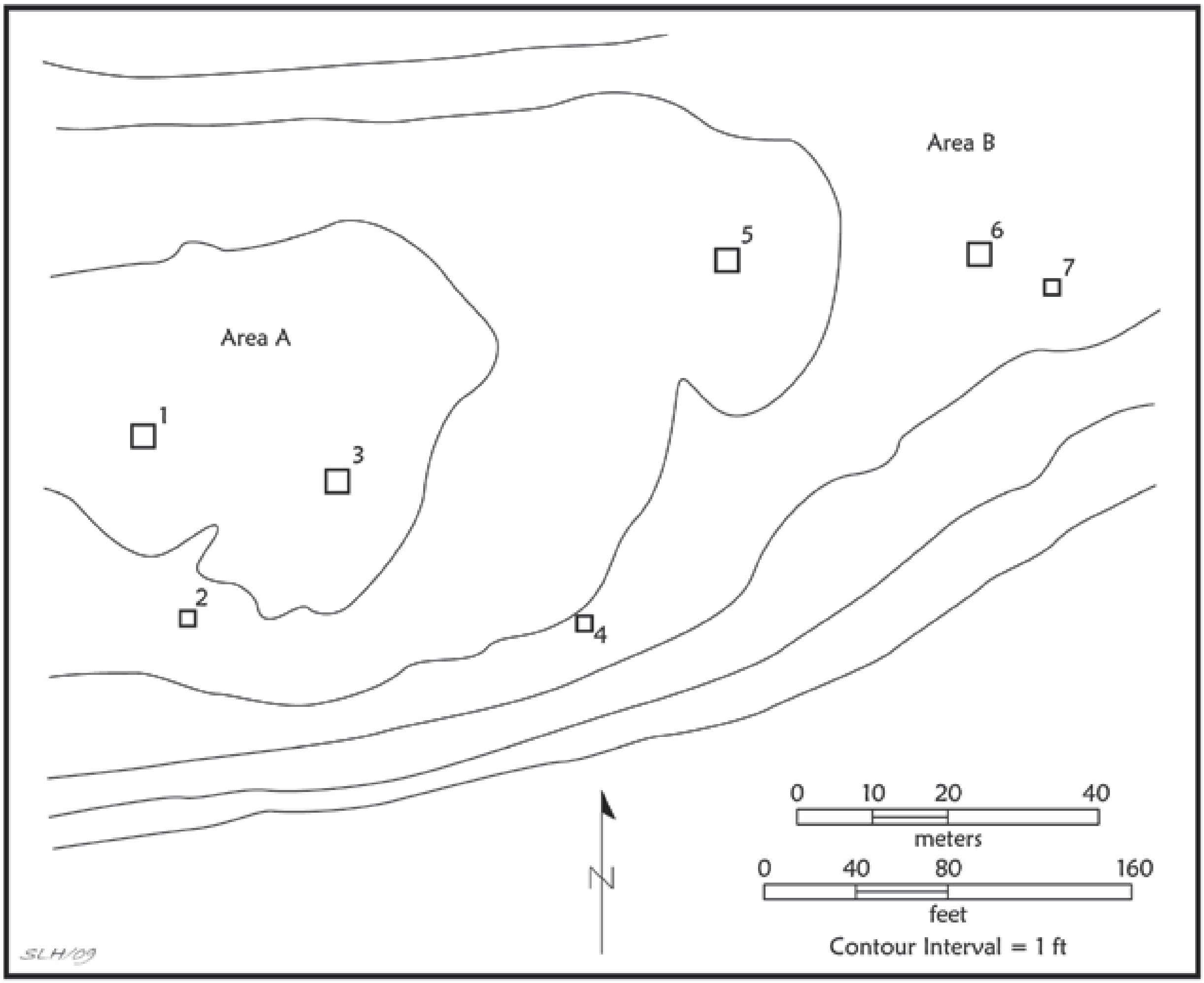

Figure 1. Map of the Hickory Creek #2 site and the location of Units 1-7. Map prepared by Sandra Hannum.

Table 1. Prehistoric artifacts from the Hickory Creek #2 site units and looter pits (LP).

Unit	DP	BIF	AP	FT	LD	FCR	GS	PS	DS	BC/D	N
1	18	4	2	9	1567	20	6	34	14	5	1679
2	6	3	3	4	692	5	3	20	12	-	748
3	4	3	13	4	1363	4	2	141+	97	43	1674
4	12	19	5	9	2602	11	2	35	8	4	2707
5	9	5	2	6	1400	6	2	-	1	2	1433
6	14	11	5	7	1233	17	2	25*	7	-	1321
7	-	-	1	-	276	-	-	-	-	-	277
LP3	8	-	2	1	180	5	-	10	1	3	210
LP4	1		-	-	39	-	-	1	1	-	42
LP5	-	1	-	1	236	5	1	13	1	-	258
LP8	6	3	1	4	775	5	-	13	2	1	810
Total	**78**	**49**	**34**	**45**	**10381**	**78**	**18**	**292**	**144**	**58**	**11177**

DP=dart point; BIF=biface; AP=arrow point; FT=flake tool; LD=lithic debris and cores; FCR=fire-cracked rock; GS=ground stone tool; PS=plain sherd; DS=decorated sherd; BC/D=burned clay/daub
*includes one plain pipe sherd; +includes five plain pipe sherds

By depth, there is a stratigraphic division between the upper Caddo archeological deposits (0-40 to 50 cm bs) and the lower Woodland and Late Archaic archeological deposits (40 to 50-90 cm bs) in the character of the recovered prehistoric ceramic and lithic artifacts (Table 2). The radiocarbon sample was clearly collected from buried Caddo archeological deposits.

Plain and decorated ceramic sherds are concentrated between 10-50 cm bs (where they comprise between 4.6-6.7% of all the artifacts in those levels) in the Caddo archeological deposits at the Hickory Creek #2 site (see Table 2). In the lowermost archeological deposits, sherds by level account for only 1.2-2.5% of the artifacts; in some measure, these are not Caddo sherds displaced from the upper archeological deposit, but Woodland period sherds (plain sandy paste Goose Creek Plain, *var. unspecified* sherds) from an earlier, and deeper, prehistoric occupation. Burned clay/daub is concentrated between 20-50 cm bs (see Table 2). Dart points are found throughout the archeological deposit—which suggests the movement and mixing of artifacts by bioturbation as well as slow aggradation of these alluvial deposits—but they are concentrated from 40-90 cm bs; arrow points are concentrated from 0-30 cm bs.

Table 2. Prehistoric artifacts from the Hickory Creek #2 site by depth, all units.

Depth (cm bs)	DP	BIF	AP	FT	LD	FCR	GS	PS	DS	BC/D	N
Suggested upper archeological deposits											
0-10	-	1	6	-	630	-	-	14*	6	1	658
10-20	4	5	8	1	1299	1	-	47*	36	4	1405
20-30	3	4	10	5	1451	2	1	60+	48	19	1603
30-40	1	4	2	2	1077	7	2	34*	19	14	1162
40-50	11	6	2	2	1163	2	-	43*	14	11	1254
Suggested lower archeological deposits											
50-60	9	4	2	9	990	13	3	23	2	1	1056
60-70	16	8	-	12	969	15	4	21	5	-	1050
70-80	13	11	-	6	906	13	3	10	2	3	967
80-90	6	3	1	1	554	9	4	1	6	2	587

DP=dart point; BIF=biface; AP=arrow point; FT=flake tool; LD=lithic debris and cores; FCR=fire-cracked rock; GS=ground stone tool; PS=plain sherd; DS=decorated sherd; BC/D=burned clay/daub
*includes a plain pipe bowl; +includes two plain pipe sherds

Calibrated Radiocarbon Date

The radiocarbon analysis on animal bone (-21.3% 13C/12C ratio, probably from deer) from Unit 3 at the Hickory Creek #2 site yielded a conventional radiocarbon age of 570 ± 40 years B.P. (A.D. 1340-1420). The INTCAL04 calibration (Reimer et al. 2004) employed by Beta Analytic, Inc. indicated that the sample had a cal AD 1400 intercept, 1 sigma age ranges of cal AD 1320-1350 and AD 1390-1420, and a 2 sigma age range of cal AD 1300-1430.

Since that time, a new radiocarbon age calibration curve, IntCal09, has been published by Reimer et al. (2009). The IntCal09 calibration for the Hickory Creek #2 sample has a cal AD 1408 intercept, a 1 sigma age range of cal AD 1389-1414, and a 2 sigma age range of cal AD 1377-1434. By either calibration curve, the radiocarbon age from the Hickory Creek #2 site falls primarily in the Middle Caddo period (ca. A.D. 1200-1400) and the beginning of the Late Caddo period (ca. A.D. 1400-1650) in East Texas (cf. Story 1990).

Chronological and Cultural Implications

Although only one radiocarbon date has been obtained from the Hickory Creek #2 site, there still is a 95 percent confidence interval that the Caddo archeological deposits at the site (or at last Area A) date between AD 1377-1434. The associated material culture from this prehistoric Caddo site includes plain ware, utility ware, and fine ware pottery sherds; both long-stemmed and elbow pipe sherds; burned clay/daub; primarily Perdiz and Perdiz-Bonham arrow points; expedient flake tools, two scrapers, and one drill; and a few ground stone tools, including a chunk of ochre (Perttula and Nelson 2009).

The plain sherds include 21 rims (one with a lip tab), 186 body sherds, and 21 base sherds. The proportion of plain ware rims to decorated rims from fine ware and utility ware vessels is 21: 20, indicating that plain ware vessels are as common as decorated vessels in the Hickory Creek #2 ceramic vessel assemblage. Plain ware vessels include bowls, carinated bowls, and jars. At the nearby and generally contemporaneous Hargrove Lake site (41HO150), Jurney (2000:57 and Tables 12 and 13) estimated that there were a minimum of 30 vessels represented in the 374 sherds in the assemblage. Only about 13% of these vessels were thought to be plain.

The plain to decorated sherd ratio (P/DR), a useful chronological measure in some instances in East Texas Caddo sherd assemblages (see Perttula 2004:390), is 1.63 (i.e., 38% of the tempered Caddo pottery sherds are decorated). This is consistent with other 13th to mid-15th century Caddo assemblages in the Neches-Angelina and middle Sabine River basins. Post-A.D. 1450-1650 Caddo sherd assemblages in these areas typically have P/DR that range from 0.56-1.03. On Historic Caddo ceramic assemblages on San Pedro Creek, P/DR values range between very low values of 0.31-0.32 (Perttula and Nelson 2006:62).

The utility ware sherds from the Hickory Creek #2 site are dominated by brushed jars, probably of the Bullard Brushed type or an unnamed brushed predecessor. Approximately 67% of the utility wares have brushed decorations, either as the sole decoration, or in combination with roughened, punctated, incised, or grooved elements, including 40% of the rims (Table 3). The ubiquity of brushed pottery in the utility wares is an apparent characteristic feature of Middle Caddo pottery in this part of the Neches River basin (Jurney 2000; Perttula and Nelson 2006). One of these Middle Caddo sites is the Butler Branch site (41HO216), which has been dated to (2 sigma) cal AD 1200-1290 (Perttula and Nelson 2006:57), and the ceramics here are predominantly brushed utility wares. Incised vessels are also an important part of the Hickory Creek #2 utility ware assemblage, as they comprise 40% of the rims and 14.8% of all the utility ware sherds (Table 3). The four incised rims have sets of horizontal incised lines encircling the upper part of the rim, while body sherds primarily have cross-hatched lines (n=2) and closely- to widely-spaced parallel lines (n=5).

Table 3. Utility ware sherds from the Hickory Creek #2 site.

Decorative Method	Rim	Body	Percentage
Brushed	4	63	58.3
Roughened-Brushed	-	1	0.9
Brushed-Punctated	-	6	5.2
Brushed-Incised	-	2	1.7
Brushed-Grooved	-	1	0.9
Incised-Punctated	1	8	7.8
Incised	4	13	14.8
Punctated	1	9	8.7
Pinched	-	2	1.7
Totals	**10**	**105**	**100.0**

The engraved fine ware sherds (n=25) from the Hickory Creek #2 site are primarily from several distinctive early decorated styles of Poynor Engraved carinated bowls in Area A (Table 4). Three of the fine ware sherds are from engraved bottles. None of the engraved sherds from the site are either red-slipped or have red or white clay pigments rubbed in the engraved lines.

Table 4. Decorative elements on fine ware sherds from the Hickory Creek #2 site.

Decorative element	Rim	Body	N
Carinated bowls			
Poynor Engraved, *var. Cook*	2	-	2
Poynor Engraved, *var. B* (horizontal scroll)	6	2	8
Poynor Engraved, diagonal/hatched lines	1	2	3
cross-hatched triangles and negative triangular zone	1	-	1
horizontal-vertical-diagonal lines	-	1	1
parallel engraved lines	-	4	4
excised zone	-	1	1
single straight engraved line	-	2	2
Bottles			
opposed engraved lines	-	1	1
curvilinear engraved lines	-	2	2
Totals	**10**	**15**	**25**

There are eight rim and body sherds from a single vessel recovered in Unit 3 in Area A that are identified as Poynor Engraved, *Var. B* (Figures 2a-c, 3b, d, g, and 4a-d). This vessel, a carinated bowl, has a series of horizontal and vertical interlocking scrolls on the rim panel, as well as sets of vertical or semi-circular lines that divide the scrolls on the panel and diagonal scroll filler elements. *Var. B* of Poynor Engraved has previously been recognized as an upper Neches River variety from only a few sites (the main reason it has not received a formal variety designation at this time) with early (ca. A.D. 1400-1480) Frankston phase mortuary contexts (Perttula 2009:Figure 6-64 and Table 6-37). The description of several of the Poynor Engraved vessels (Vessels 15, 21, 23) from the Hargrove Lake site (Jurney 2000:64) may also be examples of Poynor Engraved, *Var. B.* vessels.

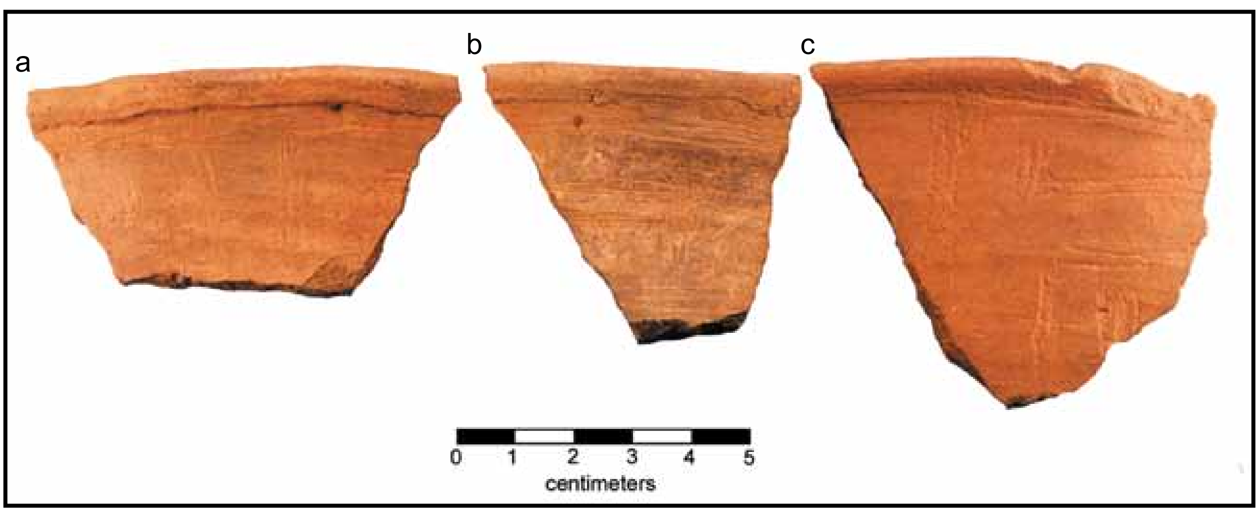

Figure 2. Rim sherds from a Poynor Engraved, *var. B* vessel (carinated bowl) from the Hickory Creek #2 site. Provenience: a, c, Unit 3, 20-30 cm bs; b, Unit 3, 30-40 cm bs.

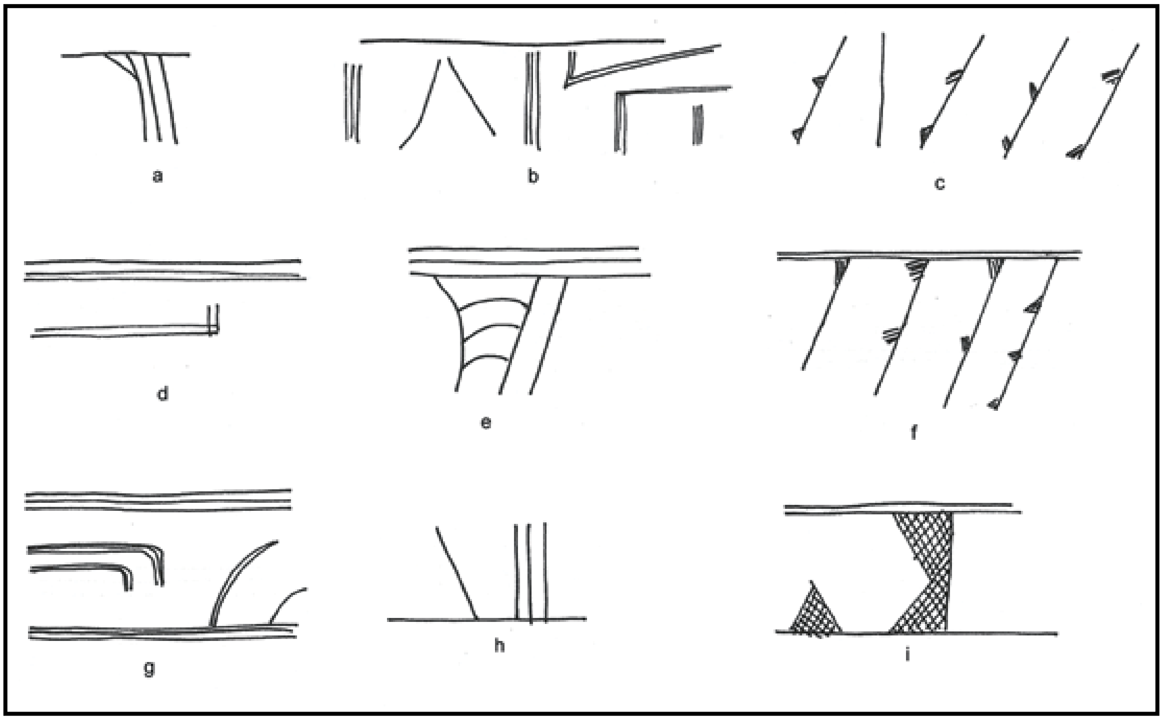

Figure 3. Selected engraved decorative elements in the Hickory Creek #2 site fine wares: a, Poynor Engraved, *var. Cook*; b, d, g, Poynor Engraved, *var. B*; c, f, diagonal engraved; e, cf. Poynor Engraved; h, opposed engraved lines; i, cross-hatched and negative triangle zone.

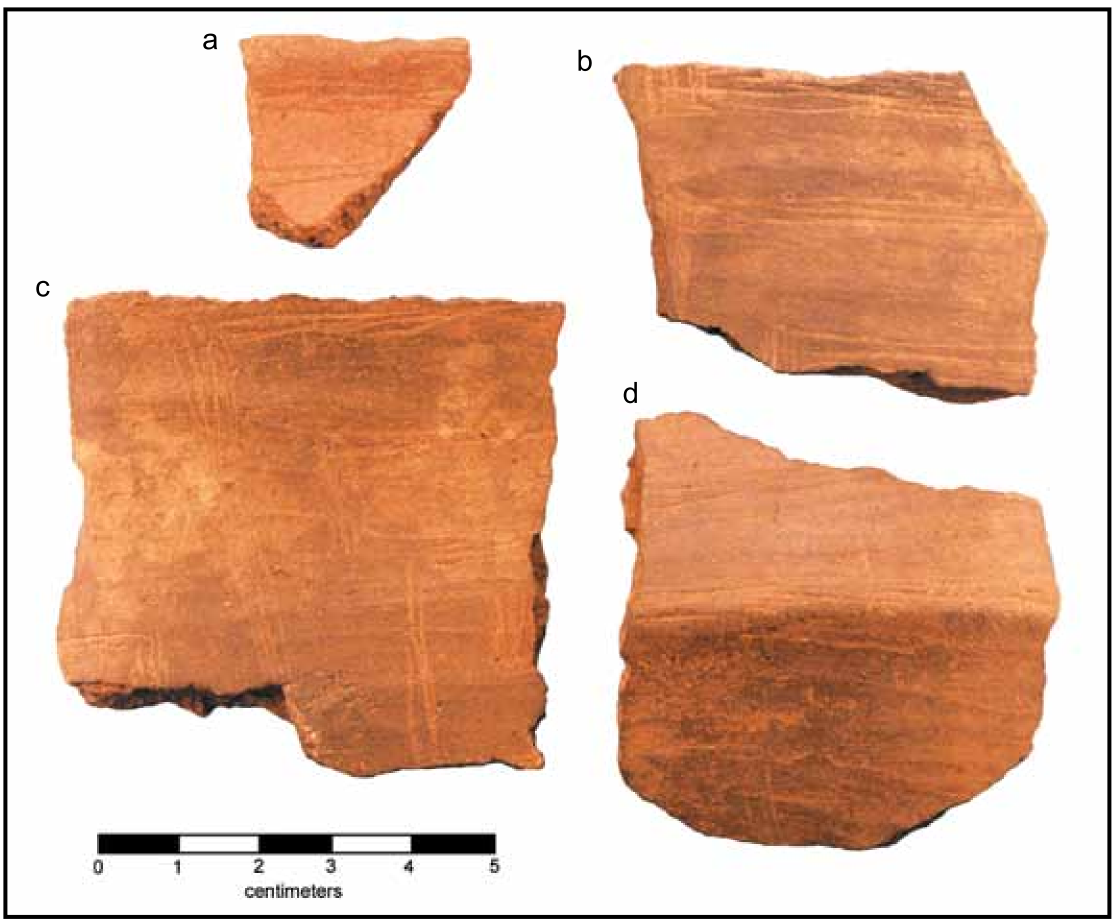

Figure 4. Rim and body sherds from a Poynor Engraved, *var. B* carinated bowl at the Hickory Creek #2 site.

In Area B (Unit 6) are three sherds from another Poynor Engraved carinated bowl. This vessel has a continuous series of diagonal engraved lines on the rim panel, and most of the diagonal lines have small hatched pendant triangles (see Figure 3c, f). This vessel closely resembles another upper Neches River variety, *Var. T*, of Poynor Engraved, except that the *Var. T* vessels have small pendant triangles rather than hatched triangles on the diagonal engraved lines (Perttula 2009:Figure 6-64). This particular variety of Poynor Engraved is known from a ca. A.D. 1560-1650 mortuary context in the upper Neches (Perttula 2009:Table 6-37). If this variety of Poynor Engraved has been correctly identified at the Hickory Creek #2 site, it suggests that the Caddo occupation in Area B postdates the Caddo occupation in Area A by at least 100-150 years.

Poynor Engraved, *var. Cook* is a recently defined upper Neches River engraved fine ware variety (Perttula 2008:Figure 1d). This variety has multiple sets of engraved ovals on the rim panel, occasionally with hatched areas at the upper and lower corners of each oval. There are two rims of Poynor Engraved, *var. Cook* from the Hickory Creek #2 site (see Figure 3a, e), both from Area A.

There is one other distinctive engraved carinated bowl from the Hickory Creek #2 site. This particular vessel, from Area A, has cross-hatched engraved triangles forming a negative triangular zone (see Figure 3i). Vessel 19 at the Hargrove Lake site has a triangular panel filled with cross-hatched engraved lines (Jurney 2000:64).

The remaining engraved sherds fall into three groups. The first group is body sherds from carinated bowls with simple geometric elements that have parallel, opposed, and straight lines in orientation. The second group consists of a single body sherd with a rectangular panel defined by sets of vertical engraved lines (see Figure 3h), reminiscent of Poynor Engraved, *var. Blackburn* (see Perttula 2008:Figure 1a). The third group includes three body sherds from bottles with either opposed (n=1) or curvilinear (n=2) engraved lines.

There are six pipe sherds from the Hickory Creek #2 site. Five are plain bowl and stem sherds from bone-tempered Red River style long-stemmed pipes, which were made by the Caddo from ca. A.D. 800 to the early 15th century A.D (see Hoffman 1967); these long-stemmed pipes are likely from the latest Haley variety. These five Red River pipe sherds are from 10-50 cm bs in Unit 3, the one area on the site with concentrated Middle Caddo period habitation deposits. The other pipe sherd is from Unit 6 (0-10 cm bs) in Area B. The first use of clay elbow pipes in the Neches River basin began in the mid-14th century A.D. (Perttula 2009), and they became increasingly popular after that time, eventually replacing the long-stemmed Red River pipes.

The post-ca. A.D. 1200-1300 arrow points at the Hickory Creek #2 site are dominated by Perdiz points (n=14) in both Area A and B. Perdiz points have been found in East Texas Caddo sites that date from the 13th to the 17th century A.D., but as of yet, no temporally distinctive varieties of the type have been defined. The dated assemblage of Perdiz points from the Hickory Creek #2 site may be useful in that regard.

The one Perdiz-Bonham point from the site has a narrow parallel to contracting stem and a flat base. It resembles a style of arrow points recovered from post-A.D. 1200 to ca. A.D. 1300 burial features at the George C. Davis site (see Shafer 1973) as well as at other sites of Middle Caddo period age where possible Alba, Bonham, and Perdiz arrow point forms seem to co-occur or be contemporaneous (Cliff and Perttula 2002:84-85 and Figure 30c, e, i; Perttula and Nelson 2003:114-115 and Figure 4.11a-e). Shafer (1973:207 and Figure 17Z-T1) noted that "most specimens fall within the Alba range but certain specimens clearly fall into the Perdiz type as well. The variation from one type to the other is indeed gradual and to separate one from the other would imply a distinction that does not visibly exist." It is suspected that there are gradual changes in the form of certain stemmed arrow points through time (from ca. A.D. 1200 to the 15th century), leading from what is called the Alba type, to the Bonham type, to that of the Perdiz type, with subtle differences in stem shape, basal form, and shoulder/barb margins, and these morphological changes are probably also associated with changes in raw material use for arrow points. The Perdiz-Bonham arrow point from the Hickory Creek #2 site fall within the continuous evolutionary development of certain stemmed Caddo arrow points, sharing attributes of both Alba and Perdiz points, as well as Bonham and Bassett points, but lacking a prominent contracting stem. Shafer (2007:Figure 1a-c, 2008:Figure 1g-m) refers to many of these from 14th and early 15th century sites in Smith County, Texas, as "Perdiz-Bassett," but the moniker "Perdiz-Bonham" (Perttula 2008, ed.:450) is preferred because the character of the stem on these points is much more like that of a Bonham than the small pointed and contracting stem of Bassett points (see Turner and Hester 1999:201-202).

Considering the gamut of recovered artifacts from the site, in both Areas A and B, the prehistoric use of the Hickory Creek #2 site is temporally complex, probably because it was a favorable location and landform setting for repeated and redundant use. The recovered artifacts from the site indicate that it was used for activities during the Paleoindian, Middle Archaic, Late Archaic, Woodland (Mossy Grove), Early Caddo, 14th to early 15th century Middle Caddo, and Late Caddo (16th to mid-17th century) periods (Perttula and Nelson 2009). The principal occupations at the site (i.e., the occupations that resulted in the most substantial accumulation of archeological materials) occurred first in the Woodland period (ca. A.D. 200-700), and then a number of centuries later, as attested to by the one radiocarbon date, by Caddo peoples in the 14th to early 15th century A.D.

There are spatial differences in the use of the Hickory Creek #2 site. Temporally diagnostic lithic and/or ceramic artifacts from Area B (see Figure 2) in the eastern part of the site testify to aboriginal use during Paleoindian, Middle Archaic, Late Archaic, Woodland, and Late Caddo periods. The Woodland occupation and the undated Late Caddo (Perdiz arrow points, later Poynor Engraved styles, elbow pipe sherds) Frankston phase occupation were the most substantial that occurred in Area B, suggesting a relatively intensive use for habitation and various domestic-related activities, but nowhere comparable in apparent intensity and/or duration of use as the Woodland and Middle Caddo occupations in Area A at the site.

In Area A at the western part of the site (see Figure 1), where a single calibrated radiocarbon age range of AD 1377-1434 has been obtained, there are dense accumulations of both Woodland and Middle Caddo archeological materials—much denser here than elsewhere at the site—such that it seems clear that Area A was the locus of a Middle Caddo domestic occupation. It is suspected that there is at least one farmstead compound in Area A (in the immediate vicinity of Unit 3). During the Middle Caddo component in Area A at the Hickory Creek #2 site, the knapping of chipped stone arrow points (Perdiz) and flake tools was important, as was the manufacture and use of a domestic ceramic assemblage comprised of cooking jars, bottles, and serving vessels (the latter early forms of Poynor Engraved). These Caddo peoples also made and used long-stemmed Red River style clay pipes.

With the completion of the analysis of the artifacts recovered at the Hickory Creek #2 site (especially those from Area A), and now the publication of the calibrated radiocarbon date from prehistoric Caddo archeological deposits in Area A, the archeological character of the Middle Caddo period in this part of the Neches River basin is coming into focus. Continuing investigations, along with additional radiocarbon dates, of the Hickory Creek #2 site, promises to contribute more temporally discrete archeological evidence of the material culture character of a Middle Caddo period occupation in East Texas, as well as substantive information on the range of habitation features present in the component. Combining and comparing these archeological data sets from the Hickory Creek #2 with comparative information obtained recently from other Middle Caddo sites in East Texas (see Middlebrook 1994; Perttula 2008, ed., 2009; Perttula et al. 2009; Shafer 2007, 2008; Walters 2008), should result in a much better understanding of the prehistory of Caddo peoples in the region between ca. 600-800 years ago.

Acknowledgements

I would like to thank Barbara Williams (U.S. Forest Service, National Forests & Grasslands in Texas, Lufkin) for providing the opportunity to work on the important collections from the Hickory Creek sites, and for providing the information about the radiocarbon date from the Hickory Creek #2 site.

References Cited

Cliff, M. B. and T. K. Perttula
2002 *Results of National Register Investigations Conducted on Site 41PN175, Panola County, Texas*. Report No. 32. Archeological Studies Program, Texas Department of Transportation, Austin.

Diggs, G. M., Jr., B. L. Lipscomb, M. D. Reed, and R. J. O'Kinnon
2006 *Illustrated Flora of East Texas*. Botanical Research Institute of Texas, Fort Worth.

Hoffman, M. P.
1967 Ceramic Pipe Style Chronology Along the Red River Drainage in Southwestern Arkansas. *The Arkansas Archeologist* 8(1):4-14.

Jurney, D. H.
2000 *Archaeological Investigations at the Hargrove Lake Site (41HO150), Davy Crockett National Forest, Houston County, Texas: 1997 Season*. United States Department of Agriculture, Forest Service, Lufkin, Texas.

Middlebrook, T.
1994 An Update of Archaeological Investigations at the Tyson Site (41SY92). *Journal of Northeast Texas Archaeology* 3:1-36.

Newell, H. P. and A. D. Krieger
2000 *The George C. Davis Site, Cherokee County, Texas*. 2nd Edition. Society for American Archaeology, Washington, D.C.

Perttula, T. K.
2004 The Prehistoric and Caddoan Archeology of the Northeastern Texas Pineywoods. In *The Prehistory of Texas*, edited by T. K. Perttula, pp. 370-407. Texas A&M University Press, College Station.

2008 Trends and Varieties in Late Caddo and Historic Caddo Fine Ware Pottery Types in the Upper Neches River Basin. *Journal of Northeast Texas Archaeology* 28:51-55.

2009 The Ceramic Artifacts from the Lang Pasture Site (41AN38) and the Place of the Site within an Upper Neches River Basin Caddo Ceramic Tradition. In *Archeological Investigations at the Lang Pasture Site (41AN38) in the Upper Neches River Basin of East Texas*, assembled and edited by T. K. Perttula and D. B. Kelley, pp. 6-1 to 6-260. Coastal Environments, Inc., Baton Rouge.

Perttula, T. K. (editor)
2008 *Lake Naconiche Archeology, Nacogdoches County, Texas. Results of the Data Recovery Excavations at Five Prehistoric Archeological Sites*. 2 Vols. Report of Investigations No. 60. Archeological & Environmental Consultants, LLC, Austin.

Perttula, T. K. and B. Nelson
2003 *The Nawi haia ina Site (41RK170): Archeological Investigations in the City of Henderson's Southside Wastewater Treatment Plant, Rusk County, Texas*. Report of Investigations No. 51. Archeological & Environmental Consultants, LLC, Austin.

2006 *Test Excavations at Three Caddo Sites at Mission Tejas State Park, Houston County, Texas*. Report of Investigations No. 76. Archeological & Environmental Consultants, LLC, Austin.

2009 *Prehistoric Artifact Assemblages from Sites along Hickory Creek in the Davy Crockett National Forest, Houston County, Texas*. Special Publication No. 14. Friends of Northeast Texas Archaeology, Austin and Pittsburg.

References Cited (cont.)

Perttula, T. K., B. Nelson, and M. Walters

2009 Caddo Ceramic and Lithic Artifacts from the Washington Square Mound Site (41NA49) in Nacogdoches County, Texas: 1985 Texas Archeological Society Field School Investigations. *Bulletin of the Texas Archeological Society* 80:145-193.

Reimer, P. J., M. G. L. Baillie, E. Bard, A. Bayliss, J. W. Beck, C. J. H. Bertrand, P. G. Blackwell, C. E. Buck, G. S. Burr, K. B. Cutler, P. E. Damon, R. L. Edwards, R. G. Fairbanks, M. Friedrich, T. P. Guilderson, A. G. Hogg, K. A. Hughen, B. Kromer, F. G. McCormac, S. W. Manning, C. Brock Ramsey, R. W. Reimer, S. Remmele, J. R. Southon, M. Stuiver, S. Talamo, F. W. Taylor, J. van der Plicht, and C. E. Weyhenmeyer

2004 IntCal04 Terrestrial Radiocarbon Age Calibration, 26-0 ka BP. *Radiocarbon* 46:1029-1058.

Reimer, P. J., M. G. L. Baillie, E. Bard, A. Bayliss, J. W. Beck, P. G. Blackwell, C. Bronk Ramsey, C. E. Buck, G. S. Burr, R. L. Edwards, M. Friedrich, P. M. Grootes, T. P. Guilderson, I. Hajdas, T. J. Heaton, A. G. Hogg, K. A. Hughen, B. Kromer, F. G. McCormac, S. W. Manning, R. W. Reimer, D. A. Richards, J. R. Southon, S. Talamo, C. S. M. Turney, J. van der Plicht, and C. E. Weyhenmeyer

2009 IntCal09 and Marine09 Radiocarbon Age Calibration Curves, 0-50,000 cal BP. *Radiocarbon* 51:1111-1150.

Shafer, H. J.

1973 Lithic Technology at the George C. Davis Site, Cherokee County, Texas. Ph.D. dissertation, Department of Anthropology, The University of Texas at Austin.

2007 Leaning Rock Site (41SM325) Lithics. *Caddo Archeology Journal* 16:57-70.

2008 A Study of Chipped Stone Artifacts from the Redwine Site (41SM193), Smith County, Texas. *Journal of Northeast Texas Archaeology* 27:49-75.

Story, D. A.

1990 Cultural History of the Native Americans. In *The Archeology and Bioarcheology of the Gulf Coastal Plain*, by D. A. Story, J. A. Guy, B. A. Burnett, M. D. Freeman, J. C. Rose, D. G. Steele, B. W. Olive, and K. J. Reinhard, pp. 163-366. 2 Vols. Research Series No. 38. Arkansas Archeological Survey, Fayetteville.

2000 Introduction. In *The George C. Davis Site, Cherokee County, Texas*, by H. P. Newell and A. D. Krieger, pp. 1-31. 2nd Edition. Society for American Archaeology, Washington, D.C.

Turner, E. S. and T. R. Hester

1999 *A Field Guide to Stone Artifacts of Texas Indians*. Gulf Publishing and Taylor Trade Publishing, Lanham, Maryland.

Walters, M.

2008 Life on Jackson Creek, Smith County, Texas: Archeological Investigations of a 14th Century Caddo Domicile at the Leaning Rock Site (41SM325). *Caddo Archeology Journal* 17:1-114.

Luminescence Dates from the Tuinier Farm Site (41HP237), Hopkins County, Texas

Timothy K. Perttula and James K. Feathers

Introduction

The luminescence dating of ceramics (see Feathers 1997, 2000, 2003) has been applied with some considerable success in a variety of settings—and on different ceramic wares—in North America (Lipo et al. 2005; Dykeman et al. 2002; Feathers 2009), but since the days of Alpha Analytic (a subsidiary of Beta Analytic) in the early to mid-1980s, there have been no luminescence dating of Caddo ceramic wares in Northeast or East Texas. Given the abundance of ceramics of several different kinds and styles at all Caddo sites, the luminescence dating of both plain and decorated sherds recovered in situ from these many sites should be explored since it is a method "that dates the manufacture and use of…ceramic objects [that] provide a closer relationship between the target event [when a site is occupied] and the dated event [the age determined by the luminescence on a sherd]. Luminescence is particularly well suited for the dating of ceramics since the method measures the time elapsed since vessels were last heated, usually corresponding to manufacture or use" (Lipo et al. 2005:535). In this article, we discuss the results of recent luminescence dating on a small sample of Caddo ceramic sherds at the Tuinier Farm site (41HP237).

Tuinier Farm Site (41HP237)

The Tuinier Farm site is thought to be a 16th to 17th century Caddo site in the modern-day Post Oak Savanna of Northeast Texas (Diggs et al. 2006:Figure 2). It is a Late Caddo period Titus phase habitation site with midden deposits, features, and an associated cemetery (Perttula 2009). In this region, based on more than 100 calibrated radiocarbon dates from a variety of sites and contexts within them, Titus phase sites date within the ca. 250 year interval of ca. A.D. 1430-1680.

Two radiocarbon dates have been obtained from the Tuinier Farm site (Table 1). The samples submitted for radiocarbon analysis are charred Hickory (*Carya* sp.) nutshells from flotation samples in the South midden.

Table 1. Radiocarbon dates from the Tuinier Farm site.

Beta No.	Provenience	Conventional radiocarbon age (B.P.)	Calibrated intercept*	Calibrated 1 sigma age range	Calibrated 2 sigma age range
B-239189	Unit 4, 10-20 cm bs	260 ± 40	AD 1650	AD 1640-1660	AD 1520-1590 AD 1620-1670 AD 1770-1800** AD 1940-1950*
Beta No.	Provenience	Conventional radiocarbon age (B.P.)	Calibrated intercept*	Calibrated 1 sigma age range	Calibrated 2 sigma age range
B-239188	Unit 4, 20-30 cm bs	400 ± 40	AD 1460	AD 1440-1490	AD 1430-1530 AD 1560-1630

*calibrated following Reimer et al. (2004) and IntCal04; **unrealistically young.

The calibrated intercepts suggest that the Caddo occupation at the Tuinier Farm (or at least that part of the South midden occupation in the vicinity of the Unit 4 archeological deposits) may have begun as early as the mid-15th century A.D. (AD 1460) and lasted until the mid-17th century A.D (AD 1660). At 2 sigma (95% probability), the two calibrated radiocarbon dates overlap between AD 1520-1630 (Table 1), and this is considered the most likely chronological range of the domestic Caddo occupation at Tuinier Farm; the burials at this site may be younger than that based on the presence of a mid-17th century style Taylor Engraved inverted rim carinated bowl.

About 91% of the engraved fine ware sherds from the site are from Ripley Engraved vessels (Perttula 2009:Table 5), mostly carinated bowls, based on the kinds of engraved motifs found on the rim panel of vessels. There is also a smattering of Taylor Engraved and probable Hodges and Womack Engraved types in the Tuinier Farm fine ware sherds. There is also one shell-tempered Avery Engraved vessel sherd from a trade vessels that likely was manufactured on a post-A.D. 1400 Caddo site along the Red River, well to the north of the Stouts Creek area. Taken together, the co-association of these engraved fine ware types suggests that the Caddo occupation at the Tuinier Farm site postdates ca. A.D. 1550, and certainly lasted into the 17th century A.D. The occupation could have lasted as late as the mid- to late 17th century given the known chronological age range of Titus phase sites (see Perttula 2005:364-370).

Luminescence Analyses

Table 2 lists the samples submitted from the Tuinier Farm site, their vertical provenience, and their expected age based on the identification of Titus phase ceramic styles in the large sherd assemblage and associated radiocarbon dates (see Perttula 2009:12-23 and Table 1). All the sherds are from Unit 4 in the South midden.

Table 2. Sherds submitted from the Tuinier Farm (41HP237) for Luminescence dating.

Sample #	*UW lab #*	*site*	*Depth (cm bs)*	*Ceramic type*	*Expected age (years AD)*
TL-1	UW1943	41HP237	19	Plain body	Post-1500
TL-2	UW1944	41HP237	19	Engraved carinated bowl	Post-1500
TL-3	UW1945	41HP237	14	McKinney Plain body	Post-1500
TL-4	UW1946	41HP237	16	Anglin Impressed	Post-1500

Dose rate measurements were made on each sample as well as an associated sediment sample. The difference in radioactivity between sherds and associated sediments was not great, suggesting the ceramics were made from similar material as the sediments. Dose rates were determined using alpha counting and flame photometry. The beta dose rate calculated from these measurements was compared with the beta dose rate measured directly by beta counting. These were in agreement for the Tuinier Farm samples. Moisture content was estimated as 80 ± 20 % of saturated value for the sherds, and 10 ± 5 percent for the sediments. Table 3 gives all relevant data, including the total dose rate for each sample. Total dose rate is the denominator of the age equation.

Table 3. Dose rate measurements.

Sample	^{238}U *(ppm)*	^{233}Th *(ppm)*	*K* *(%)*	*Beta dose rate (Gy/ka)* ß-counting	α-counting/ flame photometry	*Total dose rate** *(Gy/ka)*
UW1943	3.63±0.23	7.86±0.92	1.94±0.12	2.20±0.20	2.31±0.11	5.18±0.27
Sediment	2.82±0.21	8.25±1.19	0.94±0.03			
UW1944	2.80±0.19	6.03±0.92	0.90±0.03	1.24±0.11	1.29±0.05	4.12±0.22
Sediment	2.34±0.19	8.78±1.21	0.93±0.04			
UW1945	3.13±0.22	8.95±1.26	1.39±0.05	1.74±0.16	1.82±0.06	4.10±0.19
Sediment	2.14±0.13	1.81±0.55	0.90±0.06			
UW1946	2.51±0.18	5.89±1.00	1.59±0.14	1.65±0.16	1.80±0.12	3.36±0.16
Sediment	2.52±0.18	5.52±0.97	0.87±0.06			

* Dose rate calculated for thermoluminescence. It will be slightly lower for optically stimulated luminescence because of lower alpha efficiency.

Equivalent dose, which is the laboratory estimation of the accumulated radiation dose and is the numerator of the age equation, was determined on fine-grain (1-8μm) polymineral materials. It was measured by thermoluminescence (TL), infrared stimulated luminescence (IRSL), and optically stimulated luminescence (OSL). The TL measurements, in general, were characterized by poor temperature plateaus (Table 4). In only one sample from the Tuinier Farm site did the plateau (the region of constant equivalent dose) extend to 320°C, symptomatic of relatively low firing conditions. Anomalous fading, which is a loss of signal through time and is characteristic of feldspar minerals, was ubiquitous, and apparent in all samples (Table 4).

Table 4. TL parameters.

Sample	*Plateau (°C)*	*1st/2nd ratio**	*fit*	*g-value***
UW1943	250-310	1	quadratic	2.93±2.88
UW1944	280-310	1	Linear	6.97±3.73
UW1945	250-300	0.82±0.06	Linear	7.95±1.70
UW1946	250-320	2.12±0.21	Linear	2.84±2.77

*Refers to slope ratio between the first and second glow growth curves. A glow refers to luminescence as a function of temperature; a second glow comes after heating to 450°C. Growth curves plot luminescence as a function of absorbed dose.
**g-value is the anomalous fading rate expressed as % per decade, where a decade is a power of 10.

OSL was measured on five or six aliquots per sample. The scatter among aliquots was not high, only 15 percent over-dispersion for UW1943 and UW1944, and less than 5 percent for the other two samples. The OSL signal was generally strong, at least 10 times the intensity of the IRSL signal (as measured in the ultraviolet). The IRSL signal was not even measurable on UW1943. Weak IRSL relative to OSL is typical for ceramics, and because IRSL mainly stems from feldspars, which commonly fade, this probably means that the OSL signal in these samples does not suffer appreciably from anomalous fading. Equivalent dose values are given in Table 5, along with b-values, which is a measure of the lower efficiency of alpha irradiation in producing luminescence. The equivalent dose values differ among TL, IRSL and OSL, which is not surprising given that the b-values, the values of which are fairly typical, also differ. The meaningful comparison is among ages.

Table 5. Equivalence dose values.

Sample	*Equivalent dose (Gy)*			*b-value (Gy μm²)*		
	TL	*IRSL*	*OSL*	*TL*	*IRSL*	*OSL*
UW1943	3.56±0.20	None	6.18±0.44	2.50±0.23		0.82±0.04
UW1944	2.06±0.08	2.59±0.57	1.59±0.11	2.94±0.25	1.11±0.11	0.80±0.03
UW1945	2.51±0.22	2.47±0.20	1.60±0.04	1.98±0.15	1.23±0.11	0.49±0.01
UW1946	1.76±0.10*	2.57±0.40	1.45±0.02	1.39±0.08	1.30±0.09	0.41±0.01

Table 6 gives the ages calculated separately for TL, IRSL, and OSL for each of the Tuinier Farm sherd samples. For samples with evidence of fading of the TL signal, the correction procedure of Huntley and Lamothe (2002) was applied. No fading tests were done for either IRSL or OSL (because of exorbitant amount of machine time required), so no correction can be applied to them. The IRSL signal mainly comes from feldspars, which often fade, so the IRSL ages must be considered a minimum. The weak IRSL, and therefore feldspar signal suggests that the OSL signal probably comes mainly from quartz and does not fade, as mentioned earlier.

Table 6. TL, IRSL, and OSL age calculations for Tuinier Farm sherds.

Sample	*TL age (ka)*	*IRSL age (ka)*	*OSL age (ka)*
UW1943	0.69±0.06		1.64±0.14
UW1944	0.50±0.04	0.89±0.21	0.59±.05
UW1945	0.92±0.14*	0.71±0.07	0.57±0.03
UW1946	0.52±0.04	0.78±0.13	0.53±0.03

* Corrected for fading using Huntley-Lamothe (2002) method. Other TL ages reflect either no measured fading or a correction that was not significantly different from the uncorrected age.

Table 6 shows that the OSL age is younger than or equivalent in value to the TL ages in three of the sherds, but well older than the TL age for UW1943. The younger OSL age for UW1945 is unusual, but a possible reason is the low original firing temperature of the pottery. It is well known, at least in the case of light exposure, that the traps associated with TL and IRSL do not empty as rapidly as they do for OSL. It is possible the original firing of the pottery was not sufficient to deplete the TL and IRSL signals to the same extent as the OSL signal. In other words, the TL and IRSL still contain a residual signal from the raw material. OSL is also known to contain slower bleaching components, so it is possible that a residual is present even with the OSL. Nevertheless, the OSL is assumed to provide the best estimate of age for UW1944 and UW1945 (Table 7). For UW1946, the OSL and TL ages are in agreement, so a weighted average is taken. For UW1943, the OSL age is much greater than the TL age. The OSL age seemed unreasonably old, so the TL was taken as the best estimate.

Table 7. Final ages for Tuinier Farm sherds, based on TL and OSL.

Sample	*Age (ka)*	*% error*	*Calendar age (years AD)*	*Basis for age**
UW1943	0.69±0.06	8.3	1320 ± 60	TL
UW1944	0.59±0.05	8.6	1420 ± 50	OSL
UW1945	0.57±0.03	5.1	1440 ± 30	OSL
UW1946	0.52±0.03	4.8	1480 ± 30	OSL/TL

The ages for the sherd samples from the Tuinier Farm sites are all older than expectations, as they range from A.D. 1260-1510 at 1 standard deviation. Taking out the significantly older UW1943 sherd, the weighted age of UW1944, UW1945, and UW1946 is AD 1460 ± 20, about 100 years older at 2 standard deviations than the estimates obtained from ceramic stylistic analysis and the period of overlap from two radiocarbon dates (see Table 1).

The UW1946 sample from the Tuinier Farm site, considering the error term, could be post-A.D. 1500 in age (see Table 7). It is significant that the UW1946 sample is the only one where the OSL and TL ages agree. This lends support to the hypothesis that insufficient heating may be causing the age overestimation for the other samples. These ceramics were part of a larger lot submitted for analysis (Feathers 2010), most of which seemed to have age overestimations. A number of these ceramics were reported as "soft" by the students preparing them for measurement, which suggests low firing. These can be compared to another batch of Caddo ceramics processed from the Lang Pasture site (41AN38). These also had poor plateaus indicative of low heating, but the OSL and TL agreed for most of them and the ages were not known to be overestimates, see Feathers 2008; Perttula 2008).

Conclusions

The luminescence dating of four Late Caddo period sherds from the Tuiner Farm site (41HP237) is a recent attempt to better establish the chronological age of Caddo ceramics—and the components they are associated with—on East Texas Caddo sites. Radiocarbon dating and Oxidizable Carbon ratio dating methods have been employed on a wide range of Caddo sites (see Perttula 1997), but not always with satisfactory results, and often with contradictory results when assessed relative to archaeological estimates of when a site is occupied. Luminescence dating of ceramic sherds may be more useful in attempts to build and strengthen regional Caddo chronologies in East Texas. This is simply because the dating result obtained from luminescence dating is specific to the manufacture and use of a ceramic vessel or a umber of ceramic vessels since it measures the time that has elapsed since a ceramic vessel was last heated, and in archaeological terms that time usually corresponds to when that vessel was manufactured or used, and not necessarily to when that vessel was broken and discarded or entered the archaeological record (see Lipo et al. 2005; Feathers 2009).

In the case of the luminescence dates from the Tuinier Farm sherds (excluding UW1943), their weighted age is A.D. 1460 ± 20, or the ages range from A.D. 1420-1500 at two standard deviations. This weighted age for the luminescence dates is in complete concordance with one of the calibrated radiocarbon dates from the site, which has a AD 1460 intercept and a AD 1440-1490 age range at 1 sigma (see Table 1). Furthermore, the principal Ripley Engraved motifs identified in the Tuinier Farm fine ware sherds (see Perttula 2009:Table 5), are known to occur in seriated burial lot contexts dating at its broadest from ca. A.D. 1430-1600 (see Perttula 1992:Table A-2), also confirming the accuracy of the luminescence dating findings.

The second radiocarbon date from the Tuinier Farm site, cal AD 1520-1670 at 2 sigma with a AD 1650 intercept, as well as the occurrence of post-A.D. 1550 ceramic types and motifs (including Ripley Engraved, pendant triangle motif; Womack Engraved; Taylor Engraved; and Hodges Engraved, see Perttula 2009:Table 5), would seem to indicate that there is a second and younger Titus phase occupation at the site. No luminescence dates have been obtained on sherds from any of the afore-mentioned post-A.D. 1550 fine ware sherds to provide further confirmation of the age of this component.

We think it is important that Caddo archaeologists continue to explore different methods of dating components and the material culture remains that characterize them. Luminescence dating is a credible chronological dating method that rightly deserves further consideration in the dating of the very abundant ceramic artifacts from Caddo sites in East Texas, as well as in southeast Oklahoma, southwest Arkansas, and northwest Louisiana.

References Cited

Dykeman, D. D., R. H. Towner, and J. K. Feathers
2002 Correspondence in Tree-Ring Dating and Thermoluminescence Dating: A Protohistoric Navajo Pilot Study. *American Antiquity* 67(1):145-164.

References Cited (cont.)

Feathers, J. K.

1997 The Application of Luminescence Dating in American Archaeology. *Journal of Archaeological Method and Theory* 4:1-66.

2000 Why Luminescence Dating Deserves Wider Application in American Archaeology. In *It's About Time*, edited by S. Nash, pp. 168-185. University of Utah Press, Salt Lake City.

2003 Use of Luminescence Dating in Archaeology. *Measurement Science and Technology* 14:1493-1509.

2008 Luminescence Dating of Ceramics from an Archaeological Site in East Texas. Luminescence Dating Laboratory, University of Washington, Seattle.

2009 Problems of ceramic chronology in the Southeast: Does shell-tempered pottery appear earlier than we think? *American Antiquity* 74:113-142.

2010 Luminescence Analysis of Ceramics from Four Caddoan Sites in East Texas. Luminescence Dating Laboratory, University of Washington, Seattle.

Huntley, D. J. and M. Lamothe

2002 Ubiquity of anomalous fading in K-feldspars, and measurement and correction for it in optical dating. *Canadian Journal of Earth Sciences* 38:1093-1106.

Lipo, C. P., J. K. Feathers, and R. C. Dunnell

2005 Temporal Data Requirements, Luminescence Dates, and the Resolution of Chronological Structure of Late Prehistoric Deposits in the Central Mississippi Valley. *American Antiquity* 70(3):527-544.

Perttula, T. K.

1992 *"The Caddo Nation": Archaeological & Ethnohistoric Perspectives*. University of Texas Press, Austin.

1997 A Compendium of Radiocarbon and Oxidizable Carbon Ratio Dates from Archaeological Sites in East Texas, with a Discussion of the Age and Dating of Select Components and Phases. *Radiocarbon* 39(3):305-341.

2008 The Ceramic Artifacts from the Lang Pasture Site (41AN38) and the Place of the Site within an Upper Neches River Basin Caddo Ceramic Tradition. MS on file with the author and Coastal Environments, Inc., Austin.

Perttula, T. K., with contributions by E. Dowd, L. Green, G. Morgan, B. Nelson, L. Schniebs, B. Schriever, J. Todd, and M. Walters

2009 The Archaeology of the 16th and 17th Century Caddo in the Post Oak Savannah of Northeast Texas: The Tuinier Farm (41HP237), R. A. Watkins (41HP238), and Anglin (41HP240) Sites in the Stouts Creek Basin, Hopkins County, Texas. *Journal of Northeast Texas Archaeology* 30:1-132.

Perttula, T. K. (editor)

2005 *Archeological Investigations at the Pilgrim's Pride Site (41CP304), a Titus Phase Community in the Big Cypress Creek Basin, Camp County, Texas*. 2 Vols. Report of Investigations No. 30. Archeological & Environmental Consultants, LLC, Austin.

Reimer, P. J., M. G. L. Baillie, E. Bard, A. Bayliss, J. W. Beck, C. J. H. Bartrand, P. G. Blackwell, C. E. Buck, G. S. Burr, K. B. Cutler, P. E. Damon, R. L. Edwards, R. G. Fairbanks, M. Friedrich, T. P. Guilderson, A. G. Hogg, K. A. Hughen, B. Kromer, G. McCormac, S. Manning, C. B. Ramsey, R. W. Reimer, S. Remmele, J. R. Southon, M. Stuiver, S. Talamo, F. W. Taylor, J. van der Plicht, and C. E. Weyhenmeyer

2004 IntCal04 Terrestrial Radiocarbon Age Calibration, 0-26 Cal Kyr BP. *Radiocarbon* 46(3):1029-1058.

An Earspool from near Ada, Pontotoc County, Oklahoma??

Robert L. Brooks

Introduction

Earspools are generally acknowledged as status markers for ranking elites in Caddoan populations occupying the Arkansas River basin as well as the Caddo homelands in the Red River basin. In the Arkansas River basin, Baerreis (1957) and more recently Brown (1996) have discussed the attributes of earspools found at Spiro. There is also documentation for earspools found at other Arkansas River basin sites such as Harlan (Bell 1972) and Huffaker (Baerreis 1954). Earspools at sites reported for the Red River basin include Gahagan (Webb and Dobb 1939) and George C. Davis (Shafer 1973) among others. However, the appearance of earspools at sites outside of the core areas is not well documented. Two exceptions from central Oklahoma are Bell's 1981 discussion of an earspool from the Allcorn site (34ML1) in McClain County and Schaeffer's (1957) description of earspools from the Nagle site in Oklahoma County. This paper reports an earspool from near Ada in Pontotoc County, Oklahoma, examines earlier data pertaining to the presence of Caddoan populations in this area of east-central Oklahoma, and discusses the implications for isolated reports of earspools outside the core culture areas.

The Ada Earspool

The Ada earspool was found along Springbrook Creek, some six miles northwest of Ada (Figure 1). A landowner originally found the earspool on the Arrowhead Ranch in the 1970s. Following the death of this individual, the earspool was given to an avocational archaeologist from the Oklahoma City area who made it available for study. The Ada earspool is a fragment of a pulley-type with the core perforation area present but most of the inner and outer flange missing (Figure 2). Considering that the general area where the earspool was found has been under cultivation for generations, it may have been broken by plowing activities in the past. Or, perhaps it was broken during its uselife. The incomplete nature of the earspool makes detailed analysis impractical. However, some general observations are possible. Like many of the earspools found within the Arkansas River basin and peripheral areas, it is made of fine grain sandstone. In fact, many of these earspools appear to be so similar in material that they may come from a common source. The Ada earspool retains green staining indicative of copper mineral salts even after being exposed on the surface for an unknown number of years. As noted above, the earspool is a pulley design with a central perforation. Decoration on the earspool appears to represent the cross pattern although the absence of the outer flange limits knowing whether the edge had some sort of decoration. Baerreis (1957) and Brown (1996) have documented a progressive development in earspools through time. Earlier earspool forms are unperforated and undecorated. Later versions are perforated but undecorated with the final version including perforations as well as decoration. Based on this progression, the Ada earspool represents the latest version. Bell (1981) described a similar earspool from the Allcorn site (34ML1) north of Purcell, Oklahoma and suggested that it would date to around A.D. 1200. The earspool found near Ada also appears similar to ones from the Nagle site (34OK4), an Arkansas River basin Caddoan cemetery northeast of Oklahoma City that dates to circa A.D. 1200 (Shaeffer 1957).

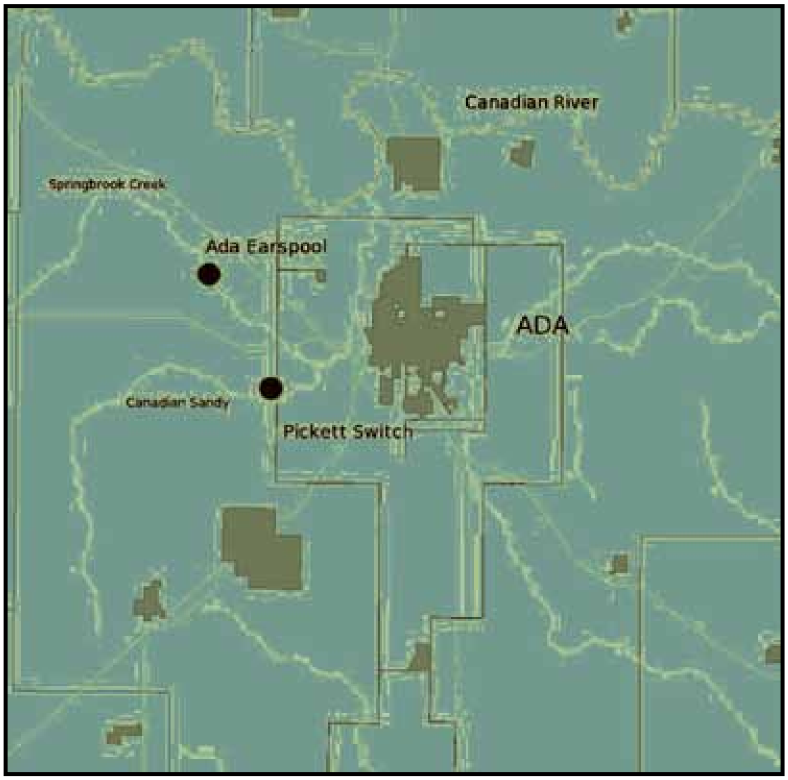

Figure 1. Map of Ada vicinity showing relative location of earspool and Pickett Switch site.

Figure 2. Earspool fragment from Arrowhead Ranch near Ada, Oklahoma.

Evidence of Caddoan Occupation in East-Central Oklahoma

There is some evidence for the presence of mound building Caddoan people in east-central Oklahoma. The evidence is intriguing and also contentious. H. R. Antle, a math teacher from nearby Sulphur, Oklahoma investigated a number of sites in the Ada vicinity in the 1930s (Albert 1984). Mr. Antle had no professional training as an archaeologist and his study of these sites was more unsystematic digging than measured excavation. To his credit, he made efforts to document his findings and also report on his work. The principal site bearing on possible Caddoan occupation of the area is Pickett Switch (34PN1). Pickett Switch is located at the juncture of an intermittent stream and Canadian Sandy Creek (Figure 1). Antle (1934) initially dug at the Pickett Switch site in 1930 with assistance from the Boy Scouts. However, after reading of Joseph Thoburn's investigations, he halted work until he could learn more of proper archaeological procedures (although Thoburn was not necessarily the best teacher). He returned to work on Pickett Switch in 1933 and continued his studies of this site and others in Pontotoc County into the early 1940s. Antle reported a number of mounds at the site that he thought represented earth lodges. His work in 1930 and in 1933 revealed what he described as grass structures, some of which had been burned and contained the remains of adults and children. He assumed that the remains represented victims of a raid by another prehistoric group. There did not appear to be funerary offerings with the individuals and Antle characterized the ceramics as unsophisticated bowls and gourd shaped vessels. However, a photo of artifacts retrieved from one or more of these structures clearly illustrate a Caddoan water bottle that appears highly polished. He makes no mention of color treatment so it is assumed that these are not red-slipped. The water bottle may be Spiro Engraved or a similar style. Bowls are not characteristic of Plains Village ceramics assemblages and it is difficult to envision what ceramic type these may have represented.

O. C. Walz and Kenneth Campbell of East-Central University (Ada) subsequently worked at the Pickett Switch site during a period extending from November 1956 through January 1957 (Shaeffer 1956a, Shaeffer 1956b). Dr. Bell, Oren Evan, William Lipe, and McKay Gibson (as well as James Shaeffer) visited the East-Central University investigations twice during this period. Based on their field observations, there were clearly structures of circular construction with evidence of two center posts and possibly grass walls. The structures uncovered by the East-Central University researchers (Campbell was the Curator of the Museum) also were burned and contained human remains. Although currently the Pickett Switch site is assumed to represent a Plains Village occupation, Shaeffer (1956a: 5) in viewing the ceramics from the site stated that they were unlike those of the Washita River focus.

Antle also dug at another village site (which has not been rediscovered) some five miles east of Pickett Switch on Little Sandy Creek (Antle 1935). Features at this site had been exposed by sand quarrying operations leaving large areas of graded surfaces for Antle to explore. He identified a number of bell shaped refuse (cache) pits some three feet in diameter and three to four feet deep in this village area that extends some distance along the terrace above the creek. These cache pits were described as containing ash, burned soil and wood, and an abundance of animal bone although only deer and box turtle were specifically mentioned. Antle also described a structure that he characterized as a grass earth lodge some 40-50 feet in diameter. Ceramics found in the cache pits and amidst the debris from the structure are cord-impressed. The relationship between this site and Pickett Switch is unclear.

Antle provided a few other hints of Caddoan occupation from the Ada vicinity. In an article for *American Antiquity*, he describes an incised piece of copper that was found in association with shell-tempered pottery at a rockshelter in southern Pontotoc County (Antle 1942: 402). Antle, in his 1935 report on the site adjacent to Little Sandy Creek also mentions another location with a mound three feet high and 60 feet in diameter. The location of this mound is unknown and we also do not know whether Antle ever explored its contents.

Clearly, these reports suggest a Caddoan occupation of the Ada area that extends beyond the earspool fragment found on Springbrook Creek. Considering that the Canadian River drainage is only about five miles north of Ada, it is certainly plausible that Arkansas River basin Caddoans could have traveled upstream to this area—with the knowledge that they traveled further west to the Purcell area by around A.D. 1200 (Brooks 2010).

The Social Implications of Earspools

Earspools served as status markers beginning in the Woodland period and continuing into Mississippian times. They are prominently portrayed in the engraved shell iconography from Spiro (Phillips and Brown 1989). While it can be demonstrated that earspools were a widespread item of status distinction and that both sexes wore them (Shafer 1973), there are aspects of earspools that remain poorly understood. For example, do they connote specific rank that falls outside of lineage society or are they restricted to certain lineage groups? Do you have to obtain a certain age before earspools can be worn? Are they worn all the time or only during certain ceremonial events? These questions remain to be explored. But, it also appears that earspools, being indicators of status, were not items that were transferable. By this, I mean that Caddoans would not give earspools to non-Caddoans or to Caddoans of lesser status. An examination of funerary offerings at Plains Village cemeteries in south-central and west-central Oklahoma found no evidence of earspools. We can assume that finding earspools at a site in the region indicates the presence of Caddoan elites. The earspool from the Springbrook Creek area points to a Caddoan group's presence. [It is doubtful that they (the elites) would travel alone to east-central Oklahoma.] This may be further substantiated by reexamination of Antle's work at the Pickett Switch site. Certainly, sites in the Ada area merit further study, as do collections at East-Central University from Antle's and Walz and Campbell's excavations.

References Cited

Albert, Lois E.
1984 Survey of Archaeological Activity in Oklahoma. In *Prehistory of Oklahoma,* edited by Robert E. Bell, pp. 45-64, Academic Press, Orlando.

Antle, H. R.
1934 Excavation of a Caddoan Earth Lodge. *Chronicles of Oklahoma* 12(4): 443-446.
1935 Report of an Archaeological Site. *Chronicles of Oklahoma* 13(2):191-196.
1942 A Southern Oklahoma Copper Ornament. *American Antiquity* 7:402.

Baerreis, David A.
1954 The Huffaker Site. *Bulletin of the Oklahoma Anthropological Society* 2: 35-48.
1957 The Southern Cult and the Spiro Ceremonial Complex. *Bulletin of the Oklahoma Anthropological Society* 5:23-38.

Bell, Robert E.
1972 *The Harlan Site, Ck-6, A Prehistoric Mound Center in Cherokee County, Eastern Oklahoma.* Oklahoma Anthropological Society Memoir 2.
1981 A Stone Earspool from the Allcorn Site, McClain County, Oklahoma. *Newsletter of the Oklahoma Anthropological Society* 29(5):10.

References Cited (cont.)

Brooks, Robert L.

2010 The Allcorn Site (34ML1) and the Nagle Site (34OK4), and Their Relationship to the Arkansas River Caddoan Area. Paper presented at the 52nd Annual Caddo Conference, Tyler, Texas.

Brown, James A.

1996 *The Spiro Ceremonial Complex: The Archaeology of Arkansas Valley Caddoan Culture in Eastern Oklahoma.* Memoirs of the Museum of Anthropology, University of Michigan, Ann Arbor.

Phillips, Phillip and James A. Brown

1978 *Pre-Columbian Shell Engravings from the Craig Mound at Spiro, Oklahoma.* Peabody Museum Press, Peabody Museum of Archaeology and Ethnology, Harvard University, Cambridge, Massachusetts.

Shaeffer, James A.

1956a News- East Central College Excavations. *Newsletter of the Oklahoma Anthropological Society* 5(5):5.

1956b East Central State College Dig. *Newsletter of the Oklahoma Anthropological Society* 5(7):4-5.

1957 The Nagle Site, Ok-4. *Bulletin of the Oklahoma Anthropological Society* 5:93-100.

Shafer, Harry

1973 *Lithic Technology at the George C. Davis Site, Cherokee County, Texas.* Ph.D. dissertation, Department of Anthropology, University of Texas, Austin.

Webb, Clarence and Monroe Dodd

1939 Further Excavations at the Gahagan Mound: Connections with a Florida Culture. *Bulletin of the Texas Archeological and Paleontological Society* 11:90-128.

52nd Caddo Conference and 17th East Texas Archeological Conference, March 2010

Timothy K. Perttula, Mark Walters, Thomas H. Guderjan, and Patti Haskens

The 52nd Caddo Conference and the 17th East Texas Archeological Conference was held March 18-20, 2010, at the Ornelas Activity Center at The University of Texas at Tyler (see attached Abstracts to papers given at the conference). The conference was sponsored by The University of Texas at Tyler, the Friends of Northeast Texas Archaeology, Texas Parks and Wildlife, Humanities Texas, Archeological & Environmental Consultants, LLC, Stephen F. Austin State University Archaeology Program, the Maya Research Program, the East Texas Archaeological Society, the Texas Archeological Society, and Native Historic Preservation Associates, LLC.

By all measures, it was a very successful conference. We had over 208 registrants, a full and interesting program, with 27 papers being presented on a multitude of topics concerning Woodland period archeology, prehistoric Caddo archeology, and events in Historic Caddo times. Conference participants were also involved in a discussion (moderated by Bobby Gonzalez) concerning the Caddo Nation of Oklahoma's desire to establish a World Wide Web-based Caddo Research Portal.

Conference participants also discussed the establishment of a formal Caddo Conference organization, akin to the Southeastern Archaeological Conference and the Plains Anthropological Conference. The general consensus was that the Caddo Conference needs a formal organization to take care of the varying activities and tasks associated with the Caddo Conference that arise during the year. These include such things as the obligations and responsibilities of the annual meeting hosts; maintaining a database of attendees at past Conferences; perhaps developing a Caddo Conference website to pass on news and information about Caddo Conference doings; maintaining and building on our financial resources for the continued use of the Caddo Conference; as well as helping to coordinating the future business of the Caddo Conference with that of the *Caddo Archeology Journal*, especially the boosting of subscriptions to the journal. It was also mentioned, and agreed upon, that there should be a Student's group associated with the Conference. Plans are now afoot to formalize the Caddo Conference, and we look forward to your participation. Stay tuned for news as plans develop; if you would like to be involved in the discussions to formalize the Caddo Conference, please contact Timothy K Perttula (tkp4747@aol.com).

In addition to these different parts of the Conference, we were able to host a very successful silent auction, with many intriguing offerings from many generous donors, and consequently we raised more than $2300 for use in future Caddo Conferences and East Texas Archeological Conferences. Wonderful refreshments were plentiful (thanks in part to the volunteers and docents from the Gregg County Historical Museum)! The Thursday night social also went very well.

Finally, in recent years, an important part of each Caddo Conference are the dances provided by members of the Caddo Nation of Oklahoma. This year, thanks to the help of Phil Cross, enrolled Caddo member and Caddo Culture Club member, the Caddo Culture Club and the Shuwititi drum group performed in front of a large audience both Friday and Saturday afternoon at the Ornelas Activity Center.

We look forward to the 2011 Caddo Conference (the 53rd) in Fort Smith, Arkansas!

Figure 1. The Thursday night social.

Figure 2. The audience at the Conference.

Figure 3. Bobby Gonzalez moderating the Research Portal discussion.

Figure 4. Caddo dancing at the Ornelas Activity Center.

Figure 5. Shuwititi Drum Group at the Conference.

ABSTRACTS OF PRESENTED PAPERS

The Allcorn Site (34ML1) and the Nagle Site (34OK4), and their Relationships to the Arkansas River Caddoan Area,

Robert L. Brooks, Oklahoma Archeological Survey, University of Oklahoma

The Allcorn (34ML1) and Nagle (34OK4) sites represent the presence of Arkansas River Basin Caddoans in central Oklahoma. This paper reviews existing data for the Nagle site and presents previously unpublished data for the Allcorn site. The analysis of information on the Allcorn and Nagle sites is reviewed in respect to their position on the western periphery of the Southern Plains cultural area and speculations are made concerning the role of these sites in Arkansas River Basin Caddoan/Southern Plains interaction.

Intertribal Warfare between the Trans-Mississippi South and the Southern Plains,

Barbara A. Burnett, University of Arkansas, Arkansas Archeological Survey

The dismembered remains of 353 human beings were excavated at Crenshaw (3MI6), an important Fourche Maline/Caddo site in the Great Bend region of the Red River in Arkansas. The mortuary feature contained 116 skulls, many with articulated mandibles and cervical vertebrae. The skulls were found in 27 small clusters of up to 10 individuals. Another 237 disarticulated mandibles were uncovered in three large pits. Three lines of evidence are used to test the ethnicity of these people: (1) Strontium isotope assay (n=60) establishes they were not residents of Crenshaw; rather, the isotope signatures suggest their geographic origins are found within the Southern Plains; (2) a comparison of distinctive dental dietary markers to Southern Plains subsistence practices also supports the idea that these individuals may have been Plains Indians; and (3) a pattern of skeletal defects demonstrates that they likely died through violence, closely followed by beheading and/or mandibular dismemberment. The large number of individuals represented in the many clusters suggests this behavior was not inconsequential. Decapitated bodies, mandibular dismemberment, embedded projectile points, cranial trauma, and scalping are reported in Plains Woodland/Plains Village sites of Texas and Oklahoma. Crenshaw's unique mortuary feature may offer the first tangible evidence that prehistoric warfare existed between the ancestral Fourche Maline/Caddo peoples of the Trans-Mississippi South and the prehistoric Indians of the Southern Plains.

Immigrant and Resident Indian Tribes Settlements in or near Caddo Territory in the 18th and 19th Centuries,
Phil Cross, Caddo enrolled member and a member of the Caddo Culture Club

Many Indian tribes moved into Caddo people's territory in the 18th and 19th centuries. Comments will be made on the location, number, movement, and significant interactions between Caddos and those tribes as well as with other resident Indian tribes near the Caddo territory up to the Civil War.

New Research in Southeastern Oklahoma: Archaeology of the Mountain Fork,
Elsbeth Dowd, Department of Anthropology, University of Oklahoma

Much of our knowledge about Caddo archaeological sites along the Mountain Fork comes from surveys and excavations conducted during the Oklahoma River Basin Survey prior to the construction of the Broken Bow Reservoir. This summer, new excavations will take place at Ramos Creek, the recently discovered northernmost (known) site in this drainage. This paper will review the existing state of knowledge for Caddo archaeology in this region, including new dates for both Ramos Creek and the Woods Mound Group. Goals for the forthcoming research include acquiring more radiocarbon dates from new and existing collections and conducting detailed stylistic analyses of the pottery throughout the drainage to investigate sociopolitical dynamics.

Chronology of a Caddo Ceremonial-Residential Complex, the Pine Tree Mound Site, in the Middle Sabine River Basin, Texas, A.D. 1300–1800,
Ross C. Fields, Prewitt and Associates, Inc.

The Pine Tree Mound site in the middle Sabine River valley of Northeast Texas is a Caddo ceremonial and residential complex that was occupied beginning in the A.D. 1300s and continuing perhaps through the A.D. 1700s. Test excavations across the entire site in 2004 and data recovery excavations in several residential areas in 2006–2007 resulted in 105 radiocarbon dates from a variety of contexts. This paper uses the dates to look at the history and evolution of the complex.

Caddo Bowls, Bottles, Social Identity and the Mississippian Cosmos,
Eloise Frances Gadus, Prewitt and Associates, Inc.

A rich iconography reflecting a deeply rooted belief system was an integral part of the Mississippian florescence seen at such grand early sites as Spiro. This study demonstrates correspondences between Mississippian iconography and Ripley Engraved vessel motifs from the Pine Tree Mound site (41HS15), a Caddo habitation and ceremonial complex located in the Sabine River drainage of Northeast Texas. These correspondences suggest that the essential belief system and by extension symbolic system of Caddo societies in Northeast Texas are linked with the early Mississippian florescence through a common worldview. Recognition of these iconic motifs on vessels and their placement in burial context provide a means to address questions of social identity within Caddo groups.

Excavations at the Copperhead Site (3CW951) in Crawford County, Arkansas,

J. Eric Gilliland, Burns & McDonnell

During 2003, 2004, and 2005 archaeologists from Burns & McDonnell Engineering Company conducted extensive excavations at the Copperhead site (3CW951) located near the town of Mountainburg in Crawford County, Arkansas. The Copperhead site was a large, open air occupation site located on a rise in the floodplain of Frog Bayou. Excavations at the site revealed extensive occupations at the site dating to the Middle Woodland, Late Woodland, and Mississippian periods. The site appears to have been multi-functional and contained numerous cultural features, including a possible structure, distinct activity areas, and one human burial.

Investigations Near Mound 2, Mounds Plantation Site, Caddo Parish, Louisiana,

Jeffrey S. Girard, Northwestern State University of Louisiana

Test units excavated during 2008 and 2009 adjacent to Mound 2 at the Mounds Plantation site (16CD12) revealed two burned features containing charcoal radiocarbon-dated to the 11th century A.D. Most of the recovered ceramics are undecorated or decorated only with simple horizontal incised lines. The investigated context near Mound 2 likely relates to a habitation area that pre-dates construction of the mound/plaza complex.

Architecture and Mound Stratigraphy at Two Caddo Sites in Northeastern Oklahoma,

Scott W. Hammerstedt, Oklahoma Archeological Survey and University of Oklahoma and Sheila Bobalik Savage, Oklahoma Archeological Survey and University of Oklahoma

The Reed and School Land sites were excavated in the late 1930s by Works Progress Administration crews under the direction of David A. Baerreis. One platform mound and several clusters of superimposed structure patterns were identified at Reed. School Land was a habitation site with multiple structure areas. In this presentation, we examine the stratigraphy of the platform mound and the architecture from three different areas at Reed. This architectural information is compared with that observed for the School Land site and general patterns are discussed.

Sharing Caddo Culture: A Heritage Education Activity at the USFWS Natchitoches National Fish Hatchery,

Randall Hart, Northwestern State University of Louisiana

The goal of this project is to share the Caddo culture. To obtain this goal, activities for children in grades K-5 have been researched and created. For each grade, there are six stations and each station has the appropriate Grade Level Expectations (GLEs). Some station examples are: Perfecting Pinch Pots, Learning with Raven, and Caddo Music and Dance. Each of these stations provided the children with a memorable event. Evaluation measures are in place to determine the information gained by the children. A coloring/workbook has been created for the fifth graders, and there are mechanisms in place to create the same for K-4. Also, a dry run of the event was put into action using fifth graders from Natchitoches Magnet School.

Fourche Maline: Problems with Terminology and a Proposed Solution,

Luther J. Leith, Department of Anthropology, University of Oklahoma

The term Fourche Maline has been used to label so many things (a creek, a site type, and even a cultural assemblage) that without a frame of reference the term is meaningless. A broader, encompassing term needs to replace the use of “Fourche Maline” when referring to the culture occupying the four corners area of Oklahoma, Arkansas, Texas, and Louisiana commonly referred to as the Caddoan heartland. The term Formative Caddoan is proposed for describing ancestral groups preceding the Caddoan culture, with Fourche Maline used only to describe the Woodland period.

Characterization and INAA Analysis of Ceramic Assemblages from Three Caddo Sites at Barksdale Air Force Base, Louisiana,

Christopher Lintz, Texas Parks and Wildlife Department, Wildlife Division, Timothy K. Perttula, Archeological & Environmental Consultants, LLC, Jeffrey Ferguson, Missouri University Research Reactor, and Michael D. Glascock, Missouri University Research Reactor

Test excavations conducted by Geo-Marine Inc. at 16BO450, 16BO458, and 16BO473 on Barksdale Air Force Base, recovered 905 Caddo pottery sherds. The project area is just southeast of the confluence of the Red River and Big Cypress Creek in Bossier Parish, Louisiana. A series of 50 x 50 cm test units recovered, 218, 37 and 650 sherds per site, respectively. Sites 16BO450 and 16BO473 are dominated by Early Caddo (A.D. 800-1200) remains, whereas 16BO458 contained predominately Late Caddo (A.D. 1500-1700) artifacts. Only some 118 sherds (12.4% of the sample) were decorated, but most sherds were too small to confidently assign to named types. Eighteen sherds were submitted for Instrumental Neutron Activation Analysis (INAA). Initial INAA results suggest that most (n=16) were chemically related to the Titus Group and the others (n=2) were from the Red River Group. Recent reexamination of the INAA database in Texas has replaced these chemical groups with 11 or more sub-regional groups with distinctive compositional characteristics. We discuss these three sites and the current evaluation of the INAA results.

Travel Times Between Mounds Among the Red River Caddo,

Patrick Livingood, Department of Anthropology, University of Oklahoma

This paper will present a study of travel times between mound sites of the Red River Caddo. The travel times have been produced using a simulation of travel using Geographic Information System data of topography and waterways. As others have pointed out, the distribution of mounds among the Caddo is somewhat unusual, with some pairs of mounds being located much closer than would be expected among contemporaries in the other parts of the Southeast or among similar societies around the world. This paper will share the data from the analysis and provide a comparison to other cases.

A Survey of Cultural Succession: Fourche Maline and Caddo Landscapes in South Arkansas,

Jami J. Lockhart, Arkansas Archeological Survey

This study examines archeological site distributions within Arkansas' West Gulf Coastal Plain as they relate to the prehistoric homeland of the Caddo and their cultural antecedents. General settlement patterns representative of the Woodland (650 B.C. to A.D. 900) and Mississippi (A.D. 900 to 1541) time periods are compared and contrasted toward a better understanding of Fourche Maline and succeeding Caddo cultural areas. This research draws upon a statewide archeological database and geographic information system (GIS) to model environmental similarity and to survey cross-cultural site distributions and landscapes through time.

Using a Geographic Information System (GIS): An Analysis of Foster Trailed-Incised Vessel Distribution within the Caddo Archaeological Area,

Duncan P. McKinnon, Department of Anthropology, University of Arkansas

The use of a Geographic Information System (GIS) allows for dynamic visualizations in the analysis of spatial distributions and the modeling of data clusters and outliers. An on-going analysis of Foster Trailed-Incised vessels within the Caddo Archaeological Area seeks to construct a distributional framework that can be applied and compared to additional Caddo ceramic types and site location attributes using a GIS database. Preliminary results show high frequencies of Foster Trailed-Incised vessels along the Ouachita and Red River drainages. Foster Trailed-Incised vessels are also distributed along the Saline, Arkansas, and Little Missouri rivers in Arkansas. Varieties of Foster Trailed-Incised have been identified in Ouachita and Morehouse parishes in Northeast Louisiana and at Caddo sites in Northeast Texas. While a full analysis of the distribution of Foster Trailed-Incised vessels is far from complete, initial thoughts are presented in this paper.

The Story of a Lost Site,

Tom Middlebrook. Texas Archeological Stewardship Network and East Texas Archeological Society

In the summer of 1933, A. L. Self sent a letter to the President of "Texas University" asking for help with Indian artifacts found west of Douglass, Texas. A. T. Jackson, a major figure in Texas archeology at the time, responded to the letter with the offer to keep the artifacts safe in the "fireproof" museum in Austin. The correspondence remained in a University of Texas file until found by the author at the Texas Archeological Research Laboratory in the early 1990s. The list of artifacts mentioned by Mr. Self became relevant when the East Texas Caddo Research Group began focusing on Historic Caddo sites in 2006. This paper discusses the interesting search in the Fall of 2009 for A. L. Self and the Caddo site he discovered.

The McDonald Site (34Mc11/12): A Caddo Hamlet in the Glover River Valley,

Amanda Regnier, Oklahoma Archeological Survey and Elsbeth Dowd, Department of Anthropology, University of Oklahoma

In 1942, David Baerreis directed WPA excavations at the McDonald site (34Mc11/12), a Caddo hamlet and cemetery located along the Glover River in McCurtain County, Oklahoma. Excavations at the site, which is located less than 5 km upstream from the Clement (34Mc8) site, uncovered a round structure, a midden area, and a cemetery. The whole vessels from the cemetery and the artifacts recovered from the occupation have now been analyzed. The results of the analysis, which indicate substantial Woodland and Late Caddo occupations at the site, will be discussed, as well as the relationship of the site to the political center at the Clement site.

Possible Scurvy in Subadults from a Fourche Maline site in Southeastern Oklahoma,

Simone Rowe, Department of Anthropology, University of Oklahoma, and Lesley Rankin-Hill, Department of Anthropology, University of Oklahoma

The Oklahoma Akers site is a black midden mound excavated by the Works Progress Administration (WPA) in 1941. The burials from the Akers site are currently undergoing paleopathological assessment with permission from The Caddo Nation and The Wichita and Affiliated Tribes. The WPA reported recovery of 203 individuals with 11 "children." Current analysis indicates approximately 222 individuals with 33 subadults. All age ranges, from neonatal through elderly, are represented, including two probable fetal-mother burials. Examination of subadult paleopathological lesions reveals an unusual pattern consisting of low rates of porotic hyperostosis, high rates of cribra orbitalia, and moderate rates of periosteal lesions. This suggests a nutritional stressor. A possible diagnosis of scurvy (Vitamin C deficiency) in subadults is supported by strong evidence for a diet that relied heavily on hickory nuts. A diet dominated by hickory nuts would have provided good amounts of carbohydrates, fat, and protein, but very little iron and almost no Vitamin C. It is proposed that a weanling diet that relied on hickory nut mush produced a transient Vitamin C deficiency in many subadults, resulting in the pattern of paleopathological lesions observed in the subadults from the Akers site. Research currently underway on adult paleopathology will hopefully further elucidate patterns of nutritional stress.

Archaeogeophysical Investigations of Early Caddo Settlement Patterning at the Crenshaw Site (3MI6),

John Samuelsen, Department of Anthropology, University of Arkansas

The Teran-Soule model provides a testable means to establish if the prehistoric settlement pattern of the Caddo in the Great Bend region of the Red River consists of vacant mound centers with associated dispersed farmsteads. To evaluate the model, an archaeogeophysical survey of the Crenshaw site (3MI6) mound center was conducted in off-mound areas to determine if structures were present there. The 3.2 hectare survey identified over 100 geometric anomalies, of which more than 50 are possibly structures associated with either Late Fourche Maline or Early Caddo occupations. Several possible structures were found in linear rows, including a 90 x 85 m diameter oval series of possible structures. Additional finds include large circular anomalies between 25 and 48 m in diameter, sometimes around possible structures, suggesting the presence of compound fences (as shown in the Teran map) or large structures.

Toward a New Perspective of Washington Square: Future Interpretation and Preservation of a Caddo Mound Site in East Texas,

Robert Z. Selden, Jr., Department of Social and Cultural Analysis, Stephen F. Austin State University

The Washington Square Mound site has been excavated from 1977 to 2009 and has produced a large quantity of artifacts, photographs, excavation records, analyses, and publications. This project compiles the existing data into a single geographic information system (GIS) through which future investigators may base interpretations, while providing for the preservation of documentation via digital representation. The GIS generates a single interactive interface supplying researchers with a digital version of the data for the site that is both easily employed, and simple to update. The goal is to produce a GIS that is cross-comparable to similar Caddo sites throughout Arkansas, Louisiana, Texas, and Oklahoma, allowing for a more objective and comprehensive analysis of these sites in the future.

Tracking the Freeman-Custis Expedition in Eastern Harrison and Panola Counties,

Jim Tiller, Sam Houston State University

In this presentation, I will examine a possible route taken by the Spanish as they tracked the Freeman-Custis expedition along the Red River during the summer of 1806. It is my contention that the route taken by Ramon and his troops from Nacogdoches extended north to Mt. Enterprise, then forked to the northeast following roughly present-day State Highway 315 to Carthage. Continuing northeast via U.S. 79 to near De Berry, the Spanish then turned north, passing through Old Elysian Fields and Strickland Springs to a point near the site of the (as yet to be archeologically established) Big Spring Indian village on the headwaters of Paw Paw Bayou. Here, the bulk of the military unit remained for several weeks before moving northwest where they skirted the recently established Sodo Lakes complex prior to meeting the American expedition at Spanish Bluff.

A Preliminary Classification of Elbow Clay Pipes from Northeast Texas,

Jesse Todd, MA Consulting

Short-stemmed clay pipes, referred to as elbow pipes, have been recovered from Caddo archaeological sites in Northeast Texas. A variety of types and numerous forms of elbow pipes were used and in this presentation, a general classification of elbow pipes is presented based upon the archaeological literature. Chronologic data is provided as well. The elbow pipes are divided into seven categories: keeled, angular, bi-conical, distal-knobbed, thong, flat-based, and eccentric for those that do not fit into a specific category. In some cases, pipes may exhibit two characteristics such as being angled and keeled, but the pipe is classified for its most unusual attribute. In this case, it would be the keel.

Dating Caddo Archeology in Southwest Arkansas,

Mary Beth Trubitt, Arkansas Archeological Survey, Jamie Brandon, Arkansas Archeological Survey, and Ann Early, Arkansas Archeological Survey

Following similar efforts for East Texas and Louisiana, we have compiled dates obtained from archeological excavations at Caddo sites in southwest Arkansas. This work forms the basis for comparisons between sites and regions and serves as a point of departure for future research. About 130 radiocarbon dates, 60 Oxidizable Carbon Ratio dates, 20 archeomagnetic dates, and 10 thermoluminescent dates have been reported in the literature on Caddo sites from this area. Here we highlight several patterns seen in this dataset, discuss examples of site dating using multiple techniques, and point to several instances of more robust site chronologies as well as where new dates are needed in the future.

The Archaeological Conservancy: A 2010 Update and an Appeal for New Projects,

Jim Walker, Southwest Regional Director, The Archaeological Conservancy

The Archaeological Conservancy has been working in the Caddo region since 1985 acquiring and preserving cultural resources on private land. We have established 10 archaeological preserves associated with the Caddo and Fourche Maline cultures. I will update the organization's activities and make an appeal to the audience for potential new preserves.

Phenomenological Interpretation and Caddo Archaeology,

Jerry Williams, Department of Social and Cultural Analysis, Stephen F. Austin State University and Robert Z. Selden Jr., Department of Social and Cultural Analysis, Stephen F. Austin State University

In this analysis we offer a few insights about how archaeological interpretations of Caddo social and cultural behavior data might be made in a manner that corresponds to how people experience the pre-theoretical world of everyday life (the life world). In this effort we draw upon the methodological writings of the Austrian born philosopher Alfred Schutz. Our major proposition is that Caddo archaeology is interested in explaining a temporally remote human culture based upon certain trace physical evidences of material culture, and that we must always be mindful that these artifacts are products of human consciousness. For example, ceramics, lithics, organic remains, etc. are physical phenomena, but their transformation into humanly useful things was accomplished by people who had distinct purposes and therefore bestowed these items with human meanings. If we are to better understand these evidences of human culture and consciousness we must therefore make an attempt to understand the parameters by which humans bestow meaning to their projects as expressed in material culture. Using examples from Caddo archaeology we examine four phenomenological concepts from Schutz's methodological writings: the epoche, intentionality, taken-for-grantedness, and the pre-theoretical nature of everyday life.

The southern Caddo diet in the Upper Neches River Basin,

Diane Wilson, A. M. Wilson Associates

The study discussed in this presentation tests the hypothesis that the Caddo from the upper Neches River basin had a diet with relatively little maize compared to other Caddo populations. Consumption of maize among the southern Caddo of Texas has been said to have varied with rainfall, being least in the regions with the most abundant natural resources. This study examined a minimum of 72 individuals from 15 Caddo sites in the upper Neches River basin of Texas for dental evidence of diet. Of these, 34 were tested for stable isotopes. The Caddo from the upper Neches River basin did not eat less maize or adopt it later than Caddo groups living in other regions. The results of this study indicate that dietary decisions about the consumption of maize were likely influenced by a complex set of circumstances that include cultural norms, population size and composition, and micro-environmental factors that include soils and weather. This study adds to a growing body of information that suggests that the adoption of maize was variable across the Caddo culture area and that intensification of maize agriculture did not occur until the Late Caddo period.

Fourche Maline and Oklahoma's Other Woodland Societies,

Don G. Wyckoff, Sam Noble Oklahoma Museum of Natural History, Department of Anthropology, University of Oklahoma

With the adoption of pottery and the bow and arrow between 1800 and 1500 years ago, the Fourche Maline phase became the underlying cultural tradition for Caddoan-related sequences in the Red River and Arkansas River basins of the Trans-Mississippi South. But at the same time, Woodland period societies occupied the west edge of the Ozarks and portions of the Osage Savannah to the north and west of the Ouachita Mountains homeland of Fourche Maline. Sites, dates, and material culture for these other Woodland period manifestations will be compiled and summarized, particularly with reference to the Fourche Maline cultural interval.

SESSION ABSTRACTS

The Adoption of Agriculture, Scurvy, Isotopes, and Warfare: Bioarcheological Insight and Innovation in the Trans-Mississippi South and Southern Plains

This session includes three diverse bioarcheological studies representing a series of Caddo and Fourche Maline sites across the Trans-Mississippi South. The researchers make use of traditional bioarcheological techniques, as well as stable carbon and strontium isotope analyses. The various studies reflect the broad and robust nature of bioarcheological inquiry. The investigations include: a regional examination of the Neches drainage that assesses diet and the adoption of agriculture; a site-specific analysis of diet and potential scurvy at the Akers site of Eastern Oklahoma; and inferences regarding possible warfare between the Trans-Mississippi South and the Southern Plains.

Development of a Caddo Research Portal,

moderated by Robert L. Cast, Cultural Preservation Department, Caddo Nation of Oklahoma

The Cultural Preservation Department Caddo Nation of Oklahoma is interested in developing an Internet-based Caddo research portal. It is envisioned to eventually be the single largest electronic information discovery portal devoted entirely to the Caddo. The electronic content of the research portal will contain current and continually updated information on the heritage of the Caddo, including archeological, historical, traditional, and archival data, as well as links that allow access to related websites with information on the Caddo. Essentially, the Caddo Nation envision the creation of a web-based cultural geography of the Caddo in Arkansas, Louisiana, Oklahoma, and Texas from prehistoric times to the modern day. To create a Caddo research portal is a monumental and long-term task, and one that will require the help and partnership of many people, as well as funds for development, compilation of content, uploading of electronic information, and continued maintenance of the portal. The Caddo Nation is currently soliciting help in framing the structure of the research portal, and the development of partnerships, and this discussion session at the Caddo Conference is a step in both directions.

POSTER

Evaluating 18th Century Maps of Presidio Los Adaes using Geophysical Data

Michael Hargrave, Eileen Ernenwein, Jami Lockhart, Pete Gregory, and George Avery

Caddo Culture Club Activities

Phil Cross and Michael Meeks

Activities of the Club in the recent past include featured performances in the Region and many appearances in support of local educational or charitable efforts. The Club has initiated discussions with various colleges for Caddo students for projects in summer institute settings with the goal of helping Caddo youth linking their culture with paths in education. Recently, the club has created a web site **www.caddocultureclub.com** and a page on Facebook.

Figure 1. Caddo Culture Club at Caddo Lake National Wildlife Refuge, Jefferson, TX, September 26, 2009.

Figure 2. Caddo Culture Club at Caddo Mounds State Historic Site, Alto, TX, October 2, 2010.

Figure 3. Caddo Culture Club at Caddo Mounds State Historic Site, Alto, TX, October 2, 2010.

Here is a summary of a few of our activities and major appearances:

Christmas Dinner and Toys for Children Dec. 24, 2010
Many people donated toys and games that were collected at the Club's Christmas dinner which was held on December 16th as part of the Club's new youth outreach program. Club Chairman Brien Haumpo then delivered the toys and games to the Children's Hospital of Oklahoma in Oklahoma City the following day.

Contributions of Turkey Feathers to the Club, November, 2010
A number of hunters and others generously donated wild turkey feathers to the Club for use in Caddo regalia, dances and ceremonies. Many of the feathers were given to the Metro Caddo organization in Oklahoma for crafting turkey feather capes.

2010 Creativity World Forum, Cox Center, Nov. 16, 2010
At this International scope event, the Club performed with a number of Metro Caddo members at the Cox Center in Oklahoma City.

American Academy of Certified Public Managers Annual Conference, October 12, 2010
The Club performed for the AACPM group at Oklahoma City at the Cox Business Center. In addition to a number of Caddo Dances performed, a brief history was presented at this evening event.

Caddo Conference, Tyler, TX, March 2010
The Club appeared at the 52nd Annual Caddo Conference held at Tyler Texas at the facilities of the University of Texas/Tyler.

Caddo Mounds Historic Site, Alto TX, October 2, 2010
The Club performed from 9 to 5 at the Caddo Mounds site near Alto, TX. About 30 members attended the event and demonstrated or performed dances, regalia, bows and arrows, and other Caddo culture aspects. The appearance was the third straight annual appearance for the club at the Mounds.

Figure 4. Caddo Culture Club at Caddo Mounds State Historic Site, Alto, TX, October 2, 2010.

Stephen F. Austin University, Nacogdoches, TX - October 2, 2010
On the evening of October 9, the Club appeared at the SFA University Stone Fort Museum to present history and dances of Caddo people. The officers met with key University officials discussing the possibility of a Caddo Studies and Summer Institute program at the University and other joint efforts.

Caddo Lake National Wildlife Refuge, Jefferson, TX Sept. 26, 2009
The Club opened dedication ceremonies in the morning for the CLNWF with a prayer and blessing dance as part of the opening of the Refuge.

Historic Arkansas Museum, **Little Rock, AR, June 2009**
The Club joined with the Quapaw and Osage in dedicating this new permanent "We walk in Two Worlds Exhibit" in June 2009 at Little Rock.

American Cancer Society's Relay for Life, May, 2009
The Club held a fund raiser dance to help support the fight against cancer.

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