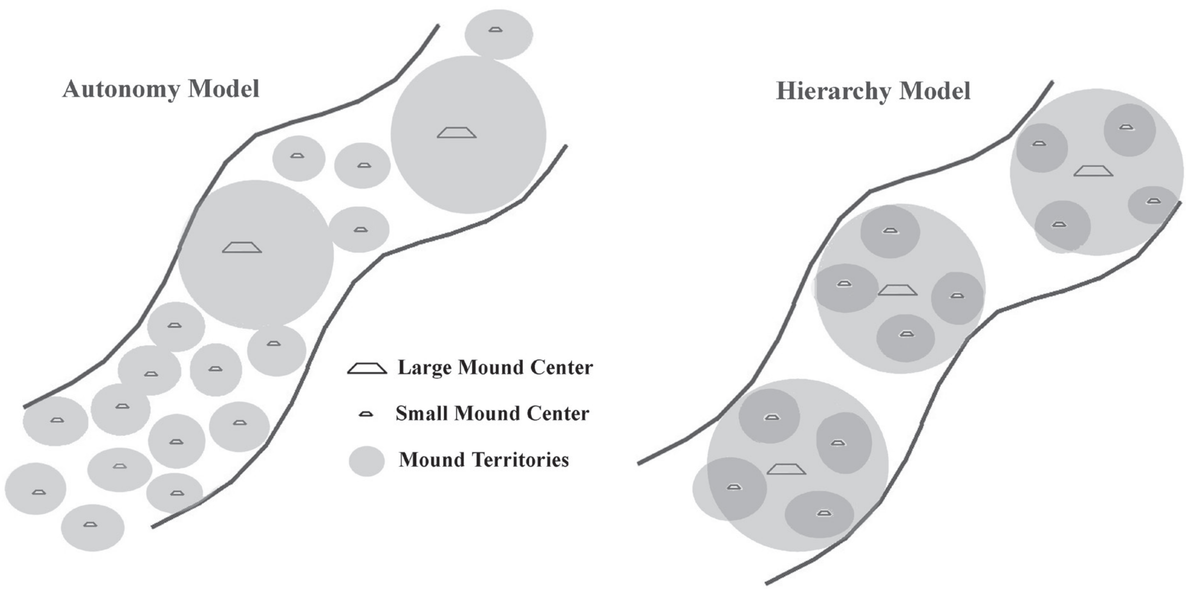
Caddoan Archeology Journal



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Announcements from the Editors

A few announcements regarding the Caddo Archeology Journal.

First off we are pleased to announce that Gregory Vogel will be joining the editorial board of the Caddoan Archeology Journal starting with issue 14. Gregory received a B.A. in anthropology from the University of Iowa, and an M.A. in anthropology from the University of Arkansas. He is currently a Ph.D. candidate in the Environmental Dynamics Program at the University of Arkansas as well as a member of the Register of Professional Archaeologists.

Gregory has fourteen years of experience in archeology and geoarcheology, and he recently wrote *A Handbook of Soil Description for Archeologists*, published by the Arkansas Archeological Survey. Gregory is conducting a regional-scale study of Caddoan mounds in the Arkansas River drainage for his dissertation, attempting to understand how Caddoan mounds relate to the landscape and natural resources, and how these mound groups may relate to one another.

As you will notice, we have raised the subscription rate for the Caddoan Archeology Journal from $15 to $20. The CAJ has relied heavily on outside sources of support to cover its publication and distribution expenses. While this $5 increase will not completely cover the journals expenses, it will help move us in that direction.

Also, starting with volume 14, we have decided to switch to a yearly publication. We have had increasing difficulty finding sufficient content for four publications a year. We are hoping to produce a 100+ page perfect bound journal once a year. This new format will allow us to entertain different approaches to the CAJ, and publish larger manuscripts and perhaps thematic volumes.

If you have any comments and suggestions about this please contact the CAJ editorial board.

A Spatial Analysis Approach to Understanding Caddoan Mounds in the Arkansas River Drainage

Gregory Vogel

Introduction

In this article I present a theoretical framework for understanding Caddoan mounds in the central Arkansas River drainage and the implications they may hold for the social structure and environmental adaptations of the people who made them. The power and efficiency of Geographic Information Systems (GIS) modeling now allows for large-scale, computationally intensive spatial analysis simply not possible before. Questions of landscape organization or spatial relationships that previously would have taken months or even years to answer can now be solved in a matter of minutes with GIS and related technologies, given the appropriate datasets. Quite importantly, though, such analyses must first be placed in context and theory if they are to be meaningful additions to our understanding of the past.

While it is conventional to refer to "GIS analysis" (and I use the term in this article), it is important to keep in mind that data manipulations alone are not analysis. GIS, along with statistical software and related computer technologies, are tools of spatial analysis just as shovels and trowels are tools of excavation. Such tools can organize and reveal information if they are employed carefully, but the tools themselves have no agency and cannot interpret anything on their own. The terms "GIS analysis" or "GIS interpretation" are therefore somewhat misnomers, just as "trowel analysis" or "trowel interpretation" would be. It is not the GIS, or any component of it, that does the analysis or interpretation; it simply manipulates spatial data. We interpret these manipulations based upon theoretical background, previous research, and the questions we wish to answer.

My goal in this article is to present one theoretical framework for understanding mounds in the central Arkansas River drainage, using analyses based in GIS manipulations of spatial data. The specific analyses proposed here are not complete, and it is not my intention to try to impose this model on all spatial analysis of mounds in this region or elsewhere. I hope to present this framework as an example of how such studies may be grounded, taking into account existing theories and methodologies. While it is clearly not appropriate for all studies of Caddoan mounds, this framework may serve as a springboard for other, related lines of inquiry.

Mississippian period mounds occur throughout the southeastern United States, and while those in the Arkansas River drainage of eastern Oklahoma, western Arkansas, and southwestern Missouri have received comparatively little attention, they represent a rich and unique archeological resource that surely holds a great deal of information. From about A.D. 900 to 1400 populations in this area constructed massive earthworks that clearly required the sustained effort of large groups of people to complete. Some of the earthworks served as burial mounds, some covered the remains of what appear to be structures for processing the bodies of the deceased, and others served as platforms for buildings, enormous fires, and ceremonies involving periodic excavation and re-working of large portions of the mound. A single one of these mounds along the Arkansas River (Craig Mound at the Spiro site) produced the majority of Southeastern Ceremonial Complex artifacts found to date. How these mounds relate to the natural environment and to the political and subsistence systems of the people who built them; why they are located where they are; and why some are much larger than others is still little understood. I propose the use of spatial analysis through GIS to assess the influences of arable bottomland, viewsheds, landforms, river travel routes, and the positions of other mounds on the location, patterning, and size of these monuments in order to better understand their meaning and the structure of the societies who built them. In other words: what accounts for the size and locational characteristics of the mounds? With this information, I propose that four specific hypotheses concerning the mounds can be tested: (1) they reflect the location and relative size of locally autonomous communities, who were primarily dependent upon locally available resources; (2) they represent administrative nodes in a regionally integrated system and their size and elaboration reflect their level within the system hierarchy; (3) they represent entrepots in a large-scale trading system; and (4) The location of mounds is patterned most directly not by political or environmental dictates, but by concerns of landscape position, viewsheds, or other matters of ritual or ceremonial importance.

The first two are competing hypotheses. The second two have implications that bear on the first two questions, but are not necessarily exclusive of each other or the first two.

Archeological Background of Mounds in the Arkansas River Drainage

Late prehistoric mound-building cultures in the central Arkansas River drainage (Figure 1) have conventionally been referred to as "Caddoan", although their cultural and genetic relation-

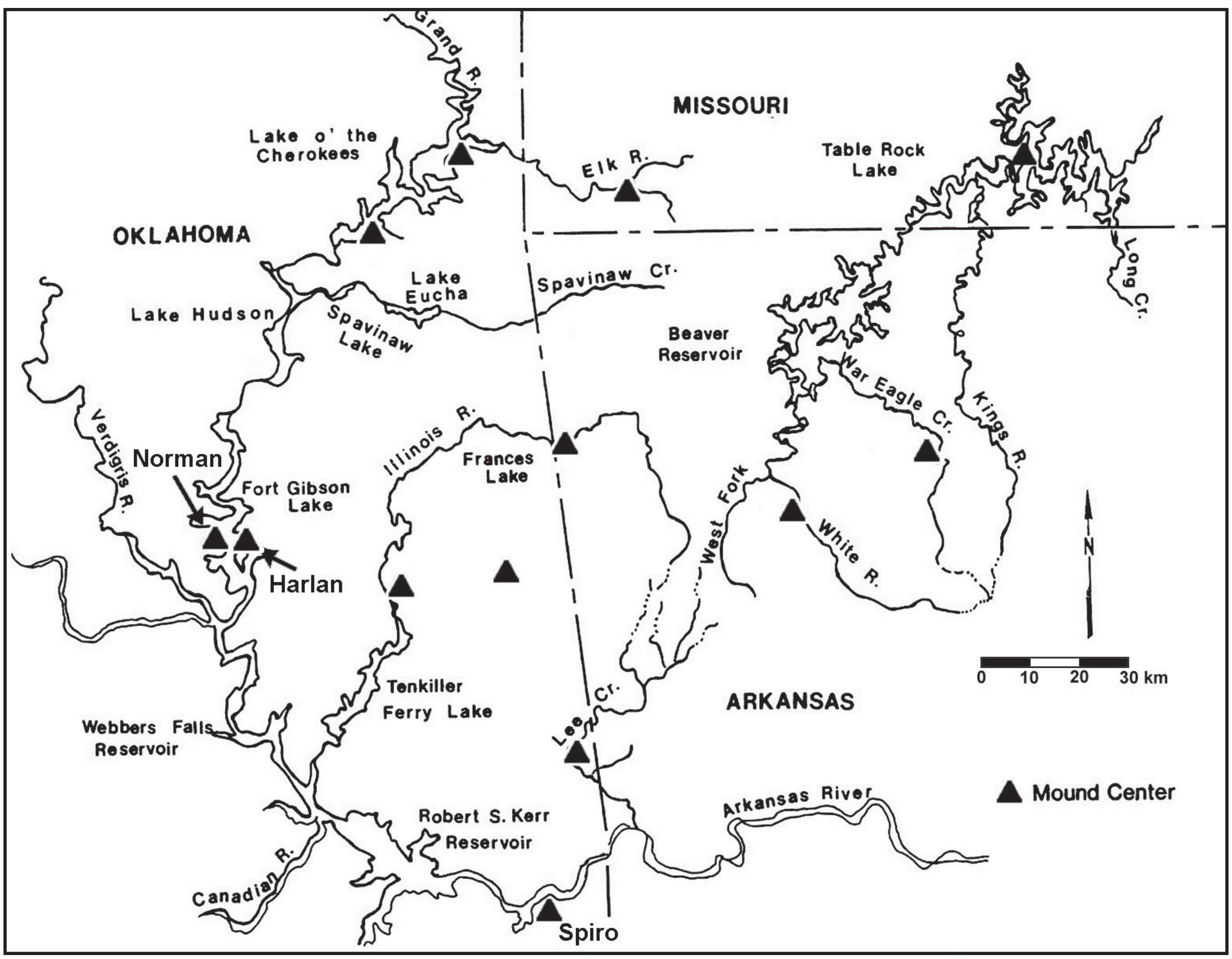

Figure 1. The location of some of the largest mound centers in the central Arkansas and upper White River drainages (Figure adapted from Kay et al. 1989)

ship to the historically documented and current Caddo Indians is unknown. Also unknown is their cultural and genetic relationship to late prehistoric groups in the Red River valley of southeastern Oklahoma and southwestern Arkansas (the "core" Caddoan area [Perttula 1996]). Brown et al. (1978) recognize three distinct types of Mississippian mounds within the region: structure mounds (which bury the remains of ritually burned structures), accretional burial mounds, and platform mounds.

Structural mounds are low, conical features erected over a previously existing structure. The structures buried at the base of the mounds appear to have been used for specialized, ceremonial purposes. Many are hypothesized to have served as charnel houses or temporary burial locations. These mounds were usually constructed in a single episode, and contain few or no burials or artifacts. Structural mounds are by far the most common type throughout the Arkansas drainage.

Accretional burial mounds are elongated, multi-lobed, or round features that are the result of multiple episodes of mound building. Each building episode generally contains multiple burials, many of them secondary burials that were probably processed in the structures underlying structural mounds. Grave goods and wooden burial vaults are common features in this type of mound. Accretional burial mounds and structural mounds likely represent a basic "pair" of earthworks – structural mounds built over short-term processing structures, and accretional burial mounds built as permanent burial platforms for the remains. Each accretional burial mound stage may correspond to a single burial processing structure, although this has not been determined conclusively.

Platform mounds are the largest earthen structures in the Arkansas River drainage. They are generally large, round or rectangular flat-topped structures. They generally contain no burials, and the fill is commonly found to be devoid of artifacts. Mound I-1 at the Norman site (Vogel 2001) is typical of such platform mounds, and reveals an internal structure sequence typical of that reconstructed from other platform mounds: first a mound stage consisting of a few decimeters of soil with a flat surface was constructed, then numerous large pits were excavated into this stage, exposed for an unknown amount of time, and refilled. The initial soils used for each mound stage and the soils used to refill pits appear to have come from many different sources – some of them probably local, and some of them perhaps from far away. Each mound stage was eventually capped by a compacted and burned layer of clay, and another cycle of construction commenced. Subsequent pits in higher mound surfaces never penetrate previous capping layers. Evidence for mounded berms, large posts, and other structures exists within many of these platform mounds as well, but the basic unit of construction seems to be a cyclical sequence of filling, pitting, and capping.

Sites consisting of several mounds in close association are termed civic ceremonial centers. These are interpreted as locations where important seasonal rituals took place, and as the gathering places for the expression of religious ideas and/or political power (Bell 1984; Knight 1986). Brown et al. (1978) recognize a hierarchy of civic ceremonial centers, termed first, second, and third echelon. First echelon centers contain at least one burial mound and an associated structural mound. Second echelon centers contain several structural mounds, at least one accretional burial mound, and an additional platform mound. Third echelon centers are essentially large second echelon centers with the addition of a fourth mound type or other large architectural element.

The additional mound type or architectural element is generally unique to the center, suggesting an "organizational discontinuity with the lower-order centers" (Brown et al. 1978:189). The unique structures often contain burials with large associated caches of finely made artifacts, and likely served as a burial place for regional elite. Numerous first and second echelon centers exist within the study area. Three centers are clearly third echelon centers in this region: Harlan, Norman, and Spiro (Figure 1), of which Spiro is considered the "premier" center. All mound centers in the study area are located on river floodplains or terraces, with only a few isolated mounds found in the uplands.

Theoretical Framework

In order to reconstruct aspects of the political and social organization of the populations who constructed the mounds, I propose focusing on how the mounds are situated in relation to the natural environment, how the mounds are situated in relation to one another, and how the distribution and patterning of mounds changed through time.

The mound centers are viewed by some researchers as individual nodes in regionally integrated political systems, while others view each mound center as comprising an essentially complete and autonomous political unit. These views are well articulated in recent volumes by Muller (1997) and Emerson (1997), who propose competing models of Mississippian political organization, both of which incorporate the place of the mound centers themselves within Mississippian society. Muller (1997) has argued strongly that mound centers, in at least some locations, represent autonomous units, and Emerson (1997) has argued equally strongly that in many locations each mound center is part of a larger hierarchically organized system. Both hypotheses have implications that are testable through spatial analysis.

Muller (1997) argues that no true social ranking was necessary for the construction of mound centers. In this interpretation, local communities were autonomous agricultural units who may have affiliated with the larger mound centers, but maintained smaller mound centers as markers of, and possibly necessary constructions for, their own autonomy. The surplus necessary for the small and large centers was generated locally in this model, and the size of mound centers conditioned by the locally available resources.

Emerson (1997) takes a nearly opposite view, arguing for strong control by elite populations who extracted tribute through a hierarchical system of government reflected in the relationships of the mound centers. In this interpretation, mound centers served as both markers of control and outposts of elite authority, possibly the very locations of tribute or tax collection. The surplus necessary for the small centers was regionally integrated in this model, derived from the surplus generated within the territory of the large mound centers, and redistributed from a central source.

Neither Emerson's nor Muller's views were developed as pan-Mississippian models of political organization, but both models have testable implications for the distribution and patterning of mounds within the central Arkansas drainage. Muller's autonomy model implies a more direct correlation between locally available resources and mound center preeminence and size. If construction of the mound centers relied chiefly on surplus generated locally, their size and elaboration should reflect available bottomland within the territory of the mound centers. The distribution of mounds within the bottomlands, and some measure of the territorial resources represented by each, would approximate the hypothetical distribution of mounds in Figure 2a. This distribution reflects sub-sets of the population who may have had close ties to neighboring groups, but maintained a large degree of political independence reflected in an investment of local resources into local monumental architecture. Graphing mound center size against locally available bottomland would approximate the scatter plot in Figure 3a.

Emerson's hierarchy model implies a non-direct relationship between locally available resources and mound center preeminence and size. Kay et al. (1989) similarly interpret the patterning of the mound centers in the Arkansas and White River drainages as reflecting a well organized, widespread settlement system. They note the nearly regular spacing of some of the larger mound centers, and of the interspersed smaller "satellite" centers (Figure 4). This interpretation corresponds closely to Emerson's view of a highly structured, hierarchical system of populations represented by large mound centers exacting tax or tribute from populations at smaller mound centers. The distribution of mounds within the bottomlands, and some measure of the territories

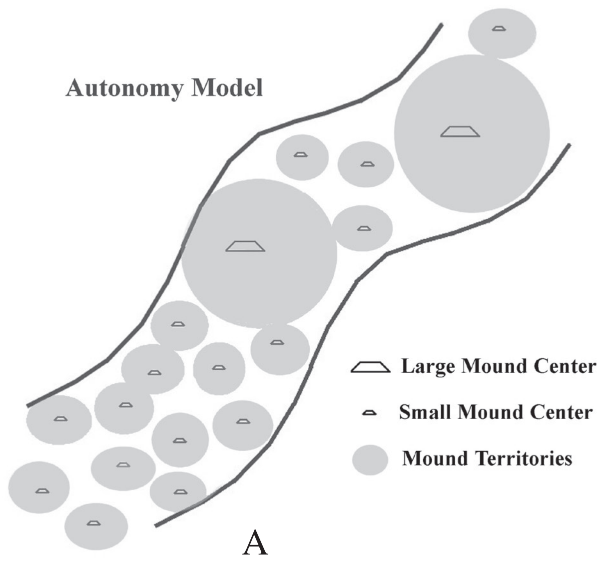

Figure 2. Idealized mound distributions. Left represents the model proposed by Muller (1997) of largely autonomous mound centers whose size and elaboration depended primarily on locally available resources. Right represents the model proposed by Emerson (1997) of hierarchically-organized mound centers, with larger centers extracting resources from smaller ones.

represented by each, would in this case approximate the hypothetical distribution of mounds in Figure 2b. This distribution reflects the necessity of not simply larger tracts of arable bottomland within the territories of the larger centers, but the necessity of a certain number of associated smaller mound centers.

The scatter plot in Figure 3b approximates the mound center size to territory size relationship that would exist if this model is correct. Note that the variable of territory size in this analysis is not a direct measure of land area, but a measure of the agricultural and biological productivity of that area.

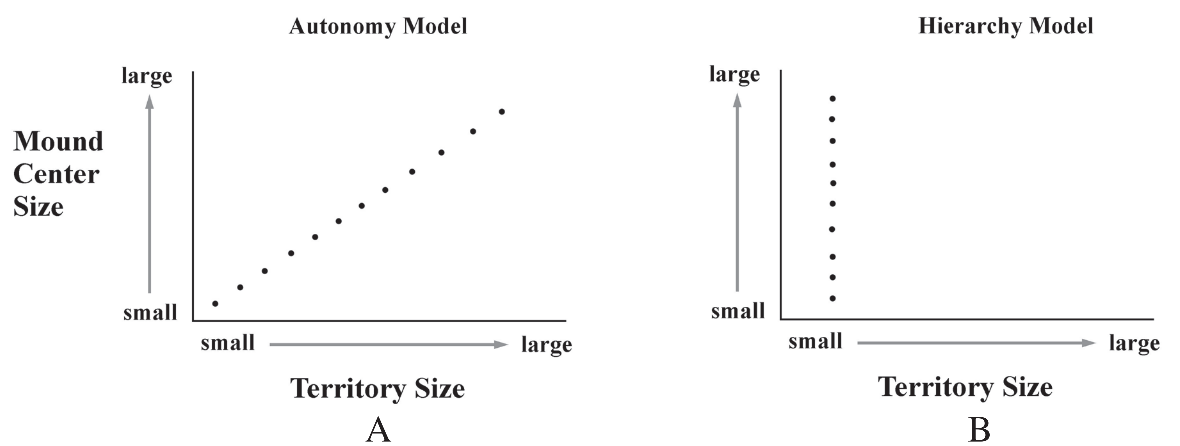

Figure 3. Idealized graphs of mound size and territory relationships. The autonomy model corresponds to Muller's (1997) view of mound centers as autonomous centers relying on locally available resources. The Hierarchy model corresponds to Emerson's (1997) view of mound centers as hierarchically organized units with larger centers extracting resources from smaller ones. Note that the variable of "Territory Size" takes into account the availability of resources within the territory.

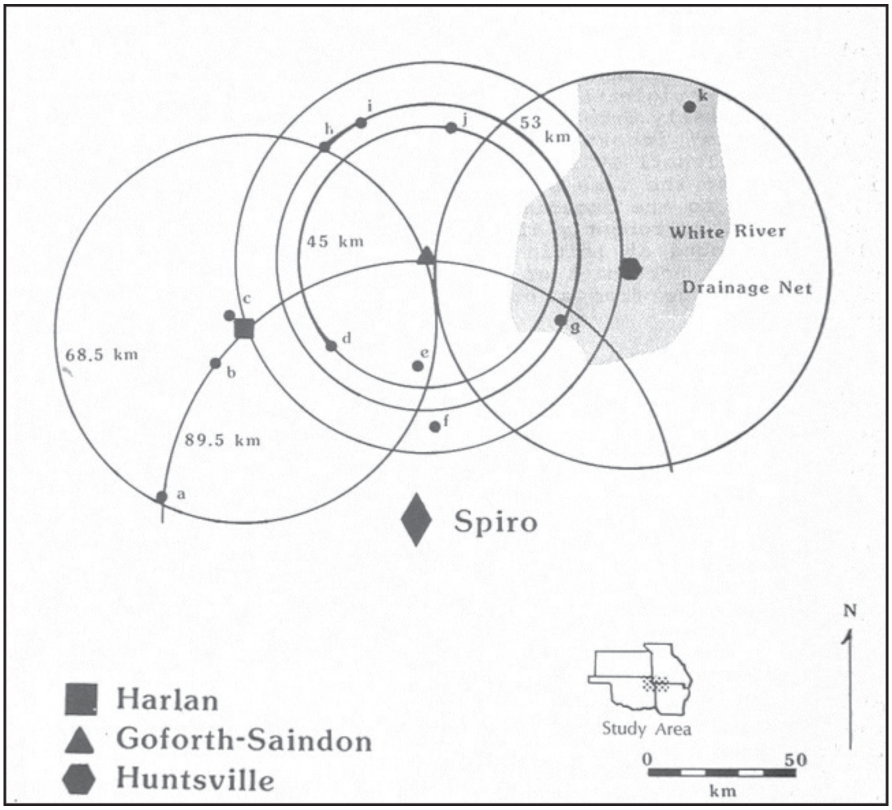

Figure 4. Distances between large and small mound centers (from Kay et al. 1989).

The Spiro site has long been recognized as a potential "gateway" trading community, situated between the plains to the west and north, and eastern woodlands and Mississippi River bottomlands to the east. Spiro's location along a major waterway connecting these regions (the Arkansas River) is often cited in support of its importance as a trading center, and the vast quantity of high-status, exotic items found at Spiro certainly point to the importance of long-distance trade in at least these items. Schambach (1999) argues that trade at the Spiro site and elsewhere in the Arkansas River drainage extended far beyond high-status, exotic goods, serving as an important economic input for the community. In this interpretation, Spiro gained preeminence in the region not directly because of locally or regionally generated agricultural surplus, but because of control over long-distance trade. If this were the case, the mound center locations may reflect waterway trade routes rather than prime agricultural lands.

Note that the "trade hypothesis" is not mutually exclusive of the hierarchy model, and may not be exclusive of the autonomy model. What spatial analysis will be able to determine is the relative strength of each model, based on the location and patterning of the mound centers across the landscape. Isolated mound centers, each within an exclusive area of bottomland resources corresponding to the size and elaboration of the mound center, would support the autonomy model. A highly organized system of mound centers, with the larger centers surrounded not by more abundant bottomland, but by numerous smaller centers, would support the hierarchy model regardless of the importance of trade.

Another possibility is that the locations of the mound centers are patterned most directly not by environmental or political concerns, but by some aspect of cosmology or ceremony related to the meaning of the mounds as ritual monuments. While all such factors may not be detectable in the location or patterning of the mounds, one such concern that is testable is the viewsheds of the mound centers – the extent of area visible from the centers- and the area from which the mound centers themselves are visible. Bradley (2000) and Gaffney (2000) have both demonstrated viewshed considerations are important in the placement of Old World monumental architecture. Sabo (personal communication) has noted that several area mound centers appear to be situated in "natural amphitheaters" within the river valleys; that is, preferentially located in areas with large viewsheds. If this is the case, other location considerations based on political organization or the distribution of environmental resources may be partly or completely obscured. Just how obscured the other influences would be depends on how important viewsheds were to mound locations.

Addressing these questions will first require determining the relative importance of landforms, locally available arable land, river travel networks, the locations of other mound centers, and viewsheds to mound patterning, size, and location through time. If locally available arable bottomland were shown to be the primary factor controlling mound center size, it would lend strength to the autonomy model. If the location of other mound centers were shown to be of prime importance, the hierarchy model would be greatly supported. If the size and elaboration of mound centers is more directly correlated with ease of travel between key trading resources, the trading hypothesis would be supported. If viewsheds turn out to be quite important to mound locations, it would demonstrate the greater influence of ceremonial or cosmological considerations over political or environmental ones in the locations of mound centers. If none of these factors were found to be significant, it may force us to reconsider the commonly held assumption that the locations of the mounds are intimately related to and reflect the political or subsistence systems responsible for their creation.

GIS models and data needs

The scope and depth of the spatial analyses I propose will only be possible through the power and efficiency of Geographic Information Systems (GIS) technology. Such analyses should expand and elaborate on previous studies conducted within the study area and elsewhere, and offer new lines of research simply not possible before GIS. Two separate datasets could be employed, one pertaining to the natural landforms and environment of the study area, the other pertaining to the mound centers themselves. Information pertaining to the location, size, use, construction, and abandonment of the mound centers is largely available in the published literature and from archeological field notes and other unpublished sources.

Little reliable documentation exists concerning several of the mound centers, however, particularly the ones which were partially or completely destroyed or inundated during river impoundments or other construction. Cavanaugh Mounds site in Fort Smith, Arkansas, for example, now consists of only a portion of a single large mound. A partial profile is exposed along the eastern side of the mound, and loading features of highly contrasting matrix, typical of area platform mounds, have been reported by Arkansas Archeological Survey personnel who have visited the site. The loading features and size of the mound suggests that other mounds were once present at the site, but no formal archeological research has been conducted in the surrounding area. Still, early narrative records or photographs will likely offer enough information for a ranking of the site within Brown et al's (1978) echelon system.

A basic chronological framework has been constructed for the area (most recently in Brown and Rogers [1999]), but placing many of the smaller mound centers in time is still a difficult task. Datable material exists for many of the mound sites, however, even those that were destroyed by construction of the river navigation system. Diagnostic lithic and ceramic artifacts and organic material suitable for AMS radiocarbon dating may help in this regard. Understanding the timing of mound use and construction is essential for many of the analyses proposed here, in particular those that evaluate the mound centers in relation to one another as well as the environmental background.

Historic aerial photographs are a particularly promising source of information concerning the mounds. The U.S. Department of Agriculture commissioned aerial photographs in the 1940s and 1950s that cover the entire study area (now curated at the National Archives in Washington D.C.). These photographs were taken prior to the inundation of the reservoirs, and prior to much of the large-scale construction and development that cover much of the area today. The photographs were mostly taken in the late winter and early spring, and contain enough detail to resolve features less than one meter on a side. Naturally formed prairie mounds, for example, far smaller than the culturally constructed mounds in the study area, are clearly visible in one of these photographs from Pea Ridge National Park within the study area. These photographs thus appear to be a largely untapped resource for mound studies, and I anticipate they could be quite useful in determining the layout of mound centers for those that were never mapped, and for confirming or revising the exact position and layout of those that have.

The environmental layers of the GIS model should be based on the pre-reservoir topography of the study area. U.S.G.S. 30 meter digital elevation models (DEMs) should serve for the upland portions of the study area. The overall topography of the uplands has changed little throughout the Late Holocene, and current elevations accurately reflect the Late Mississippian landscape, above the major river valleys.

Much of the area bottomland is now underwater as part of the McClellan Kerr River Navigation System, administered by the Tulsa District U.S. Army Corps of Engineers. Several different sources could be used to reconstruct the pre-reservoir topography and hydrology of these inundated bottomlands. The Tulsa District U.S. Army Corps of Engineers possesses topographic maps (in paper form only) of much of the area before inundation, and bathymetric data for all of the reservoirs shortly after their inundation. General Land Office and other early maps may be useful in reconstructing much of the hydrology, as well as other aspects of the natural environment (backwater lakes that may now be drained, for example).

As with the locations and layouts of the mound centers themselves, early aerial photographs appear to be a largely untapped resource for hydrological and environmental reconstruction in this area. River courses, floodplains, terraces, backwater lakes, and valley edges are clearly visible in these photographs, mostly taken prior to inundation of the reservoirs. Variations in texture and value in the photographs also express differences in soil and vegetation, which would likely be quite useful in understanding potential environmental resources in different parts of the study area bottomlands.

Specific analyses and potential outcomes

Figure 5 outlines the main components of the proposed research in a flow chart, detailed in the paragraphs below. As with most GIS-based projects, the majority of the effort would be dedicated to simply working the information into a usable format. The quality of the analysis is conditioned by the quality of the GIS model. Incorporating numerous sources (existing digital elevation models, early paper maps and aerial photographs, etc.) would ensure that the model is as accurate as possible. The actual manipulations performed on the dataset must be carefully chosen for appropriateness, but require comparatively less time and effort.

The great majority of individual mounds and all mound centers within the study area are located in stream valleys, below the uplands. It is clear that their locations across the landscape are not at all random, but highly patterned by at least this one environmental variable. A preliminary step in the analysis would be to determine the relative influence of all reconstructed natural landscape types and features on the locations of the mound centers within the river valleys. For example, are more of them located on first or second order terraces than would be expected by chance, or are

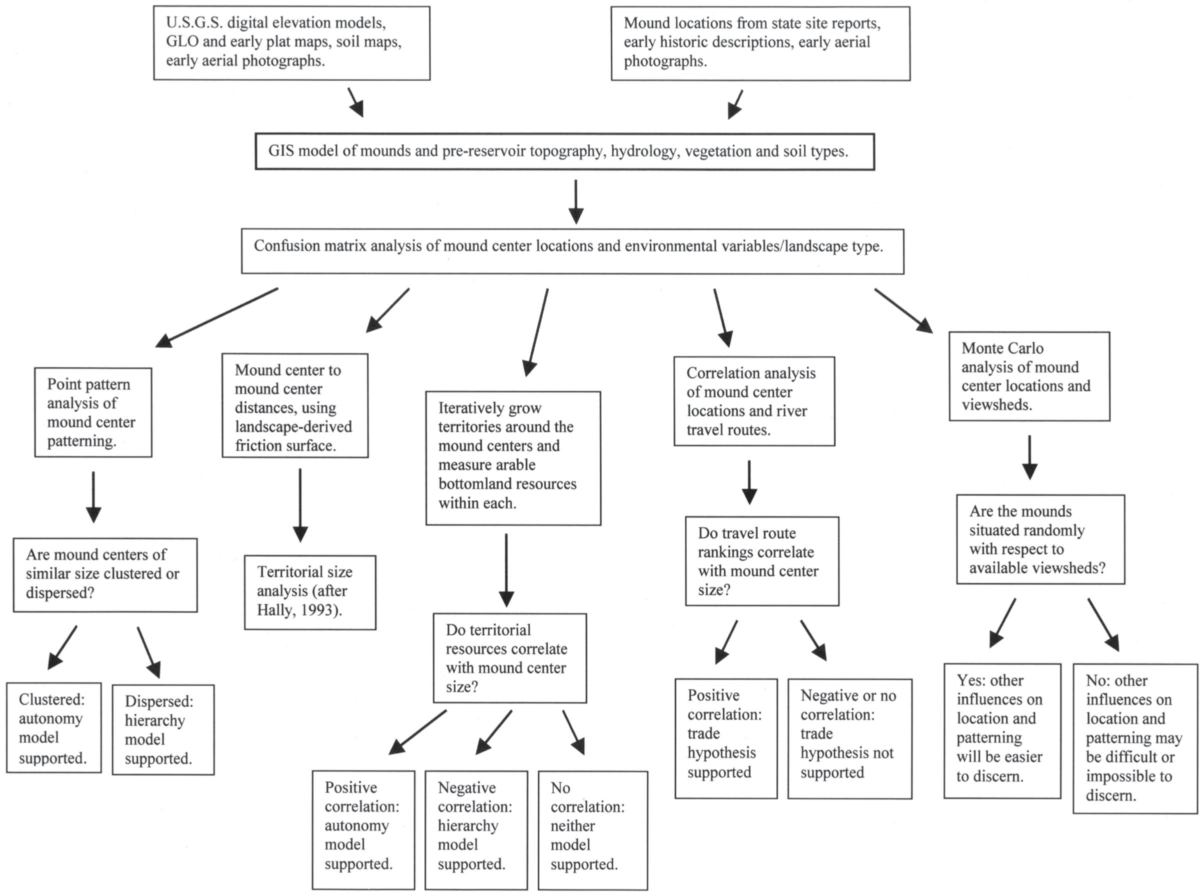

Figure 5. Flowchart of proposed analyses showing basic GIS steps and some of their analytical implications.

they closer to or farther from river channels? These analyses are easily conducted through GIS as spatially derived chi-square tests, termed "confusion matrices" in GIS terminology. The amount of area covered by any landscape type or environmental feature is quantified in this analysis, and the expected versus observed occurrence of mounds on the area is determined. Standard statistical procedures determine the significance of any discrepancies. This information could serve as the statistical background for subsequent analyses, and may in itself reveal interesting or important patterns.

Point Pattern Analysis

At a landscape scale, mounds and even mound centers can appropriately be considered one-dimensional points, and simply applying conventional point-pattern analysis techniques holds promise. Boots and Getis (1988) detail various measures of point pattern arrangement and dispersion that may prove useful. These measures reveal how clustered, how dispersed, or how randomly arranged any series of points are. These analyses are conducted without consideration of the background environment, but within a GIS model various background variables are easily taken into account.

Two specific analyses could be used to analyze the mound center point patterns: variance to mean ratio, and autocorrelation. Variance to mean ratio is a measure of point clustering or dispersion based on point counts within assigned quadrats. In this case, the quadrats will be defined by the bottomland landforms on which the mounds are located. A variance to mean ratio near 1 indicates randomness, while a ratio significantly greater than 1 indicates clustering of the points, and significantly less than 1 indicates dispersion.

Determination of spatial autocorrelation compares the actual occurrence of points per cell (again defined by the landforms on which the mounds are located) to a random distribution. A statistic near 0 signifies randomness in the points, while lower values indicate dispersion and higher values indicate clustering, or regional trends of similarity in the data (a statistic of -1 indicating perfect dispersion and +1 indicating perfect clustering).

Aside from their utility as exploratory statistics in understanding the layout of the mound centers across the landscape, these methods have the potential to confirm implications of the autonomy and hierarchy models. Because the large mound centers in this model are centers of control over smaller centers, they should not be clustered but should have a "repelling" effect on one another, particularly taking into account available resources. Kay et al. (1989) interpreted the nearly equal spacing of larger mound centers within the Arkansas and White River drainages as evidence of regional organization (see Figure 4). GIS spatial autocorrelation analysis, conducted on selected sets of mounds (grouped by a measure of mound center size, such as Brown et al's [1978] hierarchy system), could be used to refine this type of analysis by taking into account the landscape against which the mounds are set, and to quantify the results. If the larger mound centers are significantly dispersed, the hierarchy model would be supported. If they are significantly clustered (that is, the larger centers are closer to one another, on average, than they are to the smaller centers), the autonomy model would be supported: particularly if the larger centers also happen to be located within the largest stretches of arable bottomland.

Mound center to mound center distances

Mississippian mound center territories in northern Georgia have been estimated by Hally (1999), using distances between mound centers. Hally found a bimodal distribution of distances between contemporaneous mound centers, and concluded that those closer together represented administrative centers for single polities, while those farther from other mound centers represented "paramount chiefdoms" with direct control over multiple communities. Hally used straight-line distances between mound centers to serve as rough approximations of travel times.

A GIS-based study could conduct a similar analysis of the distances between mound centers, but with a more realistic approach than is possible without employing computer modeling. From the landscape model discussed above, it is possible to derive a landscape friction surface based upon terrain, hydrology, and other environmental variables. Friction surfaces classify the landscape based upon ease of travel. It is easier to walk over level terrain, for example, and more difficult to walk up steep slopes. People will generally walk around backwater swamps and lakes, while river routes and large lakes could clearly serve as relatively high-speed transportation routes. Various studies (e.g.,. Brannan 1992) have determined the calories necessary to travel across different terrains, and could serve to calibrate the friction surface to actual human cost.

Territories derived from friction surfaces

GIS is uniquely suited for estimating territories based on realistic landscape properties. Several estimations of territories have been used in archeological research with varying degrees of success. Simple circles drawn around sites were first used for site catchment analysis, and have recently been usefully applied to studies of Mississippian mound center territories in Georgia (Hally 1999). Based on the common-sense assumption that whatever is closer is easier to procure, such circles serve well in some cases, but do not take into account the environmental background against which the centers are set, or the possibility of multiple territories influencing one another.

More sophisticated are Thiessen polygons (also known as Voroni tessellations), which divide landscapes around designated points in a more realistic manner. Thiessen polygons include within the territory of each point all area that is closer to it than to any other point. Territorial approximations derived in this way have been usefully applied in many archeological studies, even revealing distinct Mississippian settlement patterns (e.g., Muller 1997). This type of analysis assumes an equal value for all points, however, and again fails to take into account the background variables against which the points are set.

Using friction surfaces derived from topographic and environmental variables (as discussed above), it is possible to "grow" territories from each mound center through iterated operations that take into account the ease of travel across the landscape. Thus territories for mound centers in narrow, deep valleys with rough adjacent uplands will spread preferentially along the bottomland where travel is easier. The landscape can be completely tessellated in this way so that no land remains outside of a territory, or the territories can be successively shrunk back to take into account different potential buffer zones between territories.

Topographic, hydrologic, and soils data could be used to rank area bottomlands for suitability for prehistoric agriculture. In general, organic-rich bottomland soils that flood infrequently are the most suited to prehistoric agriculture. In the study area, these are primarily on natural floodplain levees and low terraces without backwater lakes.

The landscape could then be tessellated with several variations of mound center territories, using territorial approximations derived from mound center distances as well as variations that take into account the potential for greater territories for larger mound centers. The resources within each territory could be quantified (amount of arable bottomland likely to flood no more than once per season, etc.) and tested first against a random distribution to check for statistical randomness, and then against mound center size as illustrated in Figures 2 and 3. This analysis has the potential to support or contest the autonomy and hierarchy models.

River travel route analysis

Surfaces from each mound center could be created in a manner similar to the generation of territories, with a polygon expanding from the mound center along a friction surface derived from the landscape and hydrological information. In this analysis, the "territories" would be expanded from each mound center to cover the entire region. Each pixel (30x30 meters) could be coded with a travel value corresponding to the cost in calories to reach it from the mound center.

Mound centers situated at the nexus of major stream branches will have larger areas with lower travel values in this analysis, indicating ease of travel to and from these sites. Mound centers located at the headwaters of streams or along low-order tributaries with no nearby branch streams will have very small areas with low travel values, indicating relatively difficult travel to and from these sites. It would then be possible to create an ease-of-travel index using a ratio of the area covered divided by the cumulative travel value for that area. A ranking of the mound centers (again using Brown et al.'s [1978] echelon system as a first approximation) could then be correlated with the index. If ease of travel over large areas was an important factor for locating the mound centers in the first place or for the elaboration of the mound centers even after they were founded, the correlation should be high. If this correlation were extremely high (that is, the size and elaboration of the mound centers correlates quite strongly with the location's access to travel routes), the autonomy and hierarchy models may not be testable, with the influence of locally or regionally available resources obscured by the importance of river travel routes.

Viewshed analysis

Viewsheds may be an important factor in mound center locations, and if this is the case, other influences on mound center location may be partly or completely obscured. Many of the mound centers appear to have commanding views up and down the river valleys, but how many sites with such views should we expect by chance, and given the landscape of the region, what exactly should we consider a "commanding" view? GIS "Monte Carlo" analysis could be used to test for the importance of viewsheds in the positioning of mound centers.

A set of observations is randomly generated in this type of analysis, within realistic parameters drawn from observation. For example, several thousand sets of mound centers could be randomly generated across the landscape model, using parameters drawn from confusion matrix analysis of the actual mound centers to ensure that the same proportion of them are on similar landforms, soil types, similar distances from river channels, and any other variable that needs to be held constant. The generated samples represent a statistical background against which to test the actual mound locations. Standard statistical procedures can be used to compare the observed and generated datasets, as appropriate. If the mound centers, or any selected subsets (third echelon centers, for example) were found to be significantly different from the randomly generated sets, viewsheds would be considered a significant contributing factor to mound center locations. This type of analysis assumes no statistical normality to the data, and is useful when population parameters are difficult to discern or quantify (Kvamme 1999), which is clearly the case with the viewsheds of the mound centers.

Aside from the viewsheds of individual mounds, studies of overlapping viewsheds and multiple viewsheds have proven useful in archeological applications (Gaffney and van Leusen 1995; Ruggles et al. 1993). Multiple viewsheds are formed by the overlap between individual viewsheds on a landscape, representing areas visible from multiple points of interest. Cumulative viewsheds rank the landscape by the number of points of interest from which an area is visible. Kvamme notes that these types of analyses have been used "as a means to perceive past social or cognitive landscapes, and even territoriality" (1999:177). While the distances between the majority of the larger mound centers are likely too great to allow for any intervisibility, there may be some overlap or even chains of connection between the viewsheds of the smaller, more numerous mound centers. These could possibly point to culturally important locations on the landscape even where little or no physical evidence exists.

Conclusions

In this articleI have attempted to outline how GIS-based spatial analysis may help us understand something of the political organization and environmental adaptations of Mississippian mound builders in the central Arkansas River drainage. Such analysis has the potential not only to refine and quantify previous research (e.g., Hally 1999; Kay et al. 1989; Muller 1997; Wyckoff 1980), but also to broaden the scope and extend the lines of inquiry in novel directions. I have proposed doing this by integrating data concerning the mounds themselves with environmental information at a regional scale. Studies of this scale and computational complexity have only been made possible by recent advances in GIS and related technologies. It is now possible to reconstruct fine-scale environmental and landform information, determine the relative influence of these variables on the position and elaboration of mound centers, and use the resulting information to directly test some of the implications of various hypotheses concerning the mounds.

This article is not simply an academic exercise. I am currently preparing the GIS model and beginning to conduct many of the analyses outlined here. I hope to present the results of these analyses in *Caddoan Archeology Journal* and other forums. When complete, the full database of mound, landform, and environmental information will be made available through web-based distribution. I hope this information will be useful to other researchers interested in similar questions, and will serve as a model of data sharing crucial for the advancement of such studies.

Acknowledgments

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41SM195A, The Browning Site

Mark Walters

A surface collection of early 19th century historic sherds led to archeological investigations in 2002 and 2003 at the Browning site (41SM195A) in Smith County, Texas. My interest was whetted by mention in the original land abstract that the property had once been deeded to the Cherokee (Walters 2003) In all, a total of 6.5 cubic meters was excavated, including twenty-two shovel tests and 10 1 x 1 m test units, and a fine-screen sample was taken from the midden. As a result, 1076 prehistoric and historic artifacts were recovered, along with new information about the Woodland period archeology in this part of East Texas.

The initial shovel tests found, in addition to the historic component, a buried midden with evidence of Woodland period occupation. Based on the excavations, the midden covered approximately 500 m^2. The 19th century historic artifacts were found in the upper sediment zone (a light brown sandy loam that was mostly gravel-free) covering the midden. The buried midden was a dark yellowish-brown gravelly loam that contained prehistoric pottery, bone, charred wood and nutshells, lithic materials, including lithic debris, flake tools, arrow and dart points, and ground stone tools. A calibrated radiocarbon date of AD 625 to 880 (2 sigma), with a calibrated intercept of AD 685, was obtained on charred nutshell from 40-50 cm bs in the midden zone. A series of Oxidizable Carbon Ratio dates from the midden indicate that the midden began to form about AD 147, with dates of AD 359-817 from the main part of the midden, indicating when the Browning site was most intensively occupied in prehistoric times.

The prehistoric (and historic) components are confined to a small corner of a 3800 m^2 terrace that overlooks the Auburn Creek floodplain; an undulating sandstone bedrock is the parent material and is exposed on the margins of the landform. Depth to the sandstone varies from 30 cm bs to more than 70 cm bs across the 12 meter length of the test units. This terrace was probably truncated at some earlier time and the present soils, excluding the recent relatively sterile overburden, developed from this sandstone parent material. Where present, the midden extends to this sandstone layer. A 20 cm thick layer of overburden, as indicated by particle size analysis, caps the midden. The origins of this soil are unknown but it could be colluvial or eolian in nature. There is also the possibility that this layer could be the result of earthworms bringing finer materials to the surface, gradually covering up the midden zone.

No definite conclusions could be reached about the function of the historic component at the Browning site, other than to note that the recovered artifacts—principally ceramics—indicate that it was occupied prior to the Civil War. The decorated whiteware ceramics include annular ware and blue shell-edge, and there are also a few yellowware sherds. A small concentration of ash and fired clay in one excavation unit may mark a possible chimney location.

Woodland period sites are not well known or documented in this part of East Texas. The role that the Woodland period cultures played in the development after ca. A.D. 900 of the later Caddo culture has been a question that was addressed at the 2003 East Texas Archeological Conference in Texarkana, Texas, but much work remains to be done before any definitive answers can be provided on how the two cultures relate to one another..

Prehistoric artifacts collected from the Browning site include eight plain grog- and grog/bone-tempered sherds, and they averaged 8.8 cm in thickness. They were collected in the midden zone between 20-60 cm bs. One sherd had a contorted paste but all had smooth surfaces and had been well-fired. Five of the sherds did have a sandy paste. Two sherds were submitted for instrumental neutron activation analysis (INAA) to determine the probable source or source zone of the clays used in the manufacture of the vessel sherds, and this INAA work is in progress at the Missouri University Research Reactor..

The 842 lithic artifacts include 16 arrow points, preforms, and fragments. Recognizable arrow points were the Friley type, and most of the arrow points were recovered between 30-50 cm bs. There were also five small dart points, including contracting stem Gary points. They were mostly heavily reworked and found scattered at various depths from 10-70 cm bs.

Most of the chipped stone tools and lithic debris were from red and gray local quartzite and petrified wood. There were three small groundstone tools made from local sandstone that were probably used in plant processing. A fine screen sample was submitted for floral analysis and the finding indicate that domesticated plant remains were not present, and that the subsistence economy was based on the gathering of local plant resources, of which nuts were the main item. A total of 43 grams of charred nutshell was collected from the Browning site excavations. Other plant remains include 31 grams of charred wood, but no seeds. Since little information is available on the character of Woodland period diets in East Texas, the 88 pieces of animal bone were also submitted for analysis. The animal bones indicate that the diet was supplemented with large game such as deer.

In summary, the Browning site represents a pre-Civil War habitation site, probably of short duration, and an intact buried Woodland period component with a small midden deposit. No evidence of prehistoric agricultural activities is apparent in the archeological deposits, and the faunal and floral remains point to a foraging lifestyle that was reliant on the collecting and processing of native plants and animals. No evidence of a structure was found at the site, but the remains of a good-sized midden indicate that the site was used for extended periods of time during the lengthy Woodland period. A small amount of plain prehistoric pottery was also found in the midden deposits, perhaps being indicative of a more sedentary lifestyle during some part of the Browning site occupation. The small amount collected, and its low density, however are from a very limited use of pottery vessels at this time, as these were probably restricted to occasional cooking activities.

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Certain Caddo Sites in the Ouachita Mountains of Southwestern Arkansas

Timothy K. Perttula and Bo Nelson

Introduction

In the last few years, we have had the opportunity to study a number of prehistoric Caddo Indian sites in the Ouachita Mountains of southwestern Arkansas through conducting archeological surveys of more than 2700 acres at three lakes constructed and managed by the U.S. Army Corps of Engineers, Vicksburg District (Perttula and Nelson 2000, 2001, 2002). The three lakes are DeGray Lake on the Caddo River, Lake Ouachita on the Ouachita River, and Lake Greeson on the Little Missouri River (Figure 1).

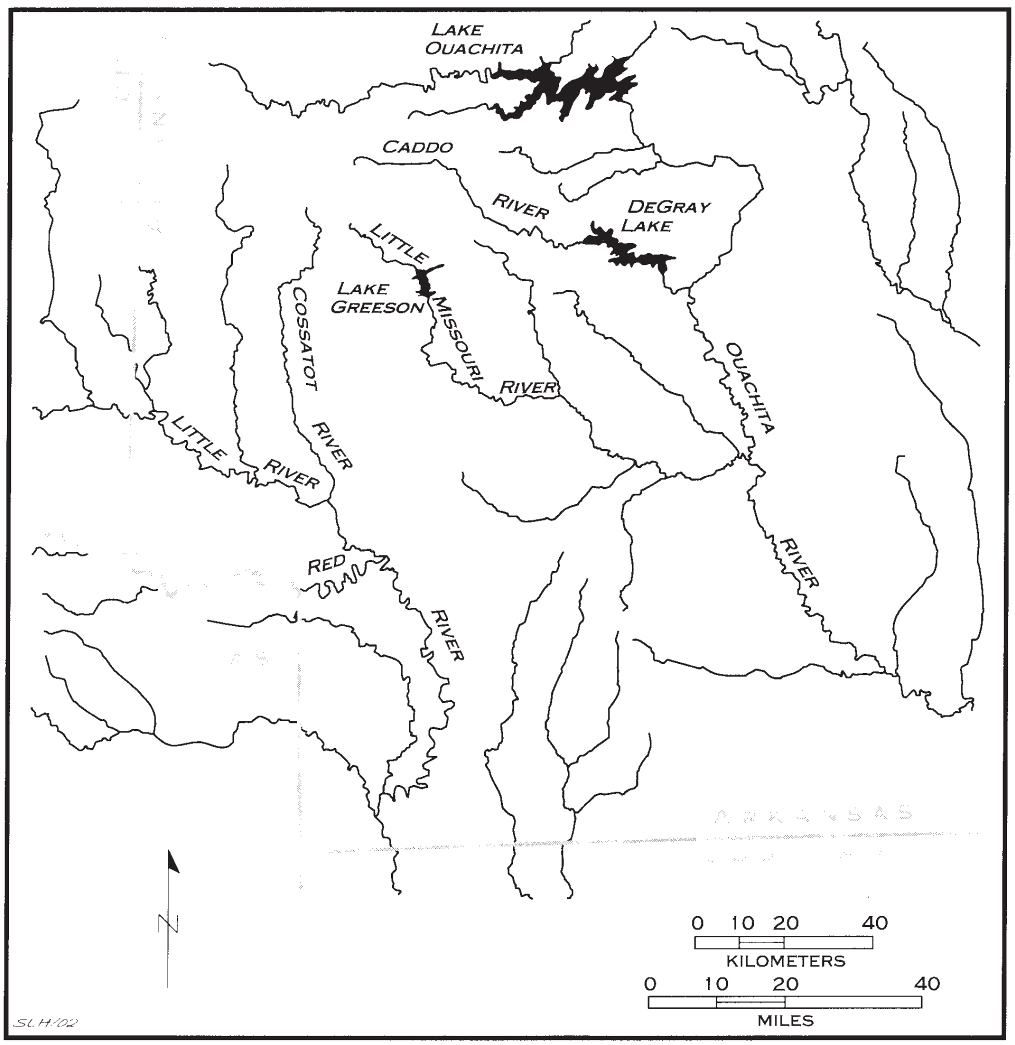

Figure 1. Locations of Lake Greeson, Lake Ouachita, and DeGray Lake in southwestern Arkansas.

Our purpose in this article is to summarize the archeological character of the prehistoric Caddo sites in these three different parts of the Ouachita Mountains. We focus in particular on the material culture record of these prehistoric Caddo settlements—especially on the ceramic sherds found on them—and discuss when these sites may have been occupied by Caddo peoples.

Caddo Sites at DeGray Lake, Clark County

Cox Creek Site (3CL739)

The Cox Creek site is an extremely large (120,000 m^2) prehistoric archeological deposit on an alluvial terrace and gently sloping ridge (410-430 feet amsl) at the confluence of Cox Creek and the Caddo River. The density of prehistoric artifacts here (63.6 artifacts per positive shovel test, or about 600 artifacts per m^2) far surpasses any of the other prehistoric sites at DeGray Lake.

The old channel of the Caddo River is about 25 m from the edge of the terrace and ridge landform, and it forms a large meander as it passes the site. This prehistoric site is in an abandoned recreational area, and has been disturbed by road construction and other park development activities, as well as looting (see below). The site is wooded, with generally poor visibility; around the looter holes, visibility is somewhat better because of the exposures created by the digging activities.

Mr. Wayne Stogsdill of the Vicksburg District pointed out one area within the site that has been looted in the last several years. The looter holes are concentrated in a 70 x 40 m area of a Vicksburg District camping area covered with hardwoods and scattered pines. The area appears to have been previously terraced for agricultural purposes. This looting is in a prehistoric Early to Middle Caddoan midden area (Figure 2), and the looting has apparently been ongoing for some time; old and new holes sometimes have been either left open or covered up to avoid detection, but the looting activities are obvious and substantial. Looting activities occurred while our archeological survey investigations were on-going.

More than 30 looter holes of various sizes were documented in this one area (Figure 3). The dimensions and depths of the looter holes were measured (Table 1), and the looter holes were mapped; any diagnostic prehistoric artifacts (i.e., projectile points or prehistoric ceramics) noted in the backdirt piles were collected as part of our investigations.

At least 76 m^2 of the midden appears to have been recently looted; there are older looter holes in the midden area that could not be accurately mapped. This comprises at least 8.5% of the midden's surface area. The recent looting has disturbed and/or removed approximately 21 m^3 (see Table 1).

Shovel testing was initiated in the looter hole area, and continued across the landform; a total of 75 shovel tests were excavated at the Cox Creek site, and 61 contained prehistoric archeological materials. The Pirum-Sherless-Shermore sediments range from 5-60 cm in thickness here, with the thinner deposits generally restricted to the ridge landform and the higher elevations.

There is a prehistoric midden deposit in the looted part of the site that is an estimated 45 x 20 m in size (see Figure 2); it is a maximum of 40 cm in thickness in ST 562. The upper 26 cm of the midden is a dark brown sandy loam, while the lower midden (ca. 26-40 cm bs) is a very dark brown sandy loam with charcoal flecks, fire-cracked rocks, and an area of oxidized soil that may be a hearth feature. Both the upper and lower midden samples contain an abundance of prehistoric Caddo pottery sherds in the shovel testing (n=18), occurring at a density of ca. 200 sherds per m^2. The midden formed in a yellowish-brown sandy loam of the Pirum-Sherless-Shermore soil; the total thickness of the A-horizon sediments is ca. 50 cm. These rest on a yellowish-red clayey loam B-horizon.

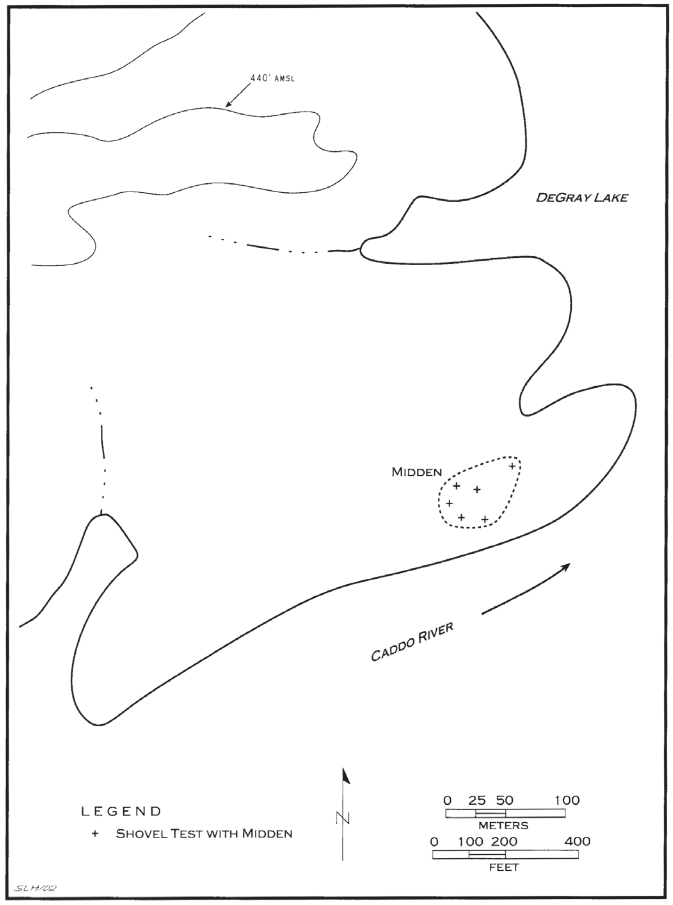

Figure 2. Location of the midden at the Cox Creek site (3CL739)

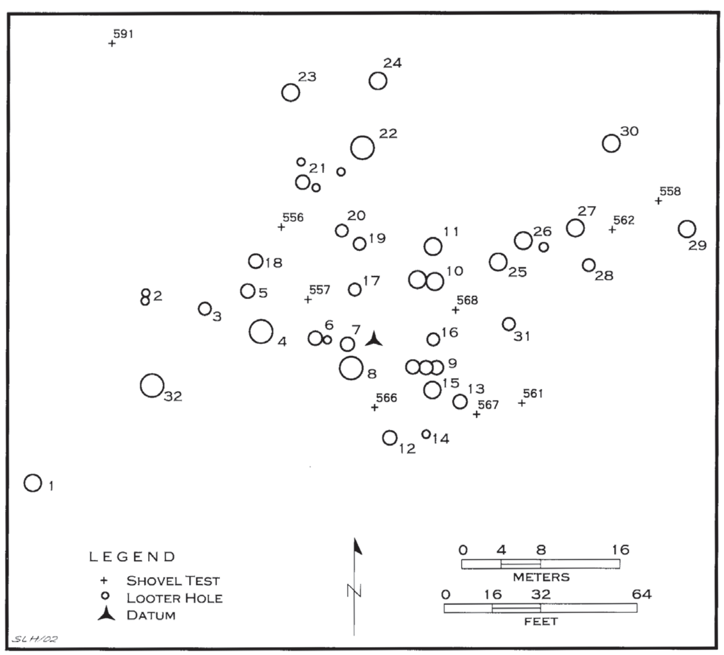

Figure 3. Looted areas and shovel tests at the Cox Creek site midden.

An area of oxidized soil, charcoal flecking, and fire-cracked sandstone (eight pieces weighing 1.4 kg) was exposed in ST 562 (see Figure 3) between ca. 28-44 cm bs in the lower midden deposit; there were also two chert cobbles and a ceramic sherd found in apparent association. The probable hearth feature covered the northern half of the shovel test, and is at least an estimated 30-50 cm in length and width.

Sediment samples (ca. 200 g) from ST 562 were submitted for Oxidizable Carbon Ratio (OCR) dating from an area with an abundance of Caddo pottery sherds. Frink (1992, 1994, 1995, 1999) and Frink and Perttula (2001) discuss the OCR dating method and procedures in detail. Sediment samples were taken at 5 cm intervals, beginning at 5 cm bs, and extending to 55 cm bs. The first eight samples are in the prehistoric midden deposit with abundant lithic and ceramic artifacts, charcoal flecks, and fire-cracked rocks; as previously mentioned, there is a concentration of oxidized soil between 28-44 cm bs. The results of the OCR dating procedure are presented in Table 2 (see also Perttula and Nelson 2000: Appendix V).

Table 1. Dimensions and depths of the recent looter holes in the midden deposits at the Cox Creek site (3CL739).

Looter Hole #	Length and Width (in m)	Depth (in cm)
1	0.75 x 0.75	35
2	0.50 x 0.50	40
3	1 x 0.50	35
4	2 x 2	20
5	0.75 x 0.75	20
6	1 x 1, 0.50 x 0.50	25
7	1 x 1.5	25
8	3 x 3	30
9	1 x 4	30
10	4 x 4	20
11	1.5 x 1.5	40
12	1 x 0.50	30
13	1 x 0.50	45
14	0.50 x 0.50	30
15	1 x 1	30
16	1 x 0.50	30
17	1 x 1	30
18	1 x 0.50	20
19	0.50 x 0.50	20
20	0.75 x 0.75	30
21	1 x 1, 0.50 x 0.50	40
22	2 x 2, 0.50 x 0.50	45
23	1.5 x 1	40
24	1 x 1	50
25	2 x 2	20
26	1 x 1	20
27	2 x 2	20
28	1 x 1	50
29	1 x 0.50	35
30	2 x 2	20
31	1 x 1	20
32	3 x 3	32

Table 2. Oxidizable Carbon Ratio dates from the Cox Creek site (3CL739).

Laboratory Sample No.	Depth below surface	Calculated OCR Dates
	Upper Midden	
ACT 4525	5 cm	440 ± 13 BP, AD 1493-1519
ACT 4527	10 cm	514 ± 15 BP, AD 1421-1451
ACT 4528	15 cm	507 ± 15 BP, AD 1428-1458
ACT 4529	20 cm	560 ± 16 BP, AD 1374-1406
ACT 4530	25 cm	531 ± 15 BP, AD 1404-1434
	Lower Midden	
ACT 4531	30 cm	616 ± 18 BP, AD 1316-1352
ACT 4521	35 cm	734 ± 22 BP, AD 1194-1238
ACT 4522	40 cm	870 ± 26 BP, AD 1054-1106
	Sandy Loam Deposits Under Midden	
ACT 4523	45 cm	1476 ± 44 BP, AD 430-518
ACT 4524	50 cm	1743 ± 52 BP, AD 155-259
	Clayey Loam B-Horizon	
ACT 4526	55 cm	3444 ± 103 BP, BC 1597-1391

Based on differences in soil pH, elevated frequencies of coarse and very coarse particles in the sediment column through the midden (see Perttula and Nelson 2000: Appendix V), and the depth and character of the midden deposits, Frink (2000 personal communication) suggested that the cultural age of the upper midden deposits range between ca. 514-560 BP, or ca. A.D. 1390-1436. The lower midden deposit's age is best represented by the OCR sample at 40 cm bs, or about A.D. 1054-1106. These dates together indicate that the prehistoric Caddo midden built up over a period of approximately 300 to 400 years. Finally, very elevated frequencies of coarse particles in sample ACT 4524 (see Table 2) at 50 cm bs, followed by elevated fine particles in the overlying sample, suggests that there was an early cultural occupation at the site around A.D. 200, during the Woodland period.

The prehistoric archeological remains at the Cox Creek site, in addition to the one midden deposit, are concentrated on the terrace paralleling the Caddo River. Lithic debris—primarily novaculite—is found in virtually every shovel test, and in great quantities. The only three cores, however, are restricted to the southwestern part of the site (420 feet amsl), in one of the two areas with the highest densities (more than 70 pieces of lithic debris per shovel test) of lithic debris, labeled Area B on Figure 4. These areas are about 75 m apart; Area A is about 220 x 100 m in size, and Area B is 150 x 50 m. These areas have more than 80% of the lithic debris found on the Cox Creek site.

Both areas contain similar kinds of lithic raw materials represented among the lithic debris (Table 3), including large amounts of white novaculite, gray novaculite, pink novaculite, orange and red novaculite, local cherts, and Big Fork chert. There are no significant differences in the proportions of the raw material in the debris, suggesting that similar sources were used for the procurement of raw materials during the different prehistoric occupations at the site.

Table 3. Lithic raw materials in Area A and B lithic debris, Cox Creek site (3CL739).

Raw Material	Area A	Area B
white novaculite	52.4%	55.3%
gray novaculite	16.4%	17.6%
pink novaculite	9.7%	8.9%
orange novaculite	4.7%	4.4%
red novaculite	4.1%	2.8%
yellow novaculite	1.0%	0.4%
white-black novaculite	0.9%	0.5%
gray-black novaculite	0.9%	0.4%
black novaculite	0.7%	1.1%
brown novaculite	0.4%	0.3%
white-gray novaculite	0.1%	0.4%
gray-yellow novaculite	trace	0.1%
red-brown novaculite	trace	0.0%
red-black novaculite	trace	0.0%
Big Fork chert	2.3%	2.8%
local cherts	5.3%	3.9%
quartz	1.0%	1.0%
quartzite	trace	0.0%
siliceous shale	trace	0.0%
Totals	2065	924

Fire-cracked rocks are also concentrated in areas A and B, but with very little areal separation between them across the terrace; one shovel test on the ridge also has a bit of fire-cracked rock. The densest amounts of fire-cracked rock are found primarily in Area A shovel tests (Figure 5).

A wide assortment of prehistoric tools are found broadly dispersed across the Cox Creek site, but as with the other classes of artifacts, the tools tend to concentrate in areas A and B (Figure 6). Tools include dart points, arrow points (n=3) and arrow point preforms (n=1), bifacial tool fragments, bifaces, groundstone tools, and various flake and scraping (end and side scrapers) tools. All the groundstone tools (five mano and mano fragments and one grinding slab fragment of Jackfork sandstone) are concentrated in the Area A midden. The temporally diagnostic artifacts include a Middle Archaic Johnson point, Woodland or Fourche Maline Gary, *var. Camden* (n=2) points, and an Early to Middle Caddo unidentified arrow tip, respectively, from Area A, along with an expanding stem side-notched dart point, possibly of the Late Archaic Mena side-notched type. In Area B, there is an orange novaculite Dalton point of Late Paleoindian age, a Late Archaic Williams point, one Gary, *var. Camden*, and two corner-notched arrow points, including one that resembles an Agee (Figure 7d). The only temporally diagnostic lithic tool on the ridge landform is an arrow point preform in ST 585 (see Figure 6).

One of the arrow points at the Cox Creek site has an expanding stem with corner-notching and a flat to slightly convex base (see Figure 7e). The blade is not serrated. It resembles Early to Middle Caddoan period arrow points, probably the Scallorn B form defined by Brown (1996:442 and Figure 2-61f-h). Another from the site may be an Agee (see Figure 7d). It has a convex base,

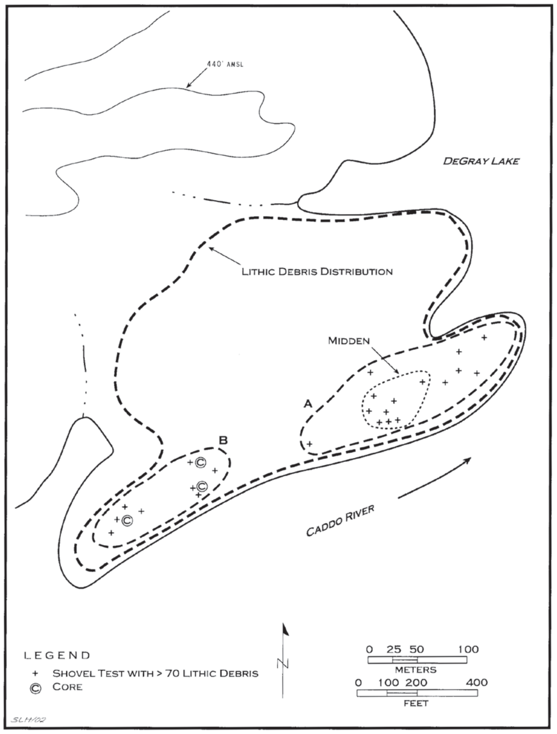

Figure 4. Distribution of cores and lithic debris at the Cox Creek site.

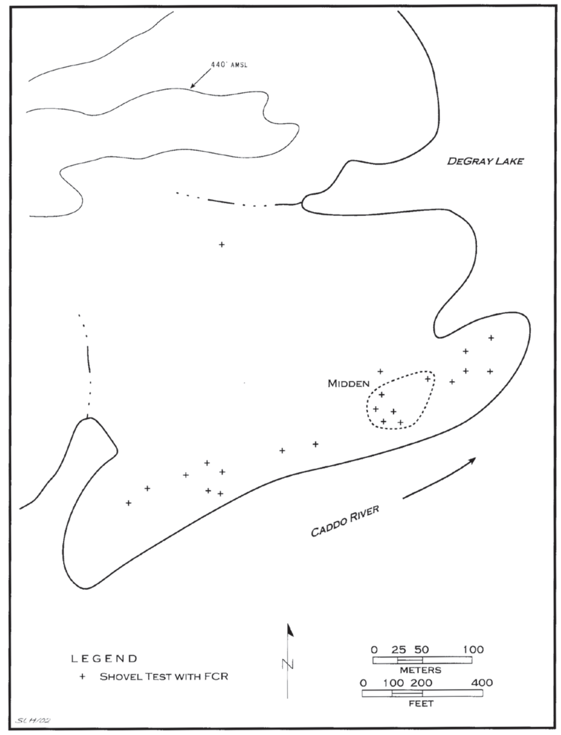

Figure 5. Shovel tests at the Cox Creek site with fire-cracked rock.

a slightly recurved blade, small barbs, and relatively deep corner notches. Schambach (1982) has suggested that the Agee arrow points at the Crenshaw site along the Red River date to the latter part of the Woodland period, and Early (1988:105) and Brown (1996) also consider Agee points to have been made in early Caddoan times, perhaps before A.D. 1050. The arrow point preform from the site is an ovoid and bifacially-worked piece of white novaculite that is only 2.8 mm thick and 18.8 mm in width.

Prehistoric ceramics are found in shovel testing and looter hole backdirt only on the terrace landform, but again they occur in two clusters (Figure 8). These correspond to Areas A and B already identified from the prehistoric lithic debris, fire-cracked rock, and chipped stone tools. The ceramics are particularly common in Area A midden contexts, and 19 of the looter hole backdirt piles had sherds exposed on them. The Area A ceramic cluster is ca. 120 x 80 m in size, compared to 50 x 50 m in size for Area B. The only piece of daub from the Cox Creek site is from Area A.

The Area A ceramic cluster contains Early to Middle Caddo plain and decorated sherds, including Military Road Incised and Friendship Engraved, and the few Late Caddoan shell-tempered sherds also occur in the Area A midden. The only decorated sherds in Area B are two grog-grit-bone-tempered pieces with broad incised lines and a fingernail punctated sherd with bone temper (Figure 9).

Bone-tempered, grit-bone-tempered, and grog-grit-bone-tempered sherds are found in both ceramic clusters, but none in large amounts. Grit-tempered sherds, probably the Woodland or Fourche Maline Ouachita Ironware, *var. Catherine*, are almost exclusively found in Area A looter holes and shovel testing. These sherds are found in low numbers throughout the midden deposit-with one sherd from a context immediately below the midden-indicating the midden was probably developed atop earlier Woodland (and Archaic) occupational debris along this part of the terrace.

The Cox Creek site has 158 sherds and one piece of daub. Included in the sherds are four

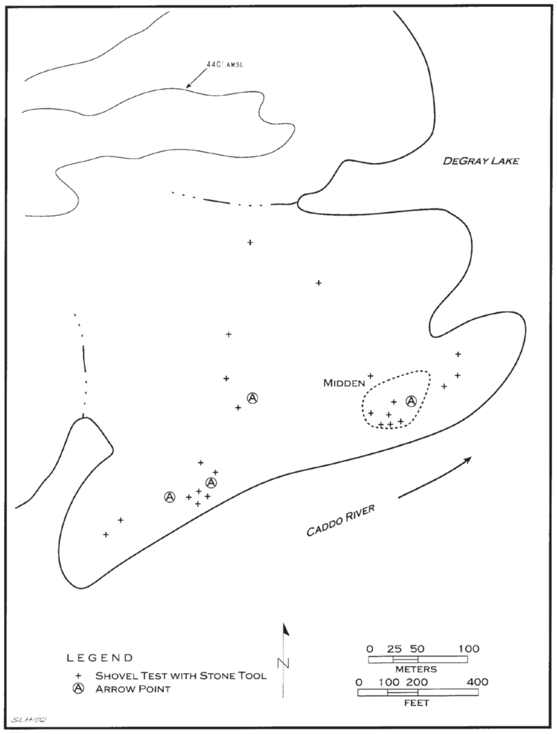

Figure 6. Distribution of stone tools and arrow points at the Cox Creek site.

rims, three bases, 129 body sherds, and 22 sherdlets. Seventeen sherds, including one rim, have decorations, representing 10.8% of the assemblage, and 12.5% of the non-sherdlets. One of the bases, tempered with grog and grit, has basketry impressions on its exterior surface.

Grog-tempered sherds are most common at the Cox Creek site, representing 41% of the sample, followed by grit-tempered, sandy paste sherds (21.9%). The total percentage of sherds with grog (crushed sherd temper) in the assemblage, irrespective of its occurrence with other temper combinations, is 69%.

The grog-tempered sherds are moderately thick (mean=6.75 $\pm$ 1.06 mm), with high proportions of sherds from vessels that were either incompletely oxidized during firing or reduced during firing, but cooled in a high oxygen environment (see Perttula and Nelson 2000: Table 25). The grog-tempered sherds may be from Williams Plain vessels, and various Caddo decorated vessels, because they are no slipped or burnished (Poole Plain) grog-tempered sherds in the assemblage.

The grit-tempered sherds have a sandy paste and are tempered with crushed rock, typically novaculite, but there are also pieces of crushed quartz in the paste. These sherds appear to be Ouachita Ironware, probably *var. Catherine*, rather than LeFlore Plain, because they are not smoothed or burnished (see Early 1988; Schambach 1998). They have thin vessel walls (5.73 $\pm$ 0.86 mm), and are from vessels that usually have been fired in a reducing environment. More than 82% of the grit-tempered sherds have been fired under those conditions. Two grit-tempered sherds have

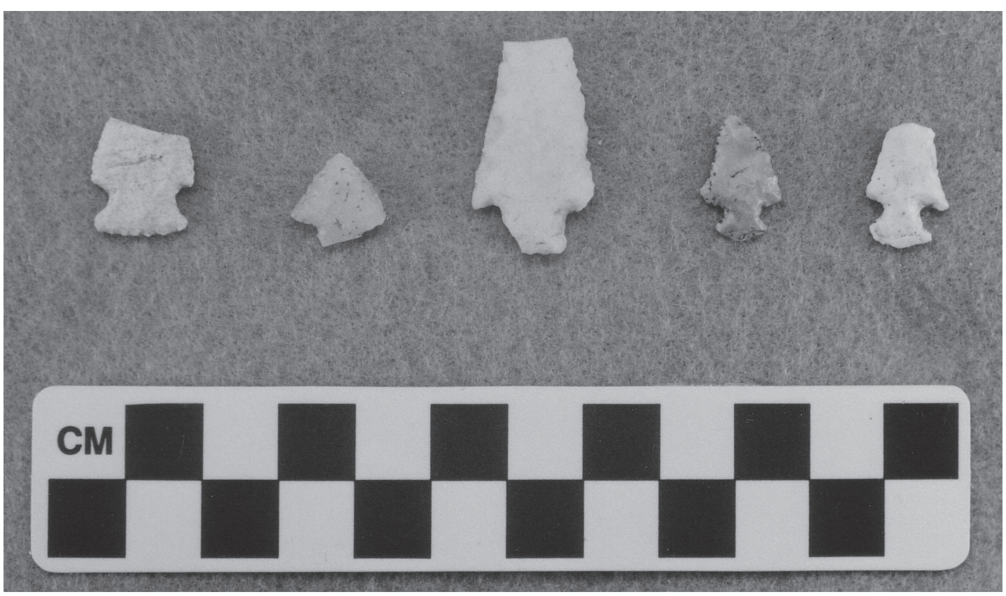

Figure 7. Arrow points from DeGray Lake Caddo sites: a, Hatchet site (3HS544); b, Point Cedar South Camp (3CL759); c; Lambert (3HS458); d-e, Cox Creek (3CL739).

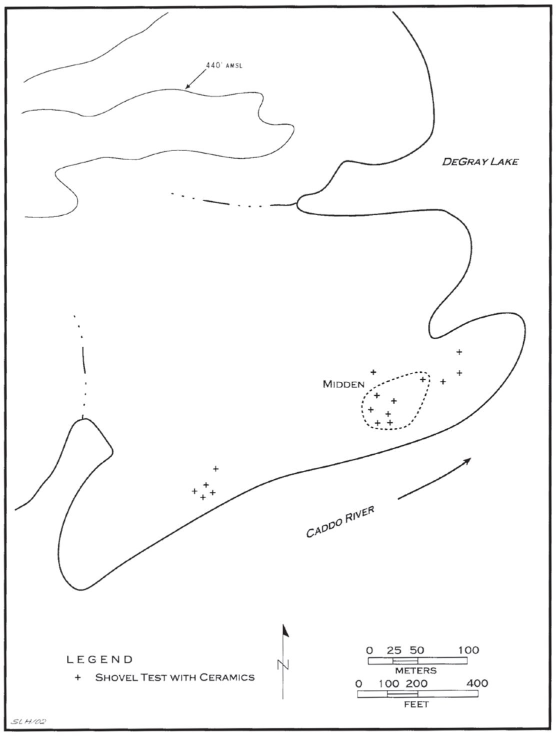

Figure 8. Distribution of ceramic sherds at the Cox Creek site.

incised or punctated decorations (see below).

The shell-tempered sherds are from Late Caddoan cooking jars of the Woodward Plain type. They are very thin (5.26 $\pm$ 0.61 mm), and principally fired in a reducing environment. Two shell-tempered sherds have Class C punctated decorations.

Grog-grit-tempered Williams Plain sherds account for 15.6% of the analyzed sherds. They are relatively thick on average (7.12 $\pm$ 0.88 mm), and were principally fired in a reducing environment, but cooled in a high oxygen environment. One grog-grit-tempered sherd has an incised decoration. There are also nine sherds (7%) of Williams Plain that have a grog temper and a sandy paste. They have slightly thinner vessel walls (6.49 $\pm$ 1.05 mm), but again are from vessels that were fired in a reducing environment, but cooled in a high oxygen environment. One of these sherds also has an incised decoration.

The only other temper combinations represented in the sherds together comprise only 8.6% of the sherds, and include grit-bone (n=2), grog-grit-bone (n=4), bone (n=3), and grog-bone (n=2). The grit-

Figure 9. Prehistoric ceramics from DeGray Lake Caddo sites: a, c-i, Cox Creek (3CL739); b, Crow Road (3CL749).

bone-tempered sherds are thin (6.15 mm $\pm$ 0.25 mm), while the others have thicker vessel walls (ranging from 7.10-7.20 mm on average). The grit-bone-tempered and grog-grit-bone-tempered sherds are from vessels that were reduced during firing, as with much of the assemblage from the site (see Perttula and Nelson 2000: Table 25), while the bone and grog-bone-tempered sherds were primarily from vessels that were incompletely oxidized during firing. As previously discussed, the highest proportions of incompletely oxidized sherds occur in the grog-tempered wares.

Those few sherds with bone are not Cooper Boneware (see Schambach 1998) from Fourche Maline contexts, as the bone temper particles are finely crushed. The grit-bone-tempered and grog-grit-bone-tempered sherds may be from Mill Creek Plain, since that gritty pottery has been described as having a mixture of tempers, including clay particles, quartz grains, shale, mica, and charred organics, although Early (1988:64) does not mention charred bone as a temper inclusion. It is probably more likely that these sherds simply represent undecorated sherds from untyped Caddo vessels.

The three plain rims have direct or vertical rims (see Figure 9h-i), and two have rounded lips and the third has a flat lip. The rounded lip sherds have shell or grog-grit-temper, and are probably Caddo vessels, as is the flat lip. This sherd is tempered with grog-grit-bone.

Incised sherds comprise 60% of the decorated sherds, followed by punctated (35%), engraved (6%), and brushed (6%). Most of the decorated sherds are tempered with grog (47%), and 15% (n=8) of the grog-tempered sherds from the site have decorations. Other decorated sherds are tempered with grit (n=2), possible shell (n=2), grit-grog-bone (n=2), grog-grit (n=1), grog with a sandy paste (n=1), and bone (n=1). Decorated sherds are also common among the possible shell-tempered sherds (29%), the grit-grog-bone (50%), and bone-tempered (33%) sherds. The relatively high frequency of decorated sherds, in combination with the quantities of plain and decorated sherds with grog-tempering (69%) or shell-temper (5.5%), indicate that the ceramics from the Cox Creek site were primarily made by Caddo groups after ca. A.D. 900. The OCR dates from the midden deposits where most of the sherds were found further suggests that the Caddo occupation at the Cox Creek site took place primarily between A.D. 1050-1450, during the Early and Middle Caddo periods. The presence of plain and decorated shell-tempered sherds points to a limited use of the site after ca. A.D. 1450, based on the dating of Late Caddo components at the Standridge and Winding Stair sites in the southern Ouachita Mountains with similar shell-tempered pottery (see Early 1988; Early et al. 1999).

Because of the small size of most of the decorated sherds, it is difficult to determine in most cases if the nine incised sherds are Class A or Class B examples. One grog-tempered Class A body sherd from Looter Hole 20 has diagonally opposed incised lines, probably from a Military Road Incised jar, and a sandy paste Class B rim sherd from ST 589 has at least two rows of horizontally incised lines below the lip; the lines are widely spaced (3.6 mm apart). Five other incised sherds have broad (2 mm wide) incised lines; in four cases, the decoration is only a single incised line (see Figure 9a). One grog-tempered body sherd has at least five broad parallel incised lines (see Figure 9e). Two other sherds (ST 568 and Looter Hole 22) have fine-line incised decorations, with at least 2-6 parallel lines (see Figure 9d). Both of these sherds are tempered with grog.

The Class C punctated sherds have fingernail punctations. Two with grog and grit temper have at least two rows of deep fingernail punctations (see Figure 9c), and these (from ST 568 and Looter Hole 26) are probably from the body of Military Road Incised jars. Two others with grog-temper (ST 562 and ST 597) have fingernail punctations, although it is not clear if they occur in rows or are randomly spaced across the vessel body. The last two Class C punctated sherds are from probable shell-tempered flaring rim cooking jars that have horizontal rows of vertically-placed fingernail punctations. Early (1988:82 and Figure 42) describes similar shell-tempered jars (untyped, Group 3) from Late Caddo contexts at the Standridge site, and she notes that "[u]tilitarian jars of this shape with punctated or incised rims and undecorated bodies are well represented in both upper Ouachita and middle Ouachita drainage collections."

The one Class D (see Schambach et al. n.d.) body sherd is tempered with grog and has parallel brushed marks on the vessel exterior surface (see Figure 9g). The vessel-probably a cooking jar-was smoothed on the interior, presumably to lower its permeability and increase its resistance to thermal shock (Rice 1996:148; Schiffer et al. 1994:210).

A single Class E engraved body sherd from ST 568 has a zone of fine cross-hatching (see Figure 9f). This sherd appears to be from a carinated bowl, and may be an unspecified variety of Friendship Engraved.

A small amount of burned animal bone was recovered in the shovel testing in the midden. Two pieces of burned bone were in ST 562 (28-40 cm).

Crow Road Site (3CL749)

The Crow Road site is an extensive prehistoric site with Middle Archaic and Early-Middle Caddo components on a relatively broad and flat ridge (410-440 feet amsl) in a prominent meander loop in the Caddo River. The site covers about 98,800 m^2, and is bounded by the Caddo River on three sites; to the north the ridge crests at 470 feet amsl, and there are two small tributaries in that area. This relatively low-lying area may represent a filled-in old channel of the Caddo River.

The landform is covered with pines and hardwoods, and surface visibility is poor. The eastern part of the ridge has been recently clear-cut by the Vicksburg District to control an insect infestation, and the understory is a thick growth of vines and briars; the area has also been replanted in pine seedlings. The ridge has also been previously cultivated, as there are agricultural terraces spaced 30-40 m apart across the landform. The southern and westernmost portions of the site may also have been periodically inundated by DeGray Lake.

Thirty-two of 44 shovel tests we excavated at the Crow Road site contained prehistoric lithic and/or ceramic artifacts, with an overall density of 4.9 artifacts per positive shovel test. The Pirum-Sherless-Shermore sediments range from 10-45 cm in thickness.

Prehistoric tools include a Middle Archaic net sinker or grooved stone from ST 754, a thick biface from ST 746, and a corner-notched arrow point and arrow point preform from ST 747. The latter is associated with grog-tempered and grog-grit-tempered plain pottery sherds and fire-cracked rocks. Three other shovel tests also have prehistoric Caddo ceramics, and they cluster on the higher part of the ridge (430-440 feet amsl), and one of these shovel tests (ST 777) also has fire-cracked rock.

There are three areas within the site that have higher densities of prehistoric lithic debris (between 8-17 flakes per shovel test). The first (ST 748 and ST 750) is directly associated with the prehistoric ceramics, and immediately east of the shovel test with the corner-notched arrow point and the arrow point preform of pink novaculite, while the second (ST 756) is in the center of the site; two bifacial cores were also recovered in the shovel testing in this area. The third area with high densities of lithic debris is along the eastern margins of the site (ST 760 and ST 762), immediately east of another area with prehistoric Caddo ceramics.

At the Crow Road site, there are nine sherds from four different shovel tests; the overall site density based on the shovel testing is 3 sherds per square meter. The nine sherds include one sherdlet (i.e., less than 1 mm in length and width), seven body sherds, and one plain rim sherd.

The rim is grog-tempered, and is direct with a rounded lip; it is 5.9 mm in thickness. One of the body sherds (from ST 752), also grog-tempered, has a 2-mm wide and broad incised line (see Figure 9b). Both of these sherds are from vessels that were fired in a reducing environment. Three other plain and unsmoothed grog-tempered sherds are relatively thick-7.5-8.2 mm-and are probably from Williams Plain vessels. Each sherd is from a different vessel, one oxidized during firing, another incompletely oxidized, and the last fired in a reducing environment, but cooled in high oxygen conditions.

Two other plain body sherds have grog and grit-tempering, and one has a gritty feel. The body sherds range from 5.8-7.9 mm in thickness. The mixture of tempers, and the gritty or sandy paste suggests these sherds may be from Mill Creek Plain vessels (see Early 1988). Both sherds are from vessels that were reduced during firing, but cooled in the open air.

The final sherd is a relatively thin (6.4 mm) plain body sherd with grog, bone, and grit temper inclusions; neither the exterior or interior surfaces have been smoothed or burnished. It is also from a vessel that was fired in a reducing environment, but cooled in a high oxygen environment.

Lake Ouachita, Montgomery County

Lonesome Loblolly (3MN2157)

The Lonesome Loblolly site is a multi-component prehistoric site on a long and relatively narrow alluvial terrace (576-590 feet amsl) along Twin Creek, a tributary to the Ouachita River. Site size is estimated at 25,000 square meters (6.25 acres). There is an old creek channel along the western end of the site, and there are small streams at the northern and southern ends of the landform. At the southern and southwestern part of the site, the terrace cut is 3-4 m in height.

One relatively open area in the southwestern part of the Lonesome Loblolly site contains prehistoric ceramic sherds. The area is marked by a small rise approximately 30 m in diameter and 1 m in height, covered with grasses, briars, and vines, and a few hardwoods and pines. Overall, surface visibility ranged from 10-25% across the site, with the highest visibility along the shoreline. Vegetation here includes hardwoods, a few pines, and a thick understory of grass, briars, and vines.

A total of 36 shovel tests were excavated at the Lonesome Loblolly site, and 23 contained prehistoric lithic and/or ceramic artifacts in the Kenn fine sandy loam sediments. The majority of shovel tests have prehistoric artifacts between 0-20 cm bs, but two at the northern and southwestern parts of the site have 30-40 cm thick deposits. The density of prehistoric lithic artifacts is 2.30 per positive shovel test, and includes one Marshall dart point in a shovel test. The highest densities of prehistoric lithic artifacts occur in the central part of the site (in three shovel tests), and this area also has fire-cracked rock. The proximity of the Marshall dart point to these three shovel tests suggests this part of the site probably has a spatially discrete Late Archaic component.

The prehistoric ceramics were recovered between 0-20 cm in three other shovel tests (ST 98, 100, and 101), and the prehistoric ceramic density is 1.67. Four of the sherds are plain, and one has fingernail punctations. All five sherds are from vessels fired in a reducing environment, although 75% were subsequently cooled in a high oxygen environment. Three of the sherds have grog temper, including the one from ST 100 with a row of fingernail punctations, are relatively thin (5.93 ± 0.44 mm), and have been smoothed on exterior surfaces. One sherd has grit temper (7.4 mm thick), and the last sherd has both grog and grit aplastics (5.7 mm). None of the sherds have a sandy or gritty paste, which indicates they are not from the prehistoric Caddo Mill Creek Plain wares (see Early 1988), or earlier Woodland period pottery (see Schambach 1998). Rather, these sherds appear to be from untyped Caddo vessels of Early to Middle Caddo age, based on the thin body walls of the vessels, and the predominance of grog temper. The absence of shell-tempered pottery here suggests the Lonesome Loblolly Caddo component predates ca. A.D. 1450 (cf. Early 1988, 2000).

A Marshall dart point (see Schambach 1998:Figure 29) of grayish-white novaculite was found in ST 81 (0-20 cm bs) in the northern part of the Lonesome Loblolly site. The point is parallel-stemmed, with a flat base, deep corner-notching, and long barbs. Transverse and longitudinal fractures have removed most of the blade and one barb of the point. It has a 18.3 mm stem width and is 7.2 mm thick. Schambach (1998:Table 20) suggests that Marshall points in Southwest Arkansas date to the latter part of the Middle Archaic, between 2000-3000 B.C., but in Central Texas, where the Marshall point was defined, they appear to be later in time, from ca. 500-0 B.C. (Collins 1998:Figure 4-1). In either case, the Marshall point at the site clearly signifies an earlier pre-Caddo use of the northern part of the Lonesome Loblolly site.

The lithic debris from the Lonesome Loblolly site is dominated by novaculite (98%), particularly white novaculite. There is a single small non-cortical piece of Big Fork chert. White novaculite lithic debris comprises 86% of the novaculite, along with small amounts of gray (n=5) and yellow (n=2) novaculite. More than 83% of the lithic debris are medium to small in size according to the size grade data, and they are non-cortical (see Perttula and Nelson 2001: Appendix 2). This points to tool resharpening and maintenance activities during Archaic and Caddo occupations, as well as the secondary reduction of cores and bifaces/preforms instead of larger cobbles or slabs from quarry sites or river gravels.

Two pieces of sandstone FCR (0.7 kg) were found in ST 89 (0-20 cm bs) and ST 103 (0-20 cm bs) at opposite ends of the site. They probably represent the remains of “hot rock” cooking and baking of plant foods and/or the mass processing of nut mast.

Roundup (3MN2158)

The Roundup site is situated on a large alluvial terrace (576-580 feet amsl), with Twin Creek to the south, and a small tributary to the north. It has deep (at least 40-80 cm thick to more than 100 cm in thickness) and very compact Speer fine sandy loam sediments, and the archeological deposits at the site are 2-3 times thicker than any of the other prehistoric or historic archeological sites in this Lake Ouachita survey project. Along the northern end of the terrace, a 3-4 m high cut bank is present, with a small stream at the base of the embankment separating the Roundup and Lonesome Loblolly sites.

Surface visibility across the site is less than 10%, with thick grasses and hardwoods. The landform is currently being used as a wildlife food plot, and has recently been tilled and disc plowed with seed grasses being planted. These grasses were 15-20 cm tall at the time of the archeological survey. This tilling and disc plowing had disturbed at least the upper 20 cm of the archeological deposits, and the site has also been eroded from lake level fluctuations.

The Roundup site is about 20,000 square meters in size (5 acres). Eight of the 11 shovel tests excavated here contain prehistoric artifacts, and six also have prehistoric ceramic artifacts. The density of artifacts is 4.13 for prehistoric lithics, and 4.33 for prehistoric ceramic sherds. Six shovel tests have archeological deposits that are more than 40 cm in thickness, and in one (ST 107) the archeological materials were 80 cm deep. The other positive shovel tests had archeological materials only between 0-20 cm bs.

The highest densities of prehistoric lithic artifacts occur in ST 107 (n=11) and ST 109 (n=6) in the northeastern and eastern parts of the site (see Perttula and Nelson 2001: Appendix 2), near Twin Creek. The prehistoric ceramics, on the other hand, are most abundant in ST 110 (n=11) and ST 112 (n=5) in the northern and central parts of the terrace.

The lithic debris includes novaculite (n=29 or 88%), quartz (n=3 or 9%) and Big Fork chert (n=1). Among the novaculite, the chalky white-colored raw material is the most abundant (n=21 or 72% of the novaculite lithic debris), with smaller amounts of white-red (n=1), white-gray (n=3), gray (n=3), and pink (n=1) colors. The flakes are medium (45%) to large (42%) in size, and only 3% have cortex. This suggests that the secondary reduction, production, and shaping of bifaces or flake tools occurred here after cortex had been removed elsewhere (perhaps at a quarry location).

Including the single sherd found on the surface (see below), a total of 27 prehistoric ceramic sherds were recovered during our investigations at the Roundup site. Only a single sherd from ST 112 (0-20 cm bs) is decorated, and it has two parallel and finely incised or engraved lines; it is grit-tempered. The sherds are tempered with grit (n=5), bone-grog (n=1), grog (n=9), and grog-grit (n=11). Two of the grog-tempered sherds have a noticeable sandy paste.

The grog-grit-tempered sherds are thin (5.97 $\pm$ 0.99 mm), and lack any form of surface treatment. In some cases the grit is comprised of crushed pieces of quartz, as well as other kinds of rock (including hematite). More than 90% of the sherds are from vessels that were fired in a reducing environment (cf. Teltser 1993). This gritty pottery is probably the Early to Middle Caddo ware Mill Creek Plain, since it has been described by Early (1988) as containing a mixture of tempers, including clay particles, quartz grains, shale, mica, and charred organics. The grit-tempered sherds may be from the same ware, which is suggested in part because they do not have sandy paste; grit-tempered and sandy paste sherds seem characteristic of Ouachita Ironware, a Woodland period ceramic ware (see Early 1988; Schambach 1998). These sherds are also rather thin (5.74 $\pm$ 0.34 mm), lack any surface treatment, and 80% are from vessels fired in a reducing environment. As previously mentioned, the one decorated sherd (parallel incised body sherd) was tempered with grit.

The grog-tempered sherds are too thin (6.08 $\pm$ 0.45 mm) to be classified as Williams Plain, which is usually quite a bit thicker (see Schambach 1998:25), and they likely belong to an untyped Caddo ware. One of the sherds has been well-smoothed on the interior surface, and they are all from vessels that were fired in a reducing or low oxygen environment. The grog-tempered sherds with sandy paste are also very thin-walled (5.2 $\pm$ 0.1 mm), and are from vessels fired in a reducing environment.

Finally, the one sherd with bone and grog temper is 6.9 mm thick and has no surface treatment. It is from a vessel that was fired and cooled in a low oxygen environment.

A single body sherd (6.0 mm) of grit-tempered pottery was found on the surface near ST 110. It is from a vessel that was fired in a reducing environment, and neither the exterior or interior surfaces had any surface treatment.

Taken as a group, the small assemblage of prehistoric ceramics appear to be from an Early to Middle Caddo occupation at the Roundup site. The absence of shell-tempered sherds suggests the occupation pre-dates A.D. 1450 (see Early 1988, 2000). A similar but larger ceramic assemblage has been documented from the Cox Creek site (3CL739) on the Caddo River, where 69% of the sherds have grog-tempering, and about 65% of the sherds were from vessels that were fired in a reducing environment (Perttula and Nelson 2000:158-161). Based on the OCR dates from the midden deposits at the Cox Creek site (see Table 2), the Caddo occupation there took place primarily between A.D. 1050-1450.

3MN2185

This extensive prehistoric and historic archeological site is on a broad alluvial terrace (ca. 580 feet amsl) about 50 m north and east of Lake Ouachita. The now-inundated channel of the Ouachita River is ca. 300 m south of 3MN2185. Intermittent tributaries of the Ouachita River mark the northern and northeastern parts of the site. Vegetation across the site varies from hardwoods and cedar trees in Area A, with a dense understory of briars and vines, to mature pines and less undergrowth across the remainder of the site. Surface visibility is uniformly poor.

The soil at 3MN2185 is classified as Avilla silt loam, 1-8% slopes. A representative shovel test profile from ST 0N 0E in the northeastern part of the site indicates at least 17 cm of silt loam overlying a reddish-brown clayey silt between 17-35 cm bs. In Area A, the silt loam is thicker—perhaps as thick as 50 cm—with an increased amount of clay below 40 cm bs.

Site 3MN2185 covers a 300 x 220 m area, based on the extent of the landform and the excavation of 102 shovel tests across the alluvial terrace (Perttula and Reese 2002). Seventy-seven shovel tests contained prehistoric and/or historic artifacts. The prehistoric artifact density is 20.0 per positive shovel test. There are four areas on the alluvial terrace with higher concentrations of prehistoric artifacts. The first is in the southeastern part of the terrace (around 90S 30E), while the other three areas are along the western and central part of the terrace, centering around 60N 100W; 0N 120 W; and Area A. The highest densities of both prehistoric and historic artifacts is in Area A, and this is the only area that contains prehistoric ceramic sherds.

A total of 1537 prehistoric artifacts were recovered in the archeological survey investigations at 3MN2185, including a relatively large sample of prehistoric ceramic sherds, all from Area A (Table 4). These prehistoric materials were found between 0-50 cm bs, with a mean depth of ca. 32 cm bs for the 77 positive shovel tests.

Table 4. Summary of the prehistoric artifacts from 3MN2185.

Artifact Category	Frequency
Lithic Debris	1454
Core	5
Utilized Flake Tool	16
Retouched Flake Tool	4
Dart Point	6
Bifacial Tool Fragment	5
Thin Biface	5
Thick Biface	1
Bifacial Preform	1
Quartz Crystal	1
Fire-cracked Rock	4
Ceramic Sherds	31

The ceramic sherds from 3MN 2185 include 26 sherds and five sherdlets (pieces less than 1 cm in length and width) from six different shovel tests in Area A (Table 5). The decorated sherds are found only in two shovel tests, both in the central part of Area A, and another shovel test in the same area had the highest density of plain sherds. Overall, the sherd density in Area A is 4.33 per shovel test with ceramics.

Table 5. Inventory of ceramic sherds.

Provenience	Depth	Decorated Sherds	Plain Sherds	Sherdlets
ST 0N 0E*	N/A	1	-	-
ST 10N 0E*	0-30 cm	7	3	1
ST 0N 5W*	20-40 cm	-	9	1
ST 10N 25W*	0-30 cm	-	3	1
ST 10S 0E*	0-50 cm	-	2	2
ST 40S 130W+	0-30 cm	-	1	-

*Area A grid; +=Shovel transect grid; Area A coordinates would be 40N 15W

All 26 of the sherds are tempered with grog (Table 6) and have a clay paste. Most of these sherds are also tempered with grit or crushed rock (58%), and another sherd has been tempered with grog and bone. One sherd from ST 0N 5W had grog temper and a significant amount of charred organics/charcoal in the paste. A small number of the sherds in the assemblage have been smoothed, burnished, or scraped/wiped on interior and/or exterior surfaces, and the preservation of residue deposits on several sherds indicate that vessels at the site were used for cooking purposes.

Table 6. Ceramic attribute analysis, 3MN2185 sherds.

	Grog	Grog-organics	Grog-bone	Grog-grit
No.	9	1	1	15
Smoothed	1	-	-	-
Burnished	1	-	-	1
Scraped/Wiped	-	-	-	2
Organic Residue	-	-	-	2
Incised	3	-	-	5
Oxidized Firing	1			1
Reduced Firing	8	1	1	14
Mean Thickness (mm), body	6.48 $\pm$ 0.54	6.8	8.2	7.20 $\pm$ 0.66
Mean Thickness, (mm), base	-	-	-	9.5 $\pm$ 0.7

More than 90% of the sherds in the 3MN2185 assemblage are from vessels fired in a reducing environment (see Table 6). Furthermore, most of these vessels were then cooled in a high oxygen environment (i.e., pulled out of the fire to cool, rather than allowed to cool in the fire as it died out). The high frequency of sherds and vessels fired in a reducing environment is typical of prehistoric Caddo Indian ceramic assemblages across the Caddoan area and in Caddo ceramic assemblages from the Ouachita Mountains in southwestern Arkansas. For example, in Caddo ceramic assemblages with between 30-250 sherds dating between ca. A.D. 1050-1500+ from Lake Greeson, Lake Ouachita, and DeGray Lake (Perttula and Nelson 2000, 2001, 2002), between 55-93% of the sherds are from vessels fired in a reducing environment. Vessel sherds range between 6.48-8.2

mm in average thickness along the body walls, and the two base sherds are about 9.5-10.0 mm in thickness (see Table 6).

The eight decorated sherds are incised (see Table 6), and these sherds appear to be from two different utility ware vessels, one tempered with grog and the other tempered with grog-grit. The sherds have parallel to opposed incised lines on the vessel, and the incised lines are broad and shallow, almost trailed. In several instances, the incised lines have been partially to almost totally smoothed and obliterated from the vessel surface. Given the use of grog temper, the incised decorations (resembling Military Road Incised), the relatively thin and well-made vessel bodies, and the frequency of sherds from vessels fired in a reducing environment, it is likely that the 3MN2185 ceramic assemblage is from a prehistoric Caddo Indian assemblage. If the identification of possible Military Road Incised sherds is correct, then the ceramic-bearing occupation at the site took place in the 14th and 15th centuries A.D.

The dart points from 3MN2185 are Middle to Late Archaic in age, including one side-notched piece (ST 90S 60E, 0-30 cm bs), one expanding stem form (ST 0N 110W, 0-43 cm bs), and two with parallel stems and flat to slightly concave bases (ST 0N 130W, 0-40 cm bs and 40S 130 W, 0-30 cm bs). The dart points occur in three of the four areas with the highest concentrations of artifacts, namely in the central, southwestern (Area A), and southeastern parts of the site.

The fragmentary side-notched form of white novaculite has a flat base, but with no edge grinding, and a longitudinal fracture down the blade and stem; it is 4.9 mm thick and has a 13.0 mm stem width. The blade of the expanding stem form, of Big Fork chert, has been reworked into a drill, and the tip of the drill has subsequently been broken during use. The point has a flat to convex blade. It is 27.0 mm wide and 7.6 mm thick, with a 20.6 mm stem width.

The two parallel-stemmed points, one of quartzite and the other of gray novaculite, are probably Bulverde points, dating ca. 2500-2000 B.C. (Schambach 1998). They are relatively thick (9.4-10.8 mm), with stems that range from 16.0-19.8 mm in width; one has a resharpened blade.

The other two dart points are tips of broken specimens. One is gray novaculite (ST 10S 80W) and the second is white novaculite (ST 95S 130W).

Other bifacial tools include four bifacial tool fragment, one thick biface, and five thin bifaces. All of these chipped stone tools were made from either gray or white novaculite, and they are concentrated in the central and southwestern (Area A) parts of the alluvial terrace.

Flake tools are represented by four retouched flake tools, 16 utilized flake tools, and a single perforator. More than 90% of these tools—probably used for the cutting and shredding of plant and animal remains—were made from novaculite, and the remainder were made from Big Fork chert. The novaculite included white (n=8), gray (n=8), white-red (n=1), pink (n=1), and gray-black (n=1) colors. The flake tools are found in each of the high artifact density areas, but are particularly concentrated in Area A and the central part of the alluvial terrace.

One apparently worked and/or utilized quartz crystal (measuring 79 x 42 mm) was found in ST 80S 100W, or Area A. The function of the piece is not known.

The lithic debris includes five novaculite cores and 1454 flakes and shatter. The highest densities of these materials was in Area A, where some shovel tests had more than 100 pieces of lithic debris (i.e., densities of ca. 1000 per square meter). Tertiary flakes (n=1353) accounted for 93.1% of the lithic debris, followed by secondary decortication flakes (n=69, 4.7%), thinning flakes (n=11, 0.8%), shatter (n=9, 0.6%), primary decortication flakes (n=6, 0.4%), blade flakes (n=4, 0.3%), and indeterminate flakes (n=2, 0.1%). The great abundance of tertiary flakes, and the very few thinning or cortical flakes, indicate that the lithic knapping at 3MN2185 focused on the final shaping, edge-trimming, and resharpening of completed or near-completed tools. The reduction of cores and cobbles, and the removal of the cortex or rind, apparently took place at other locations, including quarries, gravel bars, and other lithic raw material source areas in this part of the Ouachita Mountains.

Almost 93% of the lithic debris is novaculite, by far the most abundant and knappable lithic raw material in the Ouachita Mountains. Most of the novaculite is white (n=508, 35.0%) or gray (n=795, 54.7%), but a wide range of different colors are represented in the 3MN2185 lithic debris assemblage: pink (n=23), red (n=8), black (n=6), gray-black (n=5), brown (n=3), white-black (n=2), and yellow. Various cherts comprise only 2.5% of the assemblage, and these few pieces are dominated by Big Fork chert (n=27). Other chert colors are gray (n=4), gray-brown (n=1), white (n=1), yellow-gray (n=1), red (n=1), and brown (n=1). Quartzite lithic debris (n=49) comprises 3.3% of the assemblage, and quartz (n=15) and siliceous shale (n=3) round out the lithic debris sample from 3MN2185.

A few pieces of fire-cracked rock and/or heat spalls, all of quartzite or quartzitic sandstone, were recovered in four shovel tests at 3MN2185. Two of the shovel tests were in Area A, and the others were in the northeastern part of the landform (i.e., ST 0N 20W and ST 10N 30W). Their occurrence suggests that heating and cooking features may be preserved in the site's archeological deposits.

Figure 10. Chipped stone tools from Lake Greeson sites: a, c, 3PI402; b, f, 3PI383; d, 3PI381; e, 3PI388; g, 3PI375; h, k, 3PI87; i, 3PI390; j, 3PI147.

Lake Greeson, Pike County

Gentry Site (3PI87)

The Gentry site is a large (50,000 square meters or 12.5 acres) multi-component prehistoric occupation on an upland slope and low terrace (550-600 feet amsl) in the Arrowhead Point Public Use Area at Lake Greeson. Both landforms are wooded, with fair surface visibility (26-50%) due in large measure because of erosion due to modern recreational activities. The Public use Area has several paved roads, a boat launch area at the southern end of the site on the low terrace, as well as comfort stations, picnic tables, and parking areas.

In the western part of the site, erosion is extensive, and there do not appear to be any intact archeological deposits here because the Sherless-Littlefir-Nashoba sediments have been eroded away. In the remainder of the Gentry site, however, the archeological deposits appear to be intact, and range in depth from 10-55 cm bs. At the northern part of the site in the vicinity of a comfort station—surveyed by Heartfield, Price, and Greene, Inc. (1980) and the archeological materials here thought to have little research potential—several shovel tests contain abundant prehistoric lithic artifacts as well as fire-cracked rock; one of these shovel tests also had a side-notched dart point. The latter suggest that prehistoric burned rock features that may be Archaic in age are preserved in this part of the Gentry site.

In the southern part of the site, a Late Caddo (dating after ca. A.D. 1500) midden deposit was identified in four shovel tests (ST 36, ST 108, ST 110, and ST 258), just north of the boat ramp area and between two paved park roads. The midden, a very dark brown to black sandy loam, ranges from 20-40 cm in thickness, and contains abundant lithic debris, high densities of shell-tempered ceramics, burned clay, a few chipped stone tools, including an arrow point fragment in ST 108. Overall, the Gentry site has a very high density of both lithic debris (61.57 pieces per positive shovel test) and prehistoric ceramic sherds (15.00 sherds per positive shovel test). The highest densities of these prehistoric artifacts occur in and about 25-30 m north of the Late Caddo midden area.

OCR samples were taken at 5 cm intervals from ST 258, beginning at 3-5 cm bs, and extending to 40 cm bs (see Perttula and Nelson 2002: Appendix 5). The first six samples are in the prehistoric Caddo midden deposit with abundant lithic and ceramic artifacts, and the seventh and eighth samples came from the clay loam subsoil (35-40 cm bs).

The OCR dates from ST 258 are provided in Table 7. Two pedogenic markers were identified in the ST 258 column, one in the midden, and the other at the contact between the midden and the clay loam subsoil. The upper pedogenic marker dates to A.D. 1494-1520, and the lower pedogenic marker dates between A.D. 555-635. These dates suggest the accumulation of the Gentry site midden in Late Caddo times, with a period of pedogenic activity in the 6th and 7th centuries that may also be associated with an earlier prehistoric use of the alluvial landform.

Table 7. OCR Dates from the Gentry Site.

Provenience	Pedogenic Marker	ACT #	Calculated OCR Date (A.D.)
3-5 cm bs	-	5984	A.D. 1717-1729
8-10 cm bs	-	5985	A.D. 1623-1641
13-15 cm bs	Yes	5986	A.D. 1494-1520
18-20 cm bs	-	5987	A.D. 1266-1304
23-25 cm bs	-	5988	A.D. 1062-1112
28-30 cm bs	-	5990	A.D. 799-865
33-35 cm bs	Yes	5989	A.D. 555-635
38-40 cm bs	-	5991	A.D. 59-169

Figure 11. Decorated sherds from Lake Greeson sites: a-c, 3PI87; d, 3PI146; e-f, 3PI402.

The one arrow point in the Late Caddoan midden (ST 108, 20-40 cm bs) is fragmentary, but appears to have an expanding stem, corner notches, and a concave base. It is made from a heat-treated novaculite.

A Big Sandy dart point (Figure 10h) was recovered in the northern and probably Archaic part of the site from ST 41 (20-30 cm bs). The point has small side notches and a flat base, and was made from a gray novaculite. It has a resharpened blade that was subsequently broken by an impact fracture. Big Sandy points date to the Middle Archaic, at about 3000 B.C. (Schambach 1998).

There are two flake tools in the lithic assemblage from the Gentry site (see Perttula and Nelson 2002: Table 5). Both have unilateral retouch and use wear (effective use wear lengths range from 17.5-26.0 mm). The flake tool from ST 36 (20-40 cm bs) is a non-cortical gray novaculite hard hammer flake, and the other tool is made on a soft hammer white chert flake (ST 42, 0-18 cm bs). One bifacial tool fragment was recovered in ST 39, north of the Late Caddoan midden deposit. The tool—made from a gray novaculite—had been broken by a lateral fracture during use. It had been previously resharpened and had use wear on the lateral edges of the piece.

Three bifacial preforms were collected from the surface or in shovel testing. They were made from heat-treated gray novaculite (see Figure 10k) or a non-heat-treated black novaculite, using hard hammer knapping. The cortex on all three pieces had been previously removed, probably at the location of initial reduction activities elsewhere on the site or at a raw material procurement area.

A large assemblage of lithic debris (n=862) was collected from the many shovel tests at the Gentry site. More than 98% of the lithic debris is novaculite, with 1.4% Big Fork chert, and 0.3% quartzite and siliceous shale. The white (52.8%) and red (27.2%) novaculite colors dominate the lithic debris, which is generally the case at all the Lake Greeson sites with more than 150 pieces of lithic debris (see Perttula and Nelson 2002: Table 8). Other novaculite colors present are gray (15.5%), white-gray (0.2%), white-black (0.3%), white-red (0.7%), yellow (0.6%), black (0.3%), brown (0.5%), and black-gray (0.1%).

The percentage of cortical flakes is only 4.7% for the site as a whole, but the frequency of larger size graded flakes (2.54 cm) with cortex (40.7%) is among the highest of any of the Lake Greeson sites (see Perttula and Nelson 2002: Table 9). Conversely, the percentage of cortical flakes among the medium and small pieces of lithic debris is among the lowest of the Lake Greeson sites (0-2.3%, respectively). Almost 80% of the lithic debris from the Gentry site are medium to small in size. The low amount of cortex, almost exclusively found on large flakes, and the high proportions of non-cortical flakes of medium and small size grades suggests that a wide range of lithic reduction activities took place here in the production of tools, from some cortex removal and initial thinning to the more common finishing, final shaping, and resharpening knapping activities.

There are 63 sherds and 26 pieces of burned clay (14.4 g) in the Gentry site artifact assemblage. The sherds are primarily from shell-tempered utility ware vessels, as more than 73% of the sherds are tempered with burned and crushed mussel shell. Plain shell-tempered vessels have been classified as Woodward Plain in southern and central Ouachita Mountains Caddo sites

Figure 12. Chipped stone tools and a gunflint from the Star of the East site (3PI138): a, arrow point preform; b, Massard arrow point; c, Sequoyah arrow point; d, Sequoyah or Massard arrow point; e, Massard A point; f, end-side scraper; g, Williams dart point; h-i, Gary, *var. Camden* dart points; j, gunflint; k, bifacial preform.

(Early 1988:69-71, 2000:83). The high frequency of shell tempering in the ceramic assemblage is indicative of a Late Caddoan, post-A.D. 1500 occupation at the Gentry site. For example, 59% of the ceramic sherds in the ca. A.D. 1470-1500 occupation at the Winding Stair site in the Ouachita Mountains have shell tempering (Early 2000). At the ca. A.D. 1500-1700 Helm site on the Ouachita River, 48% of the sherds have shell-tempering, and another 19% have grog and shell-tempered ceramics (Lafferty et al. 2000).

The remainder of the Gentry site ceramics are tempered with grog-grit (13.3%), grit (6.7%), and grog (6.6%). Only one of the sherds with these kinds of temper inclusions was decorated—a body sherd from ST 108 (20-40 cm) with two closely-spaced parallel incised lines—and several plain body sherds were found on the surface or in the midden deposits. It is possible that these sherds represent an earlier prehistoric Caddo occupation, but it is just as likely that they are contemporaneous with the shell-tempered wares, as the change from the use of non-shell to shell tempering inclusions apparently took at least 100 years or more (cf. Early 2002a), and even though "shell becomes the overwhelming choice for temper during the [post-A.D. 1500] Social Hill phase" (Early 2002b:10), not all vessels were tempered with shell even then.

The great majority of the sherds are from vessels fired in a reducing environment (93.3%). Only 6.7% of the sherds are from vessels that were oxidized or incompletely oxidized during firing, compared to 44.9% of the sherds from the Mid-Ouachita phase component at the Star of the East site (see below). The well-controlled firing and cooling of the Gentry site ceramic vessels—and the virtual absence of incompletely oxidized vessels—suggests they were fired for longer periods of time than in the earlier Caddo occupations. The shell-tempered vessels were thin, ranging from 4.65-4.96 mm in rim and body wall mean thickness, and the combination of thin and well-fired vessels suggests that they were designed to withstand thermal shocks from repeated heating and cooling episodes of vessel use in cooking activities.

Only six sherds are decorated, one previously mentioned incised body sherd with grog-grit temper, and the other five from shell-tempered vessels. A single body sherd from ST 110 (0-20 cm) has at least three rows of tool punctates (Figure 11c), probably arranged in horizontal bands on cooking jars. "Such jars are well-represented in both upper Ouachita and middle Ouachita drainage collections" (Early 1988:82), and Early (1993:Figure 50d) illustrates similar decorative patterns on untyped vessels from the Late Caddo occupation at the Hardman site.

The other decorated shell-tempered sherds have one or two parallel or horizontal incised-trailed lines on the rim (see Figure 11a-b). The rims are everted, with rounded lips, and they are from vessels that have been smoothed on interior and exterior surfaces. These sherds are from jars, and thus are not from Keno Trailed vessels (almost exclusively bottles), and the horizontal lines do not resemble any of the decorative patterns characteristic of Foster Trailed-Incised, a common Late Caddo utility ware jar in the southern Ouachita Mountains (see Early 2002b), but the sherds from the Gentry site are rather small and the entire decorative pattern is not identifiable on them.

Wood charcoal (n=16), charred hickory nutshell (n=1), and burned animal bone (n=1) were found in ST 40 and ST 110 between 0-40 cm bs, and these are primarily from the Late Caddo midden deposit. The wood charcoal was prevalent from 0-29 cm bs, the one nutshell came from 20-40 cm bs, and the small piece of burned animal bone was recovered from 0-20 cm bs in ST 110.

Star of the East (3PI138)

The Star of the East site is a multi-component prehistoric and historic site on an alluvial terrace (550 feet amsl) of the Little Missouri River and toe slope (560 feet amsl); between the two is a marshy area that probably represents an old channel or slough of the Little Missouri River. The old channel of the Little Missouri River is approximately 100 m south of the site. Vegetation on the toe slope is a mixture of hardwoods, with poor surface visibility (less than 10%), except where an unimproved road bisects the landform. The low-lying alluvial terrace has hardwoods, button willows, and marsh grasses, and surface visibility is also generally poor here as well.

The alluvial terrace has been eroded along its margins by wave action and lake level fluctuations, and prehistoric artifacts are abundant along the shoreline, and in the unimproved road that crosses the toe slope and the alluvial terrace. Site size is estimated at 30,000 square meters (7.5 acres). The toe slope landform has shallow Sherless-Littlefir-Nashoba sediments, but the alluvial terrace has thick Ceda fine sandy loam sediments around 80 cm in depth.

Prehistoric lithic and ceramic artifacts are abundant in surface and sub-surface contexts at the Star of the East site. Twenty-eight shovel tests excavated here contained prehistoric artifacts. There are high densities of lithic debris (24.33 pieces per positive shovel test), and there are several different concentrations of lithic debris on the alluvial terrace and the toe slope. Dart points, arrow points, bifacial preforms, and a side scraper were also recovered in shovel testing, along with a wide assortment of chipped stone tools from surface and shoreline contexts, and these are concentrated on the alluvial terrace (from 0-60 cm bs). Chipped stone tools found on the toe slope were found only between 0-20 cm bs.

Five of the 17 dart points from nine Lake Greeson sites were found at the Star of the East site. The dart points were made through the reduction of large masses from quarry sources, bifaces, and cores of novaculite (94%) and a local white chert. These tools were made during Late Paleoindian, Archaic, and Woodland periods.

The five dart points from the Star of the East site include three contracting stem Gary points (Figure 12h-i), an expanding stem Williams type (Figure 12g), and a parallel stemmed Jones Creek point. The relatively thin and narrow contracting stem dart points here, Gary, var. Camden, date to the Woodland period (ca. A.D. 200-700) (Schambach 1982, 1998). Two of the three points have been resharpened along the blades. The one Williams point has an expanding and flat stem, a relatively narrow blade, and small barbs. Williams points likely date from ca. 3000-4000 B.P. in the Trans-Mississippi South (see Schambach 1998), and a well-dated Williams component at the Big Eddy site in the Missouri Ozarks dates to ca. 4000 B.P. (Lopinot et al. 1998:137). The Jones Creek form (see Schambach 1998:Figure 28) has a flat base and a parallel stem. Schambach (1998:40) has commented on the similarity of Jones Creek and Marshall points, and noted that the two dart point forms have similar horizontal and vertical distributions at the Cooper site. Although not well-dated in the southern Ouachita Mountains, these forms probably date to the Late Archaic (ca. 4000-2400 B.P.). As a group, the Star of the East dart points indicate the prior to the principal prehistoric Caddo occupation, the site was also used during the Late Archaic (ca. 2000-450 B.C.) and then again in the Woodland period (A.D. 200-700).

Four arrow points (see Figure 12b-e) and a unifacial arrow point preform (see Figure 12a) were recovered in the archeological investigations at the Star of the East site (Table 8). The preform is made from a yellowish-gray chert, and the arrow points are all of gray novaculite. The four points have expanding stems and three are also corner-notched; bases range from flat to concave and convex, stem widths range from 4.9-6.9 mm, and two have serrated blades. They represent Massard, Sequoyah, and Massard A points (cf. Brown 1996).

Table 8. Arrow points from Lake Greeson sites.

Site	Provenience	RM*	L	W	Th	SW	S	base	Type
PI87	ST 108, 20-40	r NOV	-	12.1	2.8	6.9	-	ES-CN	Unidentified
PI138	surface	y-g chert	24.2	15.3	5.0	-	-	-	unifacial preform
PI138	surface	g NOV	19.2	10.8	3.8	4.9	+	ES-CN	Massard

Table 8. Arrow points from Lake Greeson sites (Cont).

Site	Provenience	RM*	L	W	Th	SW	S	base	Type
PI138	surface	g NOV	-	10.7	3.1	6.9	-	ES-CN	Sequoyah
PI138	surface	g NOV	18.5	10.5	2.9	4.9	+	ES-CN	Sequoyah or Massard
PI138	ST 26, 0-20	g NOV	21.2	10.7	2.7	5.5	-	ES	Massaed A
PI383	ST 172, 0-20	g NOV	21.9	-	2.0	-	-	-	Maud?
PI402	ST 147, 0-20	w NOV	29.6	13.2	3.8	5.9	+	CN	Sequoyah
PI402	ST 149, 0-20	w NOV	14.0	7.6	2.3	3.9	+	ES-CN	Massaed B

*RM=raw material; L=length (in mm); W=width (in mm); Th=thickness (in mm); SW=stem width (in mm); S=serrated; g NOV=gray novaculite; w NOV=white novaculite; r NOV=red novaculite; y-g chert=yellowish-gray chert; ES=expanding stem; CN=corner-notched

Figure 13. Decorated and rim sherds from the Star of the East site: a, Friendship Engraved; b-g, Military Road Incised; h, plain rim; i. tool punctated.

Sequoyah and Massard points appear to have been manufactured over a ca. 300-350 year period, between ca. A.D. 1100-1450 based on the chronology of burial batches at the Spiro site (Brown 1996). Guendling (2000) reports on Massard and Sequoyah points from a Middle Caddo component at the Bug Spot site (3MN979) in the southern Ouachita Mountains, and the arrow points at the Star of the East site are stylistically similar and temporally consistent with the Middle Caddo attribution. Certainly, the ceramics from the Star of the East site indicate that the principal prehistoric Caddo component dates to the Mid-Ouachita phase (ca. A.D. 1400-1500).

Similar expanding stem and corner-notched arrow points have been recovered at two other sites at Lake Greeson (see Table 8), and these were also made from novaculite. Those from the Poppy Turner site (3PI402) also have serrated blades and relatively narrow stems.

The preform is a unifacially worked ovoid piece of yellowish-gray chert that is about 5 mm in thickness and 15.3 mm in width (see Figure 12a). It was made on a billet flake, and was ready for the final thinning and notching at the time it was discarded.

Four flake tools of novaculite were found at the Star of the East site, three from the surface and one in ST 273 (Table 9). Two have unilateral retouch/use-worn areas on large non-cortical flakes, with between 15-21.2 mm of effective use length. A third is a bifacial thinning flake with end and side scraper retouch use (see Figure 12f), and the fourth is a fragment of a side scraper. These particular tools have steep retouched and working edges (marked by small use-derived step fractures). The end-side scraper has a combined working edge length of 93.1 mm (see Table 9).

Table 9. Flake tools from Lake Greeson sites with Caddo components.

Site	Provenience	RM*	L	W	TH	FT	Crtx	UL	Location
PI87	ST 36, 20-40	g NOV	35.9	25.8	4.3	HH	0%	26.0	unilateral
PI87	ST 42, 0-18	w chert	20.2	19.3	2.3	SH	0%	17.5	unilateral
PI138	surface	y NOV	34.0	23.5	6.1	UID	0%	15.0	unilateral
PI138	surface	g NOV	22.0	24.2	5.6	HH	0%	21.2	unilateral
PI138	surface	g NOV	55.2	24.2	8.4	HH/BT	0%	93.1	end-side scraper
PI138	ST 273, 0-18	w NOV	-	20.0	6.9	UID	0%	20.0+	side scraper
PI146	surface	g NOV	51.5	60.3	7.6	HH	0%	98.0	bilateral
PI372	ST 49, 0-20	g NOV	56.2	25.0	5.5	SH	0%	88.5	bilateral
PI383	ST 171, 0-20	g NOV	59.2	46.3	10.3	HH	10%	61.0	bilateral

* RM=raw material; L=length; W=width; TH=thickness; FT=flake type; Crtx=cortex; UL=use length; y NOV=yellow novaculite; g NOV=gray novaculite; w NOV=white novaculite; UID=unidentified; HH=hard hammer; BT=biface thinning; SH=soft hammer

The flake tools are found at five Lake Greeson sites (see Table 9), primarily at sites that have prehistoric Caddo components. About 90% are made from novaculite, and typically larger hard hammer non-cortical flakes were selected for flake tool use. The unilateral flake tools have effective working edges that range from 15-26.0 mm in length, compared to 61-98 mm working edges for bilateral flake tools, and a 93.1 mm use length for the end-side scraper from the Star of the East site (see Table 9).

Two bifacial tool fragments were collected from the shoreline area at the Star of the East site. Both were made from a gray novaculite, and one of the pieces had been heat-treated. The two tool fragments also had use wear damage along the lateral edges, and one had also been bifacially resharpened before it was broken and discarded.

More than 230 ceramic sherds from a Mid-Ouachita phase occupation were found on the surface of the Star of the East site. This includes three plain rim sherds, 140 plain body sherds, 10 plain base sherds, and 84 decorated sherds. Eleven different shovel tests on the alluvial terrace have prehistoric Caddo ceramics between 0-60 cm bs, and the density of sherds is 2.73 per positive shovel test. There are 22 plain body sherds in the shovel tests and eight decorated sherds. More than 90% of the sherds were recovered from 0-40 cm, however. The highest density of sherds is in ST 25 (n=10), in the central part of the terrace; one decorated piece found here is a Friendship

Engraved, var. Freeman sherd, diagnostic of the Mid-Ouachita phase (see Early 2002a).

The Star of the East ceramic sherds are overwhelmingly tempered with grog (81.4%), the highest percentage of grog tempering in the Lake Greeson sites with more than two ceramic sherds. Another 5.4% have grog-grit temper, and 3.9% are tempered with shell. Bone tempering is rare, as only 1.6% of the sherds have this aplastic, and it is generally rare at all of the Lake Greeson sites (see Perttula and Nelson 2002: Table 10).

Almost 45% of the sherds from the Star of the East site were from vessels fired in an oxidizing environment, or were incompletely oxidized during firing. These proportions are significantly different than the Late Caddo ceramic assemblage at the Gentry site (3PI87) or the Woodland period ceramics at the White Oak Creek site (3PI381). At the former, only 6.7%of the sherds were from vessels fired under those conditions, while at the White Oak Creek site, only 10% of the sherds were fired under oxidizing or incompletely oxidizing environments. The Star of the East ceramics were not fired as long or in as well-controlled a firing environment as the vessels from these earlier or later sites.

The relatively coarse and porous grog-tempered ceramics from the Star of the East site may not have performed that effectively over an open fire, although their porosity would have helped insulate the food inside the vessel from the fire. It seems likely that more low-temperature cooking was done with the grog-tempered vessels than was the case with the thinner-walled and high fired shell-tempered vessels made later in time, but the Star of the East ceramics were generally structurally sound that could stand up to repeated heating and cooling. To offset their coarse paste and higher porosity, the grog-tempered vessels here had thicker walls to stand up to repeated heating and cooling. The grog-tempered body sherds are 6.92 $\pm$ 0.93 mm in thickness, compared to the much thinner 5.64 $\pm$ 0.61 mm for the shell-tempered sherds from the site. At the later Gentry site (3PI87), the shell-tempered body sherds are only 4.96 $\pm$ 0.51 mm in thickness, which is almost a 30% reduction in body wall thickness.

The decorated sherds include tool punctated rows on vessel rims and bodies (n=8), multiple parallel incised lines (n=53), parallel and opposed incised lines (n=1), curvilinear incised lines (n=1), single straight incised lines (n=4), multiple parallel incised and punctated sherds (n=12), cane punctated (n=1), parallel brushed (n=3), Friendship Engraved (n=2), horizontal engraved lines (n=2), curvilinear engraved lines (n=1), cross-hatched engraved zone (n=1), single straight engraved line (n=1), parallel engraved lines (n=1), and parallel and rectilinear engraved lines (n=1). With one exception, these decorated sherds are on vessels made with grog-temper. The one shell-tempered decorated sherd, found on the surface along the shoreline, has seven closely spaced and parallel incised lines on the vessel body.

The parallel and opposed incised (Figure 13b), multiple parallel incised (Figure 13c-d), and multiple parallel incised and punctated (Figure 13e-g) sherds are from Military Road Incised jars. These vessels are hallmarks of the Mid-Ouachita phase, and together these 66 sherds represent more than 71% of the decorated sherds from the Star of the East site. Another ceramic type that is diagnostic of the Mid-Ouachita phase is Friendship Engraved, and two carinated bowl sherds from Friendship Engraved, *var. Freeman* are represented in the Star of the East ceramic assemblage (Figure 13a). Both sherds were collected from ST 25 between 20-60 cm bs.

Another common decorative element are rows of tool punctates on vessel rims and bodies (see Figure 13i). These are utility ware vessels or cooking jars. About 3% of the decorated sherds have parallel brushing marks, and these may be from vessels that have versions of the Military Road Incised designs that were rendered using brushing instead of incised lines (see discussion in Early [2000:85]). About 4% of the decorated sherds from the 14-15th century Standridge site have grog-tempered brushing (Early 1988:93), very similar to the frequency of brushed sherds at the Star of the East site.

Most of the other sherds are only small and unidentifiable decorative elements that cannot be typed. Most notably, a grog-tempered bottle sherd collected from the surface has a cross-hatched engraved zone on the vessel body, and may be from an Adair Engraved vessel. According to Early (2000:11), these bottles have "vertical bands filled with cross-hatching."

The few plain rims (n=3) from the Star of the East site have direct or vertical profiles, with rounded to flat lips (see Figure 13h).

A small amount of wood charcoal (n=1), charred nutshells (n=4), and burned animal bone (n=2) was recovered in four different shovel tests (ST 11, ST 19, ST 25, and ST 35) on the toe slope and/or the alluvial terrace, all between 0-40 cm bs. These remains are probably associated with the prehistoric Caddo occupation. The wood charcoal is from ST 19 (0-20 cm bs), and the nutshell is from ST 11 (20-31 cm bs) and ST 25 (20-40 cm bs). Both pieces of burned bone (ST 25, 20-40 cm bs and ST 35, 0-20 cm bs) are from unidentifiable animals.

Eden Site (3PI146)

The Eden site was apparently occupied during the prehistoric Mid-Ouachita phase (ca. A.D. 1400-1500; see Early 2002a). The Eden site is not related culturally or chronologically to the 1840s GLO field in the vicinity—also assigned state trinomial 3PI146 by the Arkansas Archeological Survey. The latter historic field has no archeological manifestation, while the Eden site contains substantial prehistoric archeological deposits.

The prehistoric site is situated on an alluvial terrace (560 feet amsl) about 200 m west of the Little Missouri River, and just west of the White Oak Creek site. The two sites are separated by an old channel cut of the river. The terrace is grass-covered, with the exception of scattered locust trees, and surface visibility is fair (26-40%). There are numerous rodent mounds in the Speer loam sediments; these soils are formed in low alluvial terraces and are rarely flooded and are also well-drained. An apparent paleosol was detected across most of the site, with the top of the paleosol between 20-45 cm bs.

Shovel testing across the terrace indicate that the Eden site is about 18,750 square meters in size (4.7 acres). Five of six shovel tests contain prehistoric archeological materials, including moderate densities of lithic debris (15.20 pieces per positive shovel test) and ceramic sherds (2.50 sherds per positive shovel tests). These materials were recovered from 40-60 cm thick archeological deposits. The highest densities of lithic debris, and the only area with sherds in buried contexts, were found in ST 134 and ST 135 in the central part of the alluvial terrace.

A single flake tool of a dark gray novaculite was found on the surface at the Eden site. The tool has serrated, bilateral use wear and retouch (98.0 mm use wear length) on a large non-cortical hard hammer flake (see Figure 10d).

The two bifacial tool fragments (medial and lateral pieces) were recovered on the surface and in ST 139 (see Perttula and Nelson 2002: Table 6). Both were made from non-heat-treated novaculite—white or gray in color—and one of the tools had use-wear damage along one of the bifacial edges.

A total of 76 pieces of lithic debris were recovered in the shovel testing at the Eden site. Only 4% are not novaculite—these being one piece of quartzite and two pieces of local yellowish-brown chert. A white novaculite is most abundant, comprising 55% of the lithic debris sample, and other colors of novaculite represented are red, black, white-gray, and gray.

There are many cortical pieces in the collection (15.8%), pointing to the importance of initial reduction and cortex removal knapping strategies, but many of the cortical pieces fall only in the medium size graded debris. As such, the lithic debris from the Eden sites also resembles the collections of lithic debris from the Fox (3PI147), Poppy Turner (3PI402), and J. Bean (3PI383) sites in the same stretch of the Little Missouri River (see Perttula and Nelson 2002: Table 9). The numbers of medium size graded pieces with cortex suggests that the raw material available for knapping may have been somewhat smaller in size (possibly from local gravel beds?) than was the case elsewhere at Lake Greeson, since in most other sites, the highest proportions of cortical flakes occur among the large (2.54 cm) size graded lithic debris. Overall, 80% of the lithic debris from the Eden site are medium to small in size.

Ten body and base sherds were found on the surface and in two shovel tests (ST 134 and ST 135). Two of the sherds (both grog-hematite-tempered) have broad parallel incised lines that are probably from Military Road Incised vessels (see Figure 11d), while the others are plain. Different tempers represented in the sherds include grog (40%), grog-hematite (20%), grit (30%), and shell (10%). The great majority of the sherds are from vessels fired and cooled in a reducing environment (70%), comparable to the firing conditions in the Late Caddo ceramics at the Gentry site (3PI87), and the one shell-tempered sherd may represent a Late Caddo use of the Eden site. Looking at the ceramic assemblage as a whole, however, it is more likely that the prehistoric Caddo occupation at the Eden site took place during the earlier part of the Mid-Ouachita phase, when the use of shell-tempering was not yet common (see Early 2002a:11). The relatively thin (6.50 $\pm$ 1.47 mm) grit-tempered sherds may be from Mill Creek Plain vessels (see Early 1988).

Nine pieces of wood charcoal were found in ST 132 between 20-80 cm bs at the southern tip of the alluvial terrace. About 90% of the wood charcoal came from 40-80 cm bs, generally from the apparent paleosol.

Fox (3PI147)

The Fox site is a multicomponent prehistoric archeological site on an alluvial terrace (560 feet amsl) of the Little Missouri River, and just west of the Eden site. The terrace is currently grass-covered, with scattered locust trees, and surface visibility is fair (26-50%) because of numerous rodent mounds in the deep Speer loam sediments. The site is estimated to cover 37,500 square meters (9.4 acres), based on the surface distribution of artifacts and the results of shovel testing across the landform.

All eight of the shovel tests contain prehistoric artifacts to depths between ca. 40-80 cm bs; the deepest archeological deposits occur in the vicinity of ST 244. The density of lithic debris is high (27.63 pieces per positive shovel test), and the highest densities are in ST 139, ST 140, ST 141, and ST 244 in the central and northern parts of the site. Bifacial tools, an arrow point, and a Gary dart point were recovered from the surface and in shovel testing. The recovery of fire-cracked rock between 20-60 cm bs in ST 244 suggests that burned rock features may be preserved here; the depth of the fire-cracked rock also suggests that such features may be from a prehistoric occupation that predates the Mid-Ouachita phase since all the ceramics in that shovel test were collected from 10-30 cm bs.

The Fox site also has a relatively high density (3.14 sherds per positive shovel test) of prehistoric Caddo ceramics, probably dating to the Mid-Ouachita phase (ca. A.D. 1400-1500). Seven of the eight shovel tests contain prehistoric ceramics between 0-60 cm bs, and 18 sherds were collected from the site surface. The highest densities of sherds are found in the northern part of the site in ST 142 (n=5) and ST 244 (n=4); burned clay was also found on the site.

OCR samples were taken at 10 cm intervals from ST 244 in the northern part of the alluvial terrace, beginning at 8-10 cm bs, and extending to 80 cm bs. These samples were obtained in order to obtain estimated dates on the age of the prehistoric Caddo occupation at the Fox site. The first six samples are in Zone 1 (a yellowish-brown sandy loam), containing prehistoric Caddo archeological materials with abundant lithic and ceramic artifacts, and the seventh and eighth samples came from Zone 2, a yellowish-brown sandy loam (68-80 cm bs). This zone contains a few pieces of temporally undiagnostic lithic debris.

The OCR dates from ST 244 are provided in Table 10. Three pedogenic markers were identified in the ST 244 column, one in the upper part of Zone 1 (18-20 cm bs), a second in the lower part of Zone 1 (38-40 cm bs), and the other at the top of Zone 2 (68-70 cm bs). Caddo ceramics were found in ST 244 only between 0-30 cm bs. The uppermost pedogenic marker dates to A.D. 1410-1440, and indicates a period of pedogenic activity associated with the occupation of the Fox site in Mid-Ouachita phase times. The second pedogenic marker dates to A.D. 986-1042, and suggests a period of pedogenic activity in Early Caddo times. The lowermost pedogenic marker dates between A.D. 640-716. These dates suggest the initiation of an accumulation of alluvium at the Fox site during the 7th and 8th centuries, and these deeper deposits may also be associated with an earlier prehistoric use of the alluvial landform in Woodland period times.

Table 10. OCR Dates from the Fox Site (3PI147).

Provenience	Pedogenic Marker	ACT #	Calculated OCR Date (A.D.)
8-10 cm	-	5976	A.D. 1562-1584
18-20 cm	**Yes**	**5978**	**A.D. 1410-1440**
28-30 cm	-	5979	A.D. 1226-1268
38-40 cm	**Yes**	**5980**	**A.D. 986-1042**
48-50 cm	-	5981	A.D. 785-851
58-60 cm	-	5977	A.D. 823-887
68-70 cm	**Yes**	**5982**	**A.D. 640-716**
78-80 cm	-	5983	A.D. 295-391

note: bolded entries represent dated pedogenic markers

A single Gary, *var. LeFlore* dart point was collected from the surface of the Fox site. This early Woodland or Fourche Maline Culture point had a rounded stem and a resharpened blade (see Figure 10j).

The lithic debris sample from the Fox site totals 221 pieces. More than 97% are novaculite, principally white (48.9%), red (20.8%), gray (17.6%), and several other colors. The frequency of gray novaculite is higher here than at other Lake Greeson sites (see Perttula and Nelson 2002: Table 8), as is white-black, black, and brown novaculite. It seems likely that the composition of raw materials varied somewhat in different gravel beds along the Little Missouri River. The only other lithic raw materials in the lithic debris are Big Fork chert (1.3%), other local chert (1.0%), and quartzite (0.5%).

The Fox site has a high percentage of cortical flakes (11.3%) in the assemblage, with particularly high amounts proportionally among the 1.27, 1.92, and 2.54 cm size grades (see Perttula and Nelson 2002: Table 9) compared to the other Lake Greeson sites. Nevertheless, fully 73% of the lithic debris is small to medium in size grade—and the frequency of small (0.64 cm) lithic debris (23.1%) is among the highest of any of the Lake Greeson sites (see Perttula and Nelson 2002: Table 9)—suggesting an emphasis on both initial lithic reduction and final tool shaping/resharpening as well as the use of smaller cobbles of stream-rolled lithic raw material, perhaps from a local gravel source.

As noted above, prehistoric Caddo ceramic sherds are relatively abundant at the Fox site in surface (n=18) and shovel test (n=20) contexts, but are not associated with the Gary dart point. Most of the sherds have been tempered with grog (52.6%), grog-hematite (18.4%), or grog-grit (10.5%), and about 10% of the sherds have some combination of grog, grit, and bone. None of the other Lake Greeson Caddo sites have more than about 3% bone-tempered sherds. A single sherd has shell temper, but six of the eight Lake Greeson sites with ceramics have shell-tempering (see Perttula and Nelson 2002: Table 10), although it is only abundant in the Late Caddo midden at the Gentry site (3PI87). The grog-tempered sherds are relatively thin (mean body wall thickness of 6.70 mm), thus contributing to more efficient use of the vessels for cooking tasks, and the sherds are from generally well-fired and well-made vessels.

Like the Mid-Ouachita phase component at the Star of the East site (3PI138), a considerable number of sherds from this site are from vessels that were fired in an oxidizing environment (8%), or were incompletely oxidized during firing (23%). By way of comparison, none of the sherds at the Late Caddoan Gentry site were from vessels fired in an oxidizing environment, and only 7% were from incompletely oxidized vessels. The frequency of oxidized/incompletely oxidized sherds suggests that the vessels here were low-fired, and probably not for a long time, while the Late Caddo potters had changed their means of firing vessels, which were mostly shell-tempered, thus firing them longer and producing a stronger (i.e., more resistant to thermal shock), more durable, but ultimately a thinner cooking vessel.

Six of the body sherds are decorated. Four are body sherds from Military Road Incised vessels, with three having parallel to diagonal incised lines, and one having diagonal incised lines adjacent to a row of small circular punctations. One other body sherd has only a single broad incised line, and another (ST 142, 40-60 cm) has light parallel brushing marks on the lower vessel body; the latter is from a cooking jar. The combination of considerable use of grog temper, the virtual absence of shell-tempered vessels, the similarity in firing conditions between the Fox site and the Mid-Ouachita phase component at the Star of the East site (3PI138), and the prevalence of Military Road Incised vessels, all point to a prehistoric Caddo occupation during the earlier part of the Mid-Ouachita phase.

Two charred hickory nutshells and one piece of wood charcoal were found in ST 141, ST 142, and ST 244 in the central and northern part of the site. The wood charcoal came from 0-20 cm bs, and the nutshell pieces were found between 20-60 cm bs.

J. Bean Site (3PI383)

The J. Bean site was occupied during the Late Paleoindian, Late Archaic, and Late Prehistoric periods. The site is on an alluvial terrace (560 feet amsl) in a bend in the Little Missouri River; the terrace stands about 1-1.5 m above the floodplain. The landform is wooded with pines and hardwoods, and the understory is thick vines. Surface visibility is poor (0-25%).

The floodplain to the north of the J. Bean site appears to have been mined for gravel in the past, but the mining has not disturbed the site itself. Several unimproved roads cross and/or border the site, and a small amount of prehistoric lithic debris was noted in the unimproved road along the northern site boundary. The shovel test investigations across the terrace suggest that the site is ca. 45,000 square meters in size (11.25 acres), but the site probably extends well to the east on to private property.

Thirteen shovel tests were excavated at the site, and each of them contained prehistoric lithic and/or ceramic artifacts between 20-60 cm bs. The density of lithic debris is 11.85 pieces per positive shovel test, and the highest densities are apparent along either the southwestern and northeastern parts of the terrace. The southwestern part of the landform also has the thickest or deepest archeological deposits (60 cm in thickness). The chipped lithic tools and fire-cracked rocks were also found in the southwestern part of the site, and the differences in depths of arrow points and ceramics (0-40 cm bs) compared with the depths of a parallel-stemmed dart point (40-56 cm bs) and a Dalton point (40-60 cm bs) suggests that the J. Bean site may contain stratified and/or older archeological deposits in this part of the landform. The recovery of fire-cracked rock in one shovel test in the southwestern part of the site may indicate that burned rock features are also preserved at the site; the depths of the fire-cracked rock (0-40 cm bs) suggest they are associated with the Late Prehistoric Caddo occupation.

A single triangular Maud, *var. Hopper* arrow point came from ST 172 (0-20 cm). It has a deep basal concavity, and was made from a dark gray novaculite (see Figure 10b). A Maud, *var. Hopper* specimen was reported by Early (2000:Figure 43e) from the Winding Stair site (3MN496) in a context dating from ca. A.D. 1470-1500, the latter part of the Mid-Ouachita phase.

One of the two dart points from the site is a Dalton lanceolate from ST 175 made from a dark gray novaculite (see Figure 10f). It has a concave base, no ears, the broad blade has been resharpened or beveled, and the stem has been ground; the tip has also been broken from an impact fracture. Recent calibrated radiocarbon dates from the Big Eddy site in southwestern Missouri indicate that Dalton points likely date from ca. 10,500-10,000 years ago (Lopinot et al. 1998:199). The other dart point is a Marshall type—dating to the latter part of the Middle Archaic period according to Schambach (1998)—made from a white novaculite. It has a parallel stem, a flat base and short stem, and corner-notching of the blade; there are small barbs and the blade has been resharpened.

One bilateral flake tool, with steep and opposed retouch and use wear, was found in ST 171 (0-20 cm bs). The flake was on a cortical flake of gray novaculite, and has a total use wear length of 61.0 mm (see Table 9).

The lithic debris sample (n=154) is comprised almost exclusively of novaculite (96.2%). The remainder is Big Fork chert (2.6%) and gray and brown cherts from local river gravels. White (55.8%), gray (11.0%), and red (10.7%) colors are the most common colors among the novaculite, with much lesser amounts of white-gray (7.1%), white-black (3.2%), white-red (1.3%), and yellow (0.6%).

The J. Bean site has a high percentage of cortical flakes (9.8%) in the assemblage, with particularly high amounts proportionally among the 0.64, 1.27, 1.92 cm size grades (see Perttula and Nelson 2002: Table 9) compared to all the other Lake Greeson sites. Notably, none of the large flakes (2.54 cm) have cortex. However, 85% of the lithic debris is small to medium in size grade—and the frequency of small (0.64 cm) lithic debris (22.7%) is among the highest of any of the Lake Greeson sites—suggesting an emphasis on both initial lithic reduction to produce flakes (rather than bifaces) and final tool shaping/resharpening as well as the use of smaller cobbles of stream-rolled lithic raw material, perhaps from a local gravel source.

The J. Bean site has a few pieces of prehistoric Caddo pottery from ST 172 and ST 176. The sherds are either grog or shell-tempered, and are probably from a Mid-Ouachita phase occupation dating from ca. A.D. 1400-1500 (see Early 2002a). Two of the sherds are grog-tempered, and have broad parallel incised lines; one has triangular punctations between two parallel incised lines. Both sherds are probably from Military Road Incised vessels, one fired in a reducing environment and the other fired in an oxidizing environment. The third sherd is a plain shell-tempered body sherd. The small ceramic assemblage at the J. Bean site, which has both grog-and shell-tempered vessels, is consistent with an occupation during the middle parts of the Mid-Ouachita phase. By the latter part of the phase, shell-tempered pottery was much more common, and even more frequent in subsequent post-A.D. 1500 Caddo occupations (see Early 2002b:11).

Finally, four pieces of wood charcoal were also recovered from ST 172 and ST 175, primarily from 20-40 cm bs.

Poppy Turner Site (3PI402)

The Poppy Turner site is on an alluvial terrace (560 feet amsl) in the Little Missouri River valley. It is a short distance northeast of the Fox site, separated by an old channel of the river, and north of the White Oak Creek and Eden sites. All four sites are on similar landforms, with Speer loam sediments. These formed in loamy sediments in floodplain and low terrace landforms of the Little Missouri River.

The alluvial terrace is a grass-covered pasture, with fair surface visibility (40%) because of the numerous rodent mounds exposed on the surface. The terrace has been previously cultivated, and a powerline crosses the site. Prehistoric lithic and ceramic artifacts are common in surface contexts, including several Gary dart points and 17 ceramic sherds. All nine shovel tests on the terrace contain prehistoric archeological deposits between 20-60 cm in thickness; the deepest archeological deposits were identified at the southern end of the alluvial terrace.

The Poppy Turner site has a high density of prehistoric lithic debris (27.89 pieces per positive shovel test), with the highest densities in the southern and central parts of the site. This area also has several chipped lithic tools, including a corner-notched arrow point and several bifacial tools between 0-40 cm bs. A number of prehistoric Caddo sherds were found in five shovel tests at the site, extending from north to south across the alluvial terrace and from 0-60 cm bs. ST 147 at the southern part of the site has the highest number of sherds (n=10), and 80% of these were recovered between 0-40 cm bs.

Two arrow points were found in ST 147 and ST 149 in the southern and central parts of the site (see Table 7). Both—a Massard B and a Sequoyah—were made from a non-heat-treated white novaculite, have serrated blades, and expanding stems with corner notches (see Figure 10a, c). These forms are consistent with a Mid-Ouachita phase Caddo occupation as suggested by the decorated Caddo ceramics found on the surface and in shovel testing.

Four dart points were collected from the surface of the Poppy Turner site. Three are contracting stem Gary points, and one has a parallel stem and a concave base, and resembles a Bulverde point. The Gary points have rounded stems and are relatively thick, with broad stem widths. Two are Gary, *var. Gary* (ca. 2800-2100 B.P.) forms (one is made of a white chert and the second from a white novaculite), and the other is a Gary, *var. LeFlore.* These forms are slightly thinner and narrower than the older *var. Gary*, and probably date from ca. 400 B.C. to A.D. 200, in the Woodland period. The probable Bulverde point of gray novaculite has a parallel stem with a flat base, and the blade has been resharpened. Schambach (1998) considers Bulverde points to be Late Archaic forms made around 2000 B.C. He goes on to suggest that the Native Americans that made Bulverde points were part of a culture "with many regional and temporal phases that was very widespread in the rolling foothills and West Gulf Coastal Plain country of east Texas, south-central and southwest Arkansas, northwest Louisiana and, probably, in the Lower Mississippi Valley as well" (Schambach 1998:116).

Three bifacial tool fragments were recovered in ST 147 and ST 150, as well as on the surface. All were made from a gray novaculite, and they each have retouching and use wear along the bifacial edges of the pieces (one medial piece and two tip/medial pieces). The novaculite had been heat-treated before the bifacial tool was manufactured.

The lithic debris from the Poppy Turner site (n=251) is dominated by novaculite (96.8%), with small amounts of Big Fork chert (2.4%), quartzite (0.4%), and quartz (0.1%). The white (43.0%) and red (26.7%) novaculite are the predominant colors, along with white-gray novaculite (13.9%); this site has the highest proportions of white-gray novaculite of any of the Lake Greeson sites (see Perttula and Nelson 2002: Table 9). Other novaculite colors present in the lithic debris sample are white-black (1.6%), yellow (1.2%), and black (1.2%).

The Poppy Turner site has a relatively high percentage of cortical flakes (6.8%) in the assemblage, with particularly high amounts proportionally among the 0.64 cm size graded debris (3.7%) compared to all the other Lake Greeson sites, where the mean percentage of cortical flakes in the 0.64 cm size class is 1.5%. Also, few of the large flakes (2.54 cm) have cortex. However, 89% of the lithic debris is small to medium in size grade—and the frequency of medium-sized (1.27 cm size grade) and small size graded lithic debris (67.8% and 21.5%, respectively) is the highest of any of the Lake Greeson sites (see Perttula and Nelson 2002: Table 9). This points to an emphasis on both initial lithic reduction to produce flakes (rather than reduce large bifaces or cores) for tools and final tool shaping/resharpening, as well as the use of smaller cobbles of stream-rolled lithic raw material.

The 29 prehistoric sherds from the surface and five shovel tests also indicate that the Poppy Turner site was occupied by the prehistoric Caddo, at least a millennia later than the Native American group that left the contracting stem dart points on the alluvial landform. At least 96% of the sherds are tempered with grog (see Perttula and Nelson 2002: Table 10), and only 3.4% have shell-tempering (a plain body sherd). Some of the sherds also have grit or crushed hematite added as temper inclusions, and this was also noted in the larger Mid-Ouachita phase ceramic component at the Star of the East site. Unlike that site, however, only 25% of the sherds at the Poppy Turner site are from vessels fired in an oxidizing environment or incompletely oxidized during firing, compared to 45% from Star of the East site (see Perttula and Nelson 2002: Table 11). The higher frequency of sherds from vessels fired in a reducing environment is more like that noted for the Late Caddo Gentry site, suggesting temporal changes in firing conditions or more diverse means of firing vessels during the Mid-Ouachita phase than was the case after ca. A.D. 1500.

Twelve of the sherds are decorated, including one with an interior/exterior red slip; tool punctated rows (n=1); single incised lines, either straight or curvilinear (n=4); fingernail punctated sherds (n=2); and four Military Road Incised body sherds (see Figure 11e-f). The latter have parallel and broadly-spaced incised lines and two also have rows of tool or fingernail punctates below sets of parallel (horizontal?) or opposed incised lines on the vessel body. As with the Fox site, the combination of considerable use of grog temper, the virtual absence of shell-tempered vessels, and the prevalence of sherds from Military Road Incised vessels, all point to a prehistoric Caddo occupation during the earlier part of the Mid-Ouachita phase.

Conclusions

Prehistoric Caddo sites are apparently abundant throughout the wooded river valleys of the southern Ouachita Mountains in southwestern Arkansas. Although the sites discussed here have only been documented throughout archeological survey investigations (including intensive shovel testing), we have gathered some significant information on the overall character of the Caddo occupations at them, as well as the kinds of prehistoric ceramic artifacts and stone tools that were being made and used by the Caddo groups living in this part of the Ouachita Mountains between about 1000 and 400 years ago.

Beginning in Late Holocene times, particularly after about 2000 years ago, the prehistoric populations in and around the Ouachita Mountains began to manipulate certain plants to increase their yield and predictability, including annuals that produced abundant seeds as well as mast crops. Sites occupied at this time were distributed differently across the landscape than those earlier sites of the more mobile hunter-gatherers as the economic focus of settlements had changed to take advantage of richer and wetter, as well as shaded, habitats near streams and amidst fertile lands where mast could be gathered and processed along with other resources. As they developed a more sedentary lifeway, this change is reflected in the character of the archeological sites themselves. That is, they manifest evidence for more intensive use, have some evidence of spatial differentiation across the land in the performance of economic tasks, and they may contain more abundant remains of plant and animal food processing, including fire-cracked rock used in hot rock cooking.

The Late Holocene sedentary Caddo communities had economies more focused on the cultivation of maize and other tropical and native cultigens, as well as a continued reliance on the bounty of the forested mountains and alluvial valleys. The Caddo groups probably lived in dispersed farmsteads and small communities, but were always to some extent linked by ties of kinship and ritual with larger communities of Caddo populations that served as centers of a rich religious and political life. These groups depended upon the availability of fertile and arable soils to raise their crops, and this is a natural resource in short supply throughout much of the Ouachita Mountains. Caddo farmsteads and small communities are present throughout this mountainous area, generally being found on flat ground near sources of fresh water, and the "extent and distribution of suitable soils in relatively flat terrain…would be one locational factor in the distribution of individual homesteads and the configuration of communities" (Early 2000:7). The major stream valleys were the nexus of Late Holocene Caddo groups, but important community centers like the Winding Stair site (3MN496) (Early 2000:126-128) can also be expected in favorable locations in the smaller and more rugged alluvial valleys within the Ouachita Mountains.

We hope that further archeological research will be carried out at the prehistoric Caddo sites mentioned in this article—as well as at others throughout the Ouachita Mountains in southwestern Arkansas—to better understand the nature of prehistoric Caddo adaptive lifeways in this rugged environment. We also hope that these Caddo sites, being on U.S. Army Corps of Engineers property, will be protected and preserved for the long-term by the federal government, and action should be taken now since they are threatened by continued shore erosion and site looting.

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EXCAVATION OF AN EARTH MOUND, BOWIE COUNTY, TEXAS

A. T. Jackson

This large artificial mound is known as Site ET-30, A.J. Hatchel place [41BW3], Bowie County (Figure 1). The mound, located on what seems to be an old channel of Red River about one mile from the present stream, is part of an extensive village, perhaps related to other mound and village groups within a radius of three miles. The entire area, containing nine or more mounds, shows evidence of long-continued occupation by fairly large numbers of people. Judging from its size, and the surrounding indications of a large village, this particular mound may have been the early cultural center of the region. The mound has long been a prominent landmark, and in historic times has served as a place of refuge for livestock in periods of overflow.

Figure 1. View of mound before after part of the timber had been cut but before staking and excavation (Courtesy of Texas Archeological Research Laboratory, The University of Texas at Austin, negative number 41BW3-9)

Clarence B. Moore, while exploring archeological sites along Red River in Arkansas in 1912, heard of the mound and navigated the Red River to that point to inspect the site. He was unable to make necessary arrangements with the landowner, and hence did no work in the mound.

Brief Facts About the Excavation

Facts pertaining to the outstanding features of the excavation will be given in very brief form. The work was made possible through a WPA-U. of T. [University of Texas] project, this unit of which began operations on November 1, 1938, and continued until August 25, 1939. During that time the size of the crew varied from 40 to 60 workmen. Mr. William C. Beatty, Jr. had immediate charge of the excavation. He came to us after three years' experience excavating mounds in Tennessee. At the close of this Texas excavation he resigned to continue his academic work.

The mound had a height of 30.4 feet, was 190 feet long east to west, and 145 feet wide north-south. On top of the mound grow a large burr oak tree, which had rings indicating an age of 170 years. This suggests that the mound probably had not been occupied for 200 years or more. There was no evidence of European contact.

Due to certain conditions met with, three techniques of excavation were used in the course of the work (Figure 2). First, the horizontal method was employed to secure photographs and ground plans of complete floors and house sites.

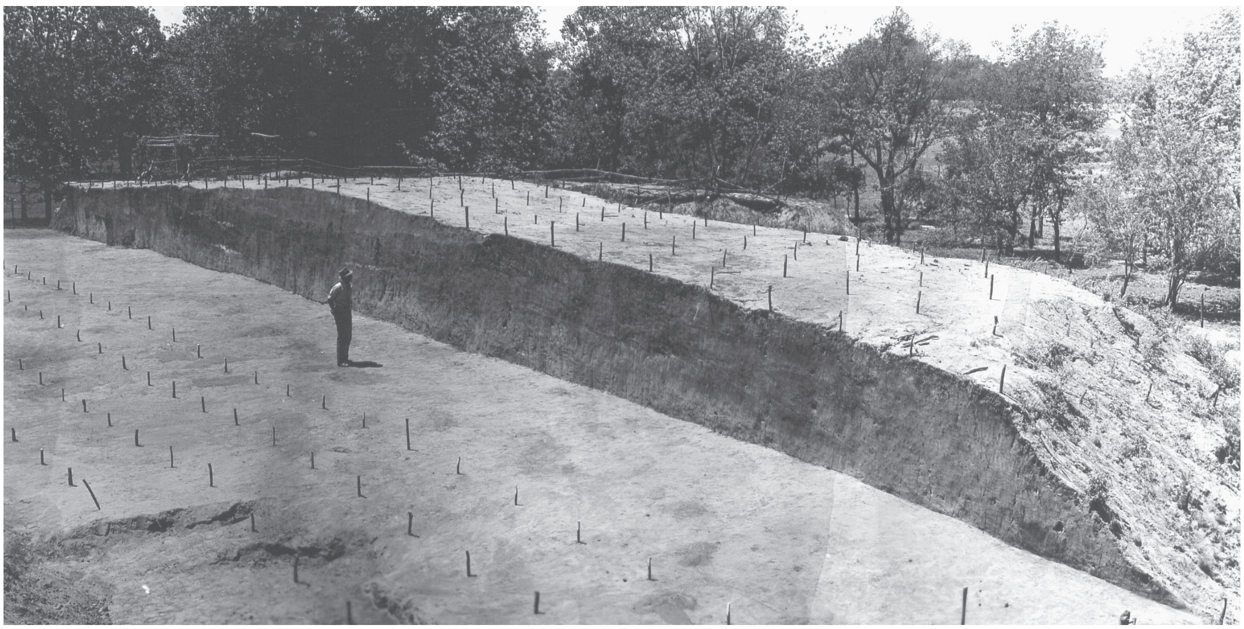

Figure 2. View showing profile of mound and two levels after excavation. Man standing on floor H. The area is staked into 5-foot squares (Courtesy of Texas Archeological Research Laboratory, The University of Texas at Austin, negative number 41BW3-207)

Next a change was made to the vertical technique. A floor was excavated to the center of the mound where notes were taken, photographs made and that half of the floor ground-planned. Lower floors then were cut to the same line to secure a taller profile. Later the remaining half was completed.

Finally, circumstances arose that made it necessary to terminate the work before the lower part of the mound was completed. Having only one month more to work, trenching was resorted to as a means of completing the profiles and securing the maximum amount of additional information. The mound was not a burial structure but a truncated pyramid of the house-mound type. Only four burials were found in the entire mound. Three of these were infants and one an intrusive adult burial.

Eight floors were found in the upper 13 feet of the mound. The presence of so many floors in a small vertical area suggests that after each period of occupation, and possible burning of the house, more soil was added and another floor prepared for building purposes. It seems very unlikely that these upper floors were built higher to guard against floods. The small vertical addition

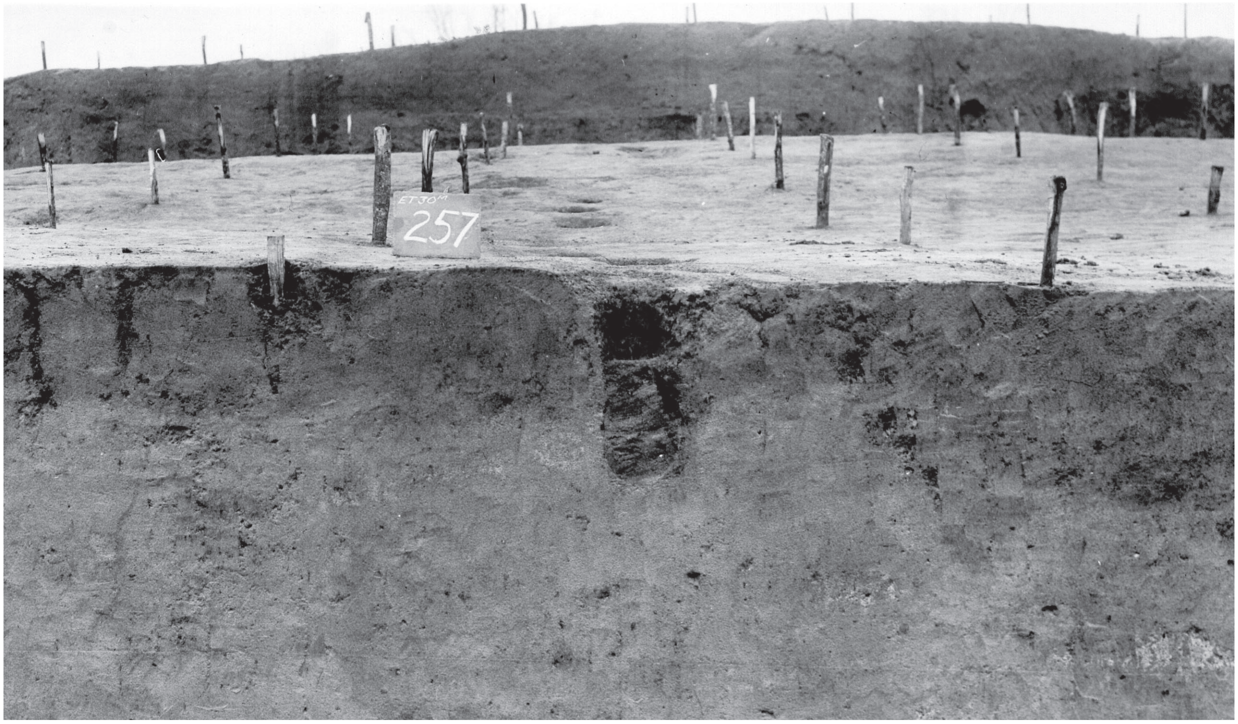

Figure 3. Posthole exposed in profile. Note the rounded bottom of the hole and the different color of the fill. Photo taken from south (Courtesy of Texas Archeological Research Laboratory, The University of Texas at Austin, negative number 41BW3-181)

resulting from a new floor could have made little difference. It is possible that after the death of a great chief or other calamity, the occupants of the village destroyed and "buried" the then existing houses on the mound.

Beneath floor "H" was a primary mound of smaller proportions, at each end of which had been fills to enlarge for the next floor, marking the beginning of the secondary mound. The primary mound seemed to have had a ramp, or slanting approach, at the south center.

Instead of including a number of closely-spaced floors, the lower portion of the mound consisted of two different structural stages. Most of the lower levels were almost sterile, as compared with the many evidences of material culture found on the upper floors.

It was found that the original mound was erected on a portion of the large, comparatively level village site and not on a natural elevation.

Burials

The first burial in the mound was on floor "E." It was not intrusive from the floor above, as shown by lack of grave outline on that floor, but was resting exactly on floor "E," apparently having been covered with the floor "fill." With the burial were a small incised vessel and one shell bead.

In the northeastern part of the mound, directly on floor "F" was the grave of an infant buried on it's back in an extended position. Associated with the burial were two bowls, a water bottle, and a mussel shell "spoon." The bottle was east of the skull, and the shell artifact was inside a large black bowl.

The third infant burial was in a pit that showed plainly on the floor "H" surface. The skull was slightly more than a foot beneath the floor. The skeleton was in an extended position, on the back, with the head to the north. The grave contained three pottery vessels and a mussel shell. The shell was east of the left elbow.

The fourth, and last, burial was that of an adult, apparently intruded into the western edge of the mound above the old village floor. The skeleton, in a good state of preservation, was extended on the back, with three small pottery vessels between the knees. This intrusive burial seems to be more recent than any of the others.

An interesting detail in connection with the grave goods from the mound burials is that the vessels accompanying the infants were large enough to have been used for utility purposes, while those with the adult might be classed as "toys."

House sites

Each floor contained from one to three house sites, outlined by postholes (Figure 3). Of the twenty houses, 15 were roughly circular (Figure 4) and five irregular in shape. They range in size from 10 to 49 feet, with an average diameter of about 30 feet. A number of the houses had protruding roofed entranceways three to four feet wide and about five feet long, as indicated by postholes (Figure 5). Of 14 definite outside entranceways, 57% were to the southeast, 22% to the south, 14% to the east and 7% to the northwest. Wattle, apparently from burned clay roofs, was present in four of the houses. There was no evidence of a large central supporting post in any case.

Seven houses contained fire pits, while three others had deposits of ashes without definite pits. Most of the fire pits were near the center of the houses. Eight houses had storage pits (Figure 6), some with two or three such pits containing rubbish.

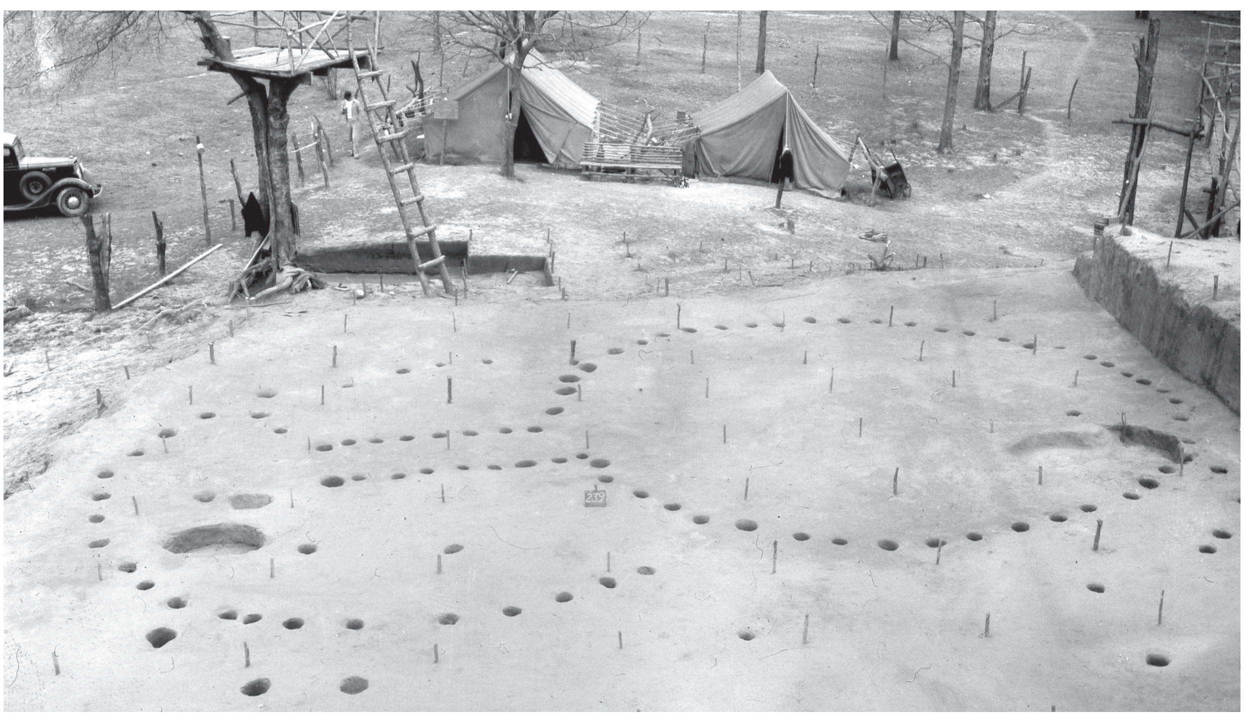

Figure 4. House sites (features 16 and 17) superimposed on phase "H" floor (Courtesy of Texas Archeological Research Laboratory, The University of Texas at Austin, negative number 41BW3-163)

Figure 5. Another view of southern half of Feature 15 with workman troweling near center (Courtesy of Texas Archeological Research Laboratory, The University of Texas at Austin, negative number 41BW3-128)

Floor "A" contained a house at the east and west ends, [and] a large storage pit in the northwest corner. Between the two houses was a "compound-like" area that may have contained drying racks or lean-to shelters, as shown by postholes.

Floor "B" had at its western end a house site 25 x 50 feet. In the center of the floor was a small house 10 feet in diameter, and at the east end was one 30 feet in diameter.

At the west end of the floor "C" was the outline of a structure 30 feet in diameter. The house remains consisted of a large section of wattle over the entranceway, a fallen roof beam and a large fire pit. A small elevation at the east end of the floor was surrounded with postholes. Two storage pits were near the center of the floor.

On floor "D" the postholes were grouped in the east and central sections. The holes suggest various superimposed structures.

Floor "E" had a large house in the center with several storage pits and ash deposits. At the west end of the floor was a circular posthole outline, enclosing three refuse pits.

Near the center of floor "F" was a house with an almost perfect entranceway to the south. The entranceway consisted of 17 wall aligned holes, some of which contained the remains of cedar posts (Figure 7).

At the northeast corner of floor "G" were 11 postholes arranged around a central fire pit. This may have been the remains of a roughly square structure (Figure 8). At the north-central part of the floor were two or more superimposed houses; or perhaps one structure with double walls and many side braces. There were 127 postholes in this feature.

Floor "H" contained three definite structures and remains of perhaps two others. To the southwest were two superimposed structures; in the center was another house with several postholes containing wood or charcoal. In the northeast section were remains of two or more circular house sites.

At the west end of, and beneath, the mound on the old village level was a large circular house site, divided by a partition into two "rooms" (Figure 9).

Figure 6. Storage pit in house site, Feature 17. Taken from west (Courtesy of Texas Archeological Research Laboratory, The University of Texas at Austin, negative number 41BW3-154)

Material Culture

Aside from the grave goods and many scattered potsherds, the material culture was scantly represented in the mound. The projectile points, mostly small, were of the stemmed and unstemmed varieties; the former had expanded and contracted bases, the latter had straight and concave bases. A cache of 16 small triangular points lay in a pile.

Many fragmentary pipes were found, as well as an occasional broken vessel. Two unusually large polished stone celts (Figure 10) lay on the floor very near together. Among the ornaments were bear tooth pendants and a turquoise bead.

Stories Gleaned From Facts

A number of interesting details regarding the probable everyday life of the people may be gleaned from the findings. For example, at the west end of the mound on floors "A," "B" and "C" was a deposit of almost sterile humic soil that showed considerable evidence of decayed plant matter. The soil was a deep, rich black and may have been used for growing a small patch of corn or vegetables on the mound.

The shard distribution on floor "H" showed that the areas of concentrated pot fragments were between and to the rear of the houses. This suggests much outdoor activity and that broken vessels may have

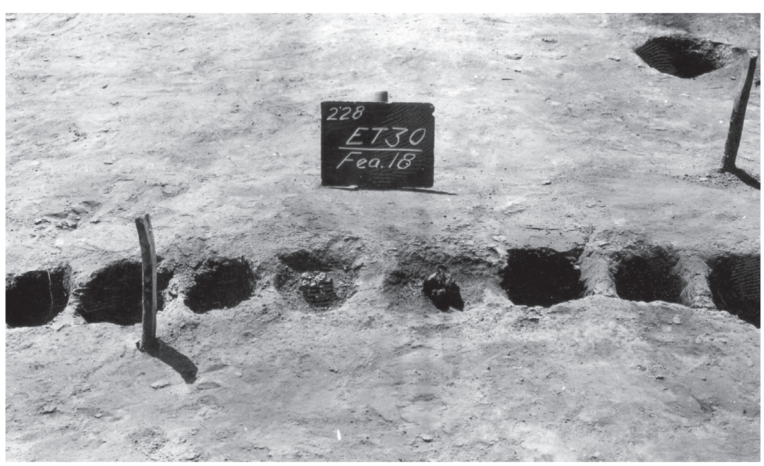

Figure 7. Part of entranceway showing wood in postholes. Charred wood, remains of posts, apparently cedar. Feature 18 (Courtesy of Texas Archeological Research Laboratory, The University of Texas at Austin, negative number 41BW3-152).

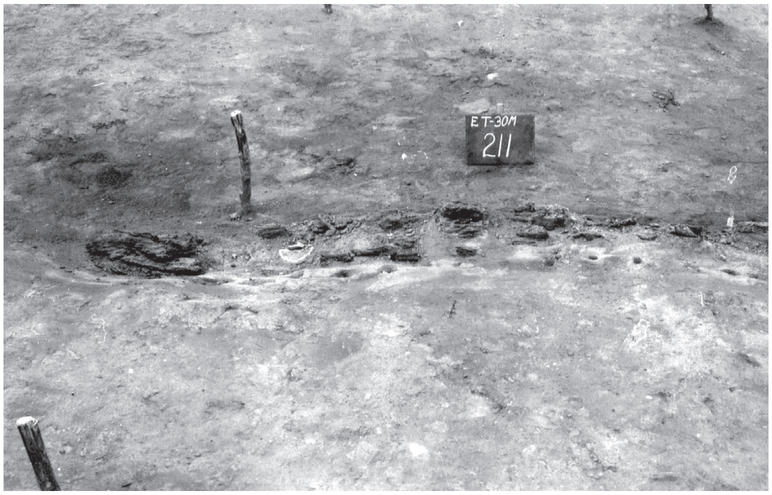

Figure 8. Remains of cedar log on phase "G" floor (Courtesy of Texas Archeological Research Laboratory, The University of Texas at Austin, negative number 41BW3-134)

been thrown out to the sides and rear of the houses, thereby leaving the south side—or main approach—more or less clear of rubbish.

Various bits of evidence indicate the existence of the caste system. In addition to the seemingly significant practice of burying in the mound infants of importance, other facts suggest that this large mound may have been the abode of ranking chiefs and their families. This theory as to the possible use of the mound agrees in general with the accounts of certain early explorers. There also remains the possibility of the mound having been the location of the "town house" or so-called temple.

An attempt to work out a step-by-step development of the large mound suggests the division of its growth into five periods. The first represents the occupation of the original village, that later was covered by the mound. This is floor "K."

The second period comprises structures "J" and "I" and might be called the period of "temple" mounds. Structure "J" may have been merely a clay base for the next higher addition.

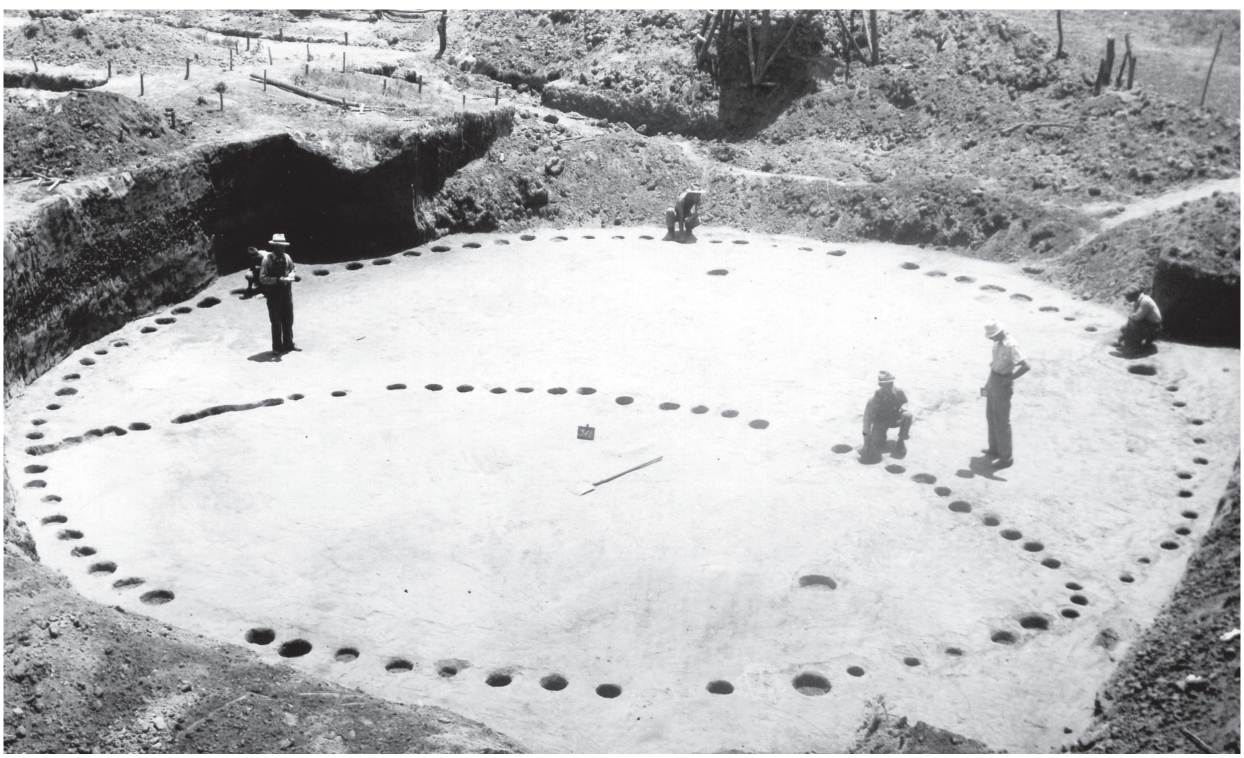

Figure 9. Feature 25, men working. Shovel blade points north (Courtesy of Texas Archeological Research Laboratory, The University of Texas at Austin, negative number 41BW3-265)

Figure 10. Large stone celts in place at mound (Courtesy of Texas Archeological Research Laboratory, The University of Texas at Austin, negative number 41BW3-143)

The third period, representing end additions to the mound and the erection of floors "H," "G," "F," "E," and "D" may be called the period of large occupational levels. It possibly shows extreme dominance of the ruling classes.

The fourth is the period of smaller occupational levels, and includes floors "C," "B," and "A"—the last additions to the mound.

The final period, since abandonment by the Indians, shows the results of greater floods, erosion and heavy wind deposit. The mound has accumulated around its edges a protective soil covering, somewhat enlarging its base.

Laboratory Study of Materials

More than 20 usable dendrochronology specimens were recovered from the mound, and will be made available to tree-ring experts working on the problem of a "calendar" for the Mississippi Valley.

Our San Antonio laboratory is now making an intensive study of other returns from this mound, and from the adjacent village and cemetery. The work is not sufficiently near completion to hazard any definite conclusions. But we are hopeful of working out, from the thousands of potsherds found on the various floors, a pottery chronology that may be helpful in East Texas, Louisiana, Arkansas and Oklahoma. If there is a "Caddo-root" in the Southwest, possibly our findings also may be of interest to that region.

Notes

Paper presented at the 1939 Texas Archeological and Paleontological Society meetings in Abilene, Texas. Printed with the premission of the Texas Archeolgical Research Laboratory. Origional on file at the Texas Archeological Research Laboratory, The University of Texas at Austin, 41BW3 File.

Book Reviews

Tribal Cultural Resource Management: The Full Circle to Stewardship,

by Darby C. Stapp and Michael S. Burney, 2002.
AltaMira Press, Walnut Creek, California. xiv + 246 pp.

Reviewed by Robert Cast, Caddo Nation Historic Preservation Officer

With only ten chapters, Tribal Cultural Resource Management provides model strategies of what it takes to properly "manage" cultural resources. Although it is geared toward tribal governments and creating the right combination of preservation and protection of their culture, don't let the title fool you, this book is for any person who has a responsibility as a land manager. Those currently involved in Cultural Resource Management (CRM) work should give this book a close read. Off hand, I can think of several federal agencies, especially those operating without Cultural Resource Management Plans, who could truly benefit from following the practical strategies outlined in this readable and informal book.

The premise of the book revolves around Stapp and Burney's definition of Cultural Resource Stewardship: "Cultural resource stewardship means preserving, protecting, and ensuring that cultural resources are accessible, as appropriate, for present and future generations, especially descendant communities" (p. 169). The book provides numerous insights, anecdotes, examples, and point-by-point discussions of many different aspects of tribal cultural resource management, from a detailed case study, to setting up a Tribal Historic Preservation Office, to examples of form letters to initiate discussions with agencies.

Stapp and Burney (both archeologists, by the way) share over 25 years of experience working with federal agencies, Indian tribes, and the bureaucracy currently known as CRM. Through the years, they have worked closely with several tribal governments, but the focus is based on their long working relationship with the Confederated Tribes of the Umatilla, and in helping them develop a preservation program along with training tribal members to actively manage the program and the resources of importance to the tribe. As the Tribal Historic Preservation Officer for the Caddo Nation of Oklahoma, I am well aware of the many pitfalls, obstacles, and truly rewarding experiences that working with a tribal government provides.

Part I, Tracing the Roots of Tribal Cultural Resource Management (Chapters 1-5) not only outlines the history of CRM, but provides this from a unique and oftentimes overlooked perspective: how it has involved American Indians over the years. They review current definitions of what CRM is from archeological and anthropological perspectives, then clarify them in terms of certain underlying themes related to their consultations in working with tribal governments. They then briefly discuss the relationship of American Indians to archeology and anthropology from 1492 to the present. The final chapter in Part I provides an overview of their involvement with the Cultural Resource Protection Program of the Confederated Tribes of the Umatilla Indian Reservation.

Part II (Implementing A Tribal Cultural Resource Management Agenda) focuses on issues related to tribal cultural resource management. Chapters 6-9 provide insight into a number of key cultural resource management ingredients: setting up a tribal historic preservation office; consultation; a discussion of cultural landscapes and how they relate to current cultural resource management practice; and a discussion of shifts needed from mere management of, to the stewardship of, cultural resources.

Part III, "The Fruits of Synergy", discusses the process of "synergy" and relates it directly to all other concepts of CRM, especially consultation. Synergy is: "people gathering, sharing ideas, looking for solutions, and coming up with better answers collectively than any of them could have developed individually" (p. 185). This should be what consultation entails and tries to accomplish. In this chapter, the authors' present four key goals they believe need to be achieved to meet the needs of American Indians and cultural resource management in general. They are:

- Ensure that federal agencies comply with cultural resource regulations;
- Increase public awareness of and appreciation for cultural resources;
- Foster the relationship among American Indians, archeologists, anthropologists, and others; and
- Keep the tribal cultural resource management movement going.

Tribal Cultural Resource Management has three basic themes: First, "…cultural resource management is more about people than about places and artifacts. While this concept might seem obvious, we will show that as the profession developed, this concept got lost. At some point archeologists forgot that sites and places were still important to living peoples. Archeological sites were the remains of people long gone, and it was the professional's job to bring the lost cultures back to life. Today, we have come to realize that many of the places and resources are ancestral to peoples living today and important for their cultural continuity" (p. 9).

Second, they discuss the paradigm of "cultural resource stewardship" and compare it to CRM. Stapp and Burney suggest that CRM focus less on what certain "sites" need protecting but more on the natural and cultural aspects of management. Hence, they advocate a "stewardship" approach, one that aims to protect both cultural and natural landscapes that have importance and uses to American Indian's past, present, and future use. The dilemma in recognizing that American Indians need certain places for their continued cultural identity does not coincide with the "mitigation" or "data recovery" philosophy of archeology. They realize that too much focus and credence has been placed on what the archeological record can tell us about the past without addressing the present living people's needs for cultural continuity. As a result, American Indians and their sacred places have been adversely impacted because these "mitigation" procedures have either altered or entirely taken away many of those very qualities (whether natural or cultural) that made these sacred places to them in the first place. Stewardship, therefore, must not only recognize the unique connection that American Indians have with the natural and cultural landscape but also openly encourage this relationship. According to Stapp and Burney, federal agencies in charge of managing lands should be more aware of the need for American Indians to actively promote their religion and cultural identity by providing them access to natural and cultural landscapes that they consider important.

Their final recurring theme "is that people who care about cultural resources must be involved if the resources are going to be preserved, protected, and made accessible."

Chapter 7 is one of the most beneficial in the book. It deals with the concept of consultation and "The Cornerstone of Tribal Resource Management" (p. 119). Stapp and Burney state that: "Consultation is an enhanced form of communication which emphasizes trust, respect, and shared responsibility. It is an open and free exchange of information and opinion among parties which leads to a mutual understanding and comprehension. Consultation is integral to a deliberative process which results in effective collaboration and informed decision making."

Too often, tribal governments are consulted after a federal undertaking has already occurred or all the archeological work has been completed. These governments thus have no opportunity to be involved in "collaboration" when decisions have already been made. Moreover, this covert slight continues to foster a lack of respect of the tribal governments for the agencies they work with and vice versa. As partners in the decision-making process, tribal governments have a voice at the table and can share their specific concerns prior to decisions being made.

Anyone in the field of CRM, whether as a private archeological contractor hired to do surveys for a federal agency, a land manager for a federal or state agency, a State Historic Preservation Officer (SHPO), or a Tribal Historic Preservation Officer, knows that the field of CRM is changing shape. Tribal Partnership programs, Programmatic Agreements, and federal laws requiring the participation of tribal governments continue to alter the face of what CRM will become in the future. The key to what it will become involves the active participation of tribal governments as coordinators, participants, and equal voices at a consultation table that has long been run by bureaucrats, archeologists, project planners, and others with little knowledge or concern for tribal beliefs and tribal cultural preservation issues. As the face of CRM changes, so will the many issues of concern to American Indians, such as religious freedom, sovereignty, cultural continuity, and cultural and economic prosperity.

Recently, the Caddo Nation of Oklahoma's Cultural Preservation Office received notice that the National Park Service had approved our 101(d)(2) NHPA proposal. This approval was two years in the making, and at the time of the publication of this book had not yet been approved. We are excited to now be added to the list of those tribal historic preservation offices that have made a firm commitment to protecting, preserving, and participating in this thing we now know as CRM. We are the first Indian tribe in the state of Oklahoma to assume such duties. Many people, including experts in the field, said that our proposal would not be accepted due to the fact that the definition of "tribal lands" according to NHPA only includes "lands within the exterior boundaries of a reservation" and that there are basically few lands that fall within that definition in the state of Oklahoma. However, our argument for the approval of the proposal proved acceptable and the Caddo Nation can now take control and manage resources that before were at the decision and discretion of the SHPO. The approval of this proposal is not merely part of a solution to a CRM issue, but in great part further defines the Caddo Nation, their resiliency, their beliefs, their sovereignty, and their need for connecting their present people to their past history. Although I am just along for the ride, I can plainly see that the Caddo Nation is well on their way to what this unique book calls "the full circle of stewardship."

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