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From the Editor

This volume of the *Caddo Archeology Journal* honors Dr. Ann M. Early, who retired from the Arkansas Archeological Survey in June 2020 as Arkansas's State Archeologist. Included in here are articles that celebrate her career and her research in the Caddo area. In addition, there is a report on current research, a book review, and a report of 2020 activities from the Caddo Conference.

Thank you to Timothy K. Perttula, Current Research editor, who compiled and edited the current research report and book review. Thank you to Don Wyckoff for serving on our editorial board for many years. I welcome our newest editorial board members: Erin Phillips, Eric D. Singleton, and Alaina Tahlate. I am grateful to the 15 peer reviewers who spent time and effort reviewing the manuscripts for this volume. I welcome your submissions for the next volume!

The *Caddo Archeology Journal*

The *Caddo Archeology Journal* is devoted to the anthropology, history, geography, and current activities of the Caddo Nation, an American Indian group with a historical range covering the four-state area of Texas, Louisiana, Arkansas, and Oklahoma. The *Caddo Archeology Journal* began as the *Caddoan Archeology Newsletter* in 1989 and in 1996 the name changed to simply *Caddoan Archeology*. In 2003 the name of the journal was changed to *Caddoan Archeology Journal*, and in 2006 the name was changed again to *Caddo Archeology Journal*.

Timothy K. Perttula was founder and editor from 1989 until 1993 when Lois Albert became editor. Perttula resumed his editorial role in 2002 until George A. Avery became editor in 2010. Duncan P. McKinnon served as editor from 2016 to 2020. Mary Beth Trubitt began in 2020 as the current journal editor. Stephen F. Austin State University publishes the journal. The *Caddo Archeology Journal* is published once a year in the spring.

Members of the Caddo Conference Organization receive a copy of the journal and access to digital copies on the Caddo Conference Organization website (http://www.caddoconference.org/). There are limited numbers of print backissues that can be ordered by contacting the journal editor.

The *Caddo Archeology Journal* publishes:

- Articles directly related to the interpretation and evaluation of Caddo archeology and history that provide relevant consideration of an issue or theoretical position.
- Preliminary, review, and updated regional summaries of anthropological and historical work conducted within the Caddo region or has linkages to Caddo studies.
- Technical and methodological reports that are comprehensible to most readers and provide new insights into evaluating Caddo archeology.
- Book reviews related to Caddo publications on history, geography, ethnography, anthropology, and current activities of Caddo Nation of Oklahoma.

Information for Authors

Articles should not exceed 10,000 words in length, including references. Reports should not exceed 5,000 words including references.

Please submit the following to the editor at mtrubit@uark.edu:

- a PDF file of the complete submission (following the Society for American Archaeology 2018 style guide),
- OR a Word file containing the complete paper (i.e., including abstract, tables and figures),
- OR a Word file containing the text, references, table and figure captions, plus an individual file of each figure (600 dpi) and/or table. Excel file of tables is preferred.

After submission, papers will be sent out to a minimum of two reviewers. Reviewer comments are requested within 30 days.

On the Cover: Ann Early (*far right*) with other members of the Gilcrease Museum IMLS Lemley collection digitalization project. See Nowak and Folsom, this issue, photograph courtesy of Zachary Qualls.

Ann M. Early's Contributions to Caddo Archeology

George Sabo III, Mary Beth Trubitt, and Kathy Cande
Arkansas Archeological Survey

Following a 48-year career at the Arkansas Archeological Survey, Dr. Ann M. Early retired in June 2020. In this short essay, we highlight her extensive contributions to the archeology of the Caddo area and her research on the culture history of the Caddo people in and south of the Ouachita Mountains.

Ann Early joined the Arkansas Archeological Survey (ARAS) in 1972 as research station archeologist at Henderson State University (HSU) in Arkadelphia, following completion of her PhD degree in anthropology at the University of Massachusetts-Amherst. Her dissertation examined the Upper Mississippian occupation of the Fox River valley in Illinois. In 1999, Ann succeeded Hester A. Davis as Arkansas's State Archeologist and served in that position in Fayetteville until her retirement.

Ann's initial foray into studying the archeology of the region involved examination of archival, artifact collection, and literature sources to develop a series of chronologically ordered Caddo settlement models for the Ouachita River basin, poorly known at the time (Early 1982). A contemporaneous CRM survey and testing project along the Caddo River provided an opportunity to further explore those models, including the first investigations of novaculite quarrying as one prominent element of Caddo land use patterns in the Ouachita Mountains (Early and Limp 1982). Her first major excavation project, designed in part to refine those models, took place at the Standridge site (3MN53), where she supervised excavations conducted in 1975 and 1976 as part of Arkansas Archeological Society training programs and University of Arkansas archeological field schools. Initially considered a minor habitation site, Ann documented a fourteenth- to mid-fifteenth-century shift from residential occupation to service as a local socioreligious center featuring specialized buildings used for ritual performances (Early 1988).

Figure 1. Dr. Ann M. Early, 2016 (Arkansas Archeological Survey photograph).

In 1978, ARAS was invited by the National Park Service (NPS) to develop one of the first "State Plans" for archeological site conservation and research, as part of the NPS Resource Protection Planning Process, an early response to 1960s-era federal historic preservation legislation. Ann Early and Frank Schambach (then the station archeologist at ARAS-Southern Arkansas University) teamed up to synthesize the existing literature and develop a research agenda for the southwest Arkansas study unit (Schambach and Early 1982). When ARAS was invited in 1984 to develop a series of cultural resource overviews intended to cover the entirety of the multi-state Southwest District of the US Army Corps of Engineers, Ann joined George Sabo III (then the station archeologist at ARAS-University of Arkansas Fayetteville) to develop

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Figure 2. Ann Early at transit with Mark Raab and Burney McClurken, Standridge site, 1976 (Arkansas Archeological Survey photograph).

the volume devoted to the Ozark and Ouachita Mountain regions of Arkansas and Oklahoma. In this volume, Sabo and colleagues (1990) applied a novel "adaptation type" framework for synthesizing regional information on cultural sequences. Both studies continue to serve as important general references for those areas.

In 1986, the Arkansas Department of Transportation discovered an extensive distribution of archeological materials within the right-of-way of a bridge replacement along Saline Bayou in the Ouachita River valley. Verification of the significance of the site via test excavations led to a rare opportunity to investigate the Hardman site (3CL418) in its entirety. The farmstead—containing dwellings and numerous work areas with support facilities surrounded by a light fence or palisade—was occupied ca. AD 1400–1700. A major series of features included several hearths used in salt making. The project report (Early, ed. 1993) not only provided major refinements to the local cultural sequence but also produced the first major investigation contextualizing Caddo salt making within community settlement and subsistence organization. Later, as part of another bridge replacement project, she analyzed ceramic artifacts following excavations at the Helm site (3HS449; Lafferty et al. 2000).

Further research in the Ouachita Mountains included a 1995 project focused on a cluster of sites in the Winding Stair recreational area of the Ouachita National Forest (ONF). This work, supported by a cost-share agreement between ARAS, the ONF, and the Arkansas Archeological Society, involved Forest Service and Survey staff and Society volunteers during the June training program. Excavations at 3MN496 uncovered the remains of a late fifteenth-century building that closely resembled Fort Coffee phase buildings in the Arkansas River valley (Early, ed. 2000). The burned structure also exhibited architectural as well as use-history evidence comparable to ritual structures excavated two decades earlier at Standridge. In 1996, Ann coordinated a cost-share agreement between the ONF and ARAS to develop

Figure 3. Ann Early in the field in Ouachita County, 1987 (Arkansas Archeological Survey photograph).

a detailed research design for investigating novaculite quarry sites in the southern Ouachita Mountains. Quarry experts came together for discussions and field trips, and the novaculite research design was later published in *The Arkansas Archeologist* (Trubitt et al. 2004). As an expert in the archeology of this region, Ann contributed a chapter to the Smithsonian Institution's *Handbook of North American Indians* (Early 2004).

In addition to her extensive list of projects centering on Caddo settlement and subsistence organization in and near the Ouachita Mountains, Ann Early directed a significant part of her research to the study of Caddo ceramics. While at HSU, she oversaw the curation and management of the HSU Museum, including its collection of artifacts from Caddo sites in southwest Arkansas. In addition, after the Joint Educational Consortium (JEC), made up of Henderson State and Ouachita Baptist universities in Arkadelphia, acquired the Hodges Collection in 1977, she curated it as well. That collection included some 1,300 whole or reconstructed ceramic vessels, and she was able to provenience many of these to archeological sites in Clark and Hot Spring counties (Early 1986). As part of her long-time examination of these and other Caddo decorated ceramics, Ann reconstructed a series of "grammars" or rule-based procedures that track the application of decorative variations aligning with discrete communities. Perhaps the best example of this analysis is reflected in her study of 251 Friendship Engraved *variety Freeman* carinated bowls from the HSU Museum and JEC Hodges collections (Early 2012). Ann worked for many years with colleague Frank Schambach to develop the "descriptive" (or "collegiate") system for classifying Caddo ceramic decorative treatments that occur systematically on specific areas of vessel surfaces. It has been applied in several specific studies (e.g., Early 1988; Early, ed. 1993, 2000; Kelley 1997; Schambach 1990; see also Early and Trubitt 2021), and Ann and Mary Beth Trubitt are finalizing the comprehensive analytic guide to this system for publication.

Venturing into the realm of ethnohistoric studies, Ann Early contributed overviews of Caddos in the Trans-Mississippi South (Early 2000) and the French-Chickasaw War in the Mississippi River Valley (Early 2011). Ann's participation in two other large

Figure 4. Ann Early and Robert Cast document Arkansas pottery collections at the Gilcrease Museum in Tulsa, 2010 (Arkansas Archeological Survey photograph).

Figure 5. Ann Early with colleagues at the Caddo Iconography Workshop, 2017 (Arkansas Archeological Survey photograph).

scale, collaborative efforts deserve mention. During the 1980s and 1990s, Charles Hudson (University of Georgia) and a large team of colleagues undertook a major effort to reexamine the route of Hernando de Soto's 1539–1543 expedition through the Southeast and the Spanish interactions with numerous Indigenous communities (Hudson 1997). Ann contributed to the route reconstruction in Ouachita Mountains, where a major series of encounters took place between the Spaniards and Caddo communities (Early 1993). A recent project of note is her contributions to the ARAS-UAF research station's long-term investigation of the Carden Bottoms site (3YE25) in the Arkansas River valley, an early seventeenth-century coalescent village that included some households whose ancestry traces to Caddo groups in the Ouachita Mountains region (Sabo et al. 2020).

Beyond research, Ann Early contributed extensively to other programs at the ARAS and at many other institutions and agencies. She developed and taught anthropology courses at Henderson State University while stationed in Arkadelphia. In Fayetteville, she mentored University of Arkansas graduate students and served on thesis and dissertation committees. As State Archeologist from 1999 to 2020, Ann consulted regularly and extensively with state agencies, including the Department of Parks, Heritage, and Tourism, the Arkansas Game and Fish Commission, the Arkansas Forestry Commission, the Arkansas Department of Transportation, and the Central Arkansas Library System. She worked closely with federal agencies with Arkansas programs, including the US Army Corps of Engineers, the USDA Forest Service, and the National Park Service. One of Ann's most noteworthy achievements as State Archeologist was managing a series of projects funded by grants awarded by the National Park Service's national NAGPRA office to complete the repatriation process for all subject materials in ARAS collections.

Professional service was an important component of Ann Early's long career. She was a decades-long member of the Society for American Archaeology's Committee on Public Archaeology and, as part of her long-term interests in combatting pseudoscience, she also contributed to the SAA Committee on Creationism. She represented the Arkansas State Division of the American Association of University Women. Ann served elected terms as President of the National Association of State Archaeologists, the Southeastern Archaeological Conference, and the Arkansas Historical Association. She also served on the Arkansas Humanities Council, the Historic Preservation Alliance, and the State Review Board for Historic Preservation. Ann organized the Caddo Conferences held in Arkadelphia in 1974, 1979, and 1998. Over the years, she contributed papers at many Caddo Conferences, published articles in the journal (Early 1991; Early and Trubitt 2003), and helped to compile the *Caddoan Bibliography* (Perttula et al. 1999).

Ann Early has been the recipient of honors awarded by the Arkansas Archeological Survey, the Arkansas Archeological Society, the Arkansas Historical Association, the Historic Preservation Alliance, the Caddo Nation, the US Forest Service, and the National Association of State Archaeologists. Here, we honor Ann as she retires from the Arkansas Archeological Survey, we thank her for her contributions to a better understanding of Caddo history, and we wish her a happy retirement.

Note

A version of this essay appeared on the Arkansas Archeological Survey's website in 2020 as "Ann M. Early ARAS Career Highlights."

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Figure 6. Ann Early giving an Arkansas Archeology Month talk, Hot Springs, 2019 (Arkansas Archeological Survey photograph).

Digitizing Gilcrease Museum's Lemley Collection: Multi-Disciplinary Perspectives from Native Artists and Scholars

Jesse C. Nowak[1] and Diana Folsom[2]

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In 2014, The Thomas Gilcrease Institute of American History and Art received a grant from the Institute of Museum and Library Services (IMLS) to fund a project that created a multidisciplinary, searchable online catalogue of ancient Mississippian and Caddo ceramic vessels, the largest of its kind to date. This paper provides a summary of the history of the Lemley collection, its contributions to Caddo archaeology, and the development of the digitization program at the Gilcrease Museum. This work also highlights the major contributions made through the collaborative effort between museum experts, Native American artists, tribal representatives, and Dr. Ann Early, the project's lead archaeological expert and advisor.

In 2014, The Thomas Gilcrease Institute of American History and Art was awarded a "Museums for America" digitization grant from the Institute of Museum and Library Services (IMLS) to work with experts and artists to image, catalogue, and tag a significant collection of ancient Caddo and Mississippian ceramic vessels. Ann Early was the primary scholar for this project, which resulted in a password-protected, searchable online database of ancient ceramic vessels that is among the largest and most comprehensive online catalogue of its kind. This digitization project focused on 3,500 whole vessels comprised primarily from the Lemley collection, an extensive corpus of artifacts from the Trans-Mississippian South. This online database is technically useful and appropriate for related indigenous tribes, and with approval, it is possible for other types of scholars, students, and artists to view these vessels and their digital record.

The Lemley collection is located in Tulsa, Oklahoma, at the Gilcrease Museum, an institute with one of the world's greatest collections of Native American and Western art. The recent digitization initiative at the Gilcrease Museum strives to improve the ways the collection is accessed and utilized to ensure it continues to contribute to scholarship in innovative ways while working with and respecting the concerns of tribal partners. It is also our goal that this living collection can allow tribal communities and Native artists new ways to connect to their ancestors. This paper provides a brief overview of the history of the collection, its contributions to Caddo and archaeological research, and concludes by discussing its potential for the future.

History of the Collection

It appears that Harold (Harry) Jacob Lemley, born in 1883, gained an interest in Native American history while living in Arkansas. For over 30 years as he practiced law and eventually became a district judge for the state (Federal Judicial Center 2020), Harry compiled a collection of an estimated 12,000 artifacts primarily from the Mississippi River valley in eastern Arkansas and the Caddo heartland in southwest Arkansas. Beyond the nearly 3,000 whole ceramic vessels, the collection includes ceramic fragments, projectile points and other tools made from stone, bone tools, shell artifacts, and carved stone pipes. Thomas Gilcrease, a member of the Muscogee (Creek) Tribe, was a known collector and art enthusiast who purchased the extensive Native American collection from the Lemley estate in 1955 (Milsten 1991). The collection is currently housed at the Gilcrease Museum, where the ceramic vessels are located in secured storage on site.

Though it appears that Lemley was attempting to conduct a more scientific approach by recording excavation data and publishing his findings, many of his collection practices continued the unethical destruction and control of Native American ancestors, sacred sites,

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and material culture. He actively purchased objects recovered from persons who often looted sites, and even removed artifacts from "indian mounds" that were located on his own farmland (Lemley 1938:62).

Because of this history and the sensitive context and nature of this collection, the Gilcrease Museum worked with tribal representatives on this IMLS project and has begun actively consulting with tribal communities related to the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA). Currently, scholars or artists who wish to study the Lemley collection are allowed access according to museum guidelines. Since many of these objects are funerary in nature, tribal approvals are required for viewing in-person or online. The massive task to digitize the thousands of artifacts in the museum collection began in a systematic way in 2013 and will take many years of work by museum staff and qualified volunteers to complete. It is our hope that collaboration with descendant communities will continue with all projects concerning material culture.

The Lemley Collection's Role in American Archaeology

With the major speculations on the origins of the North American "Mound Builders" answered by the late nineteenth century, the agenda for American archaeology in the twentieth century began to focus on chronology, regional comparative analysis, and the practice of proper excavation and data recording methods nationwide (Willey and Sabloff 1993:83-84). This new standardization was not restricted to academics or professionals from mandated institutions, but was incorporated by regional avocationalists, who at the time were conducting the majority of excavations across the nation.

Lemley was one of a number of well-off individuals, like Clarence Webb and Thomas and Charlotte Hodges, who developed interests in Caddo archaeology and collecting. Among others, these dedicated avocationalists in Arkansas and northwest Louisiana were pioneers for the region before archaeological research standards came under more scrutiny. Much of this changed with events such as the National Research Council's archaeological conferences in the late 1920s and 1930s, where anthropology professionals made the first concerted efforts to standardize and regulate American archaeology. Lemley attended the St. Louis Conference in 1929, which focused on addressing the destructive but well-intended amateurs who did not practice adequate record keeping measures during excavations, and at times destroyed invaluable archaeological context (O'Brien and Lyman 2001:32-34).

This new program of regulating and improving archaeology by corresponding with local avocationalists is exemplified in the work of Judge Lemley. Though he purchased artifacts from other collectors, he also funded excavations led by experienced archaeologists like Samuel D. Dickinson and Gregory Perino. Both Lemley and Dickinson not only kept field notes of their excavations, many of which are on record at the Gilcrease Museum, but also published their findings (Dickinson 1936; Lemley 1936; Lemley and Dickinson 1937). Lemley is regarded as initiating the first scientific excavations at the Crenshaw site (3MI6), where his subsequent publication "Discoveries Indicating a Pre-Caddoan Culture on Red River in Arkansas" gave the archaeology community reliable and accurate data (Figure 1). This work, in turn, aided in identifying pre-Mississippian cultures in neighboring regions (Ford 1936:258; Girard et al. 2014:10). Lemley's work at Crenshaw especially impacted the work of archaeologist James Ford, who headed much of the chronological research in the Mississippi River valley. Ford's assertion that the Coles Creek ceramic complex was a precursor to later Mississippian ceramic assemblages was in part based on the Fourche Maline wares identified at Crenshaw (Girard et al. 2014:11). Harry Lemley was an example of "the serious-minded, thoughtful collectors… who sought information on their origins and functions by consulting libraries, fellow collectors, and, when possible, professional archaeologists" (Guthe 1967:435 as quoted by O'Brien and Lyman 2001:20).

The Lemley collection was also foundational in the creation of arguably the most important ceramic typologies in the history of southeastern archaeology. When used correctly, artifact typologies are a tool that can connect a particular artifact to a larger body of archaeological knowledge. Additionally, typologies could also provide further insights into regional

Figure 1. Photograph of Harry J. Lemley (*left*) and S. D. Dickenson (*center left*) at the Crenshaw site (3MI6) (courtesy of texasbeyondhistory.net [Texas Archeological Research Laboratory 2001]).

chronologies and identify expressions of cultural relationships (Phillips 1970:23). The duties of creating typologies for the Lower Mississippi Valley were shouldered by archaeologists Philip Phillips, James A. Ford, and James B. Griffin (2003) from 1940-1947, and by Philip Phillips (1970) in the Lower Yazoo Basin in the 1950s. In these seminal works, they created and refined ceramic vessel types in the Southeast by using artifacts recovered from their own excavations, as well as thousands of ceramics in private collections. The Lemley collection contributed to the definition of many well-known Mississippian ceramic types including Parkin Punctated, Kent Incised, Fortune Noded, Ranch Incised, Bell Plain, Neeley's Ferry Plain, Nodena Red and White, Old Town Red, Walls Engraved, and Carson Red on Buff.

Lemley's collection also proved instrumental in the creation of formative typologies for Caddo ceramics, with early studies in northeast Texas and Belcher types in northwest Louisiana both in part utilizing Lemley's data from Crenshaw to formulate their chronological sequences (Goldschmidt 1935; Webb and Dodd 1941:89). More comprehensive ceramic typologies were published by the Texas Archaeological Society (Suhm et al. 1954) and later refined by Suhm and Jelks (1962) in the *Handbook of Texas Archaeology: Type Descriptions*. Types illustrated by examples from the Lemley collection include: Avery Engraved, Cowhide Stamped, Crockett Curvilinear Incised, East Incised, Foster Trailed-Incised, Friendship Engraved, Fulton Aspect Rattle Bowls, Glassell Engraved, Haley Complicated Incised, Hempstead Engraved, Hickory Fine Engraved, Hodges Engraved, Holly Fine Engraved, and Pease Brushed-Incised. Besides ceramics, the Lemley collection aided in the formation of projectile points typologies in Arkansas and the surrounding states. In *A Field Guide to Stone Artifacts of Texas Indians*, Lemley artifacts were used as examples of point types: Agee, Colbert, Hayes, and Homan (Turner and Shafer 1993).

As new theoretical approaches were explored in Caddo archaeology through the 1970s, scholars began to shift from the McKern taxonomic system and began to define phases and periods to classify time and space (Davis 1970; Hoffman 1970, Neuman 1970; Schambach and Early 1982). These new syntheses of the ancient

Caddo world at times relied on the Lemley collection, which also allowed for large scale and regional studies of ancient Caddo decorated ceramics. In more recent years, the Lemley collection has been utilized for diverse research topics from ceramic style analyses (Bryant 2014; Sabo et al. 2020), iconographic studies (Dye 2007; Lankford et al. 2011; Reilly and Garber 2007), NAGPRA compliance documentation (Perttula et al. 2014), Instrumental Neutron Activation Analysis and sourcing (Lambert 2017), and chemical residue studies (King et al. 2018; Lambert et al. 2021). Vessels from the collection have also been used in museum exhibitions and associated publications such as *Hero, Hawk, and Open Hand* created by the Chicago Museum of Art (Townsend 2004).

Dr. Early and the Lemley Collection

From the project's inception, Ann Early shepherded the Gilcrease Museum's IMLS effort to digitize the collection. Ann was the natural choice to be the head scholar for this project, as she has devoted much of her life to the study of Caddo archaeology and is the foremost scholar on Caddo decorated ceramics. Working at the Arkansas Archeological Survey since 1972, Ann has researched the Lemley collection for over 40 years. She has also managed and curated other major collections of Caddo ceramics, including the famous Hodges collection housed at Henderson State University. Starting in the 1990s, she and the Arkansas Archeological Survey used parts of the collection in their research on the archaeology of the Carden Bottoms area of Arkansas. Their partial photographic database and catalogue has been a source studied by graduate students and professionals alike (Stewart-Abernathy 1990, 1994). The IMLS digitization project adopted many of the cataloging methodologies and terminology used by the Arkansas Archeological Survey due to their extensive experience and familiarity with the collection. Ann also connected the images and digital records created from the IMLS project to the extensive database overseen by the University of Arkansas.

Through her time in Arkansas, Dr. Early made major discoveries about the culture history of the ancient Caddo, especially in the Ouachita River basin (Early 1982; 1993), and, along with Dr. Frank Schambach, was instrumental in updating temporal and cultural sequences throughout the state (Schambach and Early 1982). Ann has gained notoriety for her major contributions to the archaeological study of ceramics, first by adopting the "collegiate" or "descriptive" classification system for Caddo ceramics (Early 1988), and later through her innovative studies on decoration, especially on Friendship Engraved carinated vessels (Early 2012). Her exploration of intricate and masterful pottery decoration "grammars" highlighted the expert craftsmanship and complex production processes, and uncovered intricate histories about the communities that made them. Her life's work has aided the living Caddo in connecting more with their past, and has helped make ancient (and contemporary) Caddo pottery renowned worldwide as some of the finest examples of Native American craftsmanship and art.

Bringing Past to Present: The IMLS Project

Dr. Early and Dr. George Sabo trained the IMLS digitization team in archaeological cataloguing methods, which were then used in a museum collections management software called "The Museum System" (TMS) by Gallery Systems. Digitizing for the project encompassed the recording of all basic metadata for each vessel. Additionally, information such as the ceramic typology, descriptive details, provenience data and curatorial notes were applied to each artifact.

For two full years after initial cataloguing and imaging was completed, Dr. Early patiently worked to review and correct the cataloguing for all 3,500 ceramics from her office in Fayetteville using a specially developed software application called the "Distance Cataloguing Interface" (DCI) (Figure 2). The DCI software was written as part of this IMLS grant with the knowledge that experts outside of the Gilcrease Museum's small curatorial staff would be needed to catalogue the rich, important, wide-ranging collection. The Anthropology collection alone would require more than 22 experts to adequately review, confirm and catalogue the collection.

A major source of inspiration was the Steve Social Tagging project's use of model software, created by the IMALab (now called the NewfieldsLab) in Indiana for the Newfields Art Museum over ten years

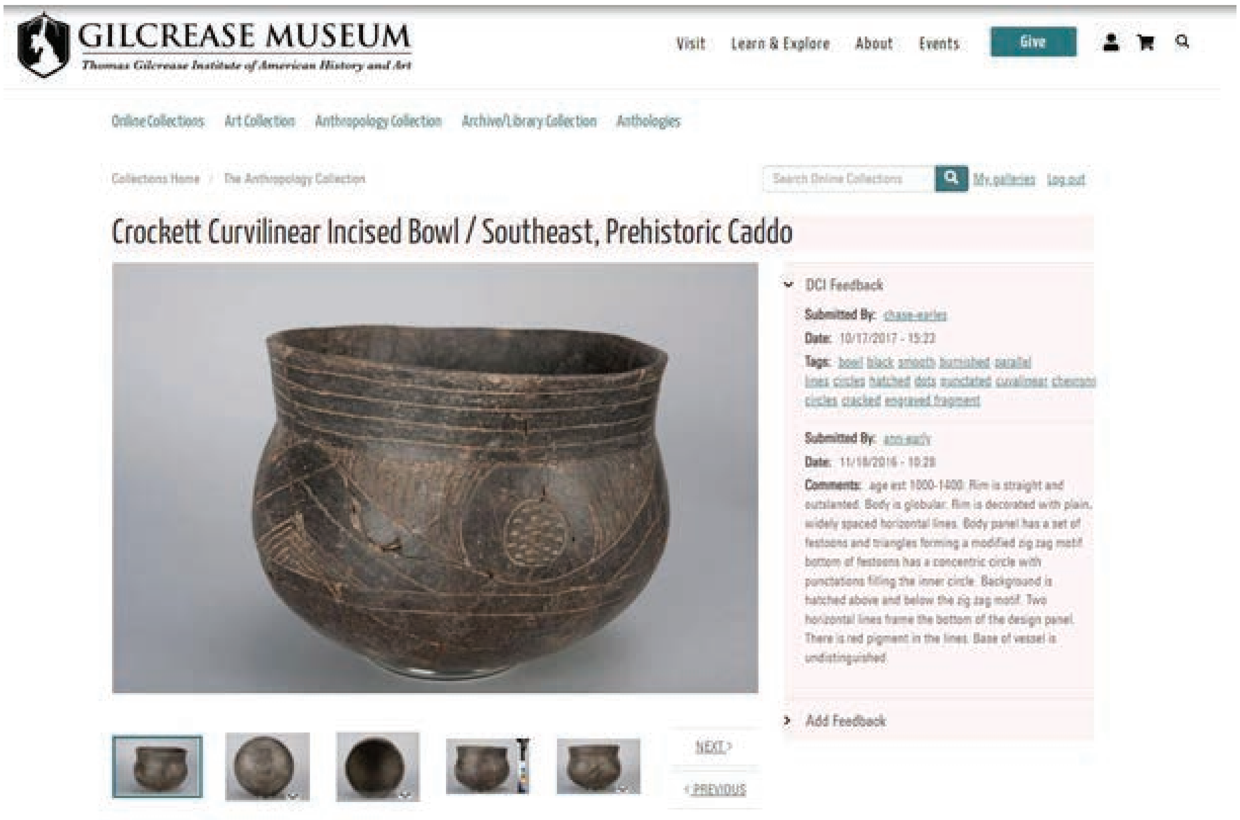

Figure 2. Example of an object record in the Distance Cataloguing Interface (DCI), showing artist tags by Caddo artist Chase Earles and comments by Dr. Ann Early.

ago. With this early model of distance cataloguing in mind, Gilcrease Museum specified a new software, which was then developed and tested to become a more robust application that allows groupings of objects to be assigned in batches to individual experts, who can also search and sort through items based on date, culture, title, and object type. Each expert's progress can be tracked, reviewed, and approved (Figure 3). At the end of each project, after approval, the new data can be pushed into the primary database for preservation and appropriate internal access. For some projects, data can be parsed and moved to share online.

The final result of this project is a database that is stored in a password-protected area of the website maintained and updated by the Digital Curation department of Gilcrease Museum (Figure 4). Since its inception, the plan for this project was for the images and information to be accessible for consultations in compliance with Native American Tribal Historic Preservation Offices and NAGPRA guidelines.

The Future of Gilcrease's Digital Collections

An unexpected positive result of the Lemley project was the start of a new naming effort initiated by the Caddo Nation of Oklahoma. The cataloguing question originally asked in the IMLS project was whether Native artists would need different search terms to help find vessels of interest. Are the archaeological naming conventions helpful for artist's research? The answer was that new search terms were needed. The project hired Caddo ceramic artists Jeri Redcorn and Chase Earles, Osage ceramic artist Anita Fields, and Quapaw ceramic artist Betty Gaedtke to develop a descriptive folksonomy for use in tagging all 3,500 vessels (Figure 5). Although the Caddo artists had already memorized the existing archaeological names, Jeri Redcorn expressed the need to go even further than adding tags for searchability. They requested new terms be developed to reflect their relationship to Caddo heritage. The terms need to be "indigenized."

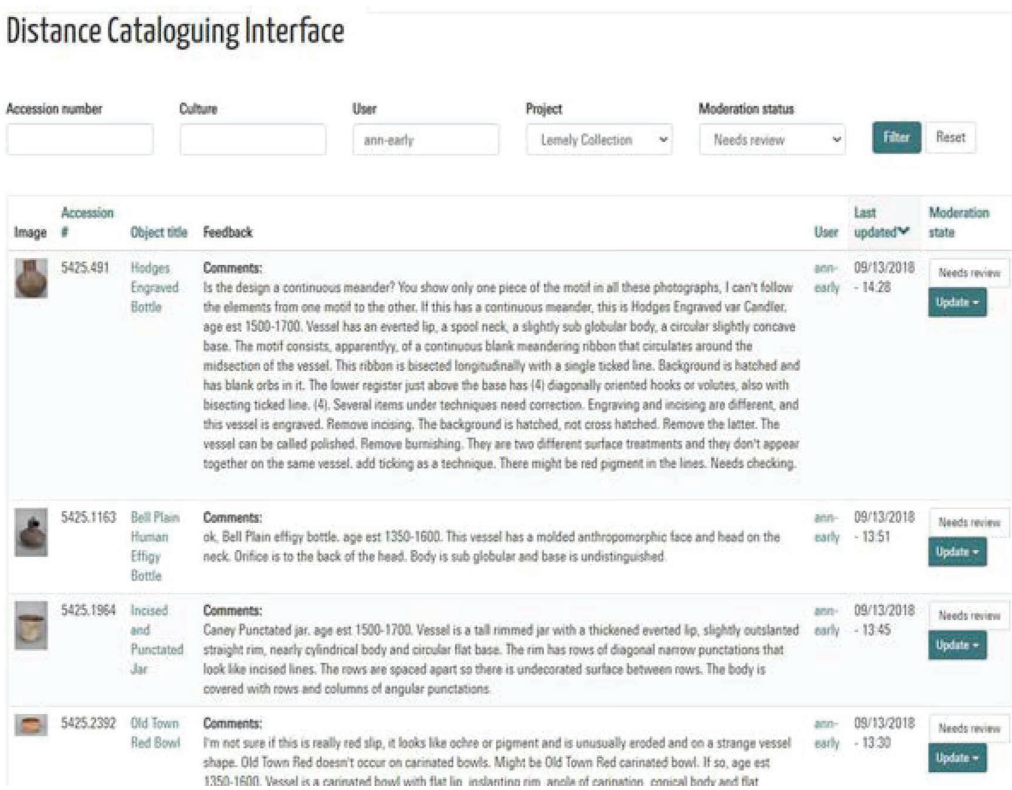

Figure 3. Example of DCI review screen with comments from Dr. Ann Early. On the right, see columns for tracking and review.

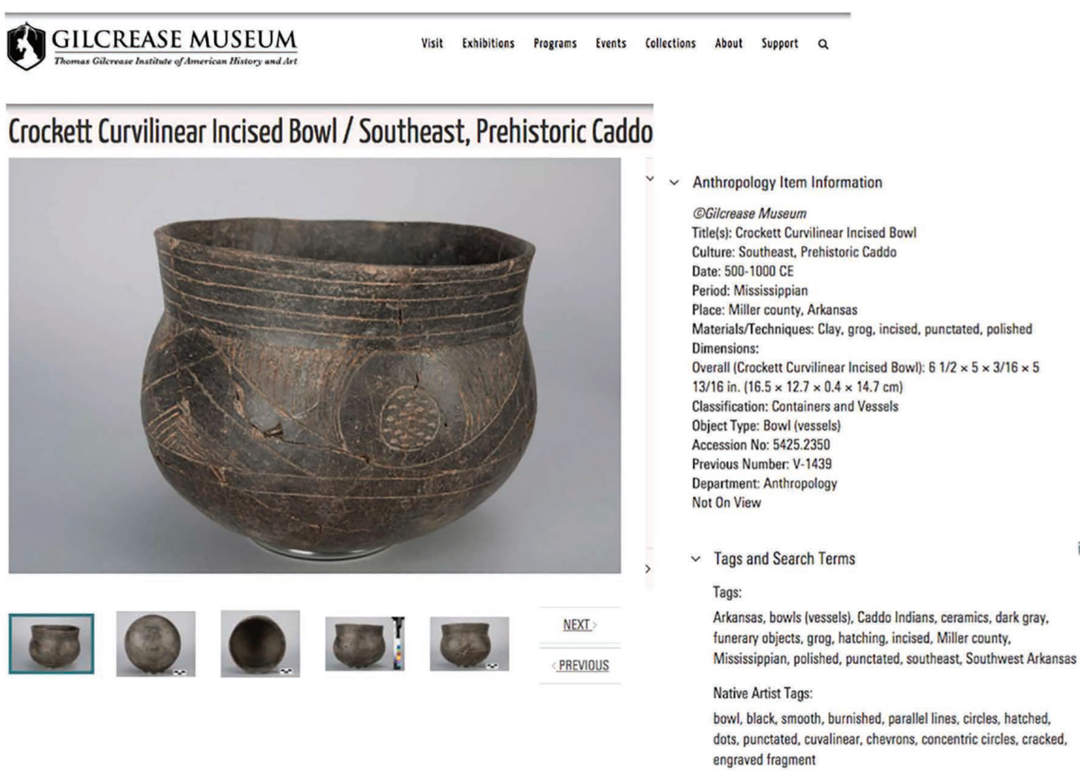

Figure 4. Example of the final project digital object record on the Gilcrease collections password-protected website.

In 2018, an entire meeting of the Caddo Festival held at the Sam Noble Museum was devoted to discussion of the naming of these ancient ceramics. The result was a decision to keep the existing archeological terms because they were so well known, and to also add terms in the Caddo language as new names to honor the Caddo creators. Both Ann Early and George Sabo agreed to begin using these new names in their archaeological studies as soon as a new system is established. It is hoped that the new system will take shape in the near future. Meanwhile, the artists' tagging component was completed for all of the vessels using everyday descriptive words about shapes, textures, finishes, animals, natural forms, terms used in pottery-making techniques, and motif names to assist them in finding vessels. Each artist who participated in the IMLS project found that their practice was enriched with this opportunity to closely work with such a large and unique ceramic collection. The authors were also impacted by working with the collection, which influenced their own artistic and academic ventures.

After the success of the Lemley project, a second IMLS digitization grant was awarded to Gilcrease Museum to expand the DCI software and increase its capabilities through a new project called "Convergence of Native Cultures in Northeast Oklahoma," which allowed the museum to work with an ethnographic expert from the University of Tulsa, Dr. Garrick Bailey, to identify or confirm information and cultural affiliation for 1,500 ethnographic items with uncertain associated information. In addition, Garrick Baily contributed a lifetime of stories about these objects and the history of northeast Oklahoma to make this project richer than ever expected.

In this second project, the DCI was used in a larger setting, displayed through a Smartboard in an Anthropology classroom where Garrick, two students, and a Digital Curation staff member showed the object images and data, asked questions, and recorded data as a team. In this setting, there were many first-hand stories shared because of Garrick's lifelong relationships with people who had ties to these objects and deep

Figure 5. Photograph of the IMLS project members. *Left to right:* Project Team Leader Jesse Nowak; Project Director Diana Folsom; Caddo artist Chase Earles; Osage artist Anita Fields; Quapaw artist Betty Geadtke; Caddo artist Jeri Redcorn; and project expert Dr. Ann Early (photograph courtesy of Zachary Qualls).

knowledge of events and subjects. In addition to cataloguing names of people, places, and events, and adding commentary, the sessions were recorded for the archives and future reference.

Recently, a third IMLS grant was awarded: "Learning from the Eddie Faye Gates Collection: From Trauma to Resilience" where the DCI will again play a prominent role in connecting with the community. This time the community members will be from North Tulsa, and they will tag photographs and audio recordings of survivors of the 1921 race massacre.

The study of the Lemley collection and the relationships with the tribes and artists continue today as the Gilcrease Museum moves forward with an interpretive plan for a new building, which will open in 2025. Informed by tribal consultations and led by descendants of the makers of these ancient vessels, new exhibitions are in early planning stages and will take a fresh approach to understanding this history. The Gilcrease Museum has purchased new pottery made in these ancient styles from artists who worked on this project, including Chase Earles, Betty Gaedtke and Jeri Redcorn. The new museum will show the pottery-making culture and traditions as they are still practiced today (Figure 6).

Conclusion

The IMLS project resulted in detailed catalogue records and six to eight high-quality images for each of the 3,500 ancient ceramic vessels from the Lemley collection. This project can now directly benefit the descendants of the pottery makers, namely the Caddo, Osage, and Quapaw nations, but other tribes in Oklahoma and surrounding states could also be affected by this collection due to their descendants' connection to ancient cultures that shared iconographic and oral traditions.

It is now possible for native communities, especially native artists connected and interested in the traditions of early potters, to have new access to their material heritage, including the ability to study pottery styles, techniques, designs, and iconography of their ancestors. We hope this will encourage the continuation of pottery making in native communities as a practice that promotes cultural traditions and as a viable professional endeavor. Further, the knowledge of Mississippian and ancient Caddo societies in the Southeast can be expanded and enhanced with this large amount of accessible data. Though this project sought to address the needs of native groups and artists, archaeologists, and Tribal Historic Preservation Officers, we prioritized and respected the authority of descendant communities, and sought permission before disseminating information about the collection and its associated data.

With the aid of new digital technologies, the Lemley collection has the ability to be shared, preserved, and appreciated in new and exciting ways. It is our hope that the ongoing digital initiative at the

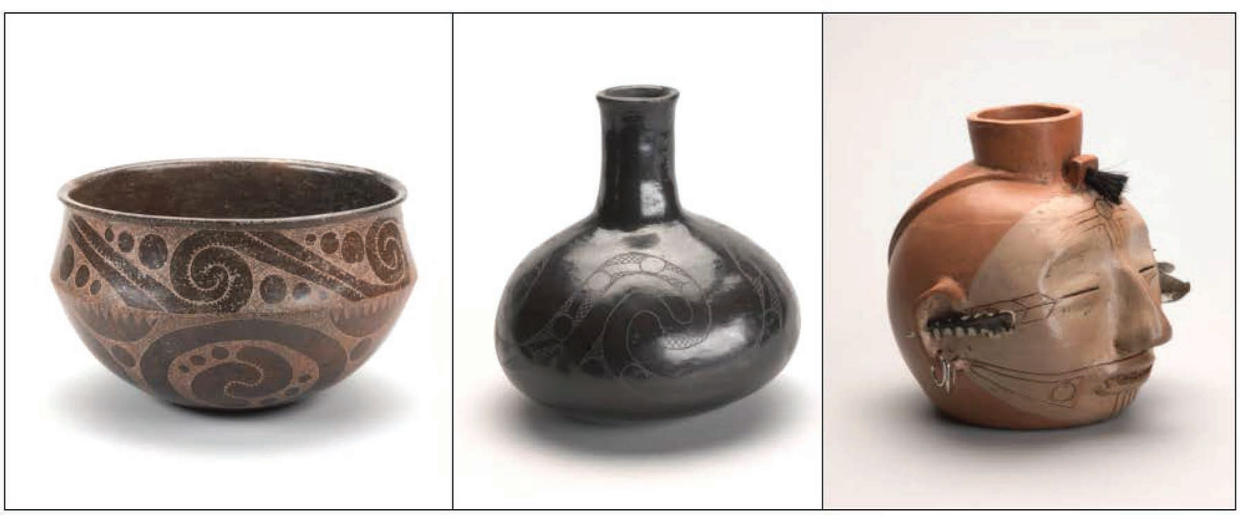

Figure 6. *Left to right:* "Kahwish Bahateno: Red River Bowl" by Chase Earles; "Caddo Bottle" by Jeri Redcorn; "Quapaw Headpot #323" by Betty Gaedtke.

Gilcrease Museum will connect Native American, local, and new communities together with mutual respect and admiration of North America's rich indigenous cultural heritage.

Acknowledgments

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Investigating a Caddo Mound Site in the Ouachita River Valley

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Archeologists from the Natural Resources Conservation Service and Arkansas Archeological Survey employed multiple techniques to investigate a newly recorded mound site (3DA673) in the Ouachita River valley in southern Arkansas. Topographic mapping documented a large two-stage mound. Geophysical surveying around the mound revealed anomalies in the gradiometry and resistance data, and soil coring detailed floodplain soils. A test unit was excavated in a large circular anomaly that corresponded to a low topographic rise north of the main mound. While very few artifacts were found, a burned zone and a post mold feature suggest the anomaly was a burned structure covered with fill, and show the potential for buried cultural deposits at the site. Based on the 2010–2011 investigations, 3DA673 and the neighboring site 3DA403 represent the archeological residues of a Middle to Late Caddo period community (ca. A.D. 1400s).

Introduction

Numerous mounds have been recorded as archeological sites in the Ouachita River valley of southern Arkansas over the past century (Lockhart 2012). Many have been destroyed in the past by looting, flooding and erosion, farming practices, or large-scale excavations by early archeologists. While we try to make revisits to previously recorded mound sites, once in a while we are able to record a new one. In 2010, we were called to investigate a newly identified mound in southern Arkansas. Over the next year, we used multiple techniques to document this construction and the surrounding cultural landscape. In this article, we summarize the results of those investigations.

A New Mound Site

In August 2010, staff from the Natural Resources Conservation Service (NRCS; John Riggs and Diana Angelo) and the Arkansas Archeological Survey (ARAS; Jamie Brandon and Mary Beth Trubitt) made a visit to a location in the Ouachita River valley in Dallas County. As part of routine field work on a project on the property, the NRCS staff had discovered a mound that appeared to be a cultural construction. It stood out from the pasture because it was covered with trees (Figure 1). While it was hard to discern the shape, it appeared to be a two-stage construction with a higher conical portion at the western end and a lower stage or ramp on the eastern end (Figure 2). The two-stage form is seen on other Caddo period mound sites in southwest Arkansas (Girard et al. 2014:74-75). Based on archeological excavations at other sites in southwest Arkansas (such as Mineral Springs [3HO1], Ozan Site 4 [3HE60], and Ferguson [3HE63]), these are structure mounds made up of series of burned and buried buildings dating to the A.D. 1200s to 1500s or Middle to Late Caddo periods (Bohannon 1973; Harrington 1920; Schambach 1996; Taormina 2015). With permission from the property owner, we made plans for additional work at the site, now recorded into the Arkansas archeological site file system as 3DA673.

Figure 1. View south of tree-covered mound in pasture, 2010 (ARASHSUD_K1972).

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Figure 2. View northwest from lower mound towards summit (people partially hidden by trees on summit show scale; ARASHSUD_K1966).

Mapping, Geophysical Surveying, and Soil Coring

Over several days in October and November 2010, ARAS and NRCS personnel mapped the mound with a total station, starting from an arbitrary N500 E500 Z100 datum. The site is in a floodplain setting with ridge/swale topography. The Ouachita River is about 230 m west of the site, and the soils in this locality are mapped as Ouachita silt loam, frequently flooded (NRCS 2019). In 2020, Jami Lockhart processed and examined bare-earth lidar data for the vicinity (included in site form but not illustrated here to protect the site location) that shows the dynamic stream morphology with multiple paleochannels. Flooding in the past is likely. The 3D map in Figure 3 shows the two-stage mound as well as a lower rise to the north of it. The larger mound is about 35 m E-W and 32 m N-S and stands about 3.2 m high. The smaller oval rise is about 28 x 25 m and 40 cm high. Based on conversations with the property owner, we suspected this represented a second mound that had been plowed down in the past.

Following the mapping, in November 2010, Jami Lockhart (ARAS) directed a geophysical survey at the site. At other Caddo sites in southwest Arkansas, geophysical surveying has been successful in locating clusters of structures, pits, and middens in the vicinity of the mounds (e.g., Lockhart 2010; McKinnon 2017; Walker and McKinnon 2012). Lockhart surveyed a 140 x 140 m area with gradiometry (trees and brush covered the mound and immediate vicinity, restricting survey there). The gradiometry survey around the mound showed patterns of anomalies that seem to correspond with elevation (that is, more concentrated anomalies were found along the higher-elevation ridges, Figure 4). These linear magnetic signatures are likely related to flood deposits, but testing would be needed to rule out cultural factors. Lidar imagery shows these topographic features, as well as east-west paleochannels to the north and south of the main two-stage mound (Figure 5). Whether these were a factor in situating construction at the site is unknown. In addition, a 40 x 40 m block over the suspected plowed-down mound north of the two-stage mound was surveyed with electrical resistance. Based on the results of the resistance and gradiometry survey, Lockhart identified a circular anomaly that corresponded to the low topographic rise (Figure 6). The anomaly is not centered on the topographic rise but is northwest of it, which may be the result of twentieth-century agricultural activity. This anomaly probably relates to mound construction; the magnetic signature in the gradiometry is weaker than would be expected from

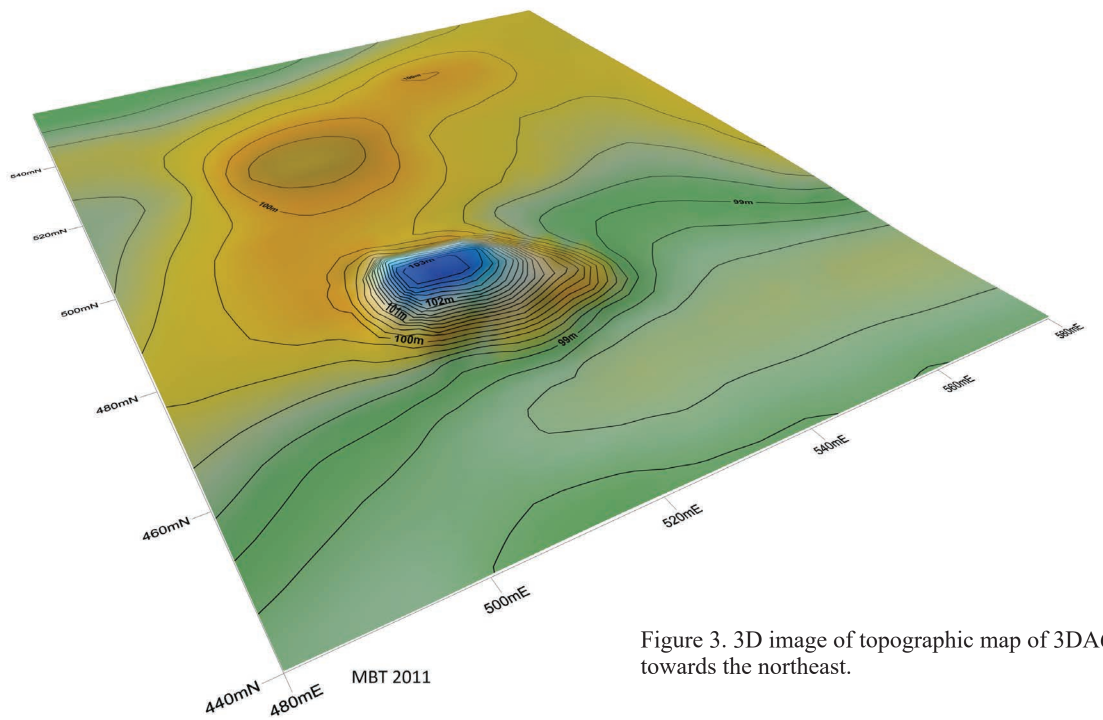

Figure 3. 3D image of topographic map of 3DA673, view towards the northeast.

a burned structure.

There are magnetic dipoles in the gradiometry that are probably metal, but other discrete magnetic monopoles of various sizes and strengths that warranted further testing. In November 2010, we placed four soil cores (P1-4) into gradiometry anomalies by hand using an Oakfield probe (Figure 7). Soils were relatively homogenous with hard dry silt. Two of the probes had small amounts of charcoal and burned clay that were collected from between about 50-110 cm below surface (bs; Accession 2011-363-1, 2; Table 1). In February 2011, NRCS soil scientist Leodis Williams did more

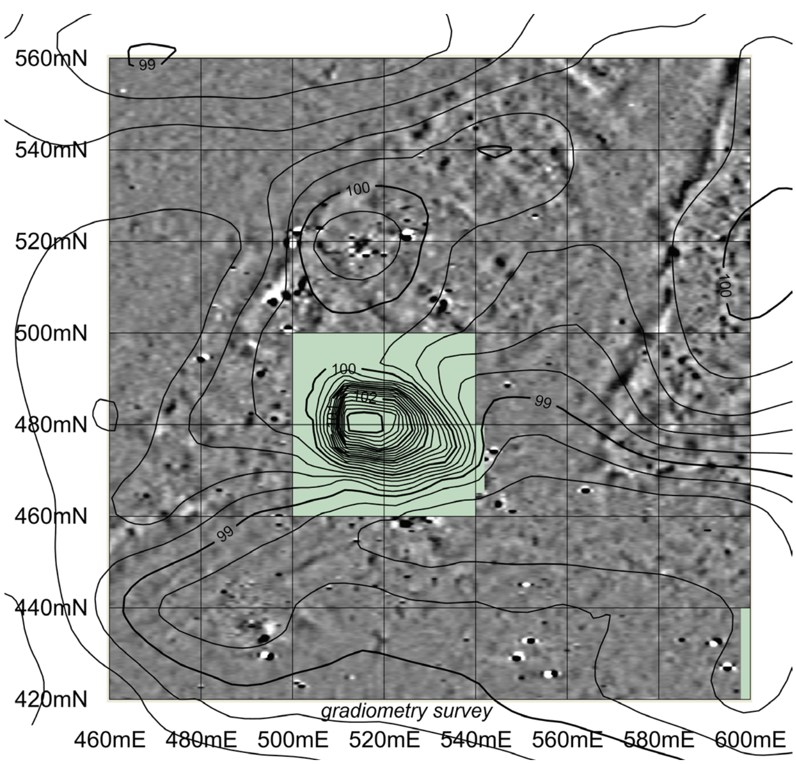

Figure 4. Gradiometry results with topographic base map; darker shades indicate increased magnetism.

Figure 5. Lidar image of 3DA673 site vicinity; dotted lines indicate locations of linear magnetic signatures from gradiometry survey.

extensive soil coring around the mound with a truck-mounted auger. He took a total of 15 cores, some going as deep as 2.25 m bs (SC1-15). Soils were described as brown silt loam to about 70-80 cm bs, when texture changed to a fine sandy loam or a silty clay loam. There was a brown loamy sand deposit below about 160 cm in several cores. While we saw flecks of charcoal in most cores, a soil sample with heavier charcoal was collected from one core (Accession 2011-363-3). Small fragments of burned clay or daub were seen and collected from two

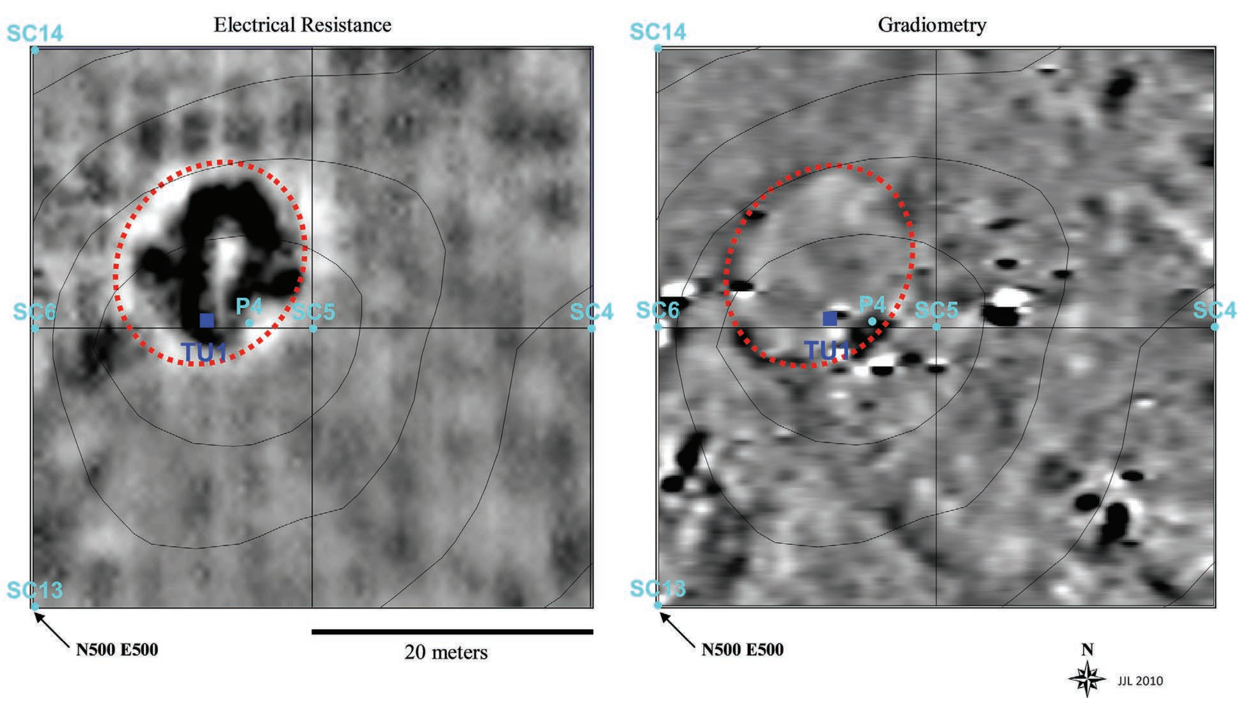

Figure 6. Detail of N500-540 E500-540 grids with electrical resistance and gradiometry results; darker shades indicate increased geophysical readings. The shared anomaly is circled in red, and locations of subsequent soil cores and test unit are shown.

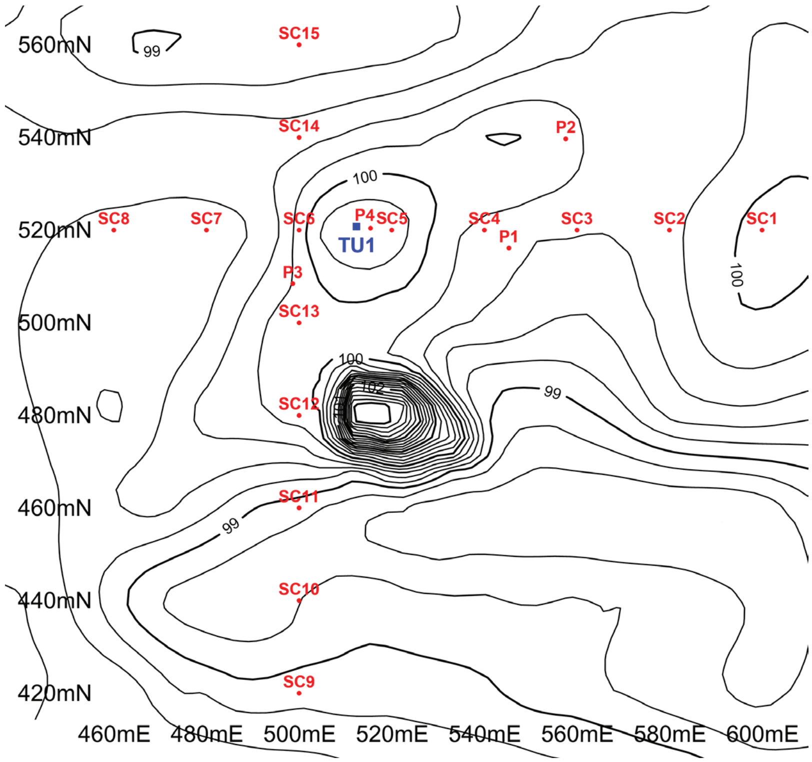

Figure 7. Locations of soil cores (P=Oakfield probe locations; SC=truck-mounted auger locations) and test unit (TU1).

cores (Accession 2011-363-4, 5), but no artifacts were found.

At this point, we had not identified any cultural artifacts at the site. No artifacts were recorded during the initial NRCS shovel testing at the site, although two pieces of daub were observed in a bare patch on the mound. One soil probe (P3) and two soil cores (SC 13, 14) had fragments of burned clay or daub,

Table 1. Soil cores from 3DA673.

ID	N	E	Z	Depth	Charcoal?	Burned clay?	Accession/FSN, Contents
P 1	516.1	545.3	99.7	-0.85	-	-	
P 2	539.7	557.6	99.9	-1.15	+	-	2011-363-1 (charcoal 110 cm bs)
P 3	508.4	498.6	99.8	-0.70	-	+	2011-363-2 (burned clay 53-65 cm bs)
P 4	520.4	515.4	100.4	0.70	+	-	
SC 1	520.0	600.0	100.1	-2.22	+	-	
SC 2	520.0	580.0	99.7	-1.80	+	-	
SC 3	520.0	560.0	99.6	-1.46	+	-	
SC 4	520.0	540.0	99.8	-1.40	+	-	
SC 5	520.0	520.0	100.4	-1.65	+	-	2011-363-3 (charcoal, 20-50 cm bs)
SC 6	520.0	500.0	99.9	-2.30	-	-	
SC 7	520.0	480.0	99.3	-2.00	+	-	
SC 8	520.0	460.0	99.4	-2.25	+	-	
SC 9	420.0	500.0	99.2	-1.80	+	-	
SC 10	440.0	500.0	98.8	-1.20	+	-	
SC 11	460.0	500.0	98.9	-2.20	+	-	
SC 12	480.0	500.0	100.0	-1.30	+	-	
SC 13	500.0	500.0	100.0	-1.30	+	+	2011-363-4 (burned clay, 32 cm bs)
SC 14	540.0	500.0	99.5	-2.25	+	+	2011-363-5 (burned clay, 55 cm bs)
SC 15	560.0	500.0	99.1	-2.22	+	-	

Note: charcoal and burned clay presence or absence indicated by + or - , bs = below surface.

indicating some potential for buried cultural features such as hearths or burned structure floors north of the two-stage mound. We decided to hand excavate a small test unit in the low topographic rise north of the mound to test the circular anomaly centered at about N525 E515 that Lockhart had identified in the resistance and gradiometry results.

Test Unit Excavation

Over two days in 2011, Trubitt and Riggs (on April 19, 2011, and Trubitt, Riggs, and Vanessa Hanvey, then ARAS-HSU station assistant, on July 13, 2011) excavated a 1 x 1 m test unit (TU 1) to investigate the circular anomaly in the low rise north of the mound. TU 1 was placed at N520-521 E512-513, in the southern part of the anomaly. Excavation methods included shovel scraping and troweling 10 cm arbitrary levels, screening soil through 0.64 cm (1/4 inch) mesh hardware cloth. The local datum was set at 5 cm above ground surface at the southwest corner of the unit (relative elevation ~ 100.45 m).

On our first day, we did not find any cultural material in the upper 40 cm of the deposits. The soil was homogenous dark yellowish-brown silt. Some mottling and charcoal flecks were present in Levels 2-4, and in the mottled zone that appeared to slope down to the south as viewed on the east wall of the unit. One piece of heat-shattered novaculite was collected just above the base of Level 5 at 55 cm below datum (Accession 2011-366-1, Table 2). Mottled soil and charcoal concentrations increased in Level 6, and three small ceramic sherds were collected (Accession 2011-366-2). At the base of Level 6 at 65 cm below datum (99.80 m elevation), we mapped an area of charcoal concentration in the northwest corner and an area with heavier charcoal (burned wood) on the south side of the unit (Figure 8). At the end of the day, plastic sheeting was laid in the bottom of the unit and we backfilled, with a plan to return to complete the excavation.

We returned in July 2011 and began with Level 7 (65-77 cm below datum, 99.80-99.68 m elevation).

Table 2. Test Unit 1 Excavation (Accession 2011-366).

Level	Technique	Soil Description	FSN	Comments
L-1, 5-15 cmbd	DS1/4"	10YR3/6 silt		plow zone, no rock
L-2, 15-25 cmbd	DS1/4"	10YR3/6 silt, mottled with 10YR5/3 silt		no rock, some mottling and charcoal at base of level
L-3, 25-35 cmbd	DS1/4"	10YR4/6 silt, mottled with 10YR5/4, 5/3 clay silt in S		more charcoal and mottling, esp. in S
L-4, 35-45 cmbd	DS1/4"	10YR4/6 silt, mottled with 10YR5/4 sandy clay-silt in S		charcoal/nutshell; mottled only at S end
L-5, 45-55 cmbd	DS1/4"	10YR3/6 silt, wetter and more clayey	1	charcoal; novaculite chunk
L-6, 55-65 cmbd	DS1/4"	10YR4/6 clayey silt, areas mottled with 10YR5/3 clay, charcoal	2	charcoal lens; b.clay/sherds
L-7, 65-75 cmbd L-7, 65-75 cmbd	Flot HF Flot LF	10YR4/6 clayey silt with charcoal fragments	3 4	10.5L soil sample, S1/2 charcoal area
L-7, 65-77 cmbd	DS1/4"	10YR4/6 clayey silt, some charcoal	5	sherds, lithic
L-8, 77-85 cmbd	DS1/4"	10YR3/6 clayey silt	6	artifact content decreased; sherd
L-9, 85-110 cmbd	DS1/4"	10YR3/6 clayey silt		NW quad only
F-1, 85-108 cmbd F-1, 85-108 cmbd	Flot HF Flot LF	10YR5/4 silt, charcoal flecks in upper portion	7 8	5.5L soil sample, F-1 E1/2

Note: Level depths are given as cmbd (centimeters below datum); the unit datum = 100.45 m, so top of L-1 is 100.40 m and base of L-9 is 99.35 m relative to arbitrary site datum of 100 m el.

Figure 8. View east at base of Level 6 (65 cm below datum or 99.80 m elevation) in TU 1, showing mottled area in northwest quadrant and charcoal flecking at south (ARASHSUD_K4313).

A 10.5 L soil sample from the south half of the unit (the area with heavier charcoal flecks) was taken for flotation, and the remainder of the level was shovel scraped, troweled, and screened to recover any artifacts. Several ceramic sherds were recovered, as well as charred wood fragments and a large flake of silicified sandstone (Accession 2011-366-5). Two areas with heavier charcoal were mapped at the base of the level. In Level 8 (77-85 cm below datum, 99.68-99.60 m elevation), the artifact content decreased (to one sherd). There was a small circular feature defined at the base of Level 8 as Feature 1 (F-1).

F-1 was an oval area (14 x 17 cm, centered at N520.66 E512.09) that was lighter in color and siltier than the surrounding soil and had more charcoal (10YR5/4 silt with charcoal flecks). We drew a plan view of the feature, and photographed (Figure 9), and cross-sectioned it, removing the east half as a flotation sample (5.5 L; Accession 2011-366-7, 8). The soil surrounding F-1 in the northwest quadrant was taken out as Level 9 (85-110 cm below datum, 99.60-99.35 m elevation) as part of the cross-sectioning process, but contained no artifacts. In profile (Figure 10), F-1 extended from 85 to 108 cm below datum (99.60-99.37 m elevation) with a rounded base. Charcoal was heavier in the upper portion than in its base. While it was defined at 85 cm below datum (99.60 m elevation), there had been a small area of charcoal flecking visible in this location since 65 cm below datum (99.80 m elevation). It is interpreted as a post mold and was likely associated with the charcoal lens that was also mapped at 65 cm below datum.

The north and east walls of the unit were photographed and profiled (Figure 11). The north profile shows an area of mottled fill overlying the burned zone at 70 cm below datum (99.75 m elevation). The east profile shows fill layers that slope down towards the south and cover the burned zone with charcoal lenses at 70-74 cm below datum (99.75-99.71 m elevation). Some of the homogenous fill in the upper portion of the profile may represent soils that were redeposited during mid-twentieth century leveling, in addition to a plow-

Figure 9. Close-up view of Feature 1 at base of Level 8 (85 cm below datum or 99.60 m elevation; ARASHSUD_K4474).

Figure 10. Feature 1 west profile (ARASHSUD_K4480, with digitized drawing).

disturbed zone at top. Repeated past flooding of this location may also have deposited and redeposited sterile soils, burying cultural zones in the past. The charcoal lenses and burned area in the profiles at 70-74 cm below datum, and associated post mold, may represent part of a burned structure covered with "clean earth," creating a low mound. Other examples have been described in the Caddo area in southwest Arkansas dating to the A.D. 1200s to 1500s (Middle to Late Caddo periods) (e.g., Harrington 1920; Reynolds 2007; Schambach 1996; Trubitt 2009). Unlike those examples, no charred posts or structural timbers were found at 3DA673.

Artifacts

There were very few artifacts encountered during excavation of TU 1 (Table 3). No artifacts came from the upper four 10-cm levels. Level 5 had one piece of tan-red novaculite angular debris (heat shatter) with cobble cortex (Figure 12*a*). The only other lithics were a silicified sandstone flake with cortex from Level 7 (Figure 12*b*), and two pieces of novaculite micro-debitage sorted from the Feature 1 flotation. A total of 10 ceramic sherds was recovered. Level 6 had three sherds (grog+shell+bone-tempered plain body, grog+shell+bone-tempered incised body, and grog-tempered incised body, Figure 13*a*). Five sherds came

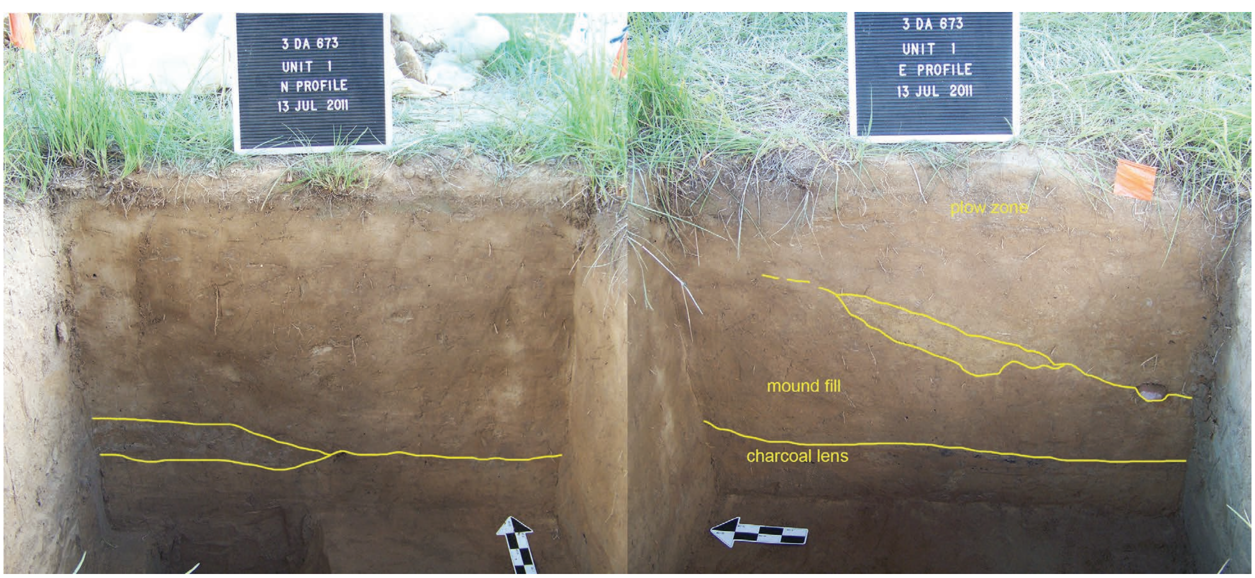

Figure 11. North and East profiles of TU 1 (ARASHSUD_K4495, 4492, with digitized drawing)..

Table 3. Artifacts from Test Unit 1 (Accession 2011-366).

		Chipped Stone		Ceramic Sherds		Floral	
Level	FSN	ct	wt g	ct	wt g	wt g	Comments
L-5, 45-55 cmbd	1	1	6.0				shatter
L-6, 55-65 cmbd	2			3	1.7	0.2	sherds; charred wood fragments
L-7, 65-75 cmbd HF	3			1	0.2	0.5	sherdlet; charred wood frags.
L-7, 65-75 cmbd LF	4					8.5	charred wood frags.
L-7, 65-77 cmbd	5	1	10.6	5	8.9	1.1	flake; sherds; charred wood frags.
L-8, 77-85 cmbd	6			1	2.2		sherd
F-1, 85-108 cmbd HF	7	2	0.1			1.9	ch. debris; charred wood frags.
F-1, 85-108 cmbd LF	8					10.7	charred wood frags.
Total		4	16.7	10	13.0	22.9	

Note: cmbd = centimeters below datum; HF, LF = heavy fraction and light fraction of flotation sample.

from Level 7 (one grog+shell-tempered engraved rim, two grog+shell-tempered engraved body, and two grog+shell-tempered plain body, Figure 13*b*), and one sherd came from Level 8 (grog+shell-tempered plain body, Figure 13*c*). At least one of these came from a carinated bowl, and the Level 7 and 8 sherds had similar paste and may have come from the same vessel. In the middle Ouachita River valley, the combination of engraved cross-hatching with red pigment filling the lines on pottery tempered with grog and shell is characteristic of Friendship Engraved and Garland Engraved, Mid-Ouachita phase types dating to the A.D. 1400s (Early 1993; Perttula et al. 2011).

Discussion

The test unit, placed in the southern portion of an anomaly visible in the resistance and gradiometry results, revealed lenses of charcoal 65 cm bs. This

Figure 12. Chipped stone debris from 3DA673 TU 1; *a*, novaculite shatter; *b*, silicified sandstone flake (Accession 2011-366-1, -5; ARASHSUD_N30803).

deposit, mainly charred wood fragments, corresponded with a very light scatter of artifacts found at that level. The engraved and plain grog+shell-tempered sherds suggest a Middle to Late Caddo period date for the deposit (ca. A.D. 1400s). The fill deposited above this charred layer slopes up to the north, and appears to form a low earthen mound centered at about N525 E515. The post mold and charred wood, with a couple of sherds, are interpreted as remnants of a burned structure. The lack of artifacts in the overlying fill may be due to purposely bringing clean earth (rather than midden) to cover the architecture as closure. Sterile flood-laid soils may also have been a factor, covering cultural deposits at the site. No excavations were done in the larger two-stage mound, but it likely contains a series of burned structures.

This part of the Ouachita River valley has seen sporadic archeological investigation. Several sites in the vicinity of 3DA673 were initially visited by Lynn Howard as part of a University of Arkansas Museum field school in the 1950s and/or by Marguerite Verley (1964) during her survey in the 1960s, but the records are confusing. Two low mounds were recorded at site 3DA403, located about 800 m to the south of 3DA673. In a shovel test dug by the NRCS/ARAS team in a low rise at 3DA403 in 2010, a burned clay/daub/ash deposit was uncovered at 20 cm bs. Artifacts from the shovel testing included novaculite flakes and several sherds tempered with grog and with shell, as well as pieces of wood charcoal, mussel shell, and animal bone (Accession 2010-347). That site appears to have been occupied during the Middle-Late Caddo period.

Figure 13. Ceramic sherds from 3DA673 TU 1; *a*, incised and plain body sherds, Level 6; *b*, engraved rim, engraved body sherds, and plain body sherds from Level 7; *c*, plain body sherd from Level 8 (Accession 2011-366-2, -5, -6; ARASHSUD_N30819).

While the mounds once noted at 3DA403 have been disturbed or destroyed, the site retains some potential for buried cultural features. The proximity of 3DA403 to 3DA673, and the presence of Caddo period artifacts at both, suggest they may have been part of the same contemporaneous community.

The 1977 New Hope project involved archeological survey east of the Ouachita River in Dallas County (Klinger 1978). Several sites were recorded along streams draining from the uplands (e.g., 3DA61, 3DA66, 3DA109) that had artifacts diagnostic of the Caddo period as well as indications of midden, structures, and/or cemeteries. West of the Ouachita River, two low mounds were recorded at site 3OU131 by Howard and Verley, and a 1979 visit and surface collection by David Kelley (then at ARAS) confirmed a Caddo period occupation, but no further work has been done there.

South of 3DA673 and 3DA403, there is a cluster of sites (3OU32, 3OU112, 3OU125/199, 3OU247) along the Ouachita River that have Caddo period artifacts and shell middens deposits. In 1987, a large crew from the ARAS and Arkansas Archeological Society conducted excavations at 3OU112 as part of a Society Training Program, uncovering part of a structure floor as well as a large sample of decorated sherds (Davis 1987). ARAS personnel plan to complete cataloguing and analyzing materials from the 1987 excavations, which should provide new insights into ancestral Caddo lifeways in the lower Ouachita River valley.

Conclusions

Archeologists from the ARAS and NRCS employed multiple techniques to investigate a newly recorded mound site in the Ouachita River valley in 2010 and 2011. The main construction at the site is a large mound (32 x 35 m and 3.2 m high), oriented east-west, with a higher platform on the west and a lower lobe or ramp on the east. This two-stage form is seen in other Caddo mound sites in southwest Arkansas. Mapping with total station, geophysical surveying using resistance and gradiometry, and soil coring revealed a floodplain setting. Geophysical anomalies were concentrated along higher elevations in the ridge and swale topography. A large circular anomaly about 12 m in diameter corresponded to a low topographic rise north of the mound. A 1 x 1 m test unit excavated near the south edge of the anomaly uncovered very few artifacts. A burned zone, with lenses of wood charcoal and a few ceramic sherds, was identified about 65 cm bs. A feature, interpreted as a post mold, provides slight evidence of a structure. Sloping fill zones appeared to cover the burned zone and post mold, making a low mound. No subsurface investigations were done on the large two-stage mound, but it is likely a structural mound as well that contains burned and buried architecture. Based on our limited investigations, this site and nearby 3DA403 contain archeological residues of a Middle to Late Caddo period community that was here at least during the A.D. 1400s.

Acknowledgments

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Fluvial Sequencing and Caddo Landform Modification at the Crenshaw Site (3MI6)

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The Red River in southwest Arkansas creates a changing environment that has had a large impact on those who lived there, including floods, channel movements, and the erosion of whole landforms. River movements, and the resulting oxbow lakes, create an environment favorable to fishing. This study uses historical documents, lidar data, and coring methods to sequence past river movements around a multiple-mound Caddo ceremonial center, the Crenshaw site. This information is used to determine the likely location of the Red River at the time the ancient Caddo constructed the mounds and to note where portions of the ancient site may have been destroyed by subsequent river migration. The cores indicate that the Red River cut off an active channel on the west side of Crenshaw, creating an oxbow lake. The Caddo (or their antecedents) constructed Mound A and the causeway on the point bar surface of a meander bend that has not been buried by significant overbank sediment. This suggests that the Caddo constructed Mound A, the causeway, and Mound E (on the south end of the point bar) after the channel was abandoned and became an oxbow lake. Areas to the east, northeast, northwest, and to the south were destroyed by more recent river movements that crosscut landforms on which the Caddo built the mounds, suggesting that the site was larger than what remains today. Clearly, the Caddo were active managers of their environment. Linear topographic patterns indicate large portions of the landscape, beyond the mounds, were crafted by the ancient Caddo.

Introduction

Understanding the geomorphology of archaeological sites is useful for determining how the surrounding landscapes changed through time, informing us of how these changes affected the ancient inhabitants and the preservation of the sites themselves. River migration can completely erode entire landforms. New landforms are deposited behind the migrating meanders, leaving no trace of the settlements and people that may have existed in the past. Understanding the changing position of a river channel over time may reveal locations where undiscovered sites, especially buried sites, may be found. It also may enable archaeologists to determine the position of the river at the time of occupation and improve our knowledge about the ecology of the landscape at the time of occupation (Stafford 1995). These studies can also aid in understanding the extent of past human occupation in space because areas that have been destroyed by the river create abrupt modern site boundaries. If cultural materials are found near these boundaries, it might indicate that parts of the site have been destroyed by past river action (e.g. Guccione 2008; Guccione et al. 1998; Pearson 1982). Beyond understanding landforms, the presence of oxbow lakes also has implications for how we understand the ecology of the site and by extension, the diet of the people who lived there. Oxbow lakes are resource-rich areas for fresh water and biota (Girard 2012; Milner 2004; Smith 1978) and may have played a role in how people selected the site's location and how they organized their settlements.

The Crenshaw site (3MI6), located along the Red River in southwest Arkansas, is a multiple-mound Caddo ceremonial center of great significance to the Caddo and archaeologists (Figure 1). The Caddo and their antecedents (Fourche Maline) occupied Crenshaw between at least A.D. 900 and 1400 (Samuelsen 2014). The site had six mounds (A through F) at the time of Clarence B. Moore's (1912) test excavations. While Mounds A and E remain mostly intact today, Mounds B, C, and D have been excavated or destroyed and three

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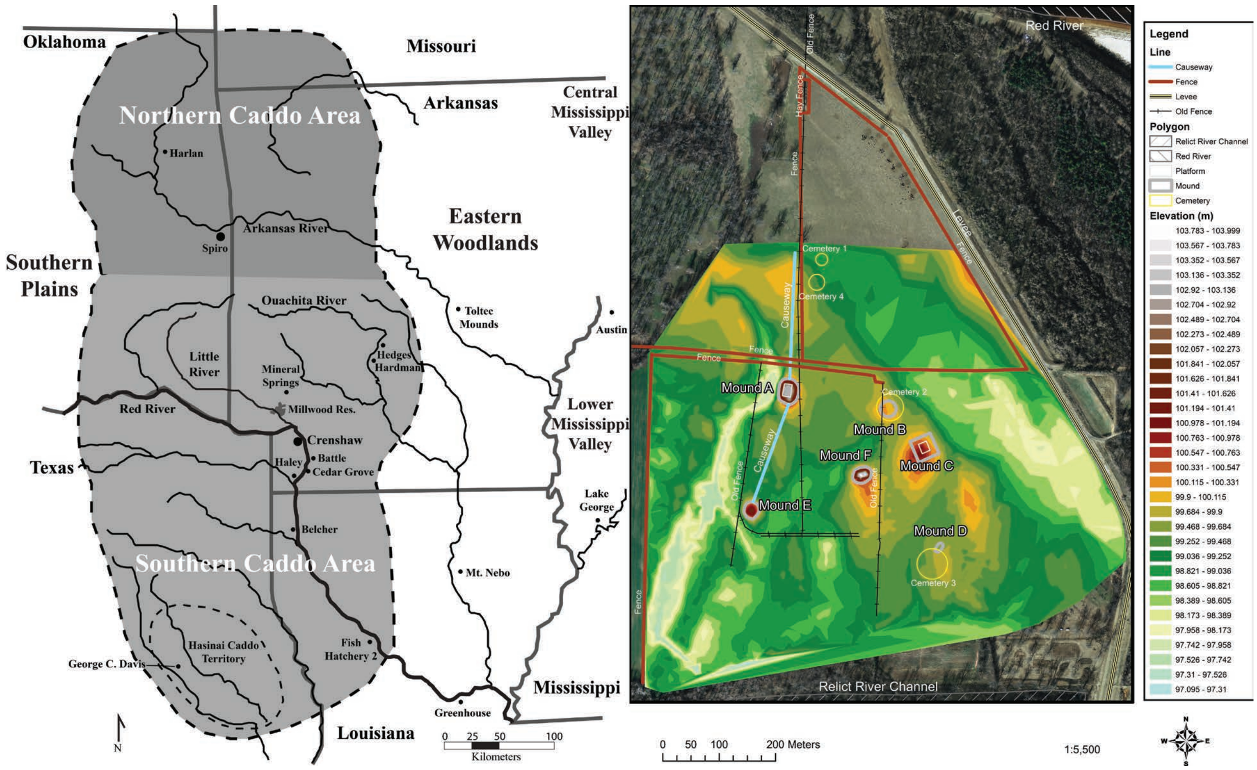

Figure 1. The Crenshaw site in the Caddo Area (*left*, from Samuelsen and Potra 2020:Figure 2) and a map of the site (*right*) with historic fencing shown.

trenches have been dug through Mound F (Samuelsen 2009). Several oxbow lakes and linear or curvilinear depressions exist around the site, making it difficult to determine which partially infilled channel was the river's location during the Caddo occupation of the site.

This study will analyze all known abandoned channels that surround Crenshaw and use historic documents and maps, Light Detection and Ranging (lidar) data, and subsurface core information to test which, if any, of the oxbow lakes or depressions west of the site may have been an active Red River channel or an oxbow lake during site occupation. Additionally, the location of the site relative to various younger channel positions will help assess how much of the site may have been destroyed by river action. This provides information about Caddo settlement patterns through the study of the spatial extent and temporal length of the ancient Caddo occupation, the nature of ritual or domestic use, and how the Caddos interacted with their environment.

Past geomorphological studies and previously hypothesized channel locations for Crenshaw enable construction of testable hypotheses. Charles Pearson (1982) conducted a geomorphological study of the Red River in the Great Bend region and identified fluvial landforms (Figure 2) that were younger than A.D. 1580 based on the location and fill of meander scars and an 1887 survey map (United States Engineer Department 1886-1892). Schambach (1996:Figure 5.2) proposed

Figure 2. Recent fluvial abandoned channels and oxbow lakes. Blue areas are younger than about A.D. 1550 (Pearson 1982).

that the low topographic area just west of Mounds A and E as the location of the active river at the time of site occupation (Figure 3). This paper seeks to test this hypothesis. There are at least two modern oxbow lakes near Crenshaw and west of the present Red River. There are also several other linear or curvilinear depressions that may represent an active or abandoned channel during site occupation. Because the Red River currently is east of the archaeological site, it is possible that the river migrated across and eroded part of the site after the channel was abandoned. Alternatively, if the river avulsed (or moved due the active channel being cut off) to a new eastern location without migration, all or part of the site could be preserved.

The Red River in Southwest Arkansas

The Red River valley in southwest Arkansas (Figure 4) includes locally preserved Pleistocene terraces that flank a broad Holocene floodplain cut into Tertiary uplands (Pearson 1982). The floodplain has a low gradient of 0.1

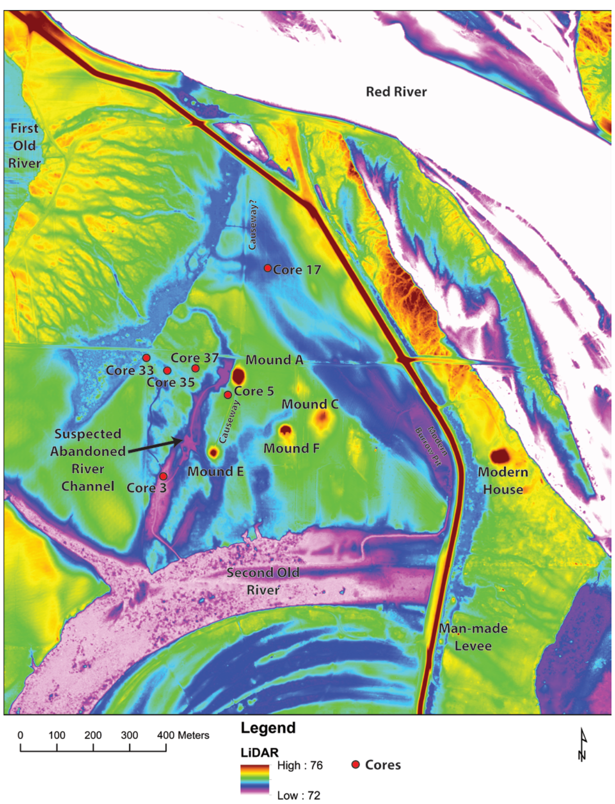

Figure 3. Lidar map of Crenshaw and surrounding areas with core locations. A suspected abandoned channel, First Old River, Second Old River, and a modern constructed levee are marked.

to 1.1 m/km with high local aggradation in the meander belt and small net aggradation (Guccione et al. 1998). Near Crenshaw in the Great Bend Region of the Red River, the 20 km wide Holocene floodplain includes a 4.5 km-wide active meander belt on the east side of the valley with most of the backswamp lying on the west side of the valley. Crenshaw is preserved in the west side of the meander belt. The archaeological site is separated from the present channel by a recently constructed levee to control flooding (see Figure 3). West of the meander belt is a 15 km-wide backswamp that borders Tertiary uplands. East of the meander belt, small areas of backswamp border the Tertiary uplands. No Pleistocene terraces are preserved near Crenshaw.

Crenshaw is half-way between the river and the boundary of the meander belt with the backswamp (see Figure 2). At the meander-belt margin, natural levees grade into the backswamp. Within the meander belt, abundant oxbow lakes mark the locations of previous channel positions. On the inside of the active and abandoned meander bends are sandy point bars and along the outer margins of the channels are silty natural levees that bury older alluvial deposits.

Before modern intervention, the Red River channel frequently shifted positions and imposed great havoc on the people in this area (Bowman 1911; Fenneman 1938; McCall 1988; Schambach 1993). Banks of the Red River are easily erodible and the low gradient result in constant migration. Rafts of woody debris, formed by collapsing of vegetated channel banks, caused floods and blockages of the river. One historic source of flooding in the area that greatly impacted the valley environment was the Great Raft, which extended north of Natchitoches, Louisiana, for nearly 320 km and blocked the Red River channel with fallen trees (McCall 1988). The Raft was not fully cleared until its final removal in 1873 (McCall 1988).

Methods

Historic maps and aerial photographs were collected and analyzed to establish a timeline of river meandering and subsequent abandonment of river channels that became oxbow lakes. The landforms associated with oxbow lakes can be relatively dated using cross-cutting relationships. Combining this information with known

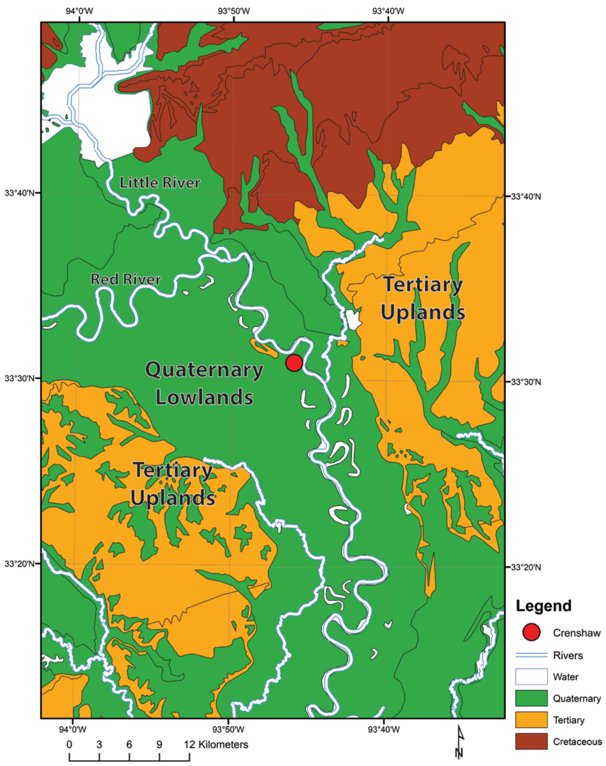

Figure 4. Geology of the Red River valley surrounding Crenshaw. Tertiary uplands surround the Quaternary lowlands on either side of the site.

site locations and their estimated date ranges confirmed the estimated landform age (see Figure 2), as done by Pearson (1982) in this region. This information was combined with lidar data around the site (see Figure 3) to better identify topographic anomalies related to fluvial events. Lidar data are measured in meters above sea level. Lidar point cloud data are from the United States Geological Survey (USGS 2020) and originally collected by the Natural Resources Conservation Service in 2016 through 2017. The data resolution was ~50 cm and was processed to remove trees and other above surface features before being interpolated to a 25 cm raster grid.

Five cores, Crenshaw Cores 3, 5, 33, 35 and 37, were taken near and within the suspected abandoned river channel west of Mounds A and E (see Figure 3). The cores were sampled with a Giddings Soil Probe drilling rig. A plastic sleeve was placed inside a five-centimeter diameter metal tube 130 cm in length. The rig pushed the metal tube into the ground until the top of the tube was just above the ground surface, filling the tube with soil. The plastic sleeve was then extracted from the metal tube. The process was repeated with new sleeves to core deeper. Coring stopped at "refusal" when the rig could not push the metal tube any deeper into the ground.

Core 3 was located within a linear depression, a possible partially infilled abandoned channel. The remaining cores (Cores 33, 35, 37, and 5) were sampled in a transect near and west of Mound A to evaluate: 1) if the linear depressions near the mound are abandoned channels; 2) if the depressions extend to the north but have since been infilled; 3) if the depression west of Mound A is an extension of an abandoned channel, a borrow pit for the mound, or both.

Cores were cut in half and one half of each was used for the sediment description, sampling, and grain-size analysis (see Appendix). The other halves were saved for future use and are stored at the Arkansas Archeological Survey Coordinating Office. Core descriptions include color, using the moist Munsell color system; texture, using USDA Soil Survey nomenclature; presence of roots and root pores, redoximorphic features and cutans, and soil structure. Cutans, or clay films, are likely formed as stress cutans during fluctuating relatively wet (expansive) and dry (shrinkage) conditions. Soil horizons and stratigraphic boundaries were interpreted and classified using standard USDA terminology (Laurent 1984). Laurent's (1984) description of soils in the region provided a baseline for comparison with the described soil properties. The depth of soil and stratigraphic boundaries were mathematically adjusted to the actual depth below ground surface to account for any expansion or compression of the core during drilling. Elevations of boundaries are relative to the lidar-based surface elevation of the core location.

Thirty selected samples from the cores were used to quantify the textures estimated in the core descriptions, following Day (1965). Some horizons were not sampled, and other horizons were thick and multiple samples were analyzed. Oven-dried samples were gently ground using a mortar and pestle and wet sieved with deionized water to separate the sand fraction from the silt and clay fractions. The sand fraction was dry sieved to separate gravel, very coarse sand, coarse sand, medium sand, fine sand, and very fine sand. Pipetted samples at appropriate times and depths were used to subsample a slurry for three silt fractions and one clay fraction. Oven-dried and desiccated weights of all sand, silt, and clay fractions were used to calculate the weight percent of each fraction.

Results

Fluvial Sequencing

Crenshaw, west of the current river, is southeast of the First Old River oxbow lake, and north of the Second Old River oxbow lake. Based on cross-cutting relationships, the archaeological site is located on a landform older than both these abandoned channels. Maps from 1842, 1864, 1887, 1912, 1929, and 1936 and the survey for the Miller County line in 1874 (Guccione et al. 1998) support the age estimates of First Old River forming between 1887 and 1912 and Second Old River forming between 1842 and 1864, long after the Caddo left Crenshaw (Figure 5). In addition to maps, aerial photographs show the path of the river channel since the 1940s (Figure 6) and the areas which have since been eroded by the river. Parts of the Crenshaw site and any satellite sites that might have existed along these meander paths would have been destroyed by the river to the south (Second Old River), northwest (First Old River), and east (modern Red River channel).

Historic maps, aerial photography, and lidar depict a more complete river meander sequence with their estimated ages (Figures 3, 5, 6, 7, 8). Figure 8 includes depressions of partially infilled abandoned channels (7 and 8) that were not recognized earlier by Pearson (1982). Thus, it shows additional areas that may have been destroyed by the river since the Caddo occupation at Crenshaw (Channel 7) and channels that may have been active or abandoned to form an oxbow lake at the time the Caddo occupied Crenshaw (Channels 7 and 8). Identification and relative ages of Channels 7 and 8 are based on their cross-cutting relationships and degree of fill evident on lidar, providing better time resolution than previous studies. A land survey in the 1840s, an 1864 drawing (see 1864

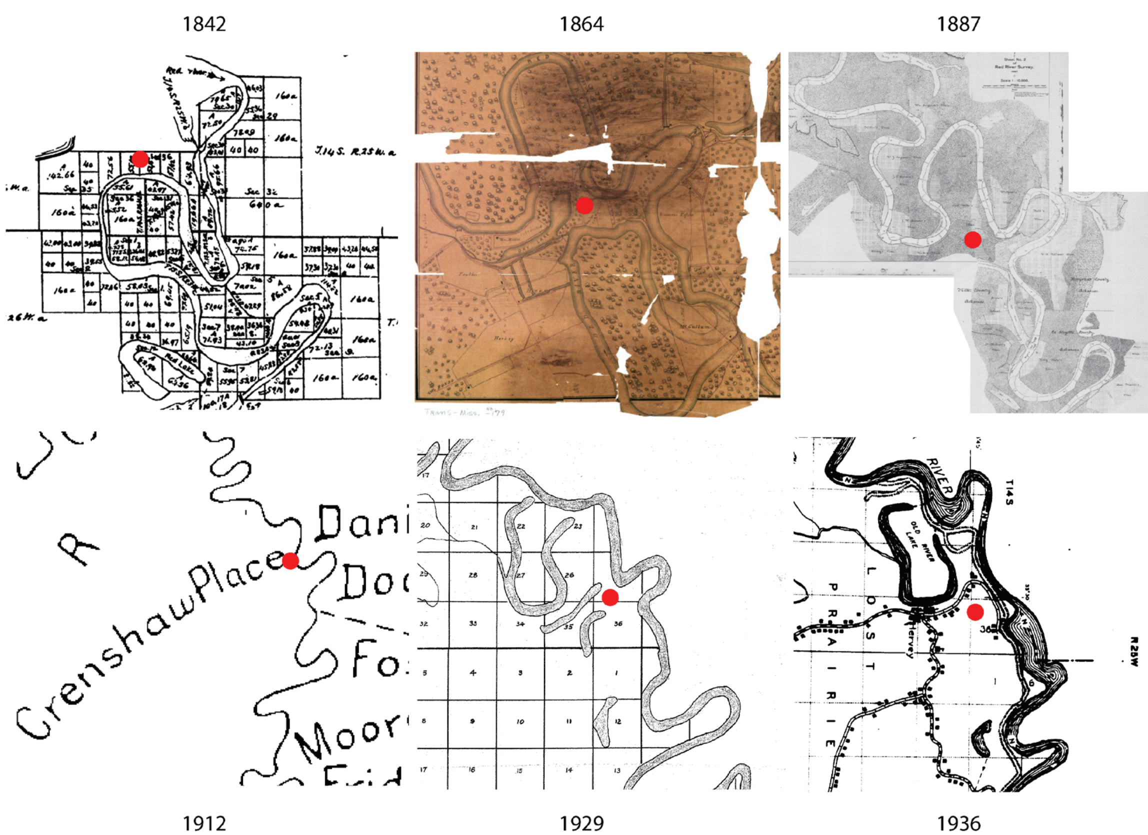

Figure 5. Location of Red River around Crenshaw in 1842 (Arkansas Commissioner of State Lands [COSL] 2000), 1864 (University of North Carolina Library 2009), 1887 (United States Engineer Department 1886), 1912 (Moore 1912), 1929 (Arkansas Highway and Transportation Department [AHTD] 2009), and 1936 (AHTD 2009). Position of Crenshaw shown in red.

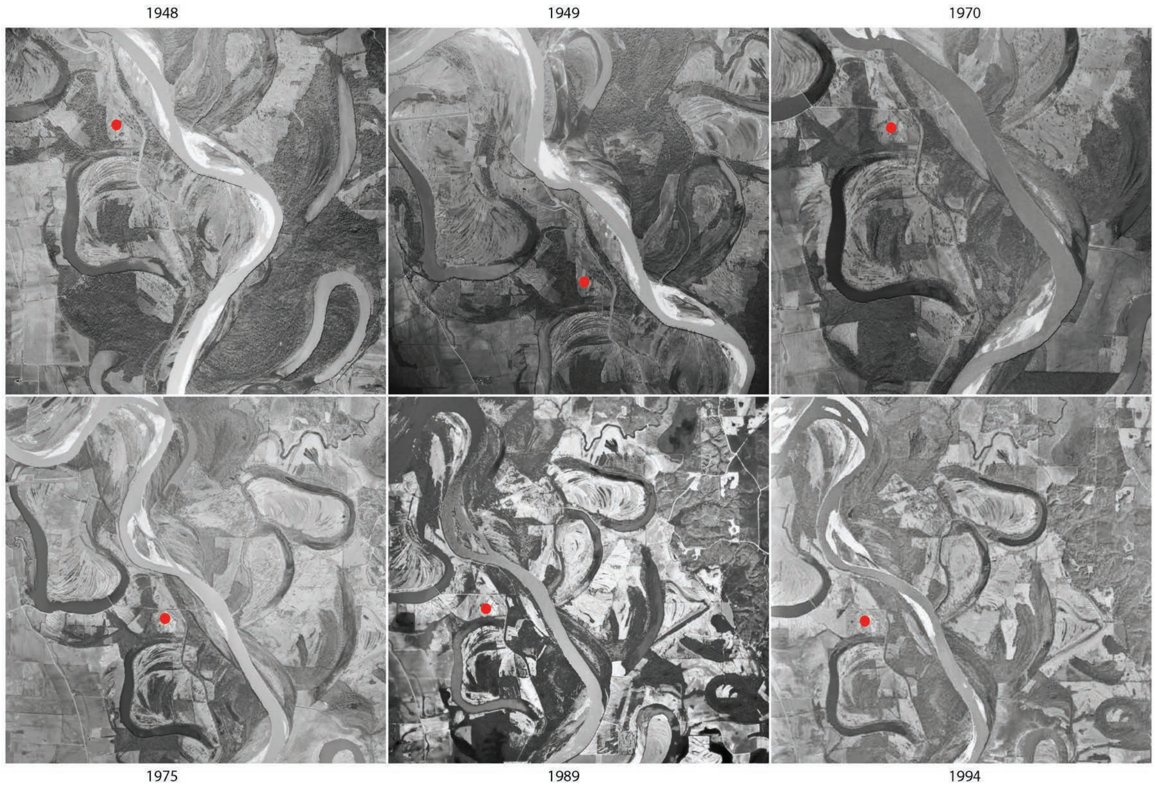

Figure 6. USGS(2009) aerial photographs around Crenshaw from 1948 to 1994. Position of Crenshaw shown in red.

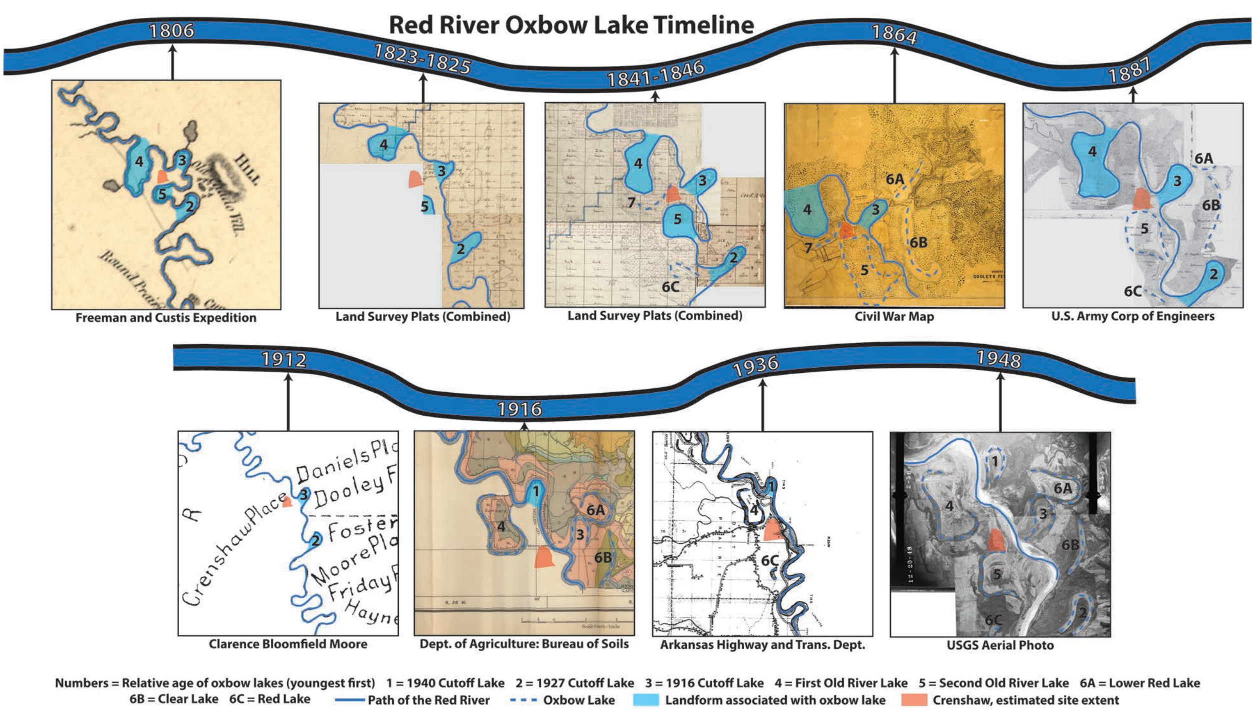

Figure 7. Maps used in fluvial sequencing include one from the Freeman and Custis Expedition in 1806 (Library of Congress 2020), plat maps (Arkansas COSL 2000), a Civil War map (United States National Archives and Records Administration 2020), USGS maps (United States Engineer Department 1886), C. B. Moore's map (Moore 1912), a 1916 map (United States Department of Agriculture [USDA] 1916), a 1936 map (AHTD 2009), and aerial photography (USGS 2009).

map in Figure 5 with lake west of Crenshaw), and an AHTD map from 1929 show the remnants of Channel 7 in the form of an oxbow lake. An on-site survey of the location confirmed the identification of Channels 7 and 8.

The eastern and northeastern edge of the Caddo occupation is unknown because the river left a fluvial landform east of the site and west of the current channel that will not contain any ancient cultural material. Based on historic records of channel movements, most areas east of the constructed levee have been destroyed as marked by Sequence 1 (Figure 8).

The current river has also eroded the eastern side of the meander belt at the latitude of Crenshaw as recently as the 1960's (Sequence 1, Figure 8). Pearson (1982) also concluded that most of the floodplain east of the river near Crenshaw is young, precluding satellite

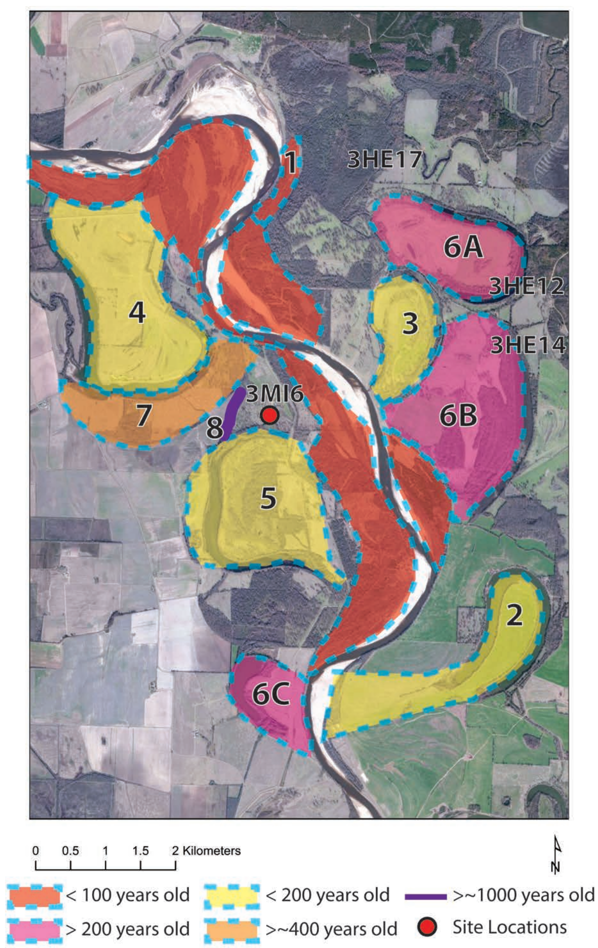

Figure 8. Fluvial sequence around Crenshaw (3MI6) from the most recent (1) to the oldest (8). It is unclear which is older or younger in Sequence 6. 3HE12, 3HE14, and 3HE17 are depicted in a general area to protect site locations.

sites from being found east of the river (Sequences 3, 6A, and 6B). However, there are small portions that have been undisturbed by historic meandering as evidenced by 3HE12 and 3HE14, two mounds that may have Fourche Maline or Caddo cultural affiliations. Both these sites lie in a thin sliver of land that appears to have preserved between three separate meanders that approached it from the north, west, and south. Just east of these sites, the uplands begin (see Figure 4). Unfortunately, the mound at 3HE14 was bulldozed into its own borrow pit to level the land. A portion of the mound may still be intact beneath the surface. Also, on the east side of the Red River and to the north of Crenshaw, another prehistoric mound has been preserved that has an unknown cultural affiliation (3HE17).

Some information can be gleaned about an important potential historic site to the east. The Freeman and Custis Expedition map (see Figure 7) from 1806 shows an "Old Caddo Village" just to the east of Crenshaw and the Red River (Flores 1986; Library of Congress 2020). If the mapping is accurate, it may still yet exist on the landscape. Though significant areas east of Crenshaw have been eroded by the migration of the river since the site's occupation, there appears to have been relatively little destruction east of the active river channel since 1806.

On the northern portion of Crenshaw, no obvious meander landforms are present and thus the site could extend north to the modern channel. Samuelsen's (2020) geophysical study found many archaeological features in this area. A shovel test survey in this area by Kelley and Coxe (1998) found midden and Caddo artifacts. Extension of the site to the north is also supported by a rim sherd found in Crenshaw Core 17, buried within a midden at 172 cm below the surface (Figures 3, 9).

To the northwest of Crenshaw, the meander that created First Old River (and probably Channel 7) destroyed any archaeological material that may have been present (see Figure 8). Outside of Channel 7, beneath its associated natural levee, archaeological material and features may be deeply buried and difficult to identify with geophysical equipment, particularly closer to the channel.

The western edge of the site is known to continue at least to the vicinity of Core 37 where

Figure 9. A rim sherd found in core 17 on the northern portion of Crenshaw. It was located 172 cm below the surface in midden and has a design consistent with the Middle Caddo period (Ann Early, personal communication 2014).

geophysical anomalies were found (Samuelsen 2020). There have also been reports in the Arkansas Archeological Survey site files of Fourche Maline material in fence postholes about 15 m north of Core 33. This area also includes a depression that likely marks an abandoned channel and/or a borrow pit for Mound A (see Discussion). In either case, the site extended west of this depression.

South of the site is Second Old River (Channel 5). If the ancient site had extended in this direction, it would have been eroded. This leaves a narrow area just southwest of the site that may still contain cultural material, though artifacts may be buried by natural levee deposits of Channel 5 (see Figure 8). Investigations in this area might provide information about the original extent of the ancient site in that direction and about the possibility of any satellite sites. The likelihood of occupation farther to the southwest and west is limited by backswamp.

In summary, based on the positions of channels on the landscape, the areas most likely to contain possible extensions of the presently known site boundaries and/or the preservation of satellite sites are west, southwest, and north of the site as presently mapped. There are many ancient sites recorded in these areas, attesting to these landforms' relatively old age. Some of these have been tentatively designated as Fourche Maline or Caddo sites. The undisturbed area north of Crenshaw could also contain satellite sites, and the site itself continues north for an unknown distance. A clear delineation between "sites" may not exist if farmsteads were constructed close to the mound center. Clearly, there are significant portions of the site that have not been eroded and have been buried by younger river sediment, making identification of an exact site boundary difficult, but the preserved site is estimated to be 60-75 hectares in size.

Cores

Two depressions west of Mound A suggest the presence of at least one abandoned channel near the site (Figure 10). The eastern depression is deep and wide and may be, in part, a borrow pit for Mound A. The western depression (near Core 35) is considerably narrower and less continuous. These two depressions merge to the south, near the location of Core 3. A core transect showing subsurface stratigraphy is used to assess whether two channels are present, to measure channel size, and to assess its relationship to the ancient Caddo occupation (Figure 11).

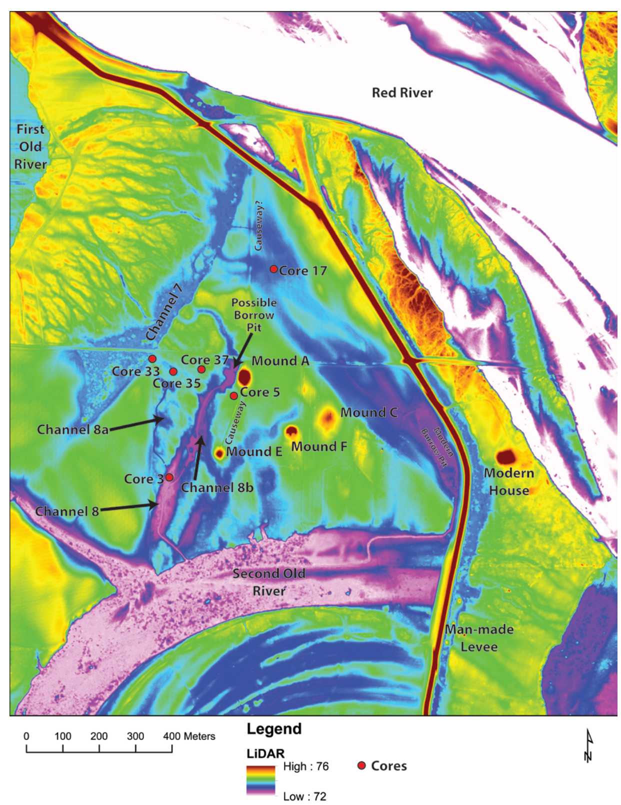

Figure 10. Lidar map of Crenshaw showing the locations of interpreted Channels 7, 8a, and 8b.

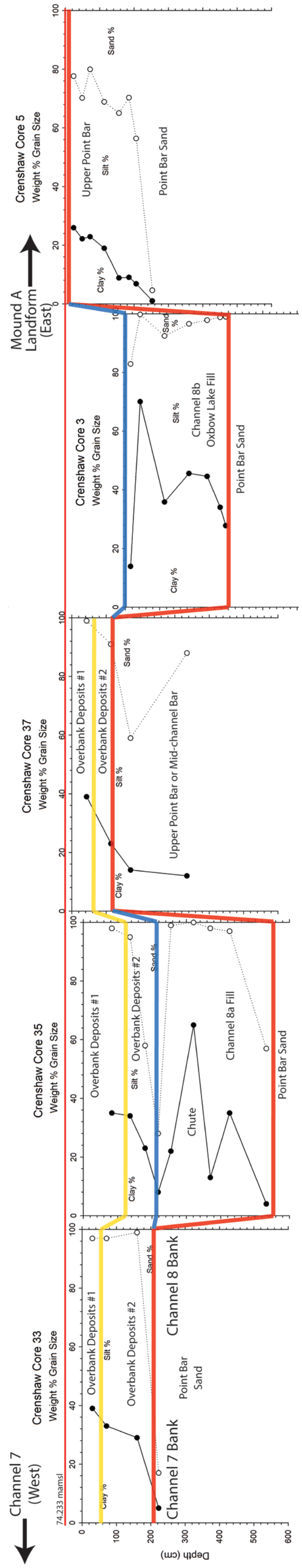

Figure 11. Profile of the five cores showing plots of grain size analysis. Complete description of the cores is in the Appendix. The surface of each core is represented by the top line for each plot, corrected for elevation based on lidar. The horizontal axis is not to scale. Lines represent boundaries of depositional units as interpreted from core descriptions and grain size analyses. The yellow line is the base of overbank #1 deposit and the top of overbank #2 deposit with a soil developed in it. The blue line represents the top of channel-fill deposits with a soil developed in the fill at Core 35. The red line represents the top of point-bar or mid-channel bar sand. Core 35 is in Channel 8a and Core 3 is in Channel 8b (see Figure 10). Overbank deposits are likely derived from Channels 7 and 4, to the west of the transect.

At the west end of the transect, Core 33 is tentatively interpreted to be positioned in a narrow area between abandoned Channels 7 and 8a (see Figure 10). Two clay- and silt-rich overbank deposits are present (see Figure 11). The upper 0.6 m-thick overbank deposit #1 is separated from the lower 1.6 m-thick overbank deposit #2 by a buried soil, indicating that there was a hiatus in deposition after the lower overbank sediment was deposited. The lower fine-grained deposit has an abrupt boundary with an underlying loamy sand, which caused core refusal. This sand is interpreted as a point-bar deposit from a channel position older than both Channels 7 and 8a. No buried soil is preserved within the sand, suggesting either erosion or that no appreciable time lapsed before the sand was buried by overbank sediment. Because the top of the sand is lower in elevation than areas to the east, erosion along a cut bank of Channel 7 is the preferred interpretation.

Located approximately 70 m east of Core 33, Core 35 exposes a 5.6 m-deep channel infilled with thick, bedded channel fill and subsequently two surficial overbank deposits, forming a land surface with only a slight depression (see Figure 10). As in Core 33, two silt and clay overbank deposits are separated by a buried soil. The surficial overbank unit is thicker compared to that in Core 33 to the west and Core 37 to the east, nearly filling the swale present in the buried land surface. In contrast, the lower overbank deposit #2 thins to the east and is intermediate in thickness compared to Cores 33 and 37, respectively east and west of this location. It is also separated from the underlying channel fill by a buried soil. Most of the fill is silt and clay but some sandy beds are present. Within the fill, boundaries are commonly abrupt, a few of the beds have internal bedding and no buried soils separate the beds. This stratigraphy attests to active channel fill where water and sediment frequently flowed through the channel at low velocities and vegetation was negligible to absent until the channel was mostly filled. At the core base, a sandy loam, which represents the base of the channel, caused refusal.

Core 37, between the subtle depression at Core 35 (Channel 8a) and the large surface depression (Channel 8b) (see Figure 10) is interpreted to be a sand bar between Channels 8a and 8b (see Figure 11). Like the locations to the west, accumulation of the upper

1.2 m of silt and clay also occurred in two episodes, as shown by a buried soil between the two units. The upper overbank deposit #1 thins a little over this topographic high compared to the adjacent swale (core 35). The lower overbank deposit #2, the thinnest identifiable exposure identified along the transect, is only 0.3 m thick. The upper 2.5 m of the underlying bar are sandy beds, most of which vary from sand to loam with only one 0.2 m-thick silt loam bed. All bedding boundaries are abrupt indicating that aggradation of this bar surface was continuous. The upper bar surface emerged above the water level and began to accumulate 0.3 m of clay (the lower overbank deposit #2) so slowly that a soil formed in this fine-grained deposit. Final aggradation of 0.9 m of overbank #1 silt and clay buried the exposed bar and became the present land surface.

Core 3, located within the large depression shown in the lidar data and easily visible on site, had to be taken south of the transect to position the drill rig within the depression. In addition, the location of Core 3 was sufficiently far from Mound A where it is unlikely the Caddo obtained sediments for mound building and thus the sample has not been disturbed.

The sediment exposed in Crenshaw Core 3 is nearly three meters of oxbow-lake clay and silt fill in a former cutoff channel of the Red River, Channel 8. This fill likely overlies an unsampled channel sand that caused core refusal. The fill is dominantly clay and silt that generally fines upward (see Figure 11). Very low amounts of very fine sand indicate low-energy deposition. Small changes in texture suggest that there may have been slight changes in sediment influx as the filling proceeded and a 0.1 m thick silt bed at 0.1 to 0.2 m depth is interpreted to have accumulated during a flood event of higher energy than the depositional events resulting in most of the oxbow lake fill.

Unlike the bedded channel fill at Core 35, the channel fill in Core 37 includes root pores, redoximorphic features, cutans, and no evident bedding within the horizons, indicating that the lake was not deep, that vegetation grew as the lake infilled, and bedding, if any had been present, was mostly or completely disrupted by bioturbation. Preservation of charcoal at 0.9 m depth indicates that oxidation was limited. The final fill was the slow accumulation of clay with soil development. At the surface is a thin blanket of historic debris of burned wood and ash.

At the east end of the transect, Crenshaw Core 5 is sampled about 40 m east of the large linear depression (Channel 8b), and approximately 30 m southwest of Mound A (see Figure 10), on the same landform as the mound. Core 5 exposed sand with 2.1 m of upward fining, bedded, loamy sediment. The lower 1 m of overbank deposition is loam and silt loam, coarser grained than the overbank deposits in the remainder of the transect and is likely the uppermost part of the sand bar. The surface meter is an overthickened dark A horizon, also formed in loam and silt loam with microdebitage in the upper 0.7 m.

Discussion

Schambach (1996:Figure 5.2) proposed that an area immediately west of Mounds A and E (Channel 8) was the location of the Red River at the time of the Caddo or Fourche Maline occupation. There is a linear low spot on the landscape there, suggesting that it may be the location of a mostly filled oxbow lake. If this channel was active during occupation, it likely would be older than the oxbow lakes currently on the landscape (Channels 4, 5, and 7, as confirmed by the fluvial sequencing, see Figure 8), making it a possible location for the Red River during occupation. If it is a filled oxbow lake, in addition to the presence of a depression, large amounts of clay and silt should be present within the depression and sandy deposits should be present along the edges of the channel. During flood stages, oxbow lake fills accumulate as muddy floodwater slowly advances across the floodplain. As the flooding abates, the muddy stagnant floodwater remains within an oxbow lake or old channel and the silt and clay slowly settles out of suspension (Bridge 2003). In contrast, a point bar is formed by deposition of coarser sediments along the inner bank of the river as it migrates. The resulting ridge and swale topography is formed by sand as thick as the channel is deep. Therefore, the results from the Crenshaw Cores provide a means to test the hypothesis that the Red River existed west of the site during occupation and later avulsed to the east.

Geomorphology

A combination of lidar data, cores, historic maps, and excavation data establishes that four channels are present west of Mound A. Furthest to the west are Channels 4 and 7. Channel 4 is younger than the Caddo occupation. There remains a possibility that Channel 7 was active at the end of the Caddo occupation. Both Channels 4 and 7 have clear boundaries (see Figure 10) and may be responsible for some overbank sediment on the western portion of the site. Two channels west of Crenshaw have been mostly filled (Channel 8a) or partially filled (Channel 8b). These channels can only be traced a short distance because they have been eroded to the south by Channel 5 and eroded or buried to the north so that they are not visible on the landscape. The two channels merge to the south and are interpreted to be part of the same meander bend. Channel 8a appears to be the furthest west position of the Red River for this meander bend as it migrated to the west. While this meander bend was still active, a chute channel cutoff formed on the meander bend and the main channel shifted from Channel 8a to Channel 8b. After this shift, Channel 8a experienced limited flow and filled with bedded sediment as Channel 8b became dominant. Eventually permanent abandonment of the inner channel, (Channel 8b), by a neck cutoff somewhere to the east allowed the Channel 8b to become an oxbow lake and slowly fill. Some of this fill was utilized by the ancient Fourche Maline or Caddo for the adjacent mound construction (Mound A).

Channel morphology can be reconstructed using lidar and stratigraphy along the core transect. Fill in Channel 8a is at least 5.7 m deep and may have been up to 140 m wide. Based on both the lidar data and the sediment exposed in Core 3, Channel 8b is estimated to have been approximately 5 m deep and has been more than half filled with oxbow-lake silt and clay. The base of Channel 8a is at least 3 m below the present abandoned channel surface and the present topographic depression is approximately 2 m below the surrounding surface. Based on lidar data (see Figure 10) Channel 8b is at least 80 m wide. Both Channels 8a and 8b are narrower than the modern channel or recently well-preserved abandoned channels that are 250 to 325 m wide. It is possible that the bar at Core 35, between Channels 8a and 8b is a mid-channel bar separating two branches of the channel and the outer channel died as the inner channel became dominant. The full width of Channel 8 in that case would be approximately 220 m, more consistent with the modern channel width.

The surface on which Mound A is constructed is an upper point bar of Channel 8a and 8b. Some fine-grained overbank sediment has been infiltrated into the upper point bar loam and the surface aggraded slightly to form a thick A horizon. It does not appear that any significant amount of the two overbank deposits across the western portion of the transect extended east of Channel 8b. It is likely that Channel 8b was an oxbow lake at the time Crenshaw was occupied and that the lake was simply a poorly drained depression by the time Mound A was constructed with some of the channel fill used for the construction of the mound. Initial occupation of Crenshaw may have occurred when 8b was an active channel, but this is impossible to ascertain with the present data.

Archaeological Importance

An unexpected, but important result of the lidar data analysis is that the depression west of Mound A, previously thought to be a borrow pit, is most certainly purposeful landscape modification by the ancient Caddo (Figure 12). Beyond the construction of the mounds, the causeway, and the borrow pits, the Caddo or the antecedent Fourche Maline appear to have modified the edge of the oxbow lake (Channel 8b) that existed west of Mound A. The rectilinear patterns in this area do not form natural geomorphological features. Instead, it appears that this area was modified to have rectilinear topographic features while also being used to construct Mound A. These results are also supported by a rectangular anomaly with a central area of high magnetism in geophysical data corresponding to the elevated rectangular area (see Samuelsen 2020:Figure 5.19). While the shape is likely the result of taking sediment for the construction of the mound and causeway, the resulting rectilinear pattern represents the Caddo purposefully excavating from specific areas. All of this landscape modification shows that the Caddo were not just inhabitants in their environment but were actively modifying their environment according to their ritual or ecological designs.

The Caddos' modification of and use of this area as a borrow pit also suggests that this was an abandoned channel and not an active channel at the

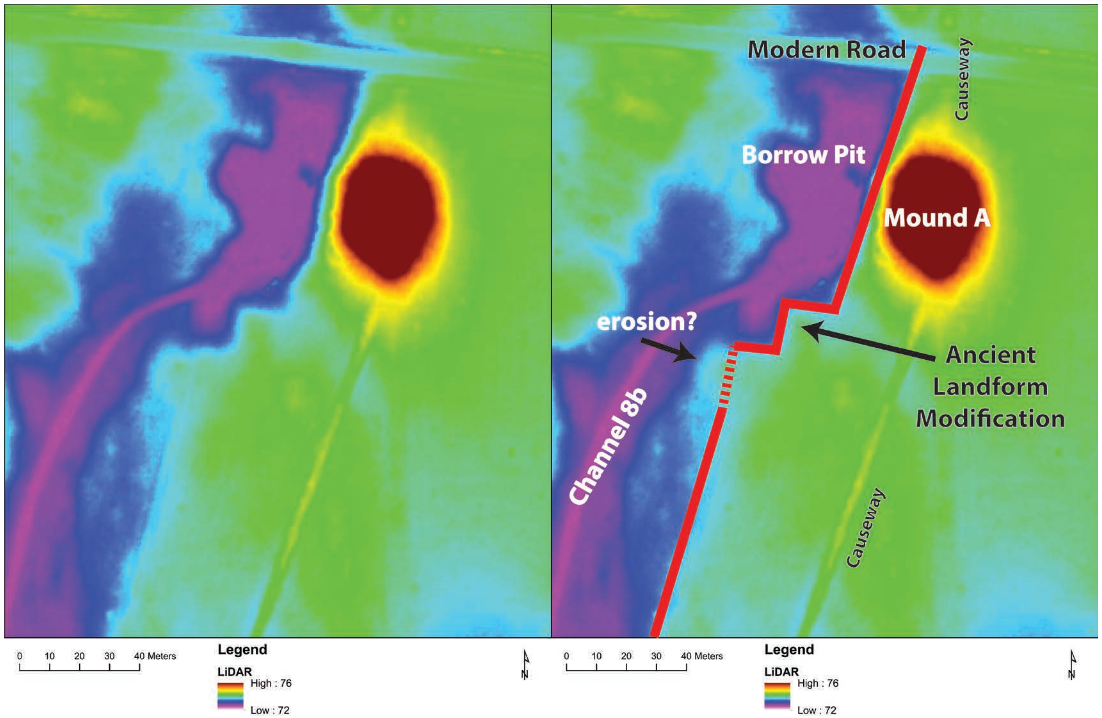

Figure 12. Rectilinear patterns are shown in the lidar at Crenshaw reflecting ancient landform modification by the Caddo. This modification of the landscape is in addition to the already apparent construction of the mounds, causeway, and borrow areas.

time it was modified and Mound A was constructed. This is because this modified shape would not have withstood the water movements of an active channel. In addition, the borrow is deeper here than the area around it, suggesting that channel fill was excavated after the channel was abandoned by the river. The human activity in Crenshaw Core 5 and a geophysical survey (Samuelsen 2020) both confirm the use of this area by the ancient inhabitants. The top meter of Crenshaw Core 5 on the adjacent point-bar landform is darkened by human activity. The overthickened A horizon and bioturbation of this horizon made it difficult to find stratigraphic boundaries and suggest minor accretion of the surface during human occupation. In addition, quartz appeared in the gravel fraction of the uppermost sample, suggesting the presence of microdebitage in the area and therefore human occupational debris.

Because Mound A and the causeway are on a point bar of Channel 8, it is impossible for them to have existed prior to its migration across the site. Therefore, Channel 8 migrated to the west before it was cut off, forming an oxbow lake. It was only long after the point bar was formed, the channel was cut off, and fill accumulated in the lake that the Caddo constructed Mound A and the causeway from the adjacent borrow pit material of channel fill. This also implies that they similarly constructed Mound E after the oxbow lake formed. While Schambach's (1996) suggestion that the river channel was active when the Fourche Maline or Caddo occupied the site could still be true for the earliest portion of the occupation, it appears that, at least when the Caddo were constructing mounds, the active channel of the Red River was to the east.

Schambach's (1996) map also shows the water flowing eastward in Second Old River's location. However, it is clear from the historic records and lidar data that Second Old River was later in time and that the water flowed westward. This is important because it means that unknown portions of the site were likely destroyed as Second Old River migrated across the southern portions of Crenshaw's landform. The current understanding of the site needs to consider the possibility that part of the originally inhabited landform was destroyed prior to Moore's (1912) site map. Crenshaw's skull and mandible cemetery and an ash bed structure were excavated near Second Old River (Samuelsen 2009), indicating that ancient Caddo occupation extended up to the current location of the oxbow lake. This is also confirmed by a geophysical survey (Samuelsen 2010). Therefore, our understanding of the timing of occupation and ritual/domestic use of the site may be distorted by preservation factors.

Previous studies (Kelley and Coxe 1998; Samuelsen 2020) and multiple pieces of information analyzed in this study all point to the Crenshaw site extending north, probably to the recently constructed levee. This provides some support for the hypothesis that the northern linear raised feature is an ancient causeway rather than an artifact of an old fence line, because the northernmost areas are deeply buried by younger river sediment in Core 17 (see Figures 9, 10). A study of the geomorphology and subsurface stratigraphy of this northern area would be beneficial to understanding the Caddos' use of this portion of the site.

Conclusions

The information obtained from the fluvial sequencing analysis, lidar data analysis, and analysis of the core transect adds to the geomorphological knowledge of the area as previously explored by Guccione and colleagues (Guccione 2008; Guccione et al. 1998) and Pearson (1982). There is little evidence that any Holocene Red River meanders exist west of Channels 8a and 8b, and the First (Channels 4 and 7) and Second Old Rivers (Channel 5). This bolsters Guccione's (2008:Figure 7) definition of the boundary between the meander belt and backswamp in this area.

The cores provide environmental information about the area during the last few hundred years. That the area was prone to flooding is indicated by the amount of surficial clay and silt deposited in the western portion of the transect (Cores 33, 35, and 37). This matches well with our understanding of prior Red River positions because Channels 7 and 4 west and northwest of the site probably caused much of this flooding. Flooding was less frequent on the higher elevation point bars of abandoned Channels 8a and 8b where the mounds and causeway are located and no identifiable overbank deposit is present. The presence of one or more oxbow lakes likely provided the Caddo with fresh water and fish. The absence of an actively meandering channel at the location allowed preservation of at least part of the site.

This study tests the hypothesis that the low areas on the west side of the Crenshaw site (Channels 8a and 8b) were abandoned Red River channels at the time the Caddo occupied the site. The results suggest that Channel 8a filled relatively rapidly as some water flowed through, but Channel 8b was abandoned and became an oxbow lake. Partial filling of that lake occurred before the Caddo constructed mounds. Based on this information, the Red River has been east of the preserved portion of the site since the time of the construction of Mound A. It is possible, if not likely, that significant portions of the occupied landform were subsequently destroyed by the migration of Second Old River. Although less clear, Channel 7 may have also eroded portions of the site to the northwest. Other areas of the site to the north are buried by overbank sediment. Therefore, our present understanding of the size, population, and timing of occupation may be distorted by preservation factors.

The analysis shows that the Caddo actively engaged with their environment. Beyond building mounds, they modified landforms according to their designs. The combination of the rectilinear modification of the landscape along the abandoned channel and the construction of causeways shows that the ancient Caddo at Crenshaw designed landscape features unrivaled elsewhere in the Caddo Area and much of the Southeast. This information, combined with the unusual ritual activity and extensive occupation documented by archaeology and geophysics (Jackson et al. 2012; Samuelsen 2020; Schambach 1996), shows that Crenshaw was a location that had great significance to the ancient Caddo.

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Appendix.

Table 1. Miller County, Arkansas, Crenshaw Core 3.

Location: 1.85 km west of the Red River, 0.29 km north of the Second Old River Lake **Elevation:** 73.67 m LIDAR	**County and State:** Miller County, Arkansas **Soil:** Mapped as Latanier Clay **Described by:** John Samuelsen

Geomorphic Position: Cutoff channel of the Red River, west of the First Old River and north of Second Old River lakes.

Elevation (m)	Depth (cm)	Thickness (cm)	Horizon	Parent Material	Description
73.67	0-3	3	Ap	Ash Deposit	Black (7.5YR 2.5/1) silt loam; granular structure; many fine roots; common fine root pores; abrupt boundary; abundant organics; burnt vegetation in area.
73.64	3-11	8	2Ap	Oxbow-Lake Deposit	Very dark grayish brown (10YR 3/2) clay; strong brown (7.5YR 5/6) concentrated few medium distinct redoximorphic features; moderate medium subangular blocky structure; common fine roots; common fine root pores; abrupt boundary; very firm as if fused.
73.56	11-19	8	2C1	Oxbow-Lake Deposit	Strong brown (7.5YR 4/6) silt loam; weak medium subangular blocky structure; few fine roots; abrupt boundary.
73.48	19-173	154	2C2	Oxbow-Lake Deposit	Strong brown (7.5YR 4/6) clay; brown (7.5YR 4/2) depleted common coarse distinct redoximorphic features; strong medium angular blocky structure; few medium roots; few fine root pores; common medium patchy cutans; gradual boundary.
71.94	173-266	93	2C3	Oxbow-Lake Deposit	Brown (7.5YR 4/3) silty clay; yellowish red (5YR 5/8) concentrated few fine faint redoximorphic features, dark gray (7.5 YR 4/1) along pressure faces; moderate medium angular blocky structure; few medium patchy cutans; indistinct bedding; abrupt boundary.
71.01	266-283	17	2C4	Oxbow-Lake Deposit	Brown (7.5YR 4/4) silty clay loam; moderate medium angular blocky structure; few fine root pores; few thin patchy cutans along root pores; clear boundary.
70.84 70.75	283-292+	9+	2C5	Oxbow Lake Deposit	Reddish brown (5YR 4/4) silt loam; minor masses of redoximorphic features around root pores; weak medium subangular blocky structure; few fine root pores. Refusal.

Table 2. Miller County, Arkansas, Crenshaw Core 5.

Location: 1.55 km west of the Red River, 0.46 km north of the Second Old River Lake
Elevation: 74.23 m LIDAR

Soil: Mapped as Severn Silt Loam
Described by: John Samuelsen

Geomorphic Position: Point bar of adjacent abandoned Red River Channel 8b, 66 m SSE of the Mound A center.

Elevation (m)	Depth (cm)	Thickness (cm)	Horizon	Parent Material	Description
74.23	0-66	66	A1	Upper Point Bar	Dark brown (7.5YR 3/3) silt loam; moderate medium subangular blocky structure; common fine roots; few fine root pores; gradual boundary.
73.57	66-100	34	A2	Upper Point Bar	Dark brown (7.5YR 3/4) loam; moderate medium subangular blocky structure; few fine roots; few fine root pores; gradual boundary.
73.23	100-130	30	C1	Upper Point Bar	Yellowish red (5YR 4/6) loam; weak coarse subangular blocky structure; few fine roots; common fine root pores; gradual boundary.
72.93	130-199	69	C2	Upper Point Bar	Yellowish red (5YR 5/8) silt loam; weak medium subangular blocky structure; few fine roots; few fine root pores; clear boundary.
72.24	199-209	10	C3	Upper Point Bar	Reddish yellow (5YR 6/8) silt loam; massive; abrupt boundary.
72.14	209-267+	58+	C4	Point Bar Deposit	Pink (5YR 7/4) sand; fine grading down to sand; bedded; single grain.
71.56					Refusal.

Table 3. Miller County, Arkansas, Crenshaw Core 33.

Location: 0.82 km south of the Red River, 0.5 km southeast of First Old River Lake **Elevation:** 73.67 m (LIDAR)	**Soil:** Mapped as Severn Silt Loam, but more like Latanier Clay **Described by:** Justin Estep, Zach Asbury, Will Harmon
Geomorphic Position: Between abandoned Channels 7 and 8b	

Elevation (m)	Depth (cm)	Thickness (cm)	Horizon	Parent Material	Description
73.67	0-8	8	Ap	Overbank #1	Brown (7.5YR 4/3) silty clay loam; moderate medium subangular blocky structure; many fine roots; common fine root pores; abrupt boundary.
73.59	8-36	28	Bw1	Overbank #1	Brown (7.5YR 4/3) silty clay loam (clayey silt); moderate medium subangular blocky structure; few fine roots; common fine root pores; few thin continuous cutans; clear boundary.
73.31	36-60	24	Bw2	Overbank #1	Dark brown (7.5YR 3/4) silty clay loam; moderate medium subangular blocky structure; few fine roots; few fine root pores; common thin continuous cutans; clear boundary.
73.07	60-92	32	2Ab	Overbank #2	Very dark brown (7.5YR 3/3) silty clay loam (clayey silt); strong fine subangular blocky structure; few fine roots; common fine root pores.
72.75	92-116	24	2Bwb	Overbank #2	Dark brown (7.5YR 3/4) silty clay loam; moderate coarse subangular blocky structure; few fine roots; few fine root pores; few thin patchy cutans; clear boundary.
72.51	116-129	13	2BCb1	Overbank #2	Reddish Brown (5YR 4/4) silty clay loam; weak coarse subangular blocky structure; few fine root pores; gradual boundary.
72.38	129-168	39	2BCb2	Overbank #2	Yellowish red (5YR 4/6) silty clay loam (silt); weak coarse subangular blocky structure; few fine roots; few fine root pores; diffuse boundary.
71.99	168-216	48	2BCb3	Overbank #2	Yellowish red (5YR 4/6) silty clay loam; weak coarse subangular blocky structure; few fine roots; few fine root pores; few thin continuous cutans; abrupt boundary. (Silt)
71.51 - 71.38+	216-229+	13+	3C	Point bar sand	Yellowish red (5YR 5/8) loamy sand (silty sand); massive. Refusal.

Table 4. Miller County, Arkansas, Crenshaw Core 35.

Location: 600 m (0.6 km) east of First Old River Lake, 510 m (0.51 km) north of Second Old River Lake, 830 m (0.83 km) south of Red River (94 paces southeast of Core 30, 33.1 m southeast of Core 31 and 67.1 m northwest of Core 34) **Elevation:** 73.65 m LIDAR	**Soil:** Mapped as Latanier Clay **Described by:** Minella Majenu, Dale Solomon, Dustin Ply

Geomorphic Position: Slight depression between abandoned Channels 7 and 8b

Elevation (m)	Depth (cm)	Thickness (cm)	Horizon	Parent Material	Description
73.65	0-15	15	Ap	Overbank #1	Very dark brown (7.5YR 2.5/3) silty clay loam; moderate medium subangular blocky structure; many fine roots; few fine root pores; abrupt boundary.
73.50	15-46	31	Bw1	Overbank #1	Brown (7.5YR 4/4) silty clay loam; weak medium subangular blocky structure; few fine roots; few fine root pores; clear boundary.
73.19	46-109	63	Bw2	Overbank #1	Brown (7.5YR 4/3) silty clay loam (clayey silt); strong medium subangular blocky structure; few fine roots; few fine root pores; common medium continuous stress cutans; clear boundary.
72.56	109-122	13	C	Overbank #1	Strong brown (7.5YR 4/6) silty clay loam; weak medium subangular blocky structure; few coarse roots; bioturbation of underlying unit; abrupt boundary.
72.43	122-166	44	2Ab	Overbank #2	Very dark brown (7.5YR 2.5/2) silty clay loam (clayey silt); moderate medium subangular blocky structure; few fine roots; few fine root pores; common thin continuous stress cutans; gradual boundary.
71.99	166-193	27	2Bwb	Overbank #2	Reddish brown (5YR 4/4) loam (mud); weak medium subangular blocky structure; few fine roots; few fine root pores; clear boundary.
71.72	193-231	38	2C	Overbank #2	Yellowish red (5YR 4/6) sandy loam (silty sand); massive; abrupt boundary.
71.34	231-272	41	3Ab	Chute-channel fill	Dark brown (7.5YR 3/3) silty clay; moderate medium subangular blocky structure; few fine roots; few fine root pores; few thin continuous stress cutans; gradual boundary.
70.93	272-305	33	3Bwb1	Chute-channel fill	Yellowish red (5YR 4/6) silty clay; few medium distinct manganese depletions; weak medium subangular blocky structure; few fine root pores; few thin patchy stress cutans; abrupt boundary.
70.60	305-349	44	3Bwb2	Chute-channel fill	Reddish brown (5YR 4/4) clay (silty clay); common medium distinct manganese depletions around root pores; weak coarse subangular blocky structure; few fine root pores; many thick continuous stress cutans; abrupt boundary.

70.16	349-379	30	3C1	Chute-channel fill	Yellowish red (5YR 4/6) silt loam (silt); few fine distinct grayish-black disseminated organic depletions around root pores; bedded; few fine roots; few fine root pores; secondary calcium carbonate concretions; abrupt boundary.
69.86	379-396	17	3C2	Chute-channel fill	Yellowish red (5YR 4/6) silty clay loam; secondary calcium carbonate concretions; few fine distinct gray-black disseminated organic depletions around root pores; weak medium subangular blocky structure; few fine roots; few fine root pores; few thin patchy cutans; secondary $CaCO_3$ concretions; abrupt boundary.
69.69	396-405	9	3C3	Chute-channel fill	Yellowish red (5YR 4/6) silt; few fine distinct depletions around roots pores; massive; few fine root pores; secondary $CaCO_3$ concretions; abrupt boundary.
69.60	405-438	33	3C4	Chute-channel fill	Yellowish red (5YR 4/6) silty clay loam (clayey silt); few fine distinct depletions; weak medium subangular blocky structure; few fine root pores; few thin patchy cutans; secondary $CaCO_3$ concretions; abrupt boundary.
69.27	438-446	8	3C5	Chute-channel fill	Yellowish red (5YR 4/6) silt; massive; few fine root pores; secondary $CaCO_3$ concretions; abrupt boundary.
69.19	446-466	20	3C6	Chute-channel fill	Yellowish red (5YR 4/6) loam; bedded; secondary $CaCO_3$ concretions; abrupt boundary.
68.99	466-472	6	3C7	Chute-channel fill	Reddish brown (5YR 4/4) silty clay; few fine distinct depletions; weak medium subangular blocky structure; secondary $CaCO_3$ concretions; abrupt boundary.
68.93	472-539	67	3C8	Chute-channel fill	Yellowish red (5YR 5/6) silt loam (sandy silt); (medium sand from 515-527 cm depth); massive; abrupt boundary.
68.26	539-550	11	3C9	Chute-channel fill	Reddish brown (5YR 4/4) silt loam; few medium distinct manganese depletions; bedded; secondary $CaCO_3$ concretions; abrupt boundary.
68.15	550-558	8	3C10	Chute-channel fill	Reddish brown (5YR 4/4) clay; common fine faint depletions; weak coarse subangular blocky structure; secondary $CaCO_3$ concretions; abrupt boundary.
68.07	558-574+	16+	4C11	Point bar Sand	Yellowish red (5YR 4/6) sandy loam; massive; tiny calcium carbonate concretions.
67.91					Refusal

Table 5. Miller County, Arkansas, Crenshaw Core 37.

Location: 0.80 km south of the Red River, 0.54 km southeast of First Old River Lake

Elevation: 74.04 m LIDAR

Soil: Mapped as Latanier Clay

Described by: Julia Heydenreich, Calvin Johnson and John Wohlford

Geomorphic Position: Slight hummock west of buried Channel 8b

Elevation (m)	Depth (cm)	Thickness (cm)	Horizon	Parent Material	Description
74.04	0-12	12	Ap	Overbank #1	Dark brown (7.5YR 3/2) silty clay loam; weak medium subangular blocky structure; common fine roots; few fine root pores; organic and charcoal fragments present; clear boundary.
73.92	12-66	54	Bw1	Overbank #1	Reddish brown (5YR 4/3) silty clay loam (clayey silt); moderate medium subangular blocky structure; few fine roots; few fine root pores; few thin patchy stress cutans; clear boundary.
73.38	66-93	27	2Ab1	Overbank #2	Dusky red (2.5YR 3/3) silty clay; moderate medium subangular blocky structure; few fine roots; few fine root pores; few thin patchy cutans, organic fragments present; clear boundary.
73.11	93-124	31	2Ab2	Overbank #2	Dark reddish brown (5YR 3/2) clay; strong medium subangular blocky structure; few fine roots; common fine root pores; common thin continuous cutans; bioturbation (burrows filled with underlying material); gradual boundary.
72.80	124-157	33	3Bwb1	Upper Point Bar Sand	Brown (7.5YR 4/3) loam with fine to very fine sand; weak coarse subangular blocky structure; few fine roots; few fine root pores; clear boundary.
72.47	157-196	39	3Bwb2	Upper Point Bar Sand	Strong brown (7.5YR 4/6) loam with fine to very fine sand (sandy silt); weak coarse subangular blocky structure; few fine roots; few fine root pores; clear boundary.
72.08	196-209	13	3Bwb3	Upper Point Bar Sand	Strong brown (7.5YR 4/6) loamy sand; weak coarse subangular blocky structure; few fine root pores; abrupt boundary.
71.95	209-225	16	3C1	Upper Point Bar Sand	Strong brown (7.5YR 4/6) loamy sand; massive; few fine roots; few fine root pores; abrupt boundary.
71.79	225-306	81	3C2	Upper Point Bar Sand	Strong brown (7.5YR 4/6) sandy loam with very fine sand; weak coarse subangular blocky structure; few fine root pores; abrupt boundary.

70.98	306-322	16	3C3	Upper Point Bar Sand	Strong brown (7.5YR 4/6) loamy sand; massive; few fine root pores; abrupt boundary.
70.82	322-343	21	3C4	Upper Point Bar Sand	Brown (7.5YR 4/4) silt loam (sandy silt); massive; few fine root pores; few fine secondary $CaCO_3$ concretions; abrupt boundary.
70.61	343-368	25	3C5	Point Bar Sand	Reddish yellow (7.5YR 6/6) sand; massive; few fine secondary $CaCO_3$ concretions; abrupt boundary.
70.30	368-374+	6+	3C6	Point Bar Sand	Yellowish red (5YR 4/6) sandy loam; massive; few fine root pores; few fine secondary $CaCO_3$ concretions. No refusal.

Someone's Best Friend: Caddo and the *Dìitsi'*

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The special relationship that humans share with Canis familiaris (Caddo: dìitsi') is the result of a long history of cohabitation with a high degree of variability in the role of dogs. In this paper, I present an inventory of dog burials documented in the Caddo Archaeological Area, consider symbolic dog representations in material culture, and examine Caddo ethnographic accounts that document human-canine interactions. Results reveal numerous forms of dog burial treatment, canine symbolism in ceramic, shell, and stone media, and a shared role of dogs in human ritual. These examples highlight the special relationship between the Caddo and their dogs, which were often buried in a similar concern as those afforded to human burials.

Introduction

The affectionate and mutually adaptive relationship that past and present humans share with the dog (*Canis familiaris*; Caddo: *dìitsi'*) is the result of a long history of domestication and cohabitation. Recent DNA research suggests that the process of domestication and morphological evolution from the wolf (*Canis lupus*) could have begun as early as 30,000 years ago in Europe (Druzhkova et al. 2013; Skoglund et al. 2015; Witt et al. 2014). Additionally, it has been suggested that early forms of domesticated canine offered a significant adaptive advantage to *Homo sapiens* who migrated into southern Europe and encountered Neanderthal competitors (Shipman 2015; see also Higham et al. 2014).

In North America, the use of skeletal and dental morphology to define evolutionary stages of domestication suggests the oldest well-documented remains of *Canis familiaris* date to at least 10,000 years ago. These examples are not interpreted as deliberate burials, but were largely preserved within the dry caves and shelters in the Great Basin region (Berta 1981:17; Grayson 1988:23; Morey and Wiant 1992). Some of the earliest known deliberate *Canis familiaris* burials are from the Koster (11GE4) site situated along the Lower Illinois River Valley (Brown and Vierra 1983; Morey and Wiant 1992). At Koster, three dog burials dating to 8,500 years ago were discovered in basin-shaped shallow dug pits. A single female dog (F2256) had a metate and mano resting near the skull, although it is inconclusive if these items are deliberate grave goods (Morey and Wiant 1992:225). If the metate and mano are considered grave goods, purposefully buried with the female dog, it is interesting to consider ethnographic accounts in the central Midwest that describe the sacrifice of dogs during corn planting ceremonies (Cook 2012:500; Nuttall 1980:106).

Further south, Early Archaic sites such as Bering Sinkhole (41KR241) and Schulze Cave in Texas contain examples of domestic dog remains (Bement 1994:51-56; Dalquest et al. 1969). In both cases, dog remains were found in close relationship to human burials. However, it is not fully understood if these were deliberate burials or a scenario in which the dogs (and perhaps the humans) had inadvertently fallen into the sinkholes and subsequently perished. Excavations at the Britton (41ML37) site suggest a Late Archaic possible multi-dog burial (Mehanchick and Kibler 2008; Story and Shafer 1965). The dogs were found among numerous features that included ash lenses, hearths, and concentrations of mussel shell (Scott et al. 2002).

Among Middle to Late Woodland period cultures, canines have been documented as deliberately buried within mounds at several important and regionally influential Marksville, Troyville, and Coles Creek culture sites in Louisiana. In these examples, dogs were often afforded a depositional location and treatment similar to humans (see Perri 2017:92-95). It has been suggested that the disposition of dogs in mounds during the Middle to Late Woodland period was part of a regional early burial mound tradition with

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"a deep seated custom" (Schambach 1997:55; see also Ford 1951:107; Ford and Willey 1940:41; Jeter et al. 1989:151). Dog burials have also been documented as buried within the thick, dark Fourche Maline (Woodland period) middens in Arkansas (Girard et al. 2014:33; see also Leith 2011; Schambach 1982). In contrast to Louisiana Woodland sites, "Fourche Maline mounds [in Arkansas] seem to have been for the human, perhaps mostly male, elite, and no dogs allowed" (Schambach 1997:55).

By the time of the Mississippian period (ca. post A.D. 1000) in the southeast, deliberate dog burials have been found at several important and regionally influential mound sites (Schwartz 2000:Table 1). At Etowah (9BR1), two dog burials were found in context with structures and activities associated with the pre-mound surface of Mound C and the communal and ceremonial use of this space related to public, political, or religious feasting events (Larson 2004:133; van der Schalie and Parmalee 1960:50). At Cahokia (11MS2), two, possibly three, dog burials were found within Monks Mound. A small adult dog (F50) was buried outside of a "Final Structure" (Mortuary Rack) on the third terrace – an area that earlier housed a massive "Major Structure" (charnel temple) and likely an "important location to the people of Cahokia" (Nelson 2009:48). The F50 dog was buried with a "shell-tempered, cuplike, plain pottery jar and about 50 g of red ocher" (Nelson 2009:49). A second dog burial (R17) was found buried in a pit with human remains within the "formal and ritualistic" Upper Ramp at the "gated entrance" to the First Terrace (Nelson 2009:60-61). Dog bones and ceramic sherds were also found in a pit (F70) south of the palisade (F56) on the Third Terrace (Nelson 2009:64). At the Sunwatch (33MY57) site – a Fort Ancient culture village (see Cook 2007) – seven deliberately buried dogs are documented, many of which are in direct association with human burials. They were buried within a large red cedar structure that is interpreted as a possible clan- or sodality-based ceremonial wolf lodge (Cook 2012:512-519).

These are but a terse few examples, as there is an enormous amount of literature documenting dog and human interactions (see Walker 2000). These studies describe the role of the domesticated dog around the world, the evolution and skeletal morphology of early dogs, the practical and ritual uses of dogs, relatedness of modern canine varieties to earlier forms, and zooarchaeological methods associated with the study and analysis of canines (Bethke and Burtt 2020; Crockford 2000; Morey 2006; Walker 2000). It is evident there is a high degree of variability in the role of dogs among humans. They served as human partners, friends, and companions in hunting and herding, as pack animals, and as guard, fighting, and dogs of war. They also served as active participants in ritual, and as meat for consumption in lean times or reserved as offerings in ceremonial feasting. There is little question that the domesticated dog was an important partner and often treated with a high degree of adulation and reverence. In many cases, they were accorded special mortuary treatments and often buried within delineated ceremonial or ritual spaces – and occasionally with humans (see Harrington 1920; Perino 1983; Webb 1946, 1950; Webb and Haag 1939; Yohe and Pavesic 2000). At times, dogs were also buried with grave goods. Burial items may be rudimentary or meager in size, but this action represents a human-made material object that was purposefully, and meaningfully, deposited with a "non-material" canine to accompany its journey into the Otherworld.

Herein, I narrow the broad scope of dog mortuary and burial practices in North America to an inventory and consideration of canine burials located within the Caddo Archaeological Area during a span of time defined as the Caddo cultural tradition from around A.D. 900/1000 to as late as the early nineteenth century in some places (see Perttula 2012). Additionally, I consider dog representations present in symbolic material form and review Caddo ethnographic accounts associated with human-canine interaction. Because of the long and enduring human-dog partnership, a comparative analysis of canine ritual and mortuary treatment can shed light on the variability of human cultural traditions linked to the care, maintenance, and treatment of *Canis familiaris* as evidence of a "special bond between people and dog that supersedes purely pragmatic considerations" (Morey 2006:164).

Criteria for Burial

Determination of deliberate dog burial and mortuary treatment in Caddo archaeology literature (and generally) is not without challenges. This is especially the case with early archaeological reports that often provide terse descriptions of canine remains or meek interpretive suggestions regarding the presence or condition of burials (see Morris 2011:168; Perri 2017:98). However, it is clear from a detailed review of archaeological reports that dog fauna is present at numerous Caddo sites and in diverse contexts. But, given the multiple roles of the dog, which can include various forms of consumption, faunal presence does not necessarily indicate a deliberate burial treatment. For example, at the Sanders (41LR2) site was found the disarticulated remains of "three long, sharp-nosed dogs" mixed in the Mound 1 midden. The disarticulated nature of the bones, their mixed deposit in the midden, and a lack of an identifiable pit suggests they are not deliberate burials. However, a fourth dog, also found within the Mound 1 midden, was an articulated "complete skeleton of another such dog" (Jackson et al. 2000:33). Because of its articulated remains, the fourth dog is considered a deliberate burial that might represent a primary or secondary burial in the midden – perhaps a high-ranking dog related to a high-ranking individual. Nonetheless, it is distinctive from the disarticulated and mixed canine remains also present in the midden. Thus, the multiplicity of roles that dogs occupied, or more adequately the roles that were assigned by humans (see Morey 2006; Pluskowski 2012), are represented archaeologically as different types of disposal. In this light, an application of "context-specific interpretations of dog deposition" can illuminate "the varying relationships between dogs and humans in the past" (Perri 2017:89) and guide canine faunal evaluations as being a deliberate dog burial or simple disposal and disposition.

Yet, there is also the very real issue of potential errors in field-based faunal species assignment, often associated with taphonomic processes or post-depositional disturbances of faunal remains. This concern was recently highlighted in a reanalysis of dog burials found at Middle Woodland mound sites in Illinois. In this study, an intentional burial, previously identified as a canine, was correctly identified as a young bobcat containing a necklace of shell beads and two bear canine teeth (Perri et al. 2015). In the Caddo Area, to my knowledge, there has not been any published reanalysis of canine remains. In fact, published descriptions on detailed zooarchaeological or faunal analysis of dog remains in the Caddo Area are infrequent. These limited zooarchaeological data are an added challenge since lack of comprehensive comparative data concerning physical injury or trauma during life, the presence of pathologies or age-related stress, or evidence of post-mortem treatment offers an incomplete understanding of human-canine relationships (see Perri 2017). Regardless, faunal interpretations and subsequent taxonomic descriptions, terse as they may be in current Caddo literature, are considered appropriately sufficient to begin this inventory and analysis.

For this discussion, canine remains in Caddo archaeological literature were evaluated using a proposed two-level typological model of dog deposition outlined by Perri (2017). Using this typological framework, remains were first considered as burials based on the presence or absence of the following variables: osteological traits (articulated, disarticulated, etc.), burial location (mound, midden, etc.), types of grave goods (lithic, ceramic, etc.), and relatedness to human depositional types (mortuary treatment, positioning, etc.). Once identified, dog burials were then classified based on five depositional types: burial within a dedicated dog "cemetery" (isolation), inclusion (association) of dogs in human burials, burials not located within a cemetery but buried within a defined pit (component), portions (elements) of dog remains found with humans, or articulated or disturbed disarticulated remains (expedient) without a defined pit (Table 1). For example:

1. Canine remains were found in an articulated position in a defined burial pit (component deposition). At the Roitsch (41RR16) site an "adult-sized dog had been buried on its side in a ca. 80 cm diameter pit, with its head at the eastern end of the pit, and the front and back legs were partially flexed" (Perttula 2008a:344). At the Arnold (41HP102) site, articulated remains of four dogs were found in burial pits such that "the dogs were [likely] pets and did not contribute to the prehistoric diet" (Henderson 1978:105). At 34CH37 in Oklahoma, a dog burial (Feature 5) was found in a "pit filled with black midden soil that had been excavated into the brownish-yellow sterile sand [containing a dog buried with] four unmodified fresh water mussel shells, one

Table 1. Current corpus of canine burials in the Caddo Archaeological Area.

Trinomial	Site Name	County	Date	# of Burials	# of Dogs	Age	Osteological Traits
41HP240	Anglin	Hopkins	AD 1500-1700, Titus phase	5	5		disarticulated/disturbed
41HP102	Arnold	Hopkins	Woodland to Early-Middle Caddo	3	4	1 elderly, 1 juvenile, 2 adult buried together	articulated
41RR16	Bob Williams/Roitsch/Sam Kaufman	Red River	AD 1550-1700	1	1	adult	articulated
41RR16	Bob Williams/Roitsch/Sam Kaufman	Red River	AD 1550-1700	1	1	adult	articulated
41RR16	Bob Williams/Roitsch/Sam Kaufman	Red River	AD 1550-1700	1	1	puppy 2/3 months	articulated
41RR16	Bob Williams/Roitsch/Sam Kaufman	Red River	AD 1550-1700	1	1	adult	articulated
41RR16	Bob Williams/Roitsch/Sam Kaufman	Red River	Late Caddo (AD 1300-1700), McCurtain phase	1	1	adult	articulated
41RR16	Bob Williams/Roitsch/Sam Kaufman	Red River	Late Caddo (AD 1300-1700), McCurtain phase	1	1	adult	articulated
41RR16	Bob Williams/Roitsch/Sam Kaufman	Red River	Late Caddo (AD 1300-1700), McCurtain phase	1	1	adult	articulated
41RR16	Bob Williams/Roitsch/Sam Kaufman	Red River	Late Caddo (AD 1300-1700), McCurtain phase	1	2	puppy, 6 weeks	articulated
41RR16	Bob Williams/Roitsch/Sam Kaufman	Red River	Late Caddo (AD 1300-1700), McCurtain phase	1	2	adult & puppy	articulated
3LA97	Cedar Grove	Lafayette	AD 1670-1730	2	2	unknown	articulated
34CH37	CH37	Choctaw	AD 1300-1500	1	1	unknown	articulated
41RR11	Dan Holdeman	Red River	AD 1000-1500	2	2	unknown	articulated
41NA27	Deshazo	Nacogdoches	AD 1690-1750	1	1	elderly	disarticulated
41BW2	E.H. Moores	Bowie	AD 1570	1	1	unknown	disarticulated
41WD3	Earl Jones Farm	Wood	AD 1430-1680, Titus phase	1	1	unknown	skull
41CS23	Goode Hunt	Cass	AD 1500-1700	1	1	unknown	articulated
41FN1	Harling	Fannin	AD 1561	1	1	unknown	articulated
3SV29	Holman Springs	Sevier		3	3	unknown	articulated
41HP106	Hurricane Hill	Hopkins	AD 1250-1400, Middle Caddo	1	1	unknown	articulated
34CH1	Mahaffey	Choctaw	Late Caddo	1	1	unknown	disarticulated/disturbed
41DT1/41DT2	Manton Miller	Delta	Terminal Archaic to Middle Caddo?	1	1	unknown	articulated
41HP238	R.A. Watkins	Hopkins	AD 1500-1700, Titus phase	1	1	unknown	disarticulated/disturbed
3.25 miles north of Ozan	Robins, H.E., Place			1	1	unknown	articulated
34MC215	Roden	McCurtain	AD 1300-1500	1	1	unknown	articulated
34MC215	Roden	McCurtain	AD 1300-1500	1	1	unknown	articulated
34MC215	Roden	McCurtain	AD 1300-1500	1	1	unknown	articulated
41BW5	Roseborough	Bowie	ca. AD 1750, Late Contact period	1	2	5+ years/puppy	articulated
41LR2	Sanders	Lamar	1300-1400, Middle Caddo	1	1	unknown	articulated
3LA83	Spirit Lake/ Cabinas	Lafayette	AD 1600-1700	1	1	adult	disarticulated/disturbed
41WD529	Steck	Wood	AD 1470, Late Caddo, Titus phase	1	4	2 adult, 2 sub-adult	articulated
41NA231	Tallow Grove	Nacogdoches	AD 1200-1500	1	3	unknown	articulated
41HP237	Tunier Farm	Hopkins	AD 1500-1700, Titus phase	3	3	unknown	disarticulated/disturbed
41WD6	Winterbauer	Wood	AD 1430-1680, Titus phase	9	9	unknown	skulls
Totals:				55	64		

Location	Burial Goods	With Human?	Depositional Type	Reference
Twelve units	none reported	No	expedient	Schniebs 2009; Todd 2013
	none reported	No	component	Henderson 1978; Todd 2013
Burial 1, "four dog burials located in what must have been a special cemetery for them in the area between house areas 2 and 4" Perino 1983:47	none reported	No	isolated?	Perino 1983:47; Todd 2013
Burial 2, "four dog burials located in what must have been a special cemetery for them in the area between house areas 2 and 4" Perino 1983:47	none reported	No	isolated?	Perino 1983:47; Todd 2013
Burial 3, "four dog burials located in what must have been a special cemetery for them in the area between house areas 2 and 4" Perino 1983:47	Small jar	No	isolated?	Perino 1983:47; Todd 2013
Burial 4, "four dog burials located in what must have been a special cemetery for them in the area between house areas 2 and 4" Perino 1983:47	none reported	Child	assocation/ isolated?	Parmalee and Opperman 1983; Perino 1983:47; Todd 2013
Block III, Feature 346, associated with a structure	Red soil, shell, sherds	No	component	Perttula 2008a:344-347; Todd 2013; Yates 2008
Block IV, Feature 401	none reported	No	expedient	Perttula 2008a:347-348; Todd 2013; Yates 2008
Feature 701, proximate to human cemetery	Ceramic sherd near right eye	No	isolated?	Perttula 2008b:372-373; Todd 2013; Yates 2008
Feature 702, proximate to human cemetery	Clay cap?	No	isolated?	Perttula 2008b:372-373; Todd 2013; Yates 2008
Feature 703, proximate to human cemetery	Shell-tempered pottery sherds (Nash Neck Banded)	No	isolated?	Perttula 2008b:372-373; Todd 2013; Yates 2008
Feature 4 and Feature 10; a few meters to the east and west of Structure 2	Single sherd on ribs of F4.	Feature 4 contained a single human tooth	association?	Kelley 2012:414; Styles and Purdue 1984:218; Trubowitz 1984:87
Feature 5	Four freshwater mussel shells	No	component	Lewis 1973:15; Perino and Bennett 1978:12
Sub-Mound	none reported	Yes	assocation	Girard et al. 2014:45; Perino 1995:9-10; Schultz 2010:160
Unit 2, Area D Midden	none reported	No	isolated	Good 1982:92-93; Henderson 1982:135; Todd 2013
150 feet from Mound 1	Fragments of a bowl	No	association?	Jackson 1932b:7-8; Todd 2013
	none reported	No	expedient	Perttula 2015c:13
	Engraved compound bowl, unknown type (Vessel 38); Perttula 2015:33	Nearby	component	Jackson 1932a; Perttula 1992:193, 2015a:33; Todd 2013
Feature 43, top of the mound	none reported	No	component	Davis 1962a, 1962b, 1996; Perttula 2015b:82
	none reported	No	component	Davis 1986:9
Feature 37	none reported	Nearby	component	Fields et al. 1997:23-33; Perttula 1999:101; Schultz 2010:258; Todd 2013; Yates 1999:352
Feature 4	none reported	No	expedient	Perino and Bennett 1978:12
Area B Midden	none reported	Nearby	expedient	Fields 1997:15-17; Johnson 1962; Todd 2013
Three teeth and foot from surface	none reported		expedient	Schniebs 2009; Todd 2013
Mound 1	Burial had a "bottle of archaic form [Hempstead Engraved], to the right of the [human] skull, and an inverted bowl on the left shoulder" Harrington 1920:51	Yes	assocation	Harrington 1920:51
Found "deep in the present bank of Red River" (Perino 1981:18)	none reported	No	expedient	Perino 1981:18
Refuse pit (Feature 31) (Perino 1981:18)	none reported	Nearby	expedient	Perino 1981:18
Feature 54, 28 inches deep near house sites" (Perino 1981:18)	none reported	No	expedient	Perino 1981:18
Area A, Feature 2, shallow pit	Close proximity to smudge pit	No	component	Gilmore 1986:26, 118-120; Todd 2013
Mound 1, Midden	none reported	No	expedient	Jackson et al. 2000:33; Todd 2013
Feature 3, midden	"Small sooted bowl… resembles McKinney Plain" Hemmings 1982:82, Table 5-4	No	expedient	Hemmings 1982:72, 88; Moore 1912:574
Midden	none reported	No	expedient	Butler and Perttula 1981; Todd 2013
Feature 25, large storage pit excavated into a midden	none reported	No	component	Perttula 2008c:239, 583; Todd 2013
57 specimens from one shovel test	none reported	No	expedient	Schniebs 2009; Todd 2013
Clumped together in a mound midden	none reported	No	isolated	Perttula 2015b:24; Wilson and Jackson 1930

placed just beneath the vertebrae and the others just beyond the distal ends of the rear legs" (Lewis 1973:15). In this instance, articulated remains in a pit are also accompanied with grave goods.

2. If the canine remains were found in an articulated or mostly articulated position without a defined pit (expedient deposition), such as the articulated "fourth dog" Mound 1 midden burial at the Sanders site (mentioned above). At the Steck (41WD529) site were "at least four individuals" with one dog burial found "lying on the left side with the head to the north, excavated from the midden" (Butler and Perttula 1981:123). At the Manton Miller (41DT1) site dog remains were found where a pit outline was not discernable, yet "the remains nevertheless seem to represent a deliberate interment judging from the well-articulated skeleton and its neat placement" (Johnson 1962:241).

3. If the canine remains were associated with more than one individual, such as a group of skulls, which might suggest a dedicated space for burial or disposal (isolated deposition). At the Winterbauer (41WD6) site, "nine canid skulls, probably marking the deliberate burial… of dogs [were found] in the midden deposits, in the southern part of the midden mound" (Perttula 2015a:24). At the Deshazo (41NA27) site, a dog was found intentionally buried with additional disarticulated dog remains scattered in a midden (Unit 2, Area D), such that it "appears to be held in high esteem" (Good 1982:93; Henderson 1982:135).

4. If the remains were located in a disturbed area containing an abundance of dog bone fragments suggesting the location of a former burial (expedient deposition). At the Mahaffey (34CH1) site, was a potential burial of canine "bones [that] had been badly destroyed by rodents. It contained a few scattered bones plus a skull and jaw sections" (Perino and Bennett 1978:12). At the R. A. Watkins (41HP238), Anglin (41HP240) and Tunier Farm (41HP237) sites, an analysis of dog faunal suggested "most likely the dog remains are from disturbed burials" (Schniebs 2009:73).

5. If dogs remains were included with human burials (association burial). At the Roitsch (41RR16) site was the burial of a child, in which a "well-preserved skeleton of a dog was found 10 cm deeper, about 30 cm from the legs of the child" (Perino 1983:44). At the Robins Place site was found a dog burial with a "bottle of archaic form [Hempstead Engraved], to the right of the [human] skull, and an inverted bowl on the left shoulder" (Harrington 1920:51).

Caddo Dog Burials

The corpus discussed in this paper is based solely on published faunal identification and described interpretations of disposed dog remains recovered from known Caddo sites. Literature on Caddo archaeology, history, and ethnography is extensive, yet fairly easily to search for citations and sites thanks to the long-standing efforts of Dr. Tim Perttula and his management of the Caddo bibliography (Perttula 2021). Additionally, a significant amount of grey literature, as well as a few complete journal volumes, are freely accessible (with in-text searching!) on the *Index of Texas Archaeology* database (https://scholarworks.sfasu.edu/ita/). The Caddo Conference Organization also maintains a membership library housing all of the *Caddo Archeology Journal* volumes and several *Journal of Northeast Texas Archaeology* volumes (http://www.caddoconference.org/library.php). Yet, despite the organization and fairly easy accessibility of Caddo citations and references in multiple databases, I certainly have not reviewed them all. Thus, this consideration of Caddo dog burials and symbolic material representations is far from complete. No doubt, additional examples of dog remains and burial treatment at sites throughout the Caddo Area remain elusive.

Building upon the work of Todd (2013), the current corpus contains 55 canine burials (see Table 1). There are a Minimum Number of Individuals (MNI) of 64 dogs. Burials have been identified at 25 archaeological sites situated within the Caddo Archaeological Area (Figure 1). Winterbauer (41WD6) and the Bob Williams/Roitsch/Kaufman (3RR16) sites each contain nine burials, whereas others have only one or two identified canine burials. Several sites are spread along the Red River and within clusters along the Sulphur, Big Cypress, and Sabine River drainages in East Texas. Burials largely fall within the Middle and Late Caddo time periods. Dog burials from six Caddo sites (mounds and farmsteads) are summarized below.

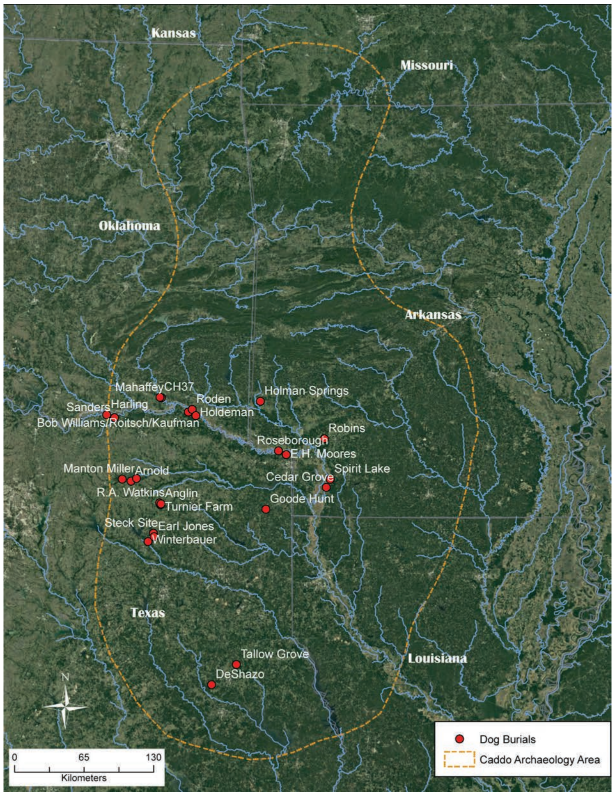

Figure 1. Distribution of identified canine burials at Caddo sites.

Bob Williams/Roitsch/Kaufman

The Bob Williams/Roitsch/Sam Kaufman (41RR16) site represents a complex or community of Middle to Late Caddo houses and cemeteries. Over the course of several investigations beginning in the late 1970s, a total of nine canine burials with 11 dogs have been identified (Parmalee and Opperman 1983; Perino 1983; Perttula 2008a; Yates 2008). In the 1970s, Greg Perino excavated dog burials associated with House Pattern 2 (Burials 1, 2, and 3) and within the floor of House 4 (Burial 4). Of note are Burials 3 and 4. Burial 3 is a puppy estimated between 2 to 3 months. It was buried on its "left side curled around a bowl made from the bottom of a small jar" (Perino 1983:47). Dog burial 4 was in a flexed position, also on its left side, and buried 30 cm from the legs of a child burial (Figure 2). Both the dog and child were buried within House 4. A small Hudson Incised bottle was with the child.

In the early 1990s, the Texas Archaeological Society conducted field schools at the related Roitsch site where five canine burials containing a total of seven dogs were excavated (Perttula 2008a). Feature 346 is an adult dog buried in an 80 cm diameter pit and in close association with a structure that had burned and collapsed at some point prior to the burial. The dog was situated in a burial pit with a mussel shell placed near the back legs, some scattered sherds near the chest, and red soil around the chest and head area (Perttula 2008a:347, Figure 19).

Burial Feature 401 is an adult dog simply recorded as a "flexed dog burial" (Perttula 2008a:344) with no burial goods reported. The burial was located outside of a possible structure, defined based on posthole configurations, a central hearth, and concentrations of daub (Figure 3).

Burial Features 701, 702, and 703 were found on the periphery of a Late Caddo McCurtain phase cemetery at the site (Perttula 2008a:364, Figure 37).

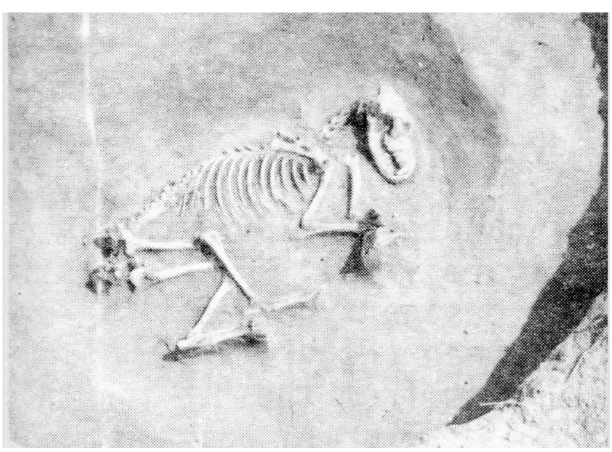

Figure 2. Dog burial at the Bob Williams/Roitsch/Kaufman site, House 4 (Perino 1983, Figure 5). Image used with permission from the Museum of the Red River.

Figure 3. Dog burial at the Bob Williams/Roitsch/Kaufman site, Feature 401 (Perttula 2008a:348, Figure 21). Image used with permission from the Texas Archeological Society.

Feature 701 is a flexed adult dog, situated on its left side, and buried with a ceramic sherd near the right eye. Feature 702 is a puppy buried in a tight bundle with a possible clay cap over the burial. Tooth buds of a second canine were also found with 702, which are suggested as a possible multi-puppy burial (Yates 2008:474). Feature 703 is a double burial containing an adult female and puppy. Buried with the dogs were shell-tempered sherds, of which one is identified as Nash Neck Banded (Perttula 2008b:372; Yates 2008:474). The cluster of dog burials found proximate to a human cemetery might suggest the location of an isolated dog cemetery.

Dan Holdman

The Dan Holdman (41RR11) site is a multi-mound site excavated by Perino in the early 1980s (see Girard et al. 2014:45). The site contained a small mound that had covered at least three likely rectangular structures. Included was a McCurtain phase child burial (Burial 15) and two associated dog burials, each buried within deliberate pits approximately 70 cm deep (Perino 1995: Figure 4; Perttula 1995:73; Schultz 2010:160). Perino also records the presence of two "smudge pits" with the hearths, pits, and burial features, although their chronological relationship to the dog burials is indeterminable (Girard et al. 2014:45; Perino 1995:10). No further discussion is given to the dog burials, apart from their location relative to excavated features. However, at the Roseborough (41BW5) site was found a dog burial containing two dogs, which was also documented in "close proximity to the smudge pit (a female activity locus)" (Gilmore 1986:119).

E. H. Moores

The E. H. Moores (41BW2) site is a multi-mound Late Caddo site. A. T. Jackson excavated at the site in the fall of 1932, where he opens his notes by stating that "each evening, shortly before dark, an aerial attack was staged against our camp by thousands of mosquitos, armed with long bills" (Jackson 1932a:1). As part of his explorations, he documents a single dog skeleton with excellent preservation, although not complete, located about 150 feet east of Mound 1 in a "crumpled position, as if a small hole had been dug and the dog skeleton crammed into it" (Jackson 1932a:7). Buried with the dog, a few inches from the head were several fragments of a ceramic bowl of an unknown type. A human burial (Burial J-1) was located six feet to the southeast and Jackson suggests that the human and dog were buried together. There is no additional information.

Spirit Lake/Cabinas

The Spirit Lake (3LA83) site, first recorded by C. B. Moore in 1911 as the Cabinas site (Moore 1912:573), is a Late Caddo farmstead. Riverbank salvage excavations in 1979 discovered a disturbed small adult dog burial (Feature 3) in Trench A and within a household midden. The dog was buried with a small "nearly plain grog-tempered [sooted] bowl with everted rim that resembles McKinney Plain" (Hemmings 1982:72). During Moore's limited investigations at Cabinas, he makes note of the burial of "a dog, judging from the size and general appearance, - which fell into fragments on removal… and on the skull was a large fragment of pottery" (Moore 1912:574). While the Moore and Feature 3 dogs may be two different burials, it is conservatively assumed that the disturbance of Feature 3 is a result of Moore's discovery and reburial of the same dog 68 years prior. As such, only one identified dog burial is assigned to this site.

Cedar Grove

The Cedar Grove (3LA97) site is a Late Caddo farmstead contemporaneous and situated close to the Spirit Lake farmstead site (Trubowitz 1984, ed.). Two flexed dog burials (Features 4 and 10) were found during salvage excavations throughout the fall of 1980 (Figure 4). Both were buried on their right side and located a few meters from Structure 2 and in proximity to a cemetery. Feature 4 contained a single sherd of an unknown type that had been placed on the ribs. Feature 10 is described as having the hind legs deliberately tucked below the stomach (Styles and Purdue 1984:218; Trubowitz 1984:87).

Good Hunt

The Good Hunt (41CS23) site is a Late Caddo site where a single dog burial was found at the northwest periphery of a cemetery. A. T. Jackson discovered the burial during his work at the site in 1932, where he describes it as "the first case noted in Texas where a vessel not with a human burial has been in direct

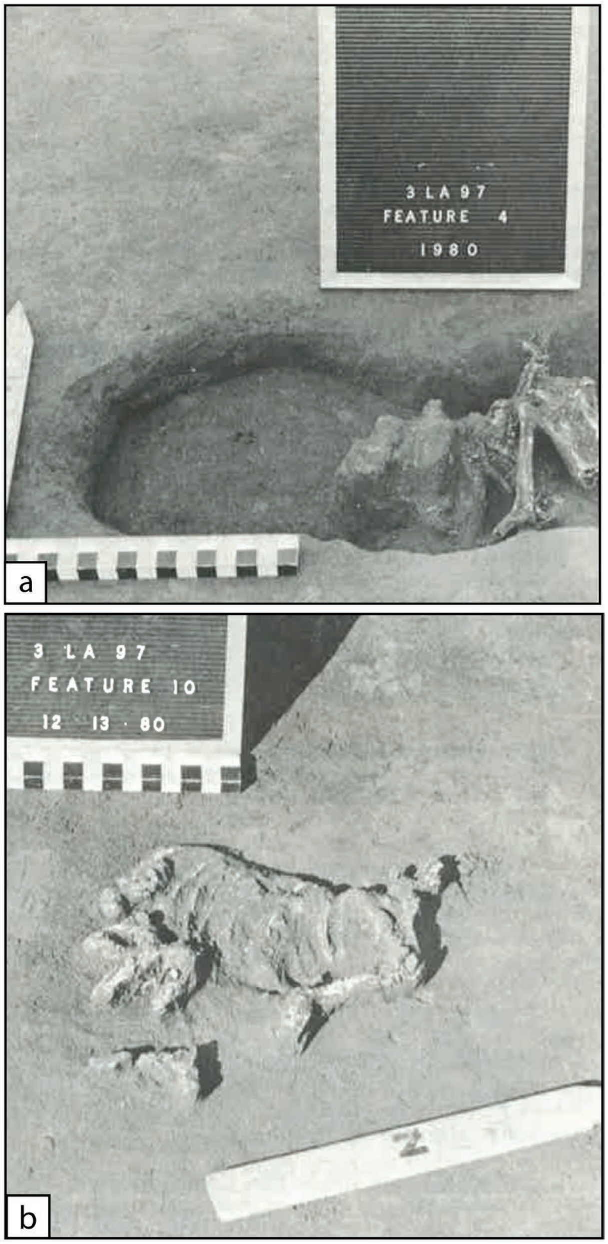

Figure 4. Dog burials at the Cedar Grove site: *a*, Feature 4 (Trubowitz 1984:Figure 9-7, ARAS # 807979); *b*, Feature 10 (Trubowitz 1984:Figure 9-8, ARAS # 808003). Images used with permission from the Arkansas Archeological Survey.

association with any part of a dog skeleton. The occurrence would seem to suggest the possibility that this might have been a dog burial, with which the vessel was placed as a token of esteem by its owner" (Jackson 1932b:15). The vessel to which he is referring is Vessel 38, an engraved compound bowl of an unknown type (Perttula 2015b:33).

In sum, the burials described, along with others in the corpus (see Table 1), reveal a suite of diverse burial treatments where dogs are buried on both the left and right sides in shallow pits, in house floors, or in middens. Eleven examples (16%) were interred with burial items, such as ceramic sherds, small bowls, jars, or bottles, or other items. There are two instances where dogs are buried in close proximity to smudge pits. There are six (10%) that are either buried with humans or in close proximity to human burials or cemetery areas. In one case, Perino (1983:47) suggests that a concentration of dog burials at the Bob Williams/Roitsch/Sam Kaufman site may represent "a special cemetery" reserved for dogs.

Dog Symbolism and Ethnography

While not as frequent as the stylistic designs, motifs, and geometric symmetry that define the Caddo ceramic tradition (see McKinnon et al. 2021; Suhm and Jelks 1962), avian, mammalian, amphibian, and reptilian zoomorphic representations do occur on a variety of media. They are visible as incised or engraved depictions on ceramic vessels (Gadus 2013; Hart and Perttula 2010; Perttula and Walters 2016; Turner 1978, 1997; Walters 2006), as effigy applique "tail riders" on ceramic bowls (Hathcock 1974; Krieger 1946:Figure 16; Perttula and Selden 2015; Trubitt 2017), as highly stylized whole effigy vessels (Bell and Baerreis 1951; Early 1988; Trubitt 2017), or as representational forms on worked shell, bone, and stone or sandstone (Dowd 2011; Emerson and Girard 2004; Jackson 1935; McKinnon 2015; Webb and Dodd 1939).

Examples of canine representations potentially occur in some of the same media forms, although more rarely. For example, recorded from the Middle to Late Caddo J. M. Riley (41UR2) site in Upshur County, Texas, is an effigy bowl that has been interpreted as a deer or dog (Figure 5) (Perttula 2019:Figure 772). The bowl is classified as Hood Engraved and has a protruding head with a long nose and ears and a flat tail on the opposing side of the vessel. Three engraved horizontal lines are on the body. Perttula and Selden (2015) document six ceramic vessels with four-legged effigy tail riders (Hood Engraved, *var. Allen*) from Middle to Late Caddo East Texas sites (Figure 6). In five examples, the quadruped tail riders are opposite an avian effigy plumed head. A single smaller vessel

Figure 5. Hood Engraved effigy bowl from J. M. Riley (41UR2) site (Perttula 2019:Figure 772). Image used with permission from the Friends of Northeast Texas Archaeology.

(Figure 6*f*) lacks the opposing avian head. Between three and four horizontal engraved lines are on the body of the vessels. In Arkansas, a similar example is present in Joint Educational Consortium's Hodges Collection. The bowl resembles the East Texas forms (although not formally typed) with four horizontal engraved lines and a four-legged tail rider facing inward (Trubitt 2017:71). An avian plume head is not present.

Tail rider effigies have been referred to as "bear" effigies (Phillips et al. 1951:169). While these effigies may contain greater meaning than naturalistic interpretations, I suggest some tail rider effigies might also represent canines. For example, a small shell-tempered effigy head from a tail rider was documented in the George T. Wright collection from Red River County, Texas (Figure 7) (Perttula et al. 2018). The effigy more resembles a dog than a bear with its "engraved open mouth, two eyes, and two upturned ears" (Perttula et al. 2018:94). An effigy vessel from the Pierce Freeman (41AN34) site (see Figure 6*b*) is similar with tall ears and a long nose (Perttula and Selden 2015:Figure 6). When compared as a group, some tail riders are more bear-like with rounded face and hunched body whereas others are more dog-like with upright ears and a more pointed, long nose. Yet, there is consistency with the vessel form, design, and positioning of the tail riders. Interestingly, there is a documented relationship of a role of the dog as a Caddo companion when hunting bear. Dogs were used during bear hunts to rout out bears from their dens and send them up into trees (Swanton 1942:137). Whether there is any correlation will likely never be known, but it is compelling enough to highlight here.

Dogs are possibly symbolically represented in other media forms. For example, Schwartz (2000) proposes an alternative interpretation of a Spiro (34LF40) Craig Mound gorget (Phillips and Brown 1984:Plate 128). Rather than a raccoon, it is observed that the animal being held by the neck is missing the distinctive raccoon eyes and possibly represents a dog about to be sacrificed (Schwartz 2000:220). Hamilton (1954:Plate 22) illustrates a possible dog-snake effigy

Figure 6: Composite of Hood Engraved effigy bowls from East Texas: *a*, Perttula and Selden 2015:Figure 3 (41AN1); *b*, Perttula and Selden 2015:Figure 6 (41AN34); *c*, Perttula and Selden 2015:Figure 13 (41AN54), Perttula and Sitters 2017:9; *d*, Perttula and Selden 2015:Figure 17 (41CE12); *e*, Perttula and Selden 2015:Figure 19 (41CE12); *f*, Perttula and Selden 2015:Figure 18 (41CE12). Images used with permission from the Friends of Northeast Texas Archaeology.

pipe also found at Spiro. He describes the pipe as having a raised serpent design on the sides, a figure of a rattlesnake on the bottom, and a "canine head on prow" which projects beyond the pipe bowl (Hamilton 1952:39).

Ethnographic data highlight that the Caddo had no domestic animals, except for the dog, and that dogs often participated in the green corn ceremony. As part of the ceremony and prior to the consumption of the green corn, a series of rituals and offerings are undertaken. If corn were eaten by a human before the precautionary rituals, the violator would "be infallibly bitten by a snake" (Swanton 1942:225). Observations by Spanish missionaries provide several examples where dogs are afforded the same precautionary restrictions (see also Carter 1995:135). In one instance, it is noted that when corn is harvested the Caddo would "tie their fore-feet to their [dog's] snouts, which prevents their eating fresh corn, of which they are exceedingly fond" (Swanton 1942:225). A second observation describes, "[The Caddo] bound their [dog's] jaws and tied one paw in front under the throat, so that they might not be able to get at the stalk of the corn," (Swanton 1942:227). And another, "even the dogs share in this threat or interdict: so, in order that a dog may not eat of the corn, the Indians tie one of his legs or paws to his neck so that he goes around hungry on three legs and can not eat the corn, for dogs are extremely fond of it" (Swanton 1942:227-228).

Conclusion

Through a combination of archaeological, ethnographic, and iconographic or symbolic data, it is clear there existed a special relationship with the domestic dog (*dìitsi'*) and the Caddo. However, there is still the pressing issue of a lack of detailed canine faunal analysis or reanalysis of collections within the Caddo Area. Such an effort can provide an additional suite of data that further highlights the special human-canine relationship evident in burial and symbolic treatment. Importantly, it can also shed light on the treatment of the canine as part of the active, living relationships, as evident in diet, provisioning, pathogens, and patterns of age and sex selection (Losey 2020:258).

Nonetheless, when current data are evaluated cumulatively they illuminate the purposeful treatment, reverence, and deliberate burial of dogs. They demonstrate a "capacity for friendship" in which deceased dogs were often treated like deceased people, thus "reflecting their status as real friends of people while they were alive" (Morey 2006:164). Certainly, in many instances they were, and are (Monagle and Jones 2020:49), considered members of the community – linked to the ever-changing social processes that define the mutually beneficial human-canine relationship (Losey 2020:255-256). Throughout the Caddo Area, there are several cases of dogs interred with burial goods within prepared pits with a similar concern shown of human burials where burial goods were placed as provisions for the next world. Canine symbolism is present in ceramic, shell, and stone, perhaps as the symbolic representation of the dog that served as guides to the next world (Schwartz 2000:224). It has also been suggested that the dogs themselves, and similarities to human mortuary treatment, may represent symbolic substitutes or proxies for humans (Larsson 1989). It is clear that the specific mortuary treatment and canine representation in material form suggests a special relationship between the Caddo and their dogs, perhaps even considered as pets to members of a family group and "buried as though they were someone's best friend" (Griffin 1967:178).

While these considerations are ongoing, as additional examples are surely expected, I conclude these considerations with a Caddo story recorded by

Figure 7. Fragmented tail rider, Perttula et al. 2018: Figure 86. Image used with permission from the Friends of Northeast Texas Archaeology.

George Dorsey in the early twentieth century entitled, "The Man and the Dog Who Became Stars" (Dorsey 1905:25).

> A young man had a Dog, which he always took with him whenever he went to hunt. When he was at home he did not pay much attention to the Dog, and the Dog acted like any other dog, but when they were off alone the Dog would talk to his master just as if he were a man. He had the power of a prophet and could always tell what was going to happen. One time, while they were out hunting, the Dog came running back to his master and told him that they were about to come to a dangerous place. The young man asked where the place was, and the Dog said that he did not know just were it was, but that he knew it was not far away. In another instant, the Dog scented a deer and started out on its trail, and the man followed. Soon they came upon a deer. The man shot it, but only wounded it, and it continued to run until it reached the lake, and then jumped into the water. The Dog jumped in after it and soon caught it, because he could swim faster than the wounded deer. He held it while the young man threw off his clothes and swam to his assistance. Soon they killed the deer, and then the man put it on his shoulders and started to swim to the shore. All at once the Dog cried out, "Look out!" There before them and all around them were all kinds of poisonous and dangerous water animals. The man thought that they would surely be killed, for the animals were so numerous that they could not possibly swim past them. He began to pray to the spirits to help him, and as he prayed the water leaped up and threw them on the shore. The young man felt so grateful to the spirits who had saved his and his Dog's lives that he cut some of the flesh from the deer and threw it into the water as a sacrifice. Then he and the Dog decided that they would not stay longer in this dangerous world, and so they went to the sky to live. There they can be seen as two bright stars in the south. The one to the east is the young man, and the one to the west is the Dog.

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Motifs in Motion: An Iconographic Evaluation of Spiro Engraved Production and Distribution between the Northern and Southern Caddo Areas

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Spiro Engraved, characterized by restricted set of curvilinear motifs, is viewed as one of the ceramic hallmarks of the Early Caddo period (A.D. 950-1150). Spatial variation in Spiro Engraved vessels has been well-documented through various provenance and stylistic studies across the northern and southern Caddo areas. However, almost no analyses of Spiro Engraved vessels have considered variation in motif occurrence and expression between the northern and southern Caddo areas. In this study, I review the most robust and comprehensive sample of Spiro Engraved vessels throughout the Caddo world to understand motif variation within the region. The results show that northern Caddo people may have chosen specific Spiro Engraved motifs to be included as part of their mortuary programs at ceremonial mound sites, while southern Caddo people seemed to have incorporated the full spectrum of Spiro Engraved motifs for domestic, ceremonial, and mortuary purposes.

During the Early Caddo period (A.D. 950-1150), communities reorganized their settlements, used highly ritualized ceramic objects, and constructed several multi-mound ceremonial centers in the Caddo Archaeological Area (Girard et al. 2014). During this time, several mound centers dotted the Caddo landscape. Some of these communities had direct social, economic, and political relationships with emerging Mississippian mound centers to the east, such as Cahokia (11MS2) in the American Bottom (Girard 2009). The widespread distribution of Spiro Engraved ceramic vessels is one of the archaeological hallmarks of this period (Lambert 2019; Perttula 2017).

Spiro Engraved vessels have been recovered in modest numbers throughout the northern Caddo (Arkansas Basin) and southern Caddo regions (Red River Valley) (Figure 1). However, the contexts in which they were deposited are quite different. The vessels seem to have been restricted within mortuary contexts at northern Caddo ceremonial centers. In contrast, they seem to be quite frequently used in domestic and ceremonial contexts at Southern Caddo mound and village sites (Lambert 2020). Recently, Spiro Engraved wares and their non-representational imagery have been theorized as a microcosm of Caddo views of the natural and supernatural realms (Lambert 2017), as ritualized

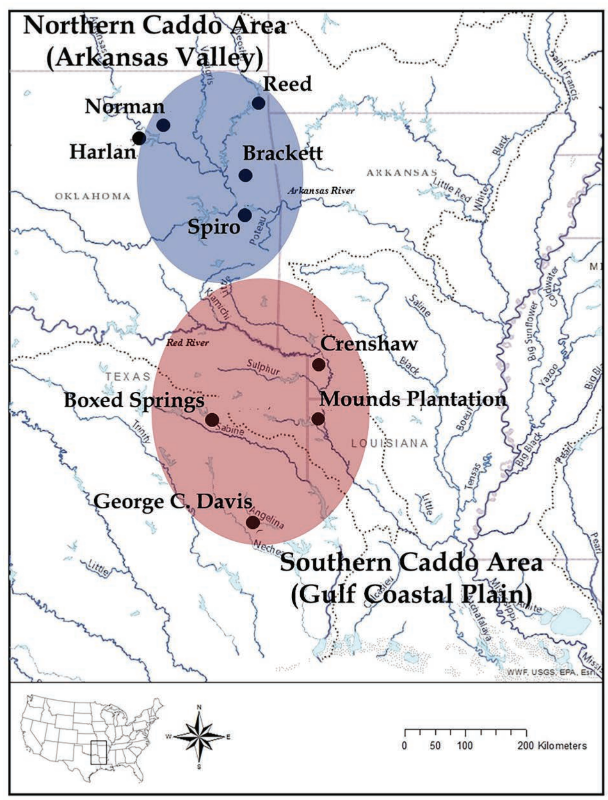

Figure 1. Map of the northern and southern Caddo areas with major ceremonial mound centers.

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vessels that functioned as sacred bundles (Nowak 2020), or as containers expressing multiple meanings as they traveled through different itineraries in time and space (Lambert 2020).

Spatial variation in Spiro Engraved vessels has been well-documented through various provenance and stylistic studies across the northern and southern Caddo areas (Lambert 2017; Perttula and Selden 2013). However, almost no analyses of Spiro Engraved vessels have considered variation in motif occurrence and expression between the northern and southern Caddo areas. In this analysis, I review the most robust and comprehensive sample of Spiro Engraved vessels throughout the Caddo world to understand motif variation within the region. The results show that northern Caddo people may have chosen specific Spiro Engraved motifs to be included as part of their mortuary programs at ceremonial mound sites, while southern Caddo people seemed to have incorporated the full spectrum of Spiro Engraved motifs for domestic, ceremonial, and mortuary purposes. I then discuss previous research and interpretations of Spiro Engraved production and distribution to show that Caddo social and ritual practices were much more heterogeneous than previously thought.

Spiro Engraved Type Description and Background

Highly skilled artisans manufactured Spiro Engraved vessels (Figure 2). They were exceptionally well-crafted, built with very thin walls, fine-grained grog temper (crushed sherds from broken vessels), highly burnished surfaces, and intricate abstract engraved motifs, sometimes highlighted with added red or white clay pigments (Girard et al. 2014; Lambert 2017). Only exceptional clay sources would have had the plasticity needed to build such vessels and have them survive the firing process. According to contemporary Caddo potters, the clay sources from which their ancestors made Spiro Engraved vessels were incredibly important places on the landscape, and the pots remained tethered to those places even as they were being made and used (Earles 2012, 2015). Strong social factors of apprenticeship, whereby skilled artisans shared the knowledge of where and how to gather clay to make Spiro Engraved vessels, preserved their continued circulation for at least 200 years.

Early Caddo potters almost exclusively used grog temper to construct Spiro Engraved vessels. At the same time, however, Mississippi River Valley groups to the east began to use mussel shell temper in their finely made pots. The use of grog was a long-held tradition of Caddo potters that extends back in time to their Woodland ancestors (Schambach 1982). The continued use of grog temper (and perhaps the locations of clay sources), at a time when most emerging Mississippian groups began to use shell, may indicate the importance of maintaining connections to earlier people and places. In this sense, Spiro Engraved pots extend further back in time before their context of production, which prevents treating the vessels as being discontinuous from their past. While Spiro Engraved ceramics are often linked to the Early Caddo period, some have shown up in later contexts at Spiro's Great Mortuary (Brown 1996), venerable heirloom objects that were (re)used to recall a more traditional past (Lambert 2018).

Figure 2. Example of a Spiro Engraved bottle from the Spiro site (34LF40), currently housed at the Sam Noble Museum of Natural History.

Potters displayed Spiro Engraved motifs on a variety of vessel forms, including bottles, bowls, beakers, seed jars, and compound vessels (Early 2012; Perttula 2013). On average, bottles make up around 80% of northern Caddo assemblages, while the distribution of vessel forms are more evenly distributed in the southern Caddo area (see Lambert 2017:209-218). The different vessel forms had specific functions and likely influenced the itineraries of the vessels, namely how they circulated in and out of places and the contexts in which they were used. As different Spiro Engraved forms encountered various people, places, and non-human objects, this may have transformed their meanings. Early Caddo bottles usually had a globular body with a long-tapered neck with a narrow opening, best used for holding liquids. Why was the bottle form used as the primary medium on which Spiro Engraved motifs were adorned in the northern Caddo area? The bottle form, its liquid contents, and iconographic meaning are likely linked, but more investigations of Spiro Engraved bottles, in particular organic residue analyses, need to be performed before we can be certain of this association.

Potters used a very limited set of design choices to create the overall repeated motifs around Spiro Engraved vessels (Lambert 2017). The central design motifs, repeated multiple times around the vessel, are comprised of either concentric circles or single or double spiral elements. In most cases, primary design motifs were separated by vertical or diagonal border panels around the vessels. A series of horizontal engraved lines were executed above and below the primary design motifs, usually just above the base and under the rim or bottle neck of the vessels. In my dissertation research, I compared the stylistic variation of Spiro Engraved vessels across the Caddo region using Early's (2012) design grammar and stylistic variation analysis and argued very few potters had the knowledge and skill to produce Spiro Engraved designs (Lambert 2017). Potters paid extra attention to the symmetry of the motifs, spacing of the engraved lines, and to learning the exact sequence of design elements: how each engraved line was placed on the surface of the vessels. Minute variations in Spiro Engraved motifs may indicate different potters learning the craft over time or closely connected potting communities making the same vessels at the same time. Early Caddo potters were thus not only concerned with teaching the overall design, but it was also the exact order the designs should be made, which implies personal tutelage in designing and decorating the pots.

Previous Interpretations of Spiro Engraved

The archaeology of Early Caddo fine wares has often been regarded as indicative of a more homogenous ritual landscape (Girard et al. 2014) and their interpretive value has not progressed much beyond defining distinct cultural groupings. Girard (2009:57) suggested early fine ware vessels were important display items and "were limited to specific groups within communities... probably involving feasts or ritual consumption of food." Perttula and Ferguson (2010) have shown that early fine wares were important items of exchange among distant Caddo communities and other groups in the eastern Woodlands and Plains. Girard and colleagues (2014:54-55) proposed that early fine wares served as accoutrements of wealth, power, and status, and became important exchange items among emerging elites who not only resided within the Caddo Area, but also at Cahokia in the American Bottom during the eleventh and twelfth centuries.

Caddo archaeologists primarily used Spiro Engraved and other Early Caddo pottery types as temporally diagnostic objects without further investigating differences in iconography, style, contexts, use, and iconographic meaning between socially diverse areas of the Caddo. This led to the assumption that potters locally manufactured Spiro Engraved pottery throughout the Caddo area. If potters living at sites across the northern and southern Caddo areas all had the knowledge and skill to produce identical vessels and motifs, then it could be argued that the meaning of Spiro Engraved motifs was fixed or "emblematic" (e.g., Weissner 1983:257) and that they sent clear messages about Early Caddo identity (Girard et al. 2014). However, new research has shown considerable diversity in the production and use of Spiro Engraved pottery (Lambert 2021). I agree with Girard and colleagues (2014:57) that Early Caddo people circulated engraved wares across different Caddo contexts to communicate and establish connections with multiple communities in distant geographical regions. What is needed now is a discussion of recent Spiro Engraved provenance studies to understand geographically where Spiro Engraved pottery was manufactured.

Spiro Engraved Provenance Studies

Wherever Spiro Engraved pots traveled, they carried with them the geochemical signature of the clay as a residue of the place from where they were produced. Caddo archaeologists have undertaken extensive chemical compositional research to understand where Early Caddo vessels were made (Lambert 2017, 2019; Perttula and Ferguson 2010; Selden 2013; Selden et al. 2014). A recent and extensive instrumental neutron activation analysis (INAA) of Early Caddo fine wares was done to determine whether they were made in the northern and/or southern Caddo areas (Lambert 2017, 2019). The findings revealed that none of the sourced Early Caddo fine wares, including Spiro Engraved, were made in the northern Caddo area. All appear to have been produced by potters in the southern Caddo area. Precise production locales could not be determined due to the homogeneity of the clays in the southern Caddo area; however, my study concluded that Spiro Engraved vessels were most likely made by very few potters in the Red River valley, which corresponds exactly to the highest density locales.

As products of potters in southern Caddo contexts, possibly along the Great Bend of the Red River, the itineraries of the containers and how they traveled to different areas are completely transformed. The movement of Spiro Engraved pots can be tracked beyond the initial moments of production. Accordingly, new meanings became embedded as they circulated, entered diverse kinds of human and object relations, and consequently were transformed across the Caddo area. The circulation of Spiro Engraved vessels from any one clay resource does not simply refer to a origin point of production. The movement of clay from its source to the pottery workshop to a succession of people who used Spiro Engraved containers in completely different ways constituted dynamic social, political, and religious relations as these objects encountered different people, places, and things. After potters dug clay from a source, perhaps near the Crenshaw site (3MI6), they may have been used it to hand-coil Spiro Engraved bottles destined for northern Caddo ceremonial centers. As a bottle with locally realized motifs and meanings was transported from Crenshaw, it accrued a history of circulation and significance as a distant object. This may have also transformed the meaning of Spiro Engraved motifs. Objects are "detachable from any one context … as they move from place to place and from person to person" (Joyce 2015:29). Thus, the meanings of Spiro Engraved motifs may have become detached from their place of origin as they encountered and became part of multiple networks.

Methods

My dissertation and documentary research allowed me to assemble one of the most comprehensive sample of Spiro Engraved motifs across both Caddo areas. Overall, there are approximately 184 sites across the Caddo landscape where Spiro Engraved vessels have been recovered (Lambert 2017:325-328). To conduct the motif analysis, I utilized available site reports, dissertations, theses, book chapters, and journal articles containing any documentary information of Spiro Engraved examples in the form of sherds or whole vessels. From the data recovered, I made a Kernel Point Density plot of the weighted distribution of Spiro Engraved vessels across the northern and southern Caddo areas (Figure 3). While not the most accurate method to study motifs, I examined photographs, illustrations, and associated descriptions of Spiro Engraved motifs from these sources. However, many of the specimens were directly observed for my dissertation research. Motif occurrences were not simply recorded as they were described in each primary source. Instead, each motif was reanalyzed based upon the hierarchical classification discussed below. Photographs and illustrations were cross-checked with written descriptions and sent to colleagues in order to obtain the most accurate classifications.

Motif classification was successful when there was at least 40% of the motif observable on the ceramic fragments. Usually a sherd displayed only a portion of a single motif. In these cases, they were successfully classified when a portion of the central area of the motif was present. In most instances, this is the only way to distinguish concentric circles from spiral motifs. Confidence in classifying sherds was also strengthened

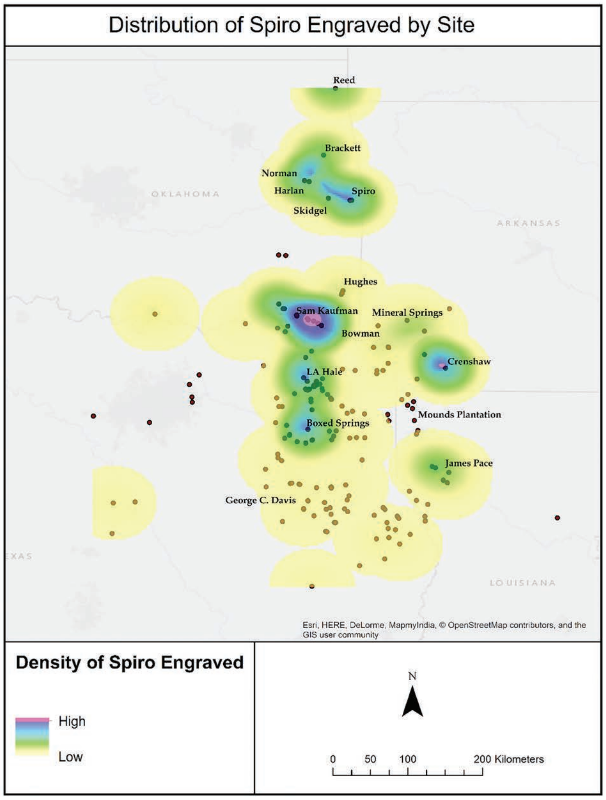

Figure 3. Kernel Point Density plot of Spiro Engraved vessels. The unlabeled red points in the southern Caddo area represent domestic sites in which Spiro Engraved vessels were recovered.

when comparing partial motifs with the large corpus of whole vessels I documented from my dissertation research. The same motif was usually repeated two to four times around a single vessel but was only calculated once per whole vessel or large sherd to decrease the chances of over-representing certain motifs over others. Potters had very strict rules for designing Spiro Engraved vessels and did not adorn different motifs on a single vessel, which made this analysis much more straightforward and consistent.

Motif Classification Structure

The primary motifs identified were organized according to a hierarchical stylistic analysis (Plog 2008) and a design grammar analysis (Early 2012) to understand the variation and the degree of design choice, organization, construction, and overall regional variability between northern and southern Caddo ceremonial centers (Figure 4). A hierarchical stylistic analysis is conducted by first determining the variation of primary design motifs across a ceramic type. Plog (2008:48) defined these as "primary decorative elements" that are painted or applied first on a vessel. Then, the primary motifs are broken down into their individual attributes to understand secondary and tertiary decorative elements that are placed on the vessel after the placement of the primary motif. Thus, this method of motif classification

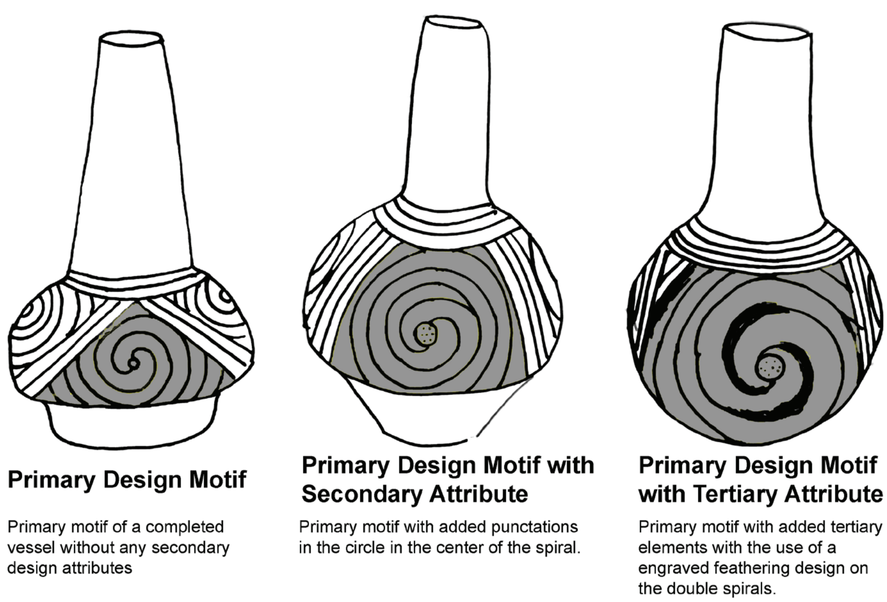

Figure 4. Primary design motif and secondary and tertiary design attributes.

documents the variation in the overall design structure and secondary and tertiary design elements, which can reveal the variation between individual or a community of potters. Spiro Engraved motifs were chosen based on their geometric or symmetrical criteria. Once motif variation is understood in different Caddo contexts, motifs can be classified based on their potential symbolic meanings.

To understand the style of Early Caddo fine wares, I first developed a method I call "design stratigraphy" to analyze the depth and overlap of lines to reveal the sequence of design construction (Figure 5). From there, I was able to reconstruct the sequence of steps of each Spiro Engraved vessel to understand design pathway variability that suggests potters placed Spiro Engraved design elements in the same order (Figure 6). This suggests Early Caddo potters were not only concerned with copying the overall design, but that it was also important to learn the exact order in which the designs should be placed, implying personal tutelage in designing the pots. Although the sequential order seems like the most efficient way to lay out each motif, research has shown there is significant variation in ceramic design layout in post A.D. 1200 Caddo contexts (Early 2012; Girard et al. 2014).

The hierarchical stylistic analysis showed that Spiro Engraved vessels had a very limited set of design choices from which potters could choose to complete a vessel. I produced a hierarchical tree diagram for Spiro Engraved vessels to visually display the range of

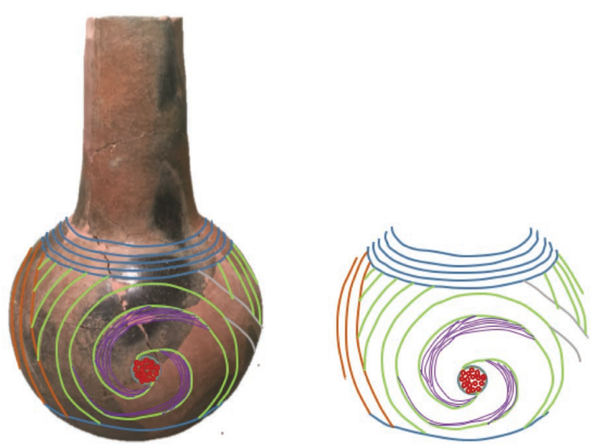

Figure 5. Example of the Design Stratigraphy process showing how Early Caddo fine ware lines overlap in the motif. Step 1 (blue lines), Step 2 (green lines), Step 3 (purple lines), and Step 4 (red circle punctate).

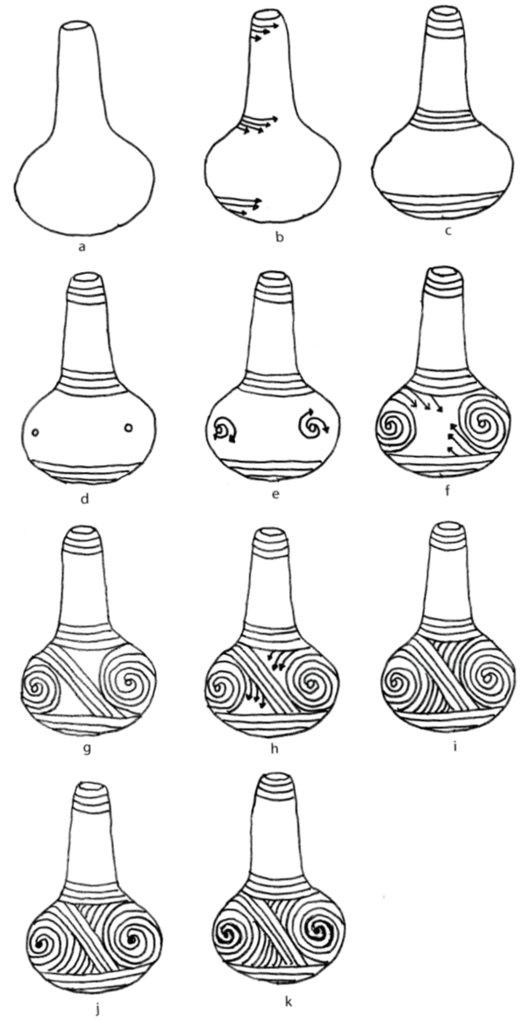

Figure 6. Overall design pathways to create a Spiro Engraved motif.

stylistic variability (Figure 7). Each element added onto the primary forms are considered secondary or tertiary elements. For Spiro Engraved vessels, there are only five primary motif forms, all of which are stylistically related to one another. It seems that Early Caddo potters were restricted to only three secondary design choices, included excising, feathering, and punctating. This is true for fine wares at both northern and southern Caddo ceremonial centers. In fact, during my dissertation research, I repeatedly found identical Spiro Engraved motifs and vessel forms in both Caddo regions, although most are from southern Caddo ceremonial centers. If several potters were making these vessels throughout the entire Caddo region, we would expect much more stylistic variation than is shown here. These findings are in concert with the INAA results and indicate the

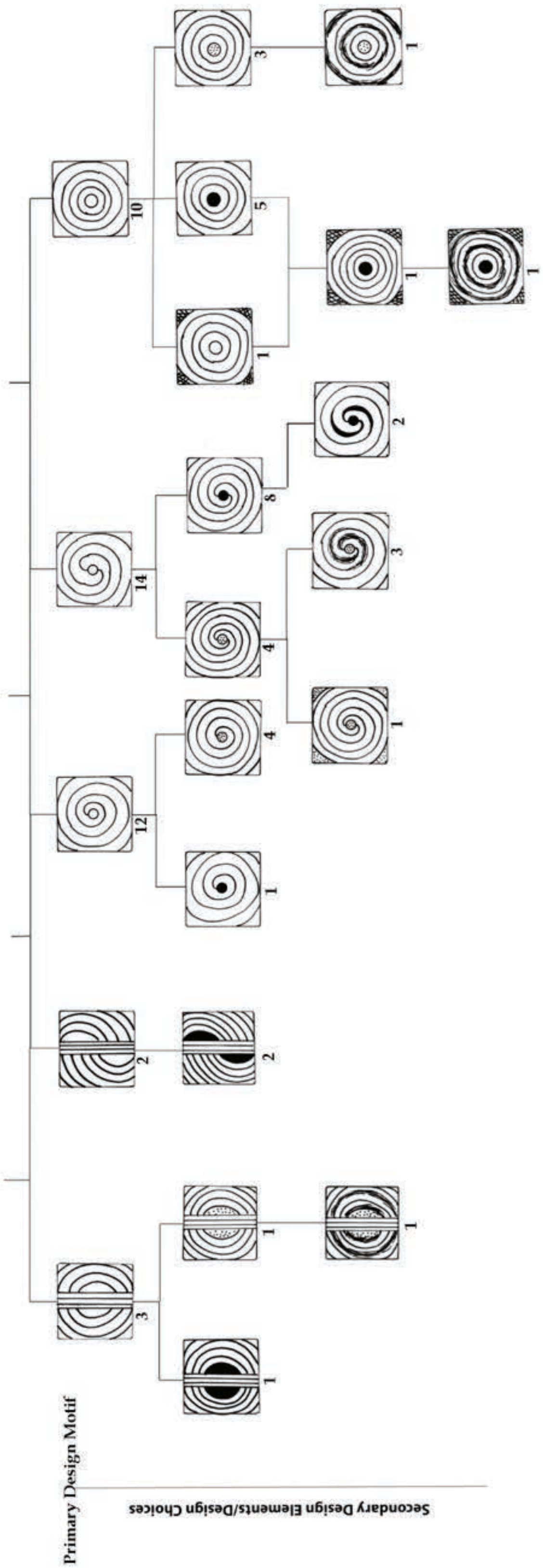

Figure 7. Spiro Engraved Hierarchical Tree Diagram showing the limited number of design choices.

emergence of ceramic specialization in the southern Caddo Area involving only a few craft specialists.

For this motif analysis, there are five primary motif forms: single spirals (S1); double spirals (S2); concentric circles (C1); and two variants of bifurcated concentric circles (C2) (Figure 8). The primary motif forms were also based on the principle of visual symmetry (see Azar 2019; Frieberg 2018; Pauketat and Emerson 1991). Within the motif categories S1-C2, there are secondary design elements added to each primary form. While it is possible that the secondary design elements may change the symbolic meaning of the primary motifs for different Caddo communities, they are considered here as variations of the overall theme and thus all motifs were analyzed by their primary forms. These secondary elements may have spatial and/or temporal meaning and much more work is needed to understand their distribution across the Caddo world.

Results

The results of the motif analysis reveal some striking patterns between the southern and northern Caddo areas and motif choice between domestic and burial

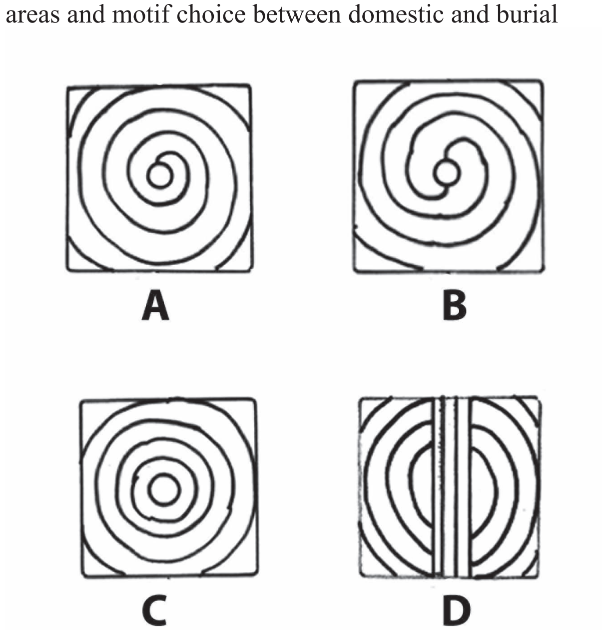

Figure 8. Spiro Engraved primary design motifs: *a*, single spiral, labeled as S1; *b*, double spiral, labeled as S2; *c*, concentric circles, labeled as C1; and *d*, bifurcated concentric circles, labeled as C2. Note that there are two variants of bifurcated circles, which yielded a total of five primary design forms.

contexts in the southern Caddo region (Table 1). When comparing burial contexts, the double spiral motif (S2) and single spiral motifs (S1) are the most popular motifs in the northern Caddo area, and the double spiral motif is by far the most favored on bottles and bowls (Figure 9). Approximately 80% (n=52) of the motifs used in mortuary contexts at northern Caddo ceremonial mound centers is the double spiral. There does not seem to be any statistically significant variation between the four primary motif forms in the southern Caddo region. As shown, when considering the study area as a whole, it is indeed the case that the mean distribution of the double spiral motif in the northern Caddo area tends to be significantly favored over the other motifs. There is a strong and statistically significant difference in motif choice in the northern Caddo area ($X^2 = 113.20$, $df = 4$, $p < 0.0001$). Another general assessment of the data when looking at the southern Caddo area suggests that the mean distribution is much more evenly distributed and thus there are no real patterned relationships between motif frequencies in burial contexts. Thus, the distribution of motifs in the southern Caddo region are

Table 1. Spiro Engraved Motif Distribution between the Northern and Southern Caddo Areas.

Spiro Engraved Motif Classification	Northern Caddo	Southern Caddo
S1 (Single Spiral)	9	37
S2 (Double Spiral)	52	126
C1 (Concentric Circles)	12	103
C2 (Bifurcated Concentric Circles)	1	8
Total	74	274

not statistically significantly different ($t = -0.73$, $df = 45$, $p = 0.471$).

When comparing motif variation between burial and domestic contexts in the southern Caddo region another interesting pattern emerges (Figure 10). Double spiral and concentric circle motifs are the most favored in burial contexts, but the motifs in domestic contexts appear to be more restricted. Over 95% of the Spiro Engraved vessels in domestic contexts have the concentric circles motif. Also, bifurcated concentric circle motifs in southern Caddo contexts are only present in burial contexts. This motif is the most uncommon in the Spiro Engraved assemblage. It is important to note here that Spiro Engraved motifs

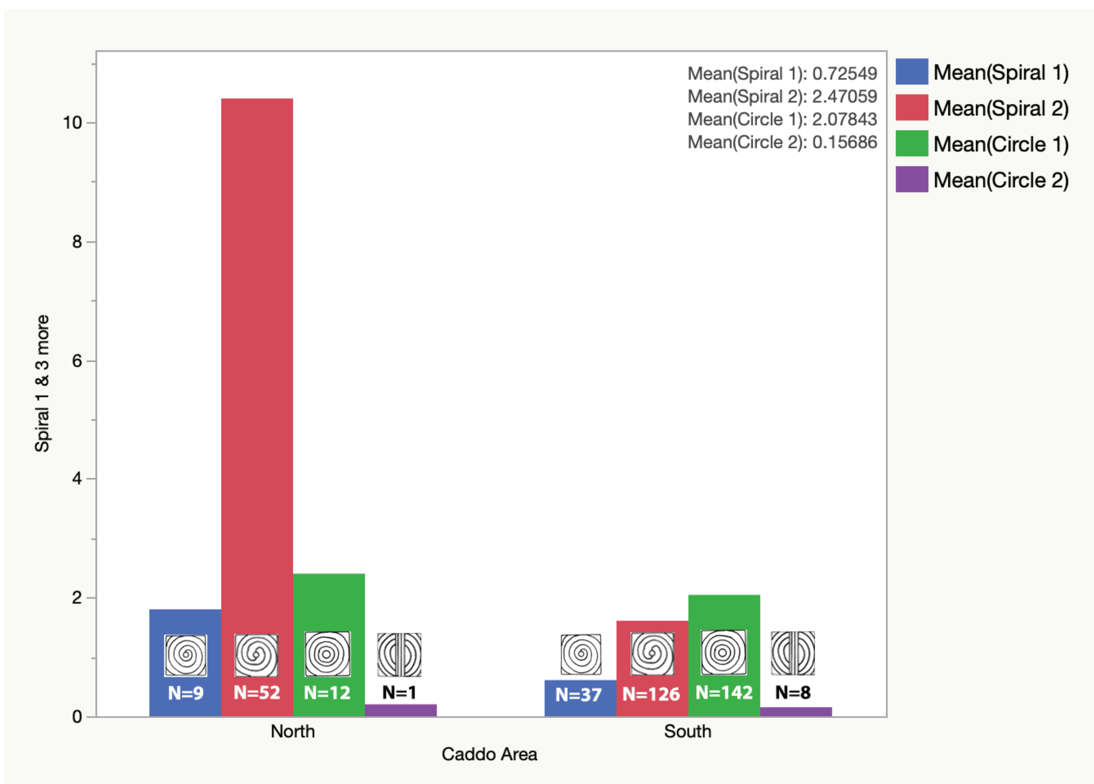

Figure 9. Mean Distribution Histogram showing the variations of motif distribution between the northern and southern Caddo area.

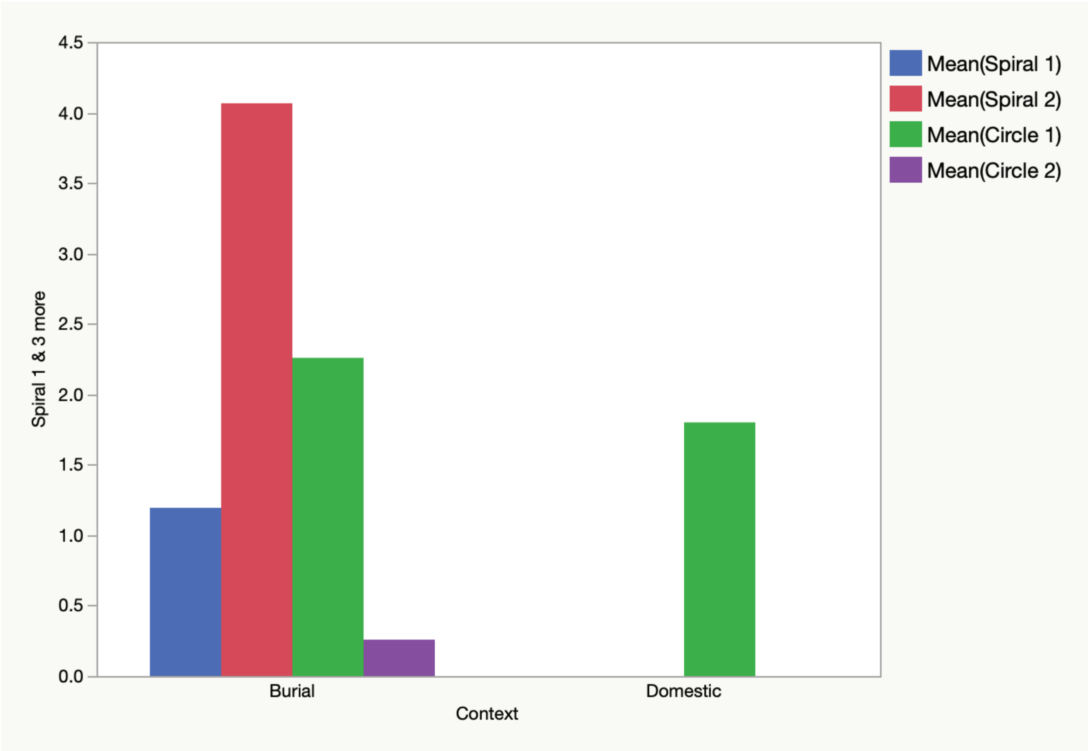

Figure 10. Mean distribution histogram showing the variation of motif distribution between burial and domestic contexts in the southern Caddo region.

were highly fragmentary in southern Caddo domestic contexts, and thus this pattern could be the result of sample bias. When considering motif variation between burial and domestic contexts in the southern Caddo area, the concentric circle motif (C1) seems to be favored in domestic contexts. There is not enough data in domestic contexts to observe the significance statistically, but it is worth noting, nonetheless. Overall, this suggests that regional patterns of motif frequencies in burial contexts are more likely related to distinct cultural notions of which motif was to be used for burial accompaniments.

Discussion

These patterns of variation of Spiro Engraved pottery provide new insight into the complex nature of interaction and motif preference between northern and southern Caddo communities. It also highlights how the distribution of local and nonlocal pottery has a direct influence on local and nonlocal ideas, values, and practices, and thus allows us to understand the Caddo, not as a homogenous cultural group, but as complex communal actors who constantly defined, communicated, and structured their own identities through the use of Spiro Engraved and other types of pottery. Spiro Engraved motifs in the northern and southern Caddo areas may indicate the scales at which local and nonlocal choice signals cultural similarity and difference in mortuary, ceremonial, and domestic contexts where these vessels were used and exchanged.

Centralized Production and Ritual Multivocality

I argue that there is provenance and stylistic evidence for the centralized production of Spiro Engraved and other Early Caddo ceramics in the southern Caddo region and then distributed north to ceremonial centers where they were deposited in burials. In previous work, I have shown that not only were Spiro Engraved vessels made by southern Caddo potters, but also suggested that the production of Early Caddo engraved wares represents the development of at least part-time craft specialization and a long-distance distribution system (Lambert 2020). Thus, it appears that the knowledge, ability, or right to craft Spiro Engraved pottery were reserved for a smaller, perhaps more localized, group(s) of ritual craft specialists.

The results of the motif analysis also suggest that northern Caddo people might have actively communicated to southern Caddo people what motifs were necessary for their mortuary practices. This motif preference for reversing spirals supports the interpretation that Spiro Engraved was an ideological tool that (1) reflected a widely shared iconographic tradition and (2) was used and perceived differently between northern and southern Caddo. The question still remains: was centralized production and specific motif preferences an ideological tool used to legitimize ritual prestige, power, or authority? The variation in production, use, deposition, and motif distribution of Spiro Engraved wares does not suggest a single dominant ideology, but rather a ritual multivocality established and maintained by different Caddo groups.

Specifically, the iconography of Spiro Engraved vessels could have served as a visual and symbolic vehicle through which Caddo people conceived and interacted differently within a broadly shared Caddo religious system. The act of people in the northern Caddo area choosing one motif over others may have been a way to broadcast to the larger Caddo world who they were in relation to other neighboring communities. In this sense, it is possible that northern Caddo people had divergent negotiations of Caddo religion and what it was "to be Caddo." The presence of spiral motifs in northern Caddo mortuary contexts suggests a divergence in meaning. Conversely, in the southern Caddo area, potters and owners of Spiro Engraved vessels freely utilized all motifs in many different contexts, perhaps as a medium to project and maintain their conceptions of Caddo identity. The development of these divergent histories and traditions may have ignited the explosion of spatially distinct Caddo pottery types in the Middle and Late Caddo periods (Early 2012; Girard et al. 2014). "It further illustrates that people can emulate the cultural practices of a dominant polity, but in the end they do so with regard to their own local traditions" (Frieberg 2018:50).

As Spiro Engraved wares moved through different contexts, they become what Joyce (2012:29) called "detached" from their original contexts. As a result, meanings and agencies are altered as they move and interact with different people, places, and things. As Spiro Engraved vessels moved through time and space, they form individual social lives. Appadurai (1986) called this the social lives of things and asserted that objects are born, get altered, and are buried – similar to the life and death of humans. I argue that the meanings of Spiro Engraved vessels were transformed as they moved between different Caddo contexts. The social lives of Spiro Engraved wares evolved as they became detached from where they were created, travelled to northern Caddo ceremonial centers, and eventually were used and deposited in mortuary contexts.

Why Spiral Motifs?

Since northern Caddo people preferred spiral motifs on Spiro Engraved vessels for mortuary contexts at ceremonial mound sites, it is worth trying to understand the possible meanings of the motif. I view Spiro Engraved motifs as a material and symbolic medium through which meaning was reaffirmed by local histories, practices, and traditions. These entanglements between object, motif, people, and place are rooted in the concept of materiality, which emphasizes not only the object itself but also how materials are continually being reshaped and given agency as humans and nonhumans engage with them (Costin 2005; Culley 2008; Emerson and Pauketat 2008; Fogelin 2007; Miller 2005). Objects and humans have a relational dependency on one another: things rely on humans for their creation, maintenance and deposition, and humans rely on things to give meaning and structure to the symbolic and material worlds (Knappett and Malafouris 2008). The meaning of Spiro Engraved is thus malleable, dynamic, and historically contingent and can change as they encounter new people, places, and other objects (Latour 2005; Meskell 2005).

Archaeologists have previously tried to understand the meaning of the spiral motif on different media and within different cultural and historical contexts. Kozuch (2013) explored the meaning of several Mississippian period (A.D. 1200 – 1400) ceramic effigies of marine shell cups from Illinois. She posited that the ceramics represented whelk shell cups and were imbued with cosmological meaning of death using concepts of directionality and were important instruments used in purification rituals. Emerson (1989) has associated the center spiral motifs on Ramey Incised vessels from Illinois with the movement of dance that signified the balance between the Upper and Under Worlds. Other Ramey Incised spiral motifs may have represented the serpent of the watery Under World (Pauketat and Emerson 1991). Marquardt and Kozuch (2016) posited that spiral motifs may represent humans' passage from birth to death and beyond to the cosmological universe. This symbolic spiraling path from life – death – afterlife parallels several southeastern Native American spiritualities of a serpent-like creature that can cross between the Upper and Lower Worlds. Marquardt and Kozuch (2016) also discuss the directionality of spiral whelk shells and suggest that clockwise and counterclockwise spirals may have had related but altering meanings. In their ethnohistorical and ethnographic research, clockwise (sinistral) spirals were associated with the cycle of the sun, fire, life, and death. Counterclockwise (dextral) spiral motifs may have been direct paths toward life, rebirth, and reincarnation. Spirals were thus metaphors for the movement and continuity of time with referents to birth, death, and rebirth (Lankford 2007a, 2007b, 2007c). This is perhaps why northern Caddo people chose specific motifs with these symbolic qualities for their mortuary traditions. The transformative power of Spiro Engraved spiral motifs in northern Caddo contexts could also have been drawn from their distant production locales. Helms (1988, 1993) emphasized that the power of ceramics used in ritual, mortuary, and ceremonial contexts came from their intrinsic qualities (e.g., their iconography, shape, and color) and/or their distant sources. These nonlocal vessels thus could be used to commune with local cosmologies and important mortuary practices. I am not suggesting that northern Caddo people conceived their cosmologies in the same way or had the same stories, legends, or cosmological understandings as other southeastern indigenous groups. There may have been a broad understanding of these motifs, and each community utilized them in specific contexts that had subtle variations of meaning. Archaeologists now realize the widespread distribution of identical motifs on ceramic vessels do not represent a widespread adoption of a singular Mississippian worldview. Frieberg (2018) conducted an iconographic analysis of Ramey Incised pottery across the Lower and Central Illinois River Valleys and showed that motif variation was reinterpreted based on local understanding and history. Azar (2019) did a more robust iconographic analysis of Ramey Incised ceramics and proposed that variation in motif design reflects local stylistic experimentation based on local traditions and histories. As Spiro Engraved motifs moved across the landscape, their meanings were not static but had the potential to be transformed as they crossed different cultural contexts. Variation in meaning reflects the various entanglements between people, places, and things (Meskell 2005). I argue that during various acts of Spiro Engraved production, use, exchange, gifting, and ritual practices, northern and southern Caddo people symbolically and physically experienced their cosmologies differently.

Conclusions

This study shows that northern Caddo communities actively chose specific Spiro Engraved motifs to be used in mortuary contexts. In this way, northern Caddo people are seen as active agents during the moments of trade and exchange of Spiro Engraved vessels from their southern Caddo neighbors. Recent chemical, stylistic, and iconographic investigations have provided better insights into Spiro Engraved histories, and their production, use, and movement across diverse areas of the precolumbian Caddo world. The meaning of Spiro Engraved vessels was further reshaped by the various ways in which they were used. When placed in this context, they become appropriated pieces of the past "that are transformed into relevant symbols in the present" (Wallis 2015:201).

In sum, this analysis constitutes a new approach to the systematic evaluation of variation in Spiro Engraved motifs between the northern and southern Caddo area. This examination suggests that northern Caddo people negotiated the movement of Spiro Engraved vessels in different ways that fit within their own local practices, traditions, and histories. Specifically, northern Caddo people selectively chose spiral motifs that they reconceptualized and made meaningful in reference to northern Caddo mortuary traditions. While more work is needed to understand these differences more fully, the motif variation between the two Caddo areas suggests differences in the perceived composition and structure of the cosmos. It reveals the complex connections of local worldviews in the constant negotiation of a broader Caddo religious identity. More attention should be paid to the subtle iconographic heterogeneity existing between different areas of the Caddo world. We have conceptualized Early Caddo iconography too broadly, discounting noticeable variation as irrelevant background noise. In this analysis and in previous research, I have highlighted these formerly overlooked elements of Early Caddo iconography, interpreting them not as evidence of cultural homogeneity but as a dynamic process of multi-vocality. Ultimately, I believe this type of research will continue to refine our understanding of the Caddo emergence and their relationships to Mississippian groups to the east.

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The Cobb-Pool Site, A Caddo Settlement in the Mountain Creek Valley

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The Cobb-Pool site was excavated in 1985-1986 by the Archaeology Research Program at Southern Methodist University (SMU) before Joe Pool Lake was constructed. The site had been located by the late R. King Harris in the 1930s and Harris collected early Caddo pottery, a Gahagan biface, Alba arrow points, and other chipped stone tools from the surface. SMU located the posthole pattern of three house structures, a large roasting pit, and several other features. Recovered during the excavation was an assemblage that complemented the Harris collection but also included a large sample of maize unlike that found in any other site in the Dallas-Fort Worth Metroplex. Radiocarbon dates and ceramic typology indicate that the site was occupied sometime between A.D. 1000 and 1200. I conclude that the Cobb-Pool site represents a Caddo group that settled in the Mountain Creek valley for several years. They farmed the fine sandy loam and hunted and gathered from the surrounding area. Future researchers should search for complementary sites in similar settings within North Central Texas.

Throughout the twentieth century, Dallas County archaeology was primarily equated with the activities of the Dallas Archeological Society (DAS), up until the group was disbanded in the early twenty-first century. Two individuals were instrumental in establishing and maintaining the DAS: Forrest Kirkland, the founder; and R. King Harris. Kirkland is best known for his rock art recordings (Kirkland and Newcomb 1967) and for his creation of *The Record of the Dallas Archeological Society* in 1939 (Harris 1988). King Harris first described North Central Texas sites in the *Bulletin of the Texas Archeological and Paleontological Society* (BTAPS) (Harris 1936). He subsequently went on to report on sites in north central and northeast Texas, including the White Rock Lake Spillway site (Kirkland and Harris 1941), the Sam Kaufman site (Harris 1953), and the Lewisville Clovis site (Crook and Harris 1957), as well as making major contributions to reports on the Gilbert site (Jelks 1967) and the Wichita Project (Bell et al. 1967). After Kirkland's demise, Harris continued to be a guiding force in the organization (Crook 1978; House 1978; Krieger 1978).

In his first article in BTAPS, Harris described "Dallas II" as a small prehistoric site located on Mountain Creek in Dallas County (Harris 1936:130). He thought the site appeared to have been occupied for a short time but it contained a few well-worked flint artifacts (Figure 1). Small points at the site were of western types (by that he meant west of the Elm Fork of the Trinity), but no pottery was mentioned occurring at the site. In 1941, Kirkland and Harris recorded the site with The University of Texas at Austin (41DL148) and identified it as a possible Caddo campsite. The site form indicates that "potsherds" were present but no types or temper descriptions were provided. In his review of the "Upper Trinity River Basin," Alex D. Krieger notes that Harris distinguishes archaeological sites from east of the Elm Fork of the Trinity as being related to the Caddo while those to the west were different and more like those in the Brazos River drainage (Krieger 1946:135-136). He does not mention the Dallas II site although he does reference Harris's article and activities of the DAS. In an article titled "Archeology of the Upper Trinity Watershed," C. A. Smith (1969:9) mentions the site as a "pure Alto Focus site representative of the early Neo-American Aspect" (Neo-American equates with Late Prehistoric and in this case Early Caddo period). Smith notes that Harris reports that pottery from sites east of the Elm Fork of the Trinity River is primarily clay-grit-tempered while west of the Elm Fork it is shell-tempered.

Over the years, the site became known as the Cobb-Poole or Cobb-Pool site, although the source of that name is unknown. When first guided to the site in

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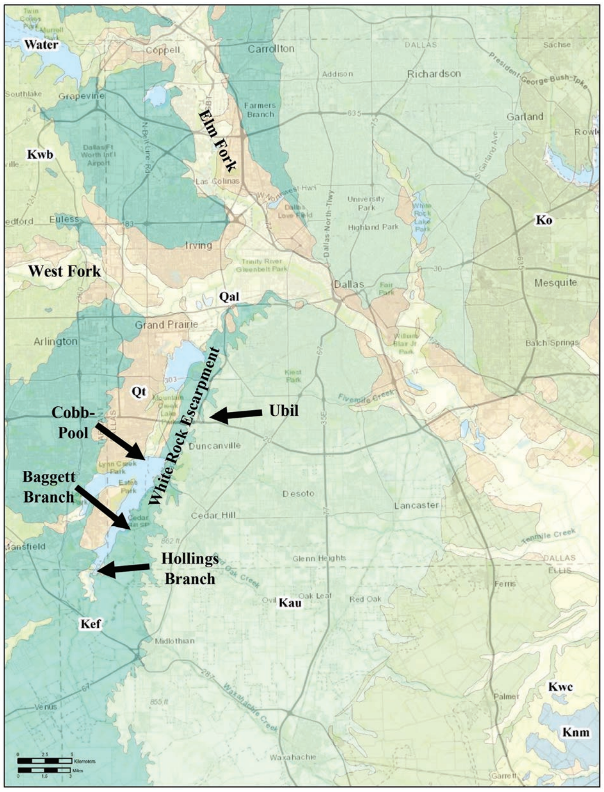

Figure 1. The Cobb-Pool site location in the DFW Metroplex showing additional sites discussed in the text and overlaid on a geological map.

1971, Harris pointed out a shallow midden along with a variety of chipped stone tools (Figures 2 and 3) as well as a sample of decorated Caddo pottery types: Canton Incised; Davis Incised; Crockett Curvilinear Incised; and Weches Fingernail Impressed (Figure 4). These are easily recognized East Texas types (Perttula 2013). In addition, 55 untyped pieces that included incised, fingernail impressed, punctated, and brushed sherds were in the surface collection from the site (Skinner and Connors 1979:Table 4). Three large well-flaked bifaces were contained in his collection, along with a Pogo dart point (Figure 2*b*), drills, and a variety of arrow points, particularly Albas. One of the bifaces has been identified as a Gahagan biface by Shafer (2006:Table 5). Harris also had some animal bones, mussel shell fragments, clay daub, and two pieces of obsidian, one of which was previously reported as having come from Mexico (Skinner and Connors 1979:37). Later review of the XRF data on the one Harris obsidian flake was carried out by the Lawrence Berkeley National Laboratory, revealing that the source was Cerro del Medio in the Jemez Mountains of northern New Mexico (TOP 52, Texas Obsidian Project; Thomas R. Hester, personal communication 2020). Based on the surface collections, Harris considered the site important and unique and was sure that it warranted major investigation in conjunction with planned construction of Lakeview Lake/Joe Pool Lake.

The Mountain Creek Watershed/White Rock Escarpment is a unique environmental setting in Dallas County and throughout North Central Texas (Kennemer 1987). The watershed is relatively short but Quaternary terrace sediments are widespread on the west side of the creek channel (Bureau of Economic Geology 1988).

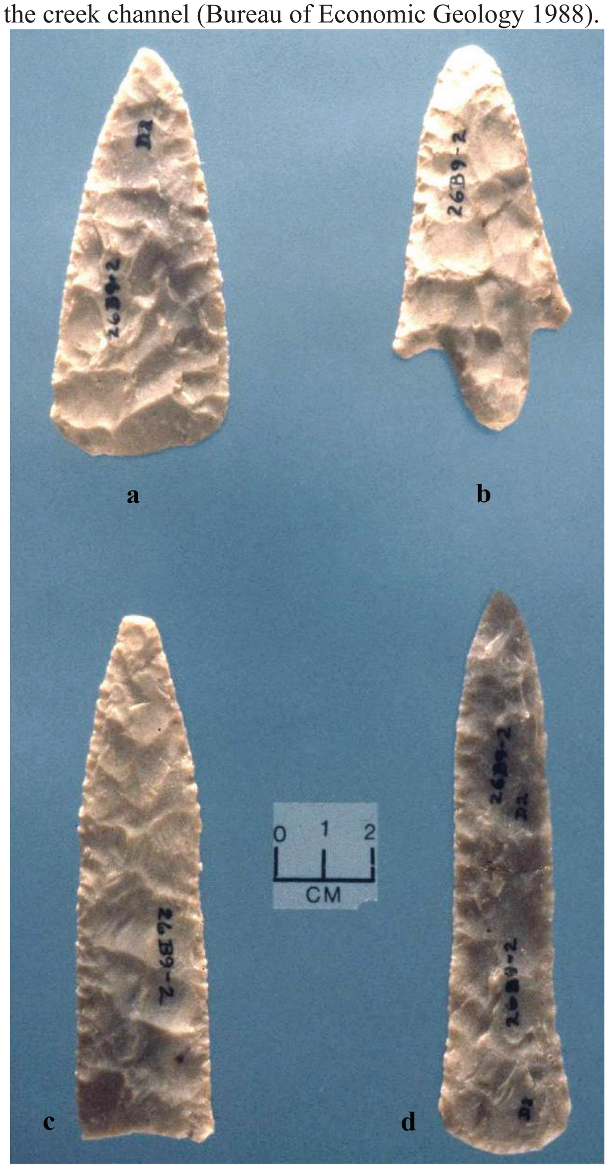

Figure 2. Bifaces (*a, d*) from the surface of the Cobb-Pool site; *b*, Pogo dart point; *c*, Gahagan biface as identified by Shafer (2006:Table 5).

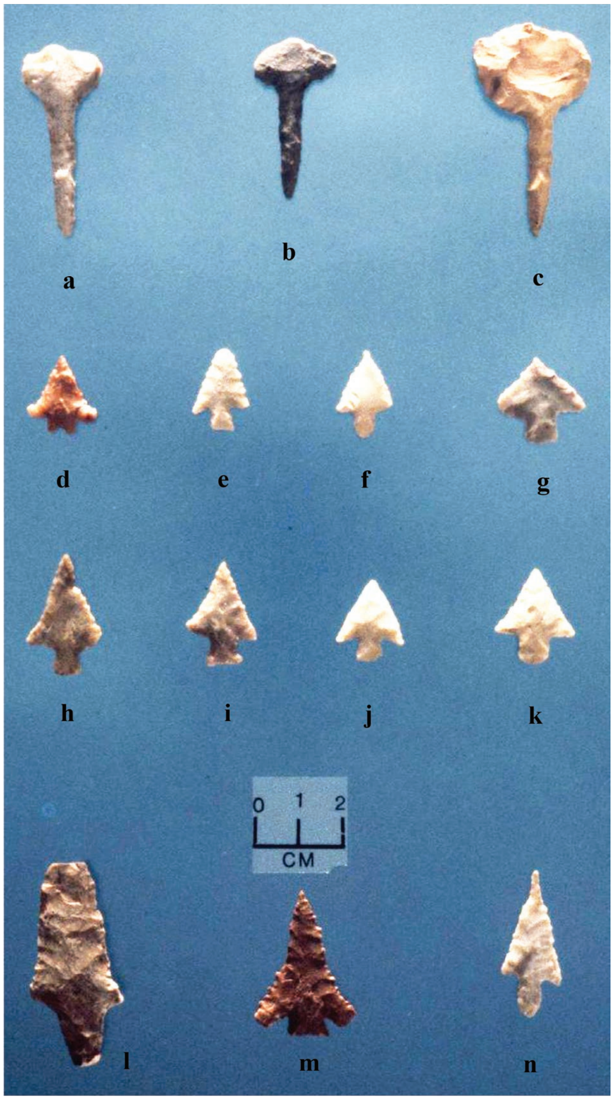

Figure 3. Artifacts from the surface of the Cobb-Pool site: *a-c,* drills; *d-k,* Alba arrow points; *l,* Gary dart point; *m,* Catahoula arrow point; *n,* Perdiz arrow point. Identifications were made by R. King Harris.

There is also a narrow zone of Quaternary alluvium that parallels the stream channel south into Ellis County. According to Twitchell (1968), Mountain Creek is the only perennial drainage in the watershed, however, seep springs at the base of the Escarpment along the east side of the valley provide a reliable water source throughout much of the year and the same is true for the Eastern Cross Timbers in the upper Walnut Creek. As a result, freshwater mussels grow in the drainages and were used as a food resource prehistorically. Historically, a major floodplain forest filled the Mountain Creek valley (Jurney 1988; Martin 1988; Peter and Jurney 1988). The Escarpment edge and slope were covered with junipers and the Blackland Prairie extended to the east. The Eastern Cross Timbers vegetation zone was to the west. An area of Silawa fine sandy loam corresponds to the site location on the north side of Walnut Creek (Coffee et al. 1980:Sheet 50). This location is roughly 15 m above the valley floor and Harris reported that there was a spring in the vicinity of the site, although it was not encountered by later survey or excavation teams.

The site was located along the dam centerline west of the intersection of Walnut Creek and Mountain Creek and the site area was thoroughly tested by the Archaeology Research Program at Southern Methodist University (SMU) (Raab 1982:15-21). The artifact assemblage included chipped stone tools and ceramics that led to the site being tentatively dated between A.D. 800 and 1200 (Suhm and Jelks 1962). No radiocarbon dates were produced due to the small charcoal samples present (Raab 1982:18). It should be noted that two brushed body sherds and three Perdiz arrow points were in the Harris collection and may represent later occupation (Perttula 2013:198). A shallow midden was recognized during testing but the most interesting discovery was the definition of a feature described as a possible house in a pit. The pit had an irregular basin-shaped floor that extended over a roughly circular 7-8 m area up to 1.8 m deep. Caddo ceramics similar to those collected by Harris were recovered from the pit fill along with pollen (Raab and Woosley 1982), but no plant remains were reported although charcoal flecks were described from the midden matrix. No evidence of agriculture was found, but the Silawa fine sandy loam soil surrounding the site offered decided advantages to raising domesticated crops, including squash and maize (Raab 1982:85-86). A row of three postholes was uncovered and it was suggested that they might be part of a prehistoric structure that was located near a mussel shell concentration (Raab 1982:21). Further investigation at the site was recommended in order to mitigate the loss of this unique prehistoric site (Raab 1982:102-103).

SMU did extensive backhoe trenching, dozer scraping, and hand excavation at the site in 1985-1986 and the extent of this work is shown on Figure 5 (Peter et al. 1988a). Feature 2 is the pit feature that was previously located by trenching. Detailed excavation and subsequent stratigraphic and artifact analysis led to the conclusion that the pit was not a house but was the result of numerous roasting activities. Animal remains (bones and mussel shells) and fire-cracked rock were found concentrated in the pit fill and immediately adjacent to the pit edges. Several artifact clusters and a basin-shaped hearth were encountered inside and outside Structure 1, which was adjacent to Feature 2. A radiocarbon date of AD 1080±79 (Beta 13960) was obtained on charcoal from the hearth (Feature 4) in the floor of Structure 1. Unfortunately this date cannot be corrected since Beta lost the records during a hurricane.

Three structural features were defined as rings of postholes. Structures 1 and 2 appear to have been houses that were lived in while Structure 3 had little evidence of occupation and may have been open sided. Structure 2 was apparently constructed after the adjacent part of Feature 2 was no longer in use and had filled in (Peter et al. 1988a:180). Structure 2 had also burned. One radiocarbon date was obtained from Posthole 7 in Structure 2 and it was dated A.D. 1275±96 (SMU-1615).

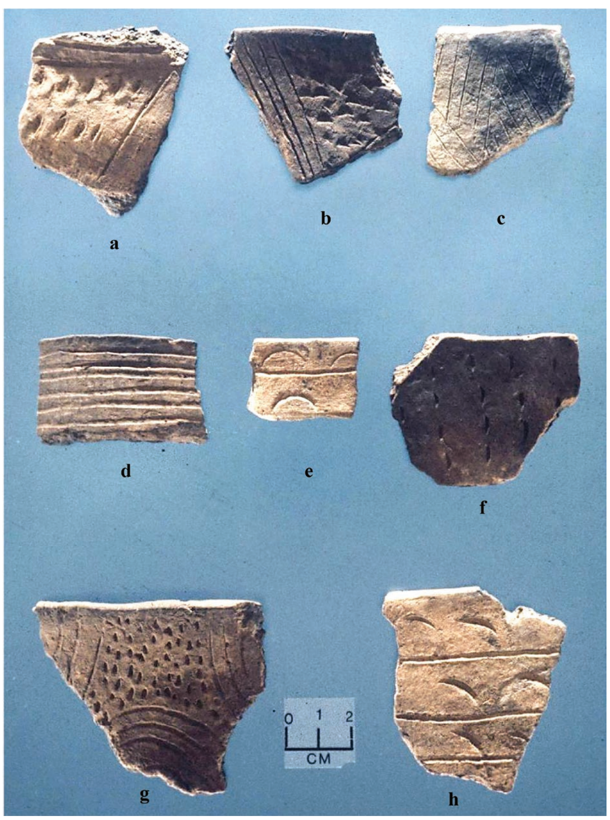

Figure 4. Decorated sherds from the surface of the Cobb-Pool site from the Harris collection: *a-c,* Canton Incised; *d,* Davis Incised; *e, h,* Weches Fingernail Impressed; *f,* untyped incised and punctated; *g,* Crockett Curvilinear Incised. Identifications were made by R. King Harris.

Maize was not found in this posthole but was recovered from other postholes in the structure. A third date of AD 1247±24 (SMU-1742) was obtained on charcoal from Feature 10, the largest hearth feature at the site and where maize was also recovered. When corrected, the dates are statistically averaged at AD 1246±18 (Britt Bousman, personal communication 2020). Other thermoluminescence dates and radiocarbon dates on humates from postholes have a wide range and do not concur with these dates. A series of 21 postholes east and south of Structure 3 and extending south to Feature 2 did not define any feature outlines.

The artifact assemblage from Cobb-Pool is not large in number but it is decidedly different from the other Joe Pool Lake sites (Peter and McGregor 1988). Lithic debitage included more than 5,000 broken flakes, of which 97.2% were chert. This is the highest amount of chert from any of the reservoir area sites. Fine-grained quartzite made up 1.8% of the sample. Only three arrow point preforms were found while 59 Alba arrow points and more unidentified and fragments were collected. Other bifacially flaked tools were present along with end and side scrapers. Three manos and a grinding stone were also recovered during excavation.

A sample of 641 ceramics was recovered during excavation and was complemented by analysis of 80 sherds from the R. King Harris collection at the Smithsonian. At least 44 different vessels were represented by 133 sherds from the SMU excavation. Grog was the most common temper and the various incised decorations led to the site being considered a single component dated between A.D. 1000 and 1200. In discussion with Tim Perttula, it was noted that this is not a large ceramic sample for a Caddo village site but it might be reasonable based on a short-term Caddo occupation. Furthermore, the full extent of the site is uncertain due to the presence of the gravel pit shown on Figure 1.

Approximately 7000 pieces of bone were recovered with deer and turtle being the most common. No bison bones were recognized. Walnut shell fragments were present but maize was the most abundant plant found. More than 70% of the plant remains recovered from flotation were maize. A small amount of maize was found at the nearby Baggett Branch site but the Cobb-Pool sample is amazingly large. The variety of identified

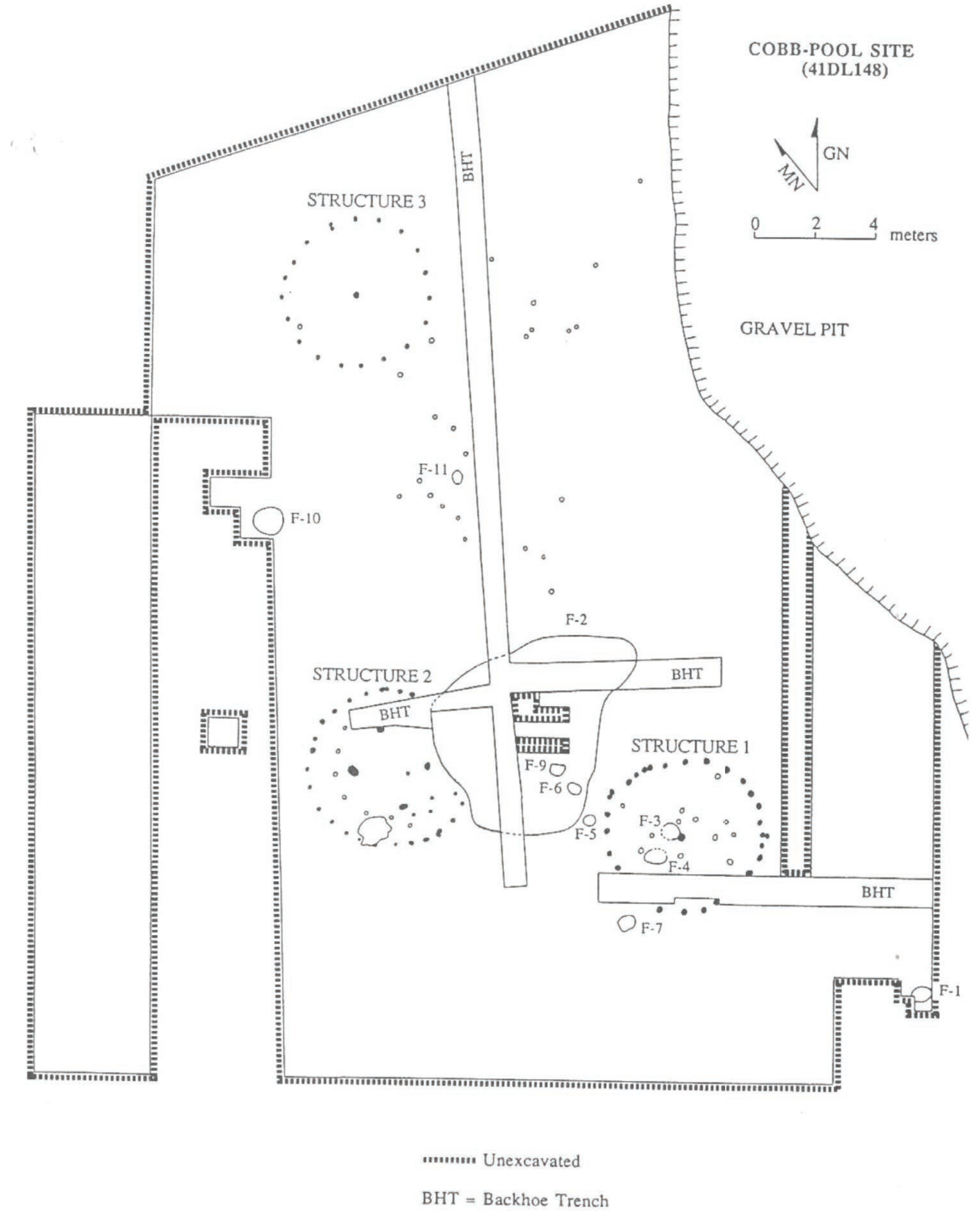

Figure 5. Plan map of the Cobb-Pool site showing mechanically stripped areas, backhoe trenches, and feature/structure locations (from Peter and McGregor 1988:Figure 9-7).

wild plants were shown to be evidence of year round occupation.

In a subsequent article that more fully discusses the plant remains from Cobb-Pool, Gayle Fritz (1993) describes the assemblage as indicative of a farmstead rather than a hunting/gathering campsite. Maize was present in more than 72% of the 43 flotation samples she analyzed while nut remains were in less than a quarter of the samples. Kernel fragments were found in 10 samples and cob pieces occurred in 31 samples. The total number of sorted cupule and glume pieces was 475. Most of the cupules were fragmentary so the actual number would be lower. Forty percent of the maize came from Feature 4 in the floor of Structure 1. A squash or gourd rind, edible wild seeds, and a possible tuber were also recovered. This intrusion into the Blackland was apparently before the Caddo adopted beans (Perttula 2008:79). Based on the fact that Silawa sandy loam is the best soil in the region for crop production (Coffee et al. 1980), and the abundance of maize remains, Fritz (1993:241) concluded that the Cobb-Pool people were Caddos who ventured into the Blackland Prairie. However, the SMU team had concluded that "the Cobb-Pool site represents an example of a local group of people who borrowed some ideas from neighbors" (Moir et al. 1988:32). Further discussion of prehistoric Caddo farming is provided by Perttula (2008).

Other sites at Joe Pool Lake are reported to be hunting/gathering campsites based on features and artifact assemblages, although they may have been occupied during the time span of Cobb-Pool. Specifically, these sites include Baggett Branch (Peter et al. 1988b) where 163 sherds from more than 12 vessels were encountered. Most of the pottery is shell-tempered, and thus later in time than Cobb-Pool. Part of five maize cupules and a single kernel were the only evidence of maize discovered in the flotation samples from this hunting/gathering campsite. At site 41DL184, a total of nine sherds of early grog-tempered pottery and Nocona Plain (Krieger 1946:109-111) were recovered in this site's deposit, which was considered to be a foraging campsite. No maize or plant remains were recovered during flotation.

At about the same time, DAS members were going through site backdirt from a recently excavated pond at the nearby Lester Lorch site (Hartig 1988) where a single shell-tempered Late Prehistoric sherd was found. In 1992, avocational archaeologists from Dallas and Fort Worth tested the Ubil site where half of a U-shaped pit had been found exposed in the bank of Artesian Creek in the Camp Wisdom Boy Scout camp. Mussel shells and deer bones were found along with a campsite assemblage. Six pieces of Nocona Plain pottery and an Alba arrow point were recovered. Two radiocarbon dates from the bisected pit are 950±60 BP (Beta 200411) and 980±110 BP (Beta 200412). The pottery, point, and dates may indicate occupation contemporaneous with Cobb-Pool but no evidence of corn was found in the flotation samples and the site is situated on the creek bank in the center of a narrow floodplain, a setting where houses would not be built even though a deep storage or cooking pit was present (Skinner et al. 2007).

Subsequent investigations further south along Hollings Branch reported small prehistoric campsites that were situated on low benches out of the creek floodplain (Skinner 1998). Fire-cracked rock, lithic debris, and fragmentary faunal remains were noted but the sites were not massive like Baggett Branch or Cobb-Pool and they remain undated.

The following discussion describes sites where Caddo trade goods and evidence of agriculture might have been discovered in the Metroplex. Over the past fifty years, avocational archaeologists have reported finding pieces of Caddo pottery at sites along the East Fork of the Trinity. The most comprehensive report of this work is a recent monograph by Wilson W. Crook, III and Mark D. Hughston (2015). Crook stated that he does not believe that the East Fork sites are Caddo (Ellis et al. 2015). On the western side of the Metroplex, the late Homer Norris of Aledo reported finding sites in Parker County along the upper West Fork of the Trinity (Todd et al. 2009). At the Bell Camp and Railroad sites, Norris recovered Weches Fingernail Impressed, Davis Incised, Crockett Curvilinear Incised, Pennington Punctated-Incised, and fingernail and cane punctated sherds along with Alba arrow points, animal bones, and fire-reddened limestone in apparent hunting/gathering sites (Perttula 2020:26-27). Perttula concludes that the vessels and their contents were likely traded/exchanged between the Caddo and the local South Fork aboriginal peoples, probably for bison products and lithic raw materials.

Numerous CRM studies in the DFW area have reported the presence of Caddo ceramics from sites but none of the assemblages included an abundance of maize associated with Alba or Bonham arrow points, posthole patterns, or other evidence of houses. Probably the most thorough analysis and discussion of Caddo presence from a single site in the surrounding area is in the report on site 41COL172 (McKee 2010). The ceramic sample is not large but several sherds were typed as Pennington Punctate. The author concludes that "the few Caddo artifacts that were identified were interpreted as trade items and not as evidence for Caddo people moving into the region" (McKee 2010:192).

The concept of the Prairie Caddo was proposed by Harry Shafer (2006:1), who posited that the material culture of the Blackland Prairie people is distinctive and can be distinguished from contemporary assemblages in adjacent geographic regions. Dallas County is included in an area Shafer (2006:Figure 1) describes as the Northern Prairie Caddo, but this northern area is not his focus. The key connection to the Prairie Caddo is the shared relationship of the South Prairie Caddo sites and the George C. Davis site in Cherokee County (Newell and Krieger 1949; Story 2000). The relationship is based on a series of distinctive artifacts that include metapodial beaming tools, bone sprinter needles, early Caddo pottery, Bonham-Alba arrow points, and Gahagan bifaces. Shafer (2006:4, 40-42) argues that Gahagan bifaces were manufactured at sites located along the Balcones Escarpment edge of the Central Texas Prairies. Many Bonham-Alba points were made of the same chert resources (Shafer 2006:41). Beamers he argues were particularly Caddoan, so the conclusion is that the people of the prairie were Caddo. Furthermore, this exchange model is based on the lithic artifacts at George C. Davis being tribute from the prairie folk and maybe the results of feasting and other exchange activities. As a result of excavation at the J. B. White site in Milam County, Ross Fields (2017) argues that the residents were not Caddos but were hunters/gatherers, and that they did not provide tribute or labor for the ceremonial center at George C. Davis, rather their chipped stone tools were obtained by the east Texas Caddo during hunting and/or trading trips made to the west of their homeland.

In summary, the Cobb-Pool site is clearly a unique Late Prehistoric Caddo farmstead located in a sea of hunting/gathering camps within the DFW Metroplex. Does the site represent an attempt by a Caddo group to expand into the Great Plains (Bellwood 2005:247, 250) with maize being the driving force? There are numerous pieces of Caddo pottery at prehistoric sites in the surrounding area (Ellis et al. 2015) and in the prairies and cross-timbers to the west and south, but I agree with Ross Fields that these sites are probably not Caddo but were campsites occupied by Metroplex hunters/gatherers who acquired pottery from the Caddo. Acquisition may have occurred when Caddo groups were traveling west to hunt buffalo or were trading for knappable chert with the prairie people who had access to upland gravel sources (Byrd 1971; McGregor 1995). Whatever the case, the Cobb-Pool site is different from the campsites of prairie hunters/gatherers based on the presence of posthole patterns that confirm the presence of houses not reported anywhere else in the area. Furthermore, Caddo pottery is abundant at the site and maize was a common plant found in flotation samples but not at other sites where flotation had been carried out.

So how and why did the Caddo come to settle at Cobb-Pool site and how did they know that maize would grow there? Had they passed through the Mountain Creek valley in conjunction with hunting or trading activities and recognized a particular soil or a suite of plants they recognized as likely to facilitate maize cultivation? It is incumbent upon investigators working in the Prairie Caddo area described by Shafer to be on the lookout for sites that match the conditions encountered at Cobb-Pool. Furthermore, petrographic and Instrumental Neutron Activation analyses of ceramic sherds could determine if they were made locally or in East Texas. To date, no such sites have been reported but areas of fine sandy loam such as Silawa are present throughout north-central Texas.

Acknowledgments

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Early Shell-tempered Pots and Corn in the Ozark Highland

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The health benefits of cooking corn (Zea mays) in a shell-tempered pot seem to be at the heart of an important innovation, and is inferred to be strong evidence of corn as an A.D. seventh-century dietary supplement if not a true staple in the Ozark Highland.

An explanation for the widespread co-occurrence of shell-tempered pots and corn (*Zea mays*) in the late prehistoric periods of eastern North America links the evolutionary adaptive fitness of this technology to corn consumption. This makes sense, given corn's prominence in late prehistoric agriculture (Smith 1989, 1992) and that a diet rich in carbohydrates (if not corn) is risky. Thus, Morse and Morse (1983:208-210) note that shell tempering increased vessel strength (see also O'Brien and Wood 1998:250-251) and liberalized shape. This made cooking more efficient due to more even heating and heat transfer, allowed for the softening of dried corn in cooking, and conferred health benefits for corn consumption by being a catalyst for B vitamin niacin that wards off the effects of pellagra. Shell-tempered pots truly were integral to but not synonymous with Mississippian period (ca. A.D. 900-1500) and later corn agriculture adaptations, principally because of the many health benefits associated with alkali processing (Osborn 1988:34-37). These range from the freeing of lysine and tryptophan bound in the gluten fraction of corn protein, improving the uptake of critical minerals such as iron and calcium, and reducing the impact of maize mycotoxins.

Corn consumption and shell-tempered pots must represent the culmination of a historical pattern. Yet, it is puzzling and contrary to expectations. In the American Midwest, corn is identified as a staple only after about A.D. 1000-1200 (Bender et al. 1981; Lynott et al. 1986). As sketched by Smith (1989, 1992, 2011), corn's sudden primacy is at variance to the gradual experimentation for native cultigens over hundreds or thousands of years in prehistoric eastern North America. The history of eastern North America cultigens squares with predictions of agriculture development as a complex agroecology of sequential coevolutionary stages (Rindos 1984); the tropical domesticate, corn, does not. Why did corn replace native cultigens with crop yields of comparable magnitude? Why does the transformation to corn agriculture occur suddenly? Was corn like tobacco or watermelon that, once available in the postcolumbian historic period, had an almost instantaneous global spread? In a similar vein, shell-tempered pots are not on the radar screen of Midwest archaeology until the Mississippian period. And then, they are a fully developed technology. An example is the American Bottom of the Mississippi River valley in western Illinois, where shell-tempered pots first show up after A.D. 1050—that is, at least 200 years after the beginnings of Mississippian developments but when corn was likely a staple (O'Brien and Wood 1998:251).

What brings us to this point, is the question I wish to address here. There are two ways to think about this, "the corn problem." One is to accept the pattern as real; the other as not. Were we to accept the pattern we could chalk it up to the amazing variety of cultural responses of complex society. Or that it is simply human nature to innovate to such a high degree. The alternative is less celebratory but, I believe, closer to the mark.

Quite apart from a viable theory of plant domestication and agriculture (Rindos 1984), we have failed to solve the corn problem. We have looked in the wrong places. We often have misconstrued and forgotten crucial evidence. And we have lacked a sufficiently intelligible climate record to compare with eastern North America prehistoric agriculture.

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We can correct these deficiencies. Not surprisingly, the data can now be shown to fit well with Rindos's evolutionary theory of agriculture and Smith's (2011; see also Weitzel and Codding 2016) chronicle of prehistoric native cultigens for eastern North America.

For reasons that will become clear shortly, I think the logical place to begin our quest is the Ozark Highland adjacent and west of the Mississippi River valley; that is, an oft overlooked area peripheral to the classic Mississippian developments of the Mississippi River valley but by no means divorced from them or their predecessors (Brown 1984). I chart the antiquity of some recent and not so recent discoveries of corn and/or shell-tempered pots in the Ozark Highland and then compare them to both a distribution of dated discoveries of corn east of the Mississippi River (Crawford et al. 1997) and decade scale or longer duration droughts of comparable or greater magnitude to those of the 1930s and 1950s for the past two millennia (Woodhouse and Overpeck 1998). In doing so, I follow the philosophy of many others who in a more detailed fashion address ceramic technological change (Braun 1983, 1987; Briggs 2016; Brown 1989; Dunnell and Feathers 1994; Lynott et al. 2000; O'Brien and Hoard 1996) in the North American Midwest as a prime adaptive response to nutritional stress, food preparation efficiency, or to sources of clay and other raw resources. I am also indebted to George Sabo III, who provided unpublished data used here and whose research at another of the principal sites is fundamental to the thesis I further develop; namely, the linkage of shell-tempered pottery to corn in eastern North America well predated the Mississippian period and first occurred beyond the major river valleys.

A Primer on Ozark Highland Shell-tempered Pots

No one source documents all shell-tempered pottery in the Ozark Highland, nor do I think it likely that any will ever be regarded as complete. The two that, in my opinion, are indispensable are by Carl H. Chapman (1980) and by Susan C. Vehik (1984). Also valuable, and often drawing heavily on one or the other or both of these works, are other compilations (Johnson and Johnson 1998:215-216; O'Brien and Wood 1998:182-270; Sabo and Early 1988:67-73), two unpublished PhD dissertations (Purrington 1970; Reeder 1988), site studies (Dickson 1991; Hilliard and Mainfort 2007; Sabo 1990b; Wood and Brock 1984), and an occasional astute observation (Schambach 1988). Last but not least, James E. Price's (in Price and Price 1984:68-100) formulation of the Varney tradition of the eastern Ozark Highland, and George Sabo III's (1990c) central Ozark Highland study provide essential, and insightful, updates.

Although the Ozark Highland is not notable for pottery, shell-tempered pot sherds are fairly widespread. They present a number of interpretative problems. They often occur in mixed or compressed contexts, rarely are complete enough to be described as vessels, or are in an understood or dated stratigraphy. But regardless of vessel form, surface treatment, or decoration, the biggest problem is the attitude summarized by O'Brien and Wood (1998:246): "When shell-tempered pottery is found, say, in the Ozarks, the usual interpretation *is* that it was traded into the region or, more commonly, that 'Mississippian' peoples brought it with them when they visited or settled in the region" (emphasis in the original). They further observe correctly, however, that "shell tempering was in no way a predictor that a group was on an evolutionary pathway toward becoming 'Mississippian'" (O'Brien and Wood 1998:252), while noting the incorrectness that "if a sherd was shell-tempered, then it had to be Mississippian" (O'Brien and Wood 1998:243).

A strong candidate for "Ground Zero" for shell-tempered pots must be the Middle Woodland period Cooper complex on the Ozark Highland's southwest flank. This shell-tempering technology was described for Delaware County of northeast Oklahoma in the early 1950s by David A. Baerreis (1953), and later for the Delaware A ceramics that preceded it and Delaware B pottery that followed (Purrington 1970:274). According to Purrington (1970:272-283), a major difference between Cooper and Delaware ceramics is the former are decorated and the later are either plain or cord-marked. They often share a similar paste having grit-shell tempering. The Cooper complex has not been directly radiocarbon dated. Its ceramics, however, are dated in north central Oklahoma (Vehik 1984:177-187). An age range of A.D. 100-450 is reasonable for Cooper. Chapman (1980:23) and Vehik (1984:177) depict Cooper geography differently (Figure 1). Shell tempering is discussed only by Vehik who, not surprisingly, better represents its distribution to northeast Oklahoma. To this, one should add Albertson in contiguous northwest Arkansas (Figure 1*a*), where the complex's distinctive shell-tempered ceramics have more recently been discovered in sealed, stratified but undated deposits in this rock shelter in Benton County, Arkansas (Dickson 1991:112-115). Cooper is in the northern tributaries of the Arkansas River. Later, this area was dominated by agrarian, civic-ceremonial centers at Harlan, Norman, and Spiro (Brown et al. 1978; Griffin 1967). It was only then—during the last millennium—that corn became a staple in the Arkansas River basin.

Baerreis's descriptions are notable in several respects. They explicitly document shell-tempered ceramics and define this technology to well-established pottery styles. Cooper ceramics unequivocally show shell tempering is part of the overall Middle Woodland technology and continues into the Late Woodland. Baerreis also identified other carbonate tempers in addition to shell. For Cowskin Dentate Stamped, one of his types, the temper consists of abundant grit with pieces of chert often 5 mm in diameter, plus crushed limestone, bone and shell. That shell is just one of several carbonate tempers mirrors Fourche Maline ceramic experimentation about the same time in the Ouachita Mountains south of the Arkansas River valley (Purrington 1970:275; Schambach 1988:7). Either Fourche Maline and/or Cooper could qualify as the point(s) of origin for the bone-tempered Middle Woodland "Marksville" ceramics of the Alexander site of central Arkansas (Hemmings 1985:36-37). Alexander is downstream in the Arkansas River valley from Cooper (Figure 1*a*), which might have facilitated movement of this technology or the idea, and is closer to Cooper than to the nearest Mississippi River valley Marksville manifestation (Figure 1*b*). Marksville is not known for bone tempering (Sabo and Early 1988:79). The illustrated Alexander sherds are truly generic Middle Woodland rather than clearly identifiable as Marksville (R. Mainfort, personal communication, February, 2001).

Cooper and Delaware pots start a ceramic technology centering on shell tempering and that continued in "all but seamless" (Schambach 1993:220) ways later on. This transition to shell tempering was well in place by A.D. 600 in the Arkansas River valley, its tributaries, and farther into the interiors of the Ozark Highland. Delaware plain and cord-marked pottery would be virtually indistinguishable from other Ozark Highland wares typical of the Late Woodland period. There is no consensus on what to call this pottery, which is largely plain or with a cord-marked surface treatment. Nor has it been systematically characterized by petrographic and trace element evaluations. In Missouri, Maramec Plain or Maramec Cord-marked now commonly refer to predominantly limestone-tempered wares in the Ozark Highland; Weaver, to grit-tempered pottery north of the Missouri River or in western or southwestern Missouri (O'Brien and Wood 1998:241). For reasons of geography alone, other designations (Boone, Moreau, etc.) occur too. Shell tempering occurs as well in Maramec (Reeder 1988) and Cooper (Baerreis 1953) ceramics related to Weaver. In the Arkansas River valley and its tributaries in Oklahoma and Arkansas, and in the interior Ozark Highland in central Arkansas, a similar shell-tempered plain ware occasionally represented by flat-bottomed vessels is called Woodward (Freeman and Buck 1959). The southeastern Ozark Highland area of Missouri and Arkansas has a different shell-tempered technology, Varney, that includes red slipped interior surfaces and that seems to be the age-equivalent of Maramec wares (see O'Brien and Wood 1998:256). Shell-tempered Owls Bend pottery also occurs in the Varney area but is distinct from it (Lynott 1989; Price and Price 1984). Owls Bend may have parallels in the Ozark Highland interior too (Sabo 1990c:320-321).

The Early Shell-tempered Pottery and Corn Connection

Shell-tempered pottery in the western and central Ozark Highland is associated with corn, or is present at the same time as corn likely occurs. According to largely consistent radiocarbon dating, the four earliest (and thus, most critical) archaeological sites (Figure 1*a*) go roughly north to south across the Springfield Plateau or its border with the Salem Plateau: Bowling Stone Mound (23CE152) in Cedar County, Missouri; Beech Creek Shelter (3NW637) and Ira Spradley (3NW101) in Newton County, Arkansas; and Dirst (3MR80) in

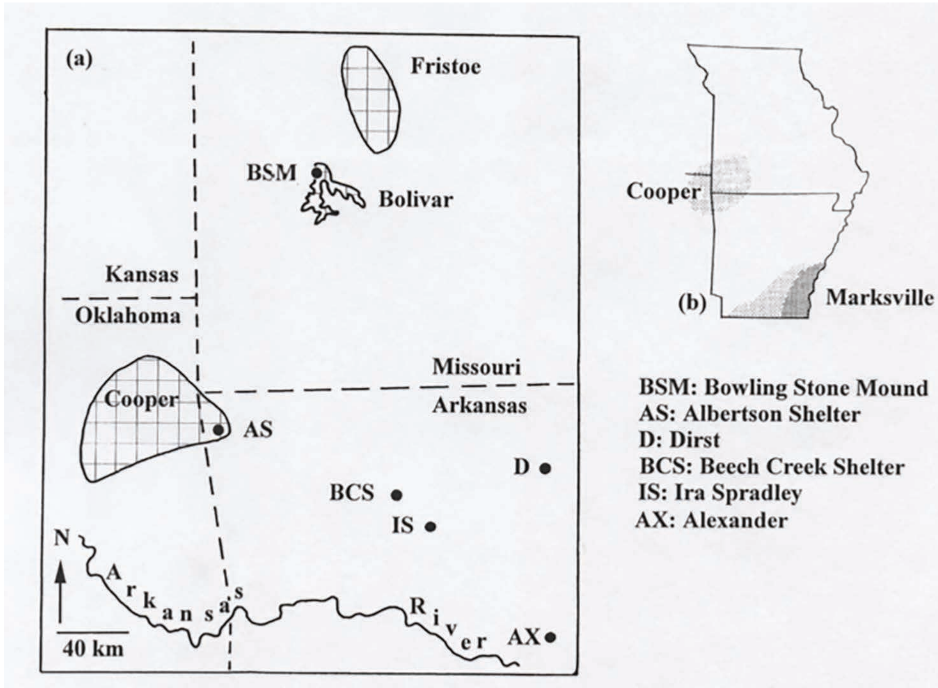

Figure 1. Principal archaeological sites and complexes discussed for the western and central Ozark Highland; *a*, Cooper complex shell tempered pottery distribution is adapted from Vehik (1984) and Dickson (1991), and *b*, Cooper and Marksville complexes are adapted from Chapman (1980).

Marion County, Arkansas. These four sites are on (or well above) widely separated creeks or small rivers that flow in different directions within the Osage, White, and Arkansas drainage basins. Undoubtedly, we are not talking about a single group but rather a general adaptation to highland streams and landscapes.

I briefly describe the associations of shell-tempered pots or corn, and their five radiocarbon assays (Table 1). In terms of the history of radiocarbon dating (Taylor 2000) the Bowling Stone Mound assay (Wood and Brock 1984:118) came before the recognition of the C3, C4 photosynthetic pathways and the need for isotopic fractionation. Fortunately, it and the other charcoal samples all follow the C3 pathways. These were directly compared, once calibrated, to determine if they are statistically the same age (Long and Rippeteau 1974). Bowling Stone Mound and Dirst (Sabo 1990a:136-137) assays employed conventional beta counting; the two from Beech Creek Shelter and Ira Spradley, atomic mass spectrometry (AMS). None dates corn directly. The assays range in radiocarbon years from 1560±140 BP (M-1967) to 1250±60 BP (Beta-123306). The calibrated assays were evaluated using Stuiver and Reimer's (1993) calibration program 4.1.2. (This calibration program has been updated almost annually but the updates do not affect the calibrations reported here.) The t-test of sample means showed no statistically significant differences among them at the 95% (0.05) level of confidence interval. This means they are statistically the same age and calculating a weighted average for the five is appropriate. At the two sigma (95.4%) range, the calibrated weighted average of the five samples is cal A.D. 611-716 with 96.9% of the relative area under the probability distribution, cal A.D. 750-763 with 3.1% of the relative area under the probability distribution. For all practical purposes, the most likely age of all four sites falls within cal A.D. 611-716, during the seventh century A.D. Of the Arkansas sites, Ira Spradley and Dirst have shell-tempered pots. Dirst's pottery is directly associated with charred corn. Beech Creek Shelter has unburnt corncobs but no pottery. When applied to the corn, Beech Creek Shelter's date could be questioned but, I think, is still likely.

Bowling Stone Mound had charred maize kernels and a shell-tempered pot. The mound overlooks the Sac River and a tributary, Hawker's Branch. Sac River is a southern arm of the Osage River basin that empties into the Missouri River. The mound is

Table 1. Radiocarbon dates.

Site*	C3 Material	Assay	Radiocarbon Age BP	Calibrated 2δ Age(s)	Relative Area Under Probability Distribution
BSM	nutshell	M-197	1560±140	cal A.D. 139-159	0.009
				cal A.D. 170-197	0.013
				cal A.D. 206-714	0.969
IS	burnt residue	Beta-12330	1250±60	cal A.D. 660-896	0.988
				cal A.D. 927-938	0.012
D	charcoal	Beta-33079	1670±210	142-139 cal B.C.	0.002
				113 cal B.C. - cal A.D. 775	0.998
D	nutshell	Beta-33080	1450±80	cal A.D. 425-713	0.991
				cal A.D. 751-760	0.009
BCS	cordage	AA-9768	1370±50	cal A.D. 597-772	1.000
		Wt. Average	1365±34	cal A.D. 611-716	0.969
				cal A.D. 750-763	0.031

* BSM: Bowling Stone Mound; IS: Ira Spradley; D: Dirst; BCS: Beech Creek Shelter.

part of the Bolivar burial complex (Wood and Brock 1984:35-41, 118). Brock regarded corn consumption as a food supplement for the burial complex as a whole (in Murray and Rose 1995:129), but one which had health consequences for the population. Compared to the largely non-corn-consuming population of the nearby Fristoe burial complex, the rate of carious teeth was 2.6% for Fristoe and 12.5% for Bolivar, dental abscesses 0% for Fristoe and 2.2% for Bolivar, periodontal disease going from 60% for Fristoe to 82% for Bolivar, and a lower survivorship among the maize-eating subadults of the Bolivar complex. The seven individuals from Bowling Stone Mound, however, are not well represented by skeletal elements likely to show pathology (only 8 teeth, of which 7 came from a single adolescent, were recovered). Bolivar burial complex radiocarbon assays date mostly to the A.D. 900 to 1200 range (Wood and Brock 1984:118-119), and include one on maize kernels. (The latter should be reevaluated, in my opinion, because it came before recognition of the C3, C4 photosynthetic pathways.) Wood and Brock (1984:118) regarded the much earlier Bowling Stone Mound assay as problematic: "The [uncalibrated] date of A.D. 250 to 530 from Bowling Stone seems to be too early, especially if the shell-tempered pottery there is not intrusive."

I see no reason to reject the Bowling Spring Mound assay, even though its exact association is unclear. This assay is on charred nut hulls (i.e., a collected annual C3 mast product, and an excellent material for conventional radiocarbon dating). Charred walnut hulls and three corn kernels were "among the bones" of burial 1a/1b in the central burial area (Wood and Brock 1984:37). Other "[s]mall pockets and individual finds of charred maize kernels and hickory shells were common enough that it is probable that the sample recovered (about two ounces) is only a small percentage of the amount originally placed in the structure" (Wood and Brock 1984:41). From this description, it seems the charred nut radiocarbon sample was not associated with any particular interment but did occur with corn deliberately grown for human consumption. All of the Bowling Stone Mound pottery came from a single concentration adjacent to burial 1a/1b in the northwest-central portion of the mound. Undoubtedly, it would not qualify as a concentration were it not for 314 limestone-tempered body sherds from two limestone tempered vessels. This concentration was affected by a "gopher pit" that "probably accomplished little more than to displace some of the sherds in the concentration of pottery in the fill overlying [a bedrock] crevice" (Wood and Brock 1984:35). The shell-tempered cord-marked pottery consists of a single small rim sherd. This "obliquely cord-roughened sherd is 4 mm thick, has a rounded lip, and bears partly smoothed, parallel, vertical Z-twisted cord impressions" (Wood and Brock 1984:38). It is the only clearly cord-marked vessel of the four recovered and has the thinnest rim. Rim thickness varies from 6 to 8 mm for the two limestone-tempered vessels that also have rounded lips. The actual number of rim sherds for each of the vessels is small. The two limestone-tempered vessels had a total of five rim sherds. A grog-tempered vessel had four body sherds but no rim sherds. So, the single shell-tempered rim sherd is not inconsistent with rim sherd representation in the concentration.

To sum up, the mound appears to represent a single burial event or related ones over a short time span. The pottery, including the shell-tempered rim sherd, is not randomly distributed but was found near a central burial feature. The assay is on nut hulls directly associated with corn, although the exact location is not specified. The only ostensible strange thing about the Bowling Stone Mound assay, as noted originally by Wood, is its age; not its integrity or association with corn or the shell-tempered sherd. In light of more recent discoveries and this reevaluation, the age of the assay seems consistent with both early corn and shell-tempered pottery in the Ozark Highland.

Ira Spradley is a cemetery on a low alluvial terrace of Big Piney Creek, a tributary of the Arkansas River in south central Newton County, Arkansas, and the farthest south of the sites. The cemetery has no obvious surface expression such as a mound or grave depressions. It was discovered when human bone was plowed up and then salvaged in 1970 and 1971. It is not referenced in a later bioarcheology summary (Rose et al. 1988). The unpublished field notes and report (Gregoire and Gregoire 1971) indicate a minimum of five individuals was interred, although the actual number could be as many or more than 30. Dietary insights from "the limited [dental] caries data from the Ira Spradley Field cemetery…are consistent with a nonmaize diet" (Hilliard and Mainfort 2007:281). A site map of the excavations, labeled 1971, shows the human skeletons include 12 skulls along with a variety of chipped stone tools and 23 shell-tempered pots (two other vessels may have had crushed limestone tempering; see Hilliard and Mainfort 2007). The discrepancy in the number of individuals represented does not materially change the implications for shell-tempered pots. According to the Gregoires' notes and subsequent formal description of Hilliard and Mainfort (2007), the vessels are mostly plain, and lack decoration (one rim has V-shaped notches, another close-spaced punctations, and two vessels have loop handles). They include flat bottoms occasionally with basketry impressions and hemispherical forms with out-flaring rims, and have wall thicknesses of 6 to 7 mm. These vessels are different from the later "standard" Mississippian globular jars that were designed to cook corn hominy and that difference in vessel form has functional implication for cooking vessel technology (see Briggs 2016). A carbonized residue on the interior of one nearly complete pot was submitted in 1998 for AMS radiocarbon dating. The assay (Table 1) provides our most conclusive evidence of the antiquity of shell-tempered pots in the south central Ozark Highland.

Dirst, on an alluvial terrace at the junction of Rush Creek with Buffalo River, is the farthest east of the four sites and is upstream of the junction of the (lower) Buffalo and White River. Dirst is a stratified, multi-component site. It begins with a late glacial Dalton component. It ends with an "apparent lack of evidence for a continuation of occupation into Middle or Late Mississippian times," although other habitations of these sorts are noted in the Rush Creek vicinity (Sabo 1990b:267). So there seems not to be a later source of shell-tempered pottery and corn that somehow might have been mixed into earlier sediments. The Stratum 5 midden contains shell-tempered along with grog, grog and bone, and bone and shell-tempered pottery. Most important is Feature 4, a large pit that originates in Stratum 5. Feature 4 contents included Scallorn arrow points (recovered at Bowling Stone Mound too) and Rice Side Notched dart points, shell-tempered Woodward Plain pottery plus two fired pottery coils, and a "layer of stacked mussel shells accompanied by a couple of handfuls of river snail shells" (Sabo 1990b:264). Although low in seed density, Feature 4 had representatives of the native Eastern North American starchy seed crop complex (Fritz 1990:170-173). Most dominant is little barley; also present is maygrass, knotweed, and sumpweed. The majority (all but two cupule fragments) of corn came from Feature 4 too and includes four whole cupules, 20 cupule fragments, seven glumes, one nearly whole kernel and two possible kernel fragments, and a possible embryo fragment (Fritz 1990:169).

This is actually not just impressive for the Dirst site but, according to Fritz (1990:170), is already more than "the total of four cupules from rich middens on Mounds B, D, and E at the Toltec Mounds site." Toltec, the premiere mound center in the Arkansas River valley near Little Rock, was subjected to a flotation recovery system comparable to the one at Dirst. Toltec is identified to Plum Bayou (Coles Creek) culture (Rolingson 1985). It is roughly the same or younger in age than Dirst. About 80 km northwest of Toltec is a second Arkansas River valley Plum Bayou example, the previously mentioned Alexander site. Systematic excavation and flotation recovery at Alexander produced but a single corn cupule from what may be but is not unequivocally a Plum Bayou midden (King 1985). The midden remains also contained hickory nutshell, black walnut, maygrass, goosefoot, knotweed, wood sorrel and purslane, plus a seed of domesticated sumpweed and rind of squash and gourd. Neither differential preservation nor recovery can account for the under-representation of corn at Toltec and Alexander. There does not appear to be nearly the focus on corn in the Arkansas River valley as there is along the Buffalo River at Dirst.

Feature 4 radiocarbon sample selection deliberately dealt in, I think, a highly appropriate strategy to evaluate possible admixtures of botanical materials (Sabo 1990a:136-137). The two samples came from pit fill and allowed for a direct comparison of "two completely different materials—nutshell and wood charcoal." Had the assays been discordant, a likely explanation would have been pit filling from sediments earlier than Stratum 5. The two assays, however, are not different statistically, and seem to date in an appropriate manner the Rice Side Notched points common to both the Stratum 5 midden and Feature 4. The implication is the dates are reasonable for the corn and shell-tempered pottery too.

Beech Creek Shelter had a single desiccated interment, who was carried into the shelter in a large burden basket of woven split cane. Although the subject of a notable textile study (Kuttruff 1988, 1993), the site and circumstances surrounding the discovery have not been written up, even in a cursory fashion, until now. The site was discovered in 1987 by Newton County locals. They first dug up the body along with pieces of the basket, a variety of textiles, corn cobs, and large fragments of gourd rind. Afterwards, they redeposited the body and many of the textiles in the original burial pit and covered it up. They then told others who eventually contacted Michael P. Hoffman of the University of Arkansas Department of Anthropology, Robert Lafferty, another professional archaeologist, and me, and provided most if not all of the materials originally taken. Hoffman's trip to the shelter in late spring recovered artifacts and additional human remains. I went back in the fall with some student volunteers. We mapped the shelter, re-excavated the grave, and retrieved all materials from the back dirt of the original finders. Among the materials left in their back dirt were corn cobs. In our examination of the grave, we found still in place additional human bones and tissue, pieces of the basket, and other textiles. We did not remove any corn cobs other than those in the back dirt. I suspect the cobs were with the burial originally. Later, the shelter was completely gutted. I visited it shortly thereafter and as best as I could tell nothing else was found. So, I think the site was primarily if not exclusively a repository for the dead.

The burial pit was dug into decomposed shale within a natural enclosure of sandstone roof fall slabs. The remarkable state of preservation for the body, basketry, other textiles, and unburnt plant remains is due to the dry conditions of the sandstone shelter. Only along the back wall and well away from the burial pit is there a seep, where gypsum has crystallized. The site overlooks the (upper) Buffalo River and is high on a sidewall of Beech Creek valley. Access to the shelter is difficult under the best of circumstances, as one either goes down a sheer bluff or up a rubble-strewn slope from the valley floor. I think the burial party came from below, because water and sufficient arable land are mainly available there. This difficult route requires a vertical climb of about 250 meters.

The body was partially examined to estimate age, sex, and pathologies (Mulvihill 1988). The interment is that of a young woman about 17 to 19 years old. Her left tibia had a healing osteomyelitis and is 1.5 cm longer than the right tibia. She may have walked with a noticeable limp. Only the teeth of the left maxilla and mandible could be examined. They showed no calculus, caries or abscesses.

Tim Mulvihill and I sampled cordage still adhering to the body for AMS radiocarbon dating in September 1992, over a year and a half after Kuttruff

(1993) had submitted her *American Antiquity* textile article for publication. The cordage provided a conclusive association, as opposed to extraneous materials probably related to the interment but not demonstrably so. This excluded the corncobs, of course.

The assay was received in May 1993, well after Kuttruff's publication and had no bearing on her attributing the textiles as Caddoan. The embedded cordage and cordage impressions are similar to, if not actually identical to, ones detached from the body. Kuttruff (1988:204) identified the latter as naturally colored, finely shredded structural vegetal fibers (stems/leaves) spun into 2-ply yarns and having a balanced twill oblique interlacing structure. Her description of textile vegetal fibers (Kuttruff 1988:128-137) mentions corn shucks from the Ozarks but none identified by her. It seems unlikely that any were in the Beech Creek shelter textiles. (One published example is from Montgomery Shelter in Barry County, Missouri [Scholtz 1975:23].) While it has obvious implications for Kuttruff's (incorrect) Mississippian period age assignment, the assay simply had no bearing on her analysis or revisions to her *American Antiquity* article. Everyone (me included) involved with the Beech Creek Shelter study accepted the conventional wisdom that corn was cultivated during the Mississippian period, because unequivocal evidence existed for the Buffalo River (Lafferty et al. 1988), the larger White River watershed (Sabo and Early 1988:99-101), and the western and central Ozark Highland (Fritz 1986). And the burial probably was Mississippian period too, in keeping with Kuttruff's (1993) published assessment.

We now know the burial significantly pre-dates the Mississippian period while demonstrating technological continuity with later Caddoan textile production. If nothing else, Beech Creek Shelter affords a second glimpse at Buffalo River adaptations far better illuminated at Dirst. It serves too as a caveat to blindly accepting a preconceived notion. Trust but verify is clearly the operative strategy. Until direct AMS dating is done, we must remain less confident about the antiquity of Beech Creek Shelter corn. In light of the Beech Creek Shelter assay, we must question too the "Mississippian period" designation (Sabo and Early 1988:83, 101) of other nearby sites such as the aptly named Cobb Cave or 3NW539 that have corn and/or shell-tempered pottery.

Corn, a Seventh-Century Staple?

Did growing corn as a staple occur as early as the seventh century? Assuming our chronology is correct, then the answer, I think, is an unequivocal yes. Our direct evidence stems from the nature of our archaeological sites and what they tell us about the Native perception of plant crops.

Our archaeological sites containing corn and shell-tempered pots are of two general types, mortuaries and habitations. Although I suspect the parallels apply to Beech Creek Shelter and Ira Spradley too, we may think of Bowling Stone Mound and Dirst as providing the crucial insights about corn as a dietary supplement if not a true staple. At Dirst, the corn remains are a by-product of intentional disposal, or trash. The evidence we have is that of a (presumably shell-tempered) pot burnt and ruined in the process of cooking corn that was disposed of in a subterranean trash pit. Under such conditions the health benefits derived from cooking corn in a shell-tempered pot seem to be at the heart of an important innovation. What is significant about Dirst is just how commonplace corn and shell-tempered pottery seem to have been. The implication is corn and a shell-tempered ceramic cooking technology was the norm. Neither would have surprised the users as anything beyond the expected, nor should they surprise us. Assuming Dirst corn was the result of everyday cooking, it was both commonplace and profane.

Bowling Stone Mound presents a different but complementary signal of corn as a staple. The corn was deliberately burnt and placed in this mortuary facility as part of a funerary ritual. This act is laden with symbolic meaning about life and death, the sacred and profane. Bowling Stone Mound corn stands in structural opposition to Dirst. Bowling Stone Mound corn was as likely a metaphor for the sacred, a chosen food offering for and—by burning—of the dead. In metaphor, Bowling Stone Mound signals corn to have been the staff of life, a staple.

Connecting the Dots

There are claims (Fearn and Liu 1995, 1997; see also summary in Crawford et al. 1997:112) and counterclaims (Eubanks 1997) for early corn pollen, but the least ambiguous if not best evidence is direct AMS dating of corn macrofossils in eastern North America. The earliest of these is from the Holding site in the American Bottom of the Mississippi River valley in west Illinois, where two AMS assays are reported at the one sigma range (Riley et al. 1994:493-494): 50 cal B.C. - cal A.D. 60 (AA-8718, a corn kernel) and 170 cal B.C. - cal A.D. 10 (AA-8717, a corncob). The two sigma calibrations of these assays is just slightly greater (see Crawford et al. 1997:114-115); and the inescapable conclusion is Holding site corn is about 2000 years old. Slightly younger AMS assays on corn macrofossils come from Tennessee, Ohio, and southwestern Ontario (Crawford et al. 1997). These put corn in eastern North America no later than A.D. 100, and with a widespread distribution east of the Mississippi River by A.D. 500.

Drought exceeding the magnitude of the 1930s was more concentrated from A.D. 250 to 450 and from A.D. 700 to 900 (Woodhouse and Overpeck 1998). So it appears initial corn growing preceded an extended drought period. Its spread in eastern North America came during the A.D. 250 to 450 drought period. Since Griffin's (1967) summary, North American archaeologists regard this time as the late and terminal parts of the Middle Woodland period, and the Hopewell culture climax. The subsequent seventh-century (or Late Woodland period) innovations in shell-tempered pottery cooking technology in the Ozark Highland occurred when pervasive drought was likely to be neither long-term nor as extensive. Or what might have been truly a low-risk period in which to innovate, or experiment, coming just before the A.D. 700 to 900 droughts.

From this perspective, our Ozark Highland data fit a much broader pattern of experimentation with corn, if not growing it as a staple. This "experimental stage" spans about a thousand years prior to the Mississippian period. The antiquity of Ozark Highland corn is, thus, not nearly so novel as its connection to shell-tempered pottery. We should further consider the implications for corn becoming economically viable in the Ozark Highland well before the Mississippian period. Arguably what compelled widespread corn agriculture and its elevation as a first-line staple was the independent and longer-term experimentation with carbonate-tempered cooking pots. It became possible to prepare and consume corn in quantity only with the advent of a predictably reliable cooking technology, not the other way around (Braun 1983). Absent innovations in ceramic cooking pots afforded most eloquently by carbonate-tempered pastes (and increasingly, using shell), it would have been impractical to heat corn to the point of gelatinization and, thereby, freeing most of its nutrients. But with the trial-and-error experimentation in ceramic cooking technology over much of the Woodland period, corn became transformed from a mere food supplement to a primary staple in the emergent Mississippian world.

For Ozark Highland people, the most crucial concerns for settlement and agriculture would have been the seasonal availability of water and the likelihood of catastrophic floods. Precipitation is likely throughout the year, although drought is common. Late spring through summer often witnesses the drying up of streams, other than where artesian springs feed them. Flash floods occur often too and rarely have more than short-term effects. Less frequent is a valley-wide flood. In December 1982, the Buffalo River at the Dirst site was over 9 m above its level measured that September, representing the historic high (Guccione 1990:84). Floods of this magnitude are clearly the exception to the rule, whether on the Buffalo River or another stream. Even so, flooding need not have been life threatening, as it is a simple matter to move oneself or an encampment higher up slope to avoid the immediate effects. More lasting is a flood that ruins a crop or destroys a farm field, as opposed to enriching them with additions of organic silt. The greater the flood, the more likely is disaster.

For agriculture to have succeeded, the so typical Ozark Highland pattern of annually recurring floods and drought-related water scarcity late in the growing season must have been offset in some way, or ways. At present, we do not have convincing evidence of water divergence and storage facilities, now recognized in the American Southwest (Bayman et al. 1997; Huckleberry and Billman 1998; Wilshusen et al. 1997), although we certainly cannot rule them out. Applying passive water-management models of prehistoric agriculture from the arid and semi-arid regions of the American Southwest to the Ozark Highland may seem like a stretch, however. But it is justified, I think, because the upland landscape is often an exceedingly dry one and is especially so during the growing season. As Schoolcraft observed on an 1818-1819 trip through the White River country (Park

1955:106), once one leaves the mainstream valleys and goes into the headwaters, the picture of the Ozark Highland rapidly changes to a semi-arid, dendritic mosaic of intermittent, ephemeral tributaries. These carve out narrow valleys in a karst-controlled landscape. Many streams have no surface flow for much of the year but support cave waterways and often spectacular artesian springs. The submerged river Dry Hollow and its alter ego Roaring River in southern Missouri near Cassville starkly show the contrasts afforded by one karst stream system.

The trick of farming corn as a prime crop would have been to balance field management costs against water scarcity or, conversely, catastrophic floods. Drought-related water scarcity would have been predictable seasonally. It could have been offset by smaller costs of water catchment systems such as check dam divergences of an intermittent stream than the larger expenditures of accomplishing the same thing but on a grander scale in the larger stream valleys. Similar weighing the potential loss of a farm field and its settlement to a flood would be less, if only because the scale of an intermittent stream valley is substantially less than the mainstream valley it drains into. Doing so would have made the upland Ozark Highland small tributary valley setting preferable initially to flood risks associated with the major trunk stream valleys. Mastery of the uplands would have been less costly and allowed time to learn how to farm the larger stream valleys. The latter would have been a structural transformation of agrarian society. And contingent on mastery of alluvial valley landscapes by substantially larger populations, which we now can estimate in this region as significantly increasing in size late in the Woodland and subsequent Mississippian periods (Weitzel and Codding 2016).

The Ozark Highland affords other natural opportunities to garden along its many ephemeral streams, to say nothing about the main rivers. In most instances, flood-borne organic silt would renew small valley bottoms. Or, in the event flooding incised a new channel or dumped gravel onto a field, one could relocate nearby to a similar location not so affected. Of interest would be the floodplain below where an artesian spring wells up and creates a pool in a stream bed. Almost every Ozark Highland stream of any consequence is spring-fed to some extent. A spring's presence is easily seen when the rest of the stream dries up. It would not take much to target spring-fed pools, and to use them as a water source during drought for settlement and small-scale agriculture. This knowledge would have made some alluvial lands along most Ozark Highland waterways a potential garden spot that could withstand a growing season drought. These locations dot the highlands and could have supported a widespread corn agriculture prior to the Mississippian period. The pattern that selected small garden areas as often away from a major stream as near one would have required a family-sized group for gardening. Such an approach seems to best suit the Ozark Highland landscape and would have been less labor intensive and risky as farming the flood plain of a major river such as the Arkansas, the Missouri, or the Mississippi. Mississippian period corn agriculture in the major river valleys could not have been more different in its scale, labor needs, and risks. Viewed this way, a fundamental structural transformation of the Mississippian period was transferring highland corn agriculture and shell-tempered pot cooking technology to the riverine setting, thereby creating a new niche.

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Current Research:
Index of Texas Archaeology Ceramic Comparative Collection

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The Index of Texas Archaeology (ITA) (https://scholarworks.sfasu.edu/ita/) was developed by the Heritage Research Center at Stephen F. Austin State University (SFASU) (Figure 1) (Bousman and Selden 2018; Selden and Bousman 2017). ITA was built using the Berkeley Electronic Press (bepress) platform, is part of SFASU's institutional repository, and is a digital repository that aggregates, distributes, and indexes scarce, limited-production, and digital archaeological works related to the State of Texas and adjacent regions, much of which was produced through publicly-funded projects. ITA also includes full runs of the *Journal of Texas Archeology and History*, *Journal of Northeast Texas Archaeology*, and the *Caddo Archeology Journal*. Volumes are organized by year, currently ranging from 1967 to 2020, and are indexed by Google, Google Scholar, Altmetric, Dimensions, Creative Commons, PlumX, and Crossref. The bepress platform also allows users to set up personalized email notices based upon their interests, which will generate an email when a new publication is added to ITA that meets with the users' notification criteria (we recommend Caddo and Caddoan to readers of this journal).

Figure 1. Index of Texas Archaeology.

In addition to publications and reports, new ceramic comparative collections were recently added (https://scholarworks.sfasu.edu/ita/ceramic.html), and are currently being expanded. These collections include images of vessels assigned to those types initially defined by Suhm and Krieger (1954) and Suhm and Jelks (1962), and were documented in museums, repositories, personal and private collections, as well as from professional archaeological investigations across the state, most from within the southern Caddo area of East Texas (Figure 2). Metadata are included with each entry, and provide additional information related to vessel form and size, temper, surface treatment, firing conditions, vessel wall thickness, and decorative motifs and elements. Both the images and metadata can be harvested using the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH), which will return Dublin Core metadata records for each entry.

Updated type descriptions for each of the type galleries are forthcoming, and will include thick descriptions (beginning from those provided in Suhm and Krieger [1954] and Suhm and Jelks [1962]), links to citations of relevant vessel documentation and typological research, as well as additional resources. A spatial distribution for each vessel types is included in each collection, and enlists the centroid for each county rather than site locations, to comply with legislation that protects the location of archaeological

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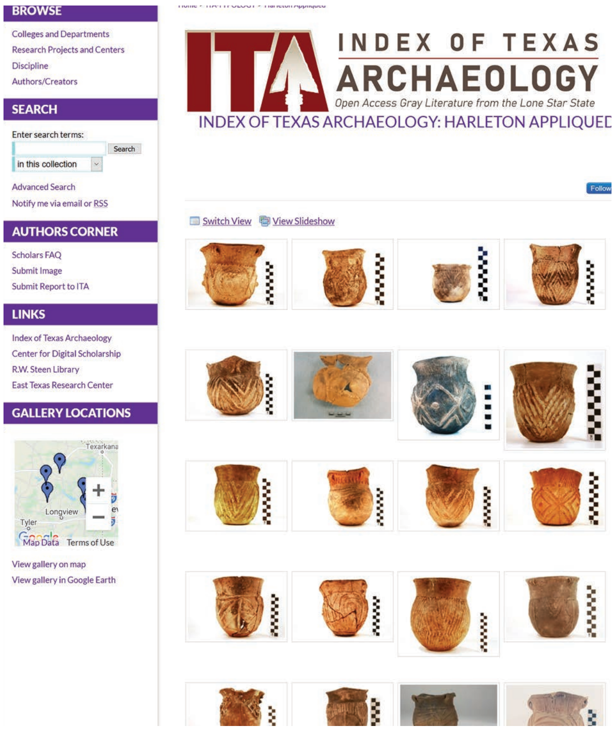

Figure 2. Ceramic comparative collection for Harleton Appliqued vessels (partial).

resources. Eventually, new age estimates will be added/updated for each of the types. Populating the collection is a significant undertaking, but one well worth the information given the significance of ancestral Caddo ceramic analysis in understanding the material culture and lifeways of Caddo groups and communities in the archaeological record (McKinnon et al. 2021). In addition to their value, these data have additional utility in developing and testing novel hypotheses (Selden 2021a), and within studies of shape, form, allometry, and asymmetry (Selden 2017, 2018a, 2018b, 2019, 2021b; Selden et al. 2014; Selden et al. 2018; Selden et al. 2020). Images of each vessel are provided at the highest resolution available, and can be downloaded at three different resolutions under a Creative Commons license (i.e., these images can be used in your own work). The largest (full-size) image is uploaded as an uncompressed TIFF, which conforms with best practices and digital curation guidelines.

Your Help is Needed

In February 2021, ITA will begin accepting submissions of vessel images and metadata to the ceramic comparative collections as one part of a large-scale citizen science project; however, the archaeological community is invited to make submissions to the collections as a beta test. In addition to 2D images, the ceramic comparative collection accommodates 3D data, and many 3D meshes have been uploaded where users can view and interact with them alongside the 2D images. Should there be an interest in uploading the 3D data only, that can be included as supplemental data (raw data + ascii STL). If uploading a photogrammetry model, OBJ and VRML files are required, and all images used to create the model should be uploaded as uncompressed TIFF images.

Acknowledgments

We express our gratitude to the Caddo Nation of Oklahoma for the requisite permissions and access needed to document these important collections. Per his (RZS) agreement with the Caddo, no texture (color) files associated with the 3D scans are included in the collections; however, all full-resolution color scan data were provided to the Caddo Nation of Oklahoma for their records. The Caddo Nation of Oklahoma also provided the necessary permissions to RZS and TKP to make the high-resolution color 2D images, as well as full-resolution color 2D screenshots of the 3D data available for all Caddo vessels that they have documented.

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Book Review:

Ouachita Mountains Archeology: Researching the Past with Two Projects in Arkansas, Mary Beth Trubitt, 2019, Arkansas Archeological Survey Popular Series No. 6, ISBN 978-1-56349-109-2.

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Oklahoma Archeological Survey

This book, written for a general audience, summarizes 10,000 years of history in the Ouachita Mountains of Arkansas. Trubitt draws upon data from Arkansas Archeological Society excavations at the Jones Mill and Dragover sites in southwest Arkansas to produce a highly readable, well-illustrated, and informative volume that introduces the non-professional reader to archaeological work. The use of text boxes to supplement the main narrative, along with a detailed glossary of key terms, allow her to present important concepts without dragging the reader into minutia.

The book opens with a brief history of the Ouachitas. This includes an overview of the archaeological, historical, and oral history sources that inform our knowledge of the area. The reader is also walked through the regional timeline starting with the Paleoindian period and concluding with a brief mention of the 20th century. Trubitt also provides brief descriptions of the Jones Mill and Dragover sites, and importantly outlines the research questions that informed her work.

The second chapter is entitled "How Do You Know It's An Artifact?" It defines what an artifact is and outlines the ways in which archaeologists use raw material, patterns of human behavior, and marks from manufacture and use to determine whether an object is an artifact or not. The chapter closes with important sections detailing how an artifact is not just important for the object itself, but that what it tells us about human behavior and the context in which it is found can be of much more importance. Subsequent chapters draw upon the data from Jones Mill and Dragover (and other sources) to introduce the reader to topics such as foodways, trade and interaction, lithics, and pottery. Trubitt presents just enough data to make her point without overwhelming the reader with tables. These chapters are very well illustrated, which complements the text nicely.

The book concludes with a brief discussion of key events in the region's history and what may lie ahead for researchers working in the area. This includes population movements, plant domestication, and studying communities. There is also a section on the development of new technology and opportunities for non-archaeologists to volunteer (which is mentioned in multiple places in this book). There is also a mention of the Caddo Conference that is accompanied by a photo of the Caddo Culture Club at the 2015 conference in Arkadelphia. If I squint at it hard enough, I can see myself way in the back!

Ouachita Mountains Archeology: Researching the Past with Two Projects in Arkansas is a masterful use of real archaeological data from local sites to explain to the lay reader the ways in which archaeology works. The copious illustrations complement the text and bring additional life to the volume. I am sorely tempted to use it the next time I teach Introduction to Archaeology, and definitely will recommend it to people who contact me to look at an object that they have found.

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Report:
The 62nd Annual Caddo Conference and 27th Annual East Texas Archeological Conference, Tyler, Texas, February 28 and 29, 2020

Thomas H. Guderjan[1], E. Cory Sills[1], C. Colleen Hanratty[1], Keith Eppich[2], Amanda Regnier[3], Christy Simmons[1], Anthony Souther[4], and Mark Walters[5]
[1]University of Texas at Tyler, [2]Tyler Junior College, [3]Oklahoma Archeological Survey,
[4]Caddo Mounds State Historic Site, [5]Texas Historical Commission Steward

The 62nd Caddo Conference and 27th East Texas Archeological Conference was held at the University Center on the campus of the University of Texas at Tyler on February 28 and 29, 2020. The conference was dedicated to the rebuilding of public facilities at Caddo Mounds State Historic Site. These facilities had been destroyed by a tornado in 2019. The conference organizers were Thomas Guderjan, Colleen Hanratty, Cory Sills, Christy Simmons (University of Texas at Tyler), Keith Eppich (Tyler Junior College), Anthony Souther (Caddo Mounds State Historic Site), Amanda Regnier (Oklahoma Archeological Survey), Mark Walters (Texas Historical Commission Steward). Sponsors included The Center for Social Science Research and Department of Social Sciences, University of Texas at Tyler, Humanities Texas, Kevin Stingley, Arkansas Archeological Survey, Beta Analytic, Inc., Friends of Northeast Texas Archeology, East Texas Archeological Society, Maya Research Program, Tejas Archeology, Tyler Junior College, Gregg County Historical Museum, the American Indian Heritage Day of Texas organization, and the Caddo Nation. Before the formal program began, a preconference gathering was held at ETX Brewing Company at 221 S Broadway Avenue in Tyler on Thursday evening, February 27th. Approximately 250 people participated in the joint conferences.

Throughout both days, Caddo artists exhibited, sold and discussed their work with the participants. The artists included: Chase Kahwinhut Earles (Ceramics, Oral), Chad Earles (Ceramics, Oral), Wayne Earles (Ceramics, Oral), Jeri Redcorn (Ceramics, Oral), Alaina Tahlata (Oral), Michael Meeks (drummer), Caddo Culture Club (Dance, Music), Metro Culture Club (Dance, Music). A portion of the Gregg County Historical Museum's Caddo archaeology exhibit was moved to the University Center and on exhibit throughout the conference (Figure 1).

Also concurrently exhibited was a collection of Caddo pottery at Tyler Junior College. The exhibit was curated by Dr. Keith Eppich.

The first session on Friday morning included a welcome by Tom Guderjan, followed by three presentations: (1) *Paying History Forward: Engaging the Public in the History of Place* by Gary Pinkerton; (2) *The Past, Present, and Future of Aerial Archaeology at Northwestern State University of Louisiana: Looking Back, Looking Ahead* by Tommy Ike Hailey and J.D. Cox; and (3) *Interpreting Caddo Effigy Vessels through Technology, Stories, and Dance* by Mary Beth Trubitt, George Sabo III, and Teka McGlothlin.

After a coffee break the presentations continued with four presentations: (1) *Biologically Available Pb: A Method for Ancient Human Sourcing Using Pb Isotopes from Prehistoric Animal Teeth* by John R. Samuelsen and Adriana Potra; (2) *Update on the Analysis of the A.S. Mann Site (41AN201), a Late Caddo Village in the Upper Neches River Valley, Anderson County, Texas* by Waldo Troell, David Kelley, Erin Phillips, August G. Costa, Leslie L. Bush, Melanie Nichols, and Timothy K. Perttula; (3) *The Anthropology/Archaeology Lab at Stephen F. Austin State University, 2019* by Jennifer Luce, Ezra Jennings, Brian Cox, Michael Andrews, and George Avery; and (4) *Archeology at Amos, 1976 and 2020* by Tommie Cotton and Mary Beth Trubitt.

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Figure 1. Caddo mural at the University of Texas Institute of Texan Cultures by George C. Nelson.

Lunch was hosted in The Met, the University Center cafeteria. The proximity of lunch to the meeting locations meant that no one had to leave the building or be late for the afternoon sessions.

In the afternoon, four presentations were offered: (1) *A Multi-Sensor Geophysical Survey of the Brackett site (34CK43) in Eastern Oklahoma* by Alexandra Flores; (2) *Examining Neosho Peoples and their Regional Interactions through Ceramic Design* by Paige Ford; (3) *The Dauber Site (34LF1624): Emergency Data Recovery Excavations at a Fort Coffee Phase Site on the Arkansas River* by Scott Hammerstedt, Amanda Regnier, Kary Stackelbeck, and Debra Green; and (4) *Understanding the Organization of a Pilgrimage at Spiro* by Patrick C. Livingood, Scott W. Hammerstedt, Jami J. Lockhart, Tim Mulvihill, Amanda L. Regnier, George Sabo III, and John R. Samuelsen. This was followed by a meeting of the membership of the Caddo Conference Organization.

At 4PM, the invited keynote address was presented by Dr. George Sabo III, Director of the Arkansas Archeological Survey (Figure 2). The topic was *The Archaeology of Caddo Storytelling*. Storytelling is a powerful instrument for teaching, learning, and creating new knowledge and information among communities around the world, including Native Americans past and present. Storytelling is primarily a dramatic performance that does not often yield a diagnostic material signature; to what extent, then, might such performances be reflected in the archeological record? This presentation explores links between Caddo narrative traditions and artistic representation, using examples from fifteenth-century storytelling performances at the Spiro Ceremonial Center and early seventeenth-century performances by a coalescent community resident in the Carden Bottoms locality of central Arkansas.

Figure 2. Dr. George Sabo III presenting the keynote address.

On Saturday, the first session in the morning included presentations: (1) *The Long Site (41CE330), An Ancestral Caddo Site on Box's Creek in the Neches River Basin, Cherokee County, Texas* by Kevin Stingley and Tim Perttula; (2) *Jowell Knives in East Texas Caddo Sites* by Drew Sitters; and (3) *The Savoy Site (41LB27): A Major Trade Entrepot for Southeast Texas* by Wilson W. Crook III.

Following a coffee break, three presentations were offered: (1) *Interpreting Troy Adams (34FL33): A Fourche Maline Mound in Eastern Oklahoma* by Candace Parker; (2) *Introducing the Center for Environment, Biodiversity and Conservation* by Josh Banta; and (3) *Caddo Language & Songs: Ha'ahut danayoh, Hasinay dohkana'ah (Sing well, talk Caddo)* by Alaina Tahlate and Chad Earles.

Lunch was again held in The Met inside the University Center.

After lunch, the conferences were given a status report on the restoration work at Caddo Mounds State Historic Site: *The Disaster at Caddo Mounds and Future Plans* by Jeff Williams and Anthony Souther. This was followed by a roundtable discussion by artists: Jeri Redcorn, Chase Earles, Wayne Earles, Chad Earles, Yonavea Hawkins, Tracy Burrows, Jenifer Reader. The discussion was led by Merrie Wright, Chair, Department of Art and Art History, University of Texas at Tyler.

After the roundtable discussion, the Caddo Culture Club, the Metro Culture Club and friends of the tribe, led by drumming by Michael Meeks, performed traditional Caddo Dances, in the new Patriot Plaza in front of the University Center, enhanced by spectacular weather (Figure 3).

Figure 3. Members of the Caddo Culture Club and Metro Caddo Culture Club exhibited the Caddo Drum Dance at the conclusion of the 62nd annual Caddo Conference and 27th annual East Texas Archeological Conference in Tyler.