UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

FROM THE GRAVELS: AN ANALYSIS OF CHIPPED STONE AND DEBITAGE FROM STRUCTURE 24 AT SPIRO (34LF48)

A THESIS

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

Degree of

MASTER OF ARTS

By

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Norman, Oklahoma

2026

FROM THE GRAVELS: AN ANALYSIS OF CHIPPED STONE AND DEBITAGE FROM STRUCTURE 24 AT SPIRO (34LF48)

A THESIS APPROVED FOR THE

DEPARTMENT OF ANTHROPOLOGY

BY THE COMMITTEE CONSISTING OF

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Acknowledgements

Thank you foremost to my parents and family, you have always been by my side through life's journeys. I would not be who I am today without you, and I am grateful for your constant love and support. I am also grateful to my high school history teacher, Ty Adair, whose passion for teaching has instilled my academic work ethic and fueled my pursuit of knowledge about the world around me.

I am very thankful for my committee members. To my chair, Dr. Hammerstedt, you have been an invaluable resource in the development of this thesis project. I cannot thank you enough for providing me with the opportunity and space to study Spiro alongside you at the Oklahoma Archeological Survey. To Dr. Randall, thank you for teaching me about lithics and igniting my passion for flintknapping. I am also grateful for all the time you have given to chat with me and putting up with me in your classroom. To Dr. Livingood, you always have an open door on campus and have assisted greatly in my confidence as a student of archaeology. Thank you for teaching me about the world of Caddo archaeology and the wonders of ArcGIS. All of you have all taught me so much about your knowledge of archaeology and contributed greatly to my academic development, thank you.

I am especially grateful to my girlfriend, Sierra Reese. You have always been there for me during the struggles of graduate school. Your joy and kindness makes every day better for those around you.

This thesis would also not be possible without everyone who was involved with the field school excavations and laboratory analysis of Structure 24. Thank you!

To all my fellow OU anthropology graduate students, thank you for all our talks in class and time spent together. Ethan Mofidi has been a dear friend and mentor of archaeology during my time at OU. Thank you for letting me sleep at your house once when my apartment was sprayed by a skunk. Delaney Horton has also been a great friend, encouraging me to present posters at the Southeastern Archaeological Conference and for the Society for American Archaeology. You have shown me how to not be afraid to approach strangers and always pick the correct spots for dinner. Josh Milon has been a compatriot of mine throughout the grind of graduate school. I am grateful to have shared hardships and wonderful experiences alongside you. Other graduate students I have shared invaluable time alongside and am grateful for are Maddie Hale, Jaylyn Gustafson, Grace Stanford, Emily Gehling, Ashley Moelling, and Maegan Taylor.

I am thankful for Derek Anderson of the Cobb Institute of Archaeology at Mississippi State University for being one of the few people that makes me smile when I walk into a room. You are a dear friend of mine, mentor, and my interest in archaeology is partially your fault. Thank you also to Dr. James Hardin at Mississippi State University for showing me that it is possible for an archaeologist to always be cheerful.

An official acknowledgement must be given to Sushi the calico cat. Thank you for deleting two pages of my thesis while also composing a few words of your own free will.

To the Caddo Nation of Oklahoma and the Wichita and Affiliated Tribes, archaeology exists thanks to the accomplishments of you and your ancestors. Thank you for supporting archaeology and providing students like me with this opportunity to learn.

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ABSTRACT

Structure 24 is a Harlan Phase (A.D. 1100-1250) nonmound building on the upper terrace of Spiro (34LF48) with an extended entryway. This structure was identified via geophysical survey in 2012 and later excavated in 2022 and 2024 by the University of Oklahoma. Spiro is located along the Arkansas River in Le Flore County, Oklahoma, nestled between the Ozark Mountains in the north and the Ouachita Mountains to the south. This thesis provides an in-depth study of all lithic debitage and chipped stone tools recovered from the household of Structure 24.

In my analysis I aim to compare my findings to previous excavations of lithic debitage at Spiro. I also question the goal of lithic reduction occurring at Structure 24. To approach these research questions I utilize lithic mass analysis, individual flake attribute analysis, and spatial exploratory analysis. Results of the study show bipolar reduction of abundant local chert gravels was the basis of an expedient lithic industry that reduced multidirectional cores into usable flakes. Cobble blades are a newly identified lithic flake tool from this thesis that expands the known lithic toolkit of Spiro. I argue that the abundant availability and domestic usage of similar, and familiar, raw material types from local streams promoted social stability across the northern Caddo region. Usage of local lithic resources counteracted the exotic goods being obtained from across the continent by the few people living at regional ceremonial sites such as Spiro. Research generated from this thesis provides a foundation for further discussions of lithic usage in domestic contexts at Spiro and the broader Caddo world.

CHAPTER 1: Introduction

In this chapter, I will provide short background information on the location of study for this thesis along with the study's objectives. A brief outline of the remaining chapters of the thesis will then be provided.

Preview of Spiro and Structure 24

Spiro is a major ceremonial mound complex located in what today is Fort Coffee, Oklahoma, in Le Flore County. The site lies only a few hundred meters from the Arkansas River and is nudged geographically between the Ouachita Mountains to the south and the Ozark Mountains in the North. Spiro is an important ancestral site to the descendent communities of the Caddo Nation and the Wichita and Affiliated Tribes. A more in-depth cultural background will be provided in Chapter 2.

Spiro is divided archaeologically into the upper terrace and the lower terrace (Figure 1.1). The world-renowned Craig Mound known for its infamous vandalism is located at the lower terrace and has been the focus of extensive archaeological research (Brown 1996; Sievert and Rogers 2011). The upper terrace contains numerous house mounds which are earthen-covered structures. Archaeological research in the 1980s focused on this area of the site following a near-50 year pause since WPA excavations prior to WWII (Hammerstedt and Regnier 2023; Regnier et al. 2019; Rogers 1982).

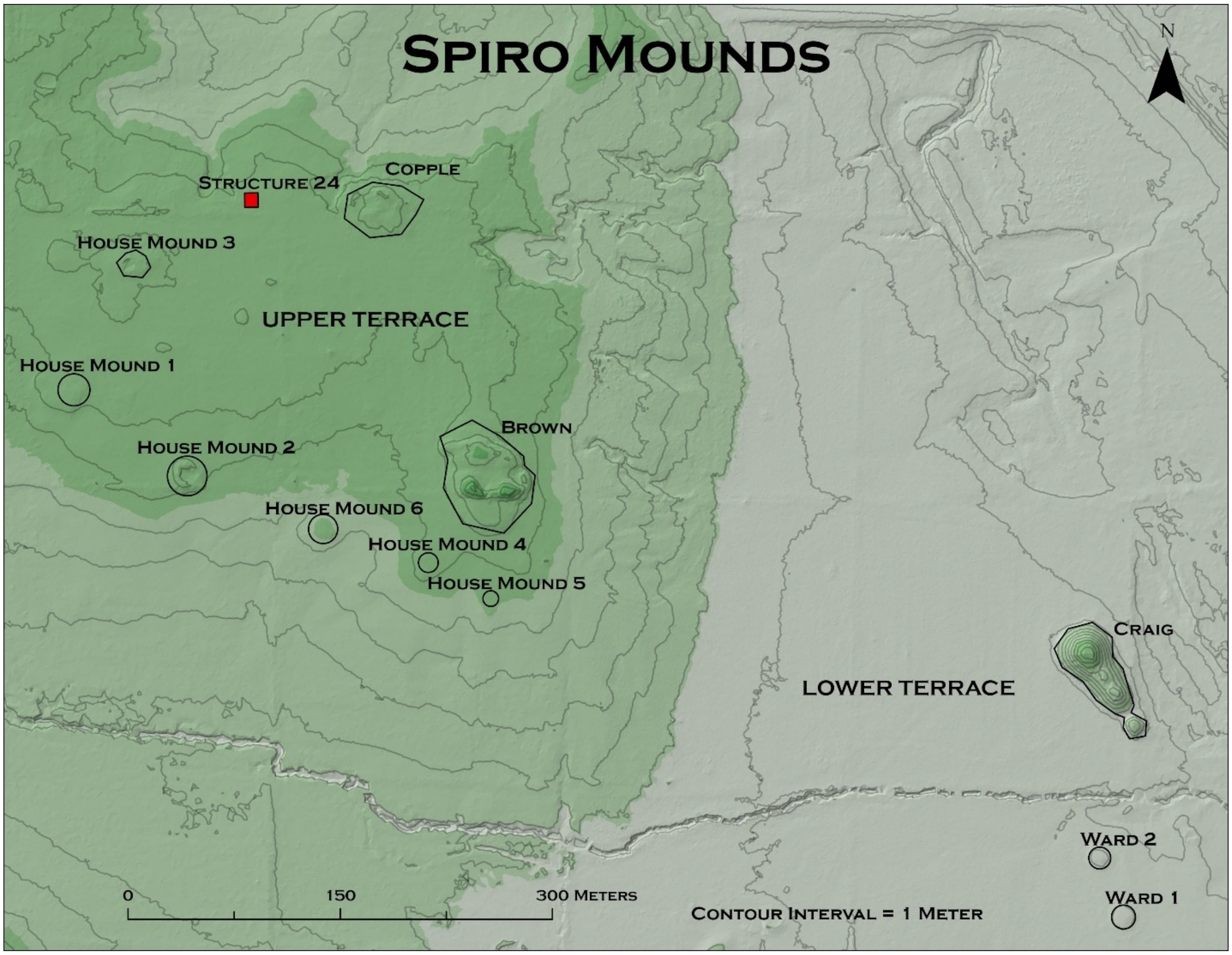

Figure 1.1 Map of Spiro Mounds.

Structure 24 was identified by a geophysical survey conducted as part of the Spiro Landscape Archaeological Project in 2011 (Figure 1.2). Under an MOU with the US Army Corps of Engineers, the Caddo Nation, and the Wichita and Affiliated Tribes, the University of Oklahoma's Department of Anthropology and the Oklahoma Archeological Survey conducted archaeological field school excavations at Structure 24 in 2022 and 2024. Structure 24 is a nonmound building containing an extended entryway with four central posts and dates to the Harlan Phase (A.D. 1100-1250). More information about Spiro and Structure 24 will be discussed in Chapter 2.

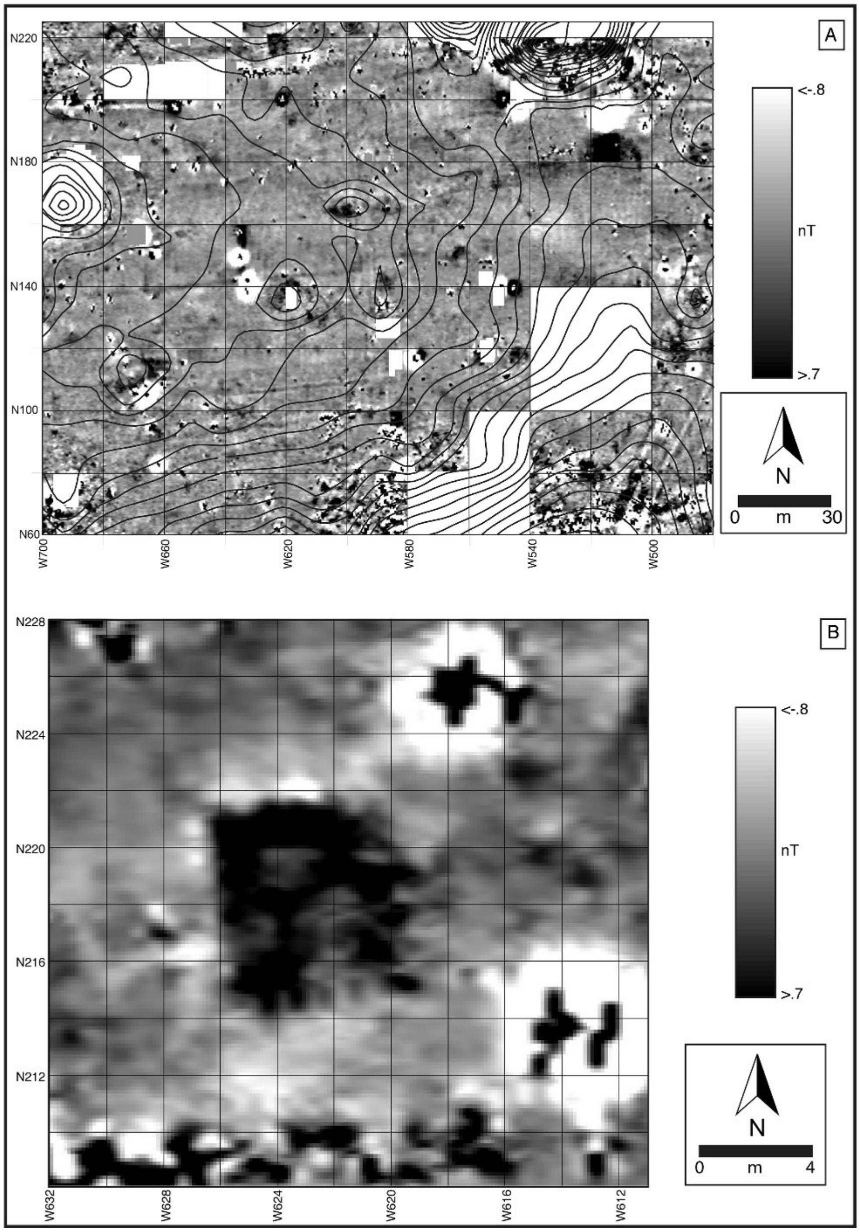

Figure 1.2: Gradiometer Results of the Upper Terrace. From Hammerstedt et al. 2017. (a) Northern portion of the Upper Terrace. (b) Close-up of Structure 24 which can also be seen in the top center of (a).

Thesis Objectives

The main objective of this thesis is to conduct the most extensive lithic debitage analysis of an excavated structure at Spiro. A call for the type of study attempted in thesis was first proposed by Dr. James A. Brown (1976:203) stating that

> "Except for the observation that Boone flint cobbles of fist size and smaller were used as chipped stone raw material, I think that descriptions and comments can be deferred until the time another investigator can systematically collect the chipped stone industry."

All excavations conducted at Spiro since this writing have screened for lithic debitage. The call for debitage analysis was corroborated by Rogers (1980:124) due to the WPA excavators' lack of recording lithic debitage in favor of larger artifacts. Orr's (1946:238) original report on Spiro described the chipped stone assemblage of Spiro as simply containing "many colors and types of flint." Addressing this gap has since been a constant goal of archaeologists working at Spiro. Structure 24 also provides a unique opportunity to report on lithic debitage from nonmound structures at Spiro which are currently severely under-researched.

Lithic production, as currently understood at Spiro, stands in as a complete contradiction to the exotic artifacts looted out of the site in the early 1930s. Most of what we know, or might expect to know, about Spiro's chipped stone industry is summarized by a single paragraph in Brown's (1996) comprehensive overview of the site. Brown (1996:489) states that

> "The chipped stone industry is given over to the reduction of locally available silicaceous materials from river gravels. Most of the lithic artifacts and debris at the site indicate an expedient technology making use of edges, tips and comers of flakes and crude bifaces that could be readily acquired through the reduction of near-at-hand river cobbles."

In only two sentences, Brown (1996) has perfectly described much of what this thesis will unravel about the chipped stone industry at Structure 24. However, details of where reduction occurs and how we might theorize special purpose buildings' role have not been discussed in the literature. This thesis also uncovers a new flake tool type that has previously gone unmentioned at the site which may provide insight into domestic household tasks.

The primary research questions of this thesis can be summarized by the following:

1.) Does lithic reduction at Structure 24 display similar patterns to other lithic debitage assemblages on the upper terrace and at Spiro?

2.) What was the goal of lithic reduction at Structure 24?

My approach utilizing mass analysis, individual flake attribute analysis, and spatial research will connect my thesis to prior works on lithics at Spiro while also producing data that has never been recorded at the site. Individual flake analysis provides information on reduction sequence and techniques that have yet to be addressed in the literature. In this thesis I will present my data alongside my interpretations of it. In turn I will draw comparisons to previous research from Spiro to relate my data to previous understandings of lithic debitage. My hope is that data presented in this thesis can assist research on Spiro for years to come.

Outline of Chapters

Chapter 2 will provide a background on Structure 24, the descendant communities of Spiro, their ancestors' architectural practices, and an archaeological chronology of the region. Further information on relevant locations at Spiro to this thesis along with a discussion of the site's history since contact involving its looting and archaeological investigations will be provided. This chapter focuses on establishing background knowledge required for contextualizing the remaining chapters of this thesis.

Chapter 3 focuses on describing the analytical methods utilized for gathering the data of this thesis. The process of gathering data for the mass analysis, the individual flake analysis, and the spatial analysis will be explained in detail to allow for future replication of the study if required. Background information on the lithic raw material types of Structure 24's assemblage will be provided along with a typology of the projectile points. I also define certain terminology used through the thesis in this chapter. Choices made in presenting spatial data are also explained.

Chapter 4 presents the results of the analysis outlined from Chapter 3. I avoid making interpretations of data in this chapter. Conveying the facts of the data was my main objective.

Chapter 5 contains a discussion of the results and my interpretations of the data. I provide comparisons to prior research and highlight areas that future research should investigate. I also present the findings of a new lithic tool type that has previously gone unmentioned at Spiro.

Chapter 6 concludes the thesis by tying the previous chapters into a final statement on the findings of this study. This study has deepened my understanding of lithic technology and garnered my appreciation of cultural practices in the southeast.

CHAPTER 2: Background

Overview of Structure 24

As explained in the previous chapter, Structure 24 is an extended entryway nonmound building located on the upper terrace of Spiro (Figure 2.1). Based upon ceramic types and projectile points found during the 2022 and 2024 excavations, the structure is dated to the Harlan Phase (A.D. 1100-1250) and lacks radiocarbon dating. I have made a map detailing the location of postholes found during excavations along with a rugged estimate of the structure's outline (Figure 2.2). Readers are encouraged to use this map as a guide in understanding the structure's orientation and features alongside the excavation units. It is not the most accurate representation of Structure 24 that can be created. I faced issues in creating a definitive map of Structure 24. In reviewing field notes, the position of postholes sometimes changed as they went through stratigraphic layers. Inconsistencies with undergraduate mapping are likely to be blamed alongside my misinterpretation of drawings. Portions of the structure likely encountered the plow zone, making it difficult to create the most accurate map possible of the structure. I was never present at the excavations of Structure 24. There are multiple posthole locations that were likely the central support posts along with at least four postholes supporting areas of the extended entryway.

Figure 2.1: Drone Photograph of Structure 24's Excavation. During the Summer 2024 OU Field School. Image Taken by Dr. Scott Hammerstedt.

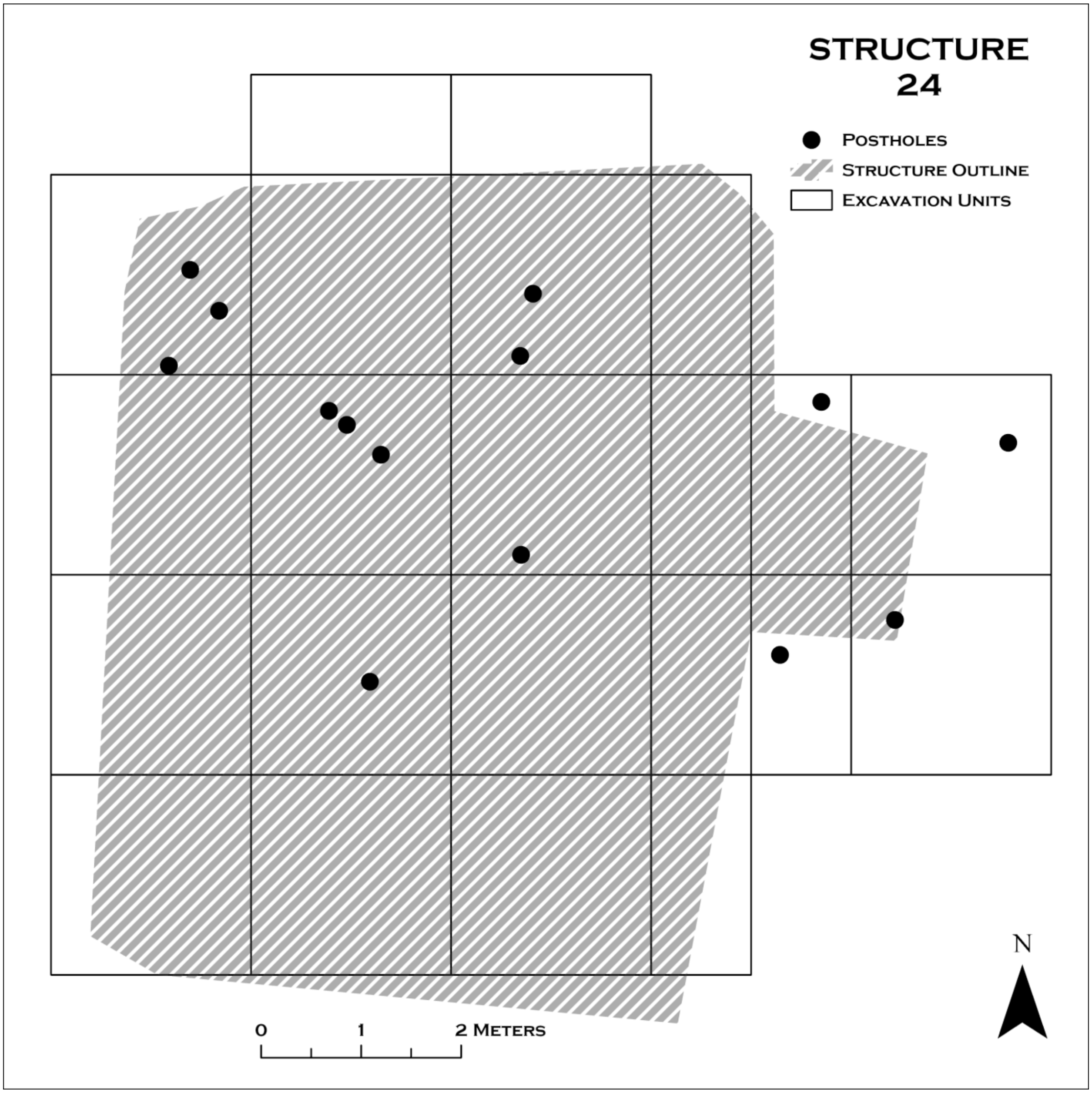

Figure 2.2: Outline of Structure 24.

The entryway of Structure 24 faces eastward towards the nearby small platformed Copple Mound laying roughly 80 meters to the west. Structure 24 is square as opposed to circular and likely contained four central support posts though not all were found during the excavations. The western portion of the structure approached the plow zone, eroding sections of the original structure floor if it was to be present. A mud cracked clay floor is present on level 6 of units 19 and 20 (Figure 2.3 and Figure 2.4). A singular floor across the entire structure was not found, however. Numbering of units for this thesis is described in the spatial methods section of chapter 3.

Figure 2.3: Photograph of Mud Cracked Floor on Level 6 of Unit 19. From Dr. Scott Hammerstedt.

Figure 2.4: Photograph of Mud Cracked Floor on Level 6 of Unit 20. From Dr. Scott Hammerstedt.

Excavation was conducted at 10cm stratigraphic levels. Levels were then mapped on grid paper and had their soil colors determined with munsell color charts. Each individual unit level's artifacts were typically given a single bag number along with provenience information. The 1x2m excavation units were extended from the original 2x2m units to help discover Structure 24's outlines. A typical archaeological arrangement of artifacts was recovered from Structure 24: animal bone, lithics, ceramics, ground stone, and daub. At the time of this writing, the Oklahoma Archaeology Survey aided by University of Oklahoma student volunteers has housed, cleaned, and analyzed all artifacts from the Structure 24 excavations prior to its eventual shipping to the Corps of Engineers. Mass analysis was conducted on the lithic debitage of Structure 24's assemblage and is described in a preliminary report by Hammerstedt et al. (2026).

Cultural Background of the Caddo

The Caddo world archaeologically is prescribed to consist of the geographical region around modern east Texas, southeast Oklahoma, southwest Arkansas, and northwest corner of Louisiana (Girard et al. 2014:1). This region ranges from the Ozark Highlands in the north, southward across the Arkansas River Basin through the Ouachita Mountains, finally meeting the Red River Basin before fanning out across the western Gulf Coastal Plains (Perttula 1997:8). Caddo emergence is understood archaeologically to appear from various Woodland cultures such as the Fourche Maline around A.D. 800-900 that begin to increasingly establish small sedentary settlements in riverine contexts (Girard et al. 2014:35; Perttula 1997:13; Rogers and Sabo 2004:618). The Caddo during the lifespan of the Spiro mounds can be best described as consisting of clusters of communities or confederations that shared ancestral, cultural, and linguistic ties with one another (Rogers and Sabo 2004:616). These various Caddo communities held great autonomy from one another maintaining "local kin-based and secularized leadership" as a norm throughout the broader Caddo world for nearly a millennium (Early 2000:125). Though the Caddo share similarities with Mississippian societies to the east, they maintained their own distinctive culture. The Caddo would adopt Mississippian traits later than their appearances in the east along with doing so selectively (Regnier 2017). Clear differences in landscape use, settlement patterns, ideology, and rituals further distinguished the Caddo from their Mississippian neighbors.

Living on the western edge of the eastern Woodlands, the Caddo and their ancestors practiced a complex system of agriculture. In the Late Archaic period sunflower and sumpweed domestication began as part of a plant husbandry system of small seeds alongside the eventual usage of squashes and gourds as containers (Perttula 2008:82). By the Woodland period, palaeobotanical assemblages attest that native starchy oily seed plants such as chenopods began to increase in size from deliberate indigenous planting practices that selected for beneficial genetic modifications (Perttula 2008:83). Maize eventually became incorporated into Caddo domesticates around A.D. 850 with beans following in A.D. 1200-1300 (Perttula 2008:85, 89). Heavy reliance upon starchy oily seeds never made up most of the diet of the Caddo nor their ancestors. Instead, larger dependence and intensive production of domesticated plants would not fully begin until tropical cultigens of maize, beans, and pumpkins were all being utilized together around A.D. 1300 (Perttula 2008:96).

The Caddo are also particularly well-known for their extensive ceramic tradition which offers archaeologists the unique opportunity to better understand shared cultural concepts of the Caddo world (Early 2012; Milon 2026; Perttula et al. 2021). Caddo ceramics were utilized for the living and the dead with a wide range of fine and utilitarian wares utilizing elaborate yet meaningful decorative decisions. Although certain iconographic symbols were shared across the Caddo world and held connects with the Mississippian world, Caddo ceramic production was highly localized to the household or community level on a specific river basin or drainage system (Horton 2025; Perttula et al. 2021:14).

The Caddo world would eventually face European colonial expansion. Spain first established contact between these two worlds in 1541 with Hernando de Soto's expedition and the French followed after much later in 1686 with Rene-Robert Cavelier, Sieur de La Salle (Rogers and Sabo 2004:619). The first period from de Soto to de La Salle's expeditions is regarded as representing an indirect process of contact that allowed the Caddo to maintain control of most of their lands while taking part in native trade networks to obtain iron, horses, beads, and cloth (Perttula 1997:12; Rogers and Sabo 2004:618–619). From the time after the initial French expeditions up to present the Caddo have been involved in continuous direct contact with European entities (Perttula 1997:11–12). The Caddo people faced major epidemics and religious conversion attempts by Spanish missionaries for over two centuries. By the nineteenth century, the Caddo had increasingly experienced White settlers encroaching on their lands with the United States' government eventually selling portions of those lands or having them directly stolen without formal sales (Rogers and Sabo 2004:620). As hostilities between settlers and indigenous populations intensified, the state of Texas established a reservation for the Caddo on the Brazos River in 1854, which was soon moved to the Indian Territory in 1859 in western Oklahoma (Perttula 1997:44). The reservation would be shared with Wichita, Delaware, and other communities also leaving their original reservations in Texas.

Ethnographic Caddo Political Organization

One of the best recorded regional clusters of the Caddo are the Hasinai who by the time of contact into the seventeenth and eighteenth centuries occupied the Upper Neches and Angelina Rivers (Rogers and Sabo 2004:616). Most of our understanding of the structure of Caddo society from this time comes from ethnographic accounts of the Hasinai in east Texas by the Spanish (Early 2000). Other regional clusters included the Kadohadacho near the Great Bend of the Red River, the Natchitoches and Doustioni further down the Red River in modern Louisiana, along with the Adai, Cahinnio, Ouachita, Yatasi, and Eyeish (Rogers and Sabo 2004:616).

The highest recognized human authority of the Caddo was the xinesí, who served as a religious authority capable of communicating between the realms to bridge deities and beings (Hatcher 1927:215; Rogers and Sabo 2004:624; Wyckoff and Baugh 1980:234). The xinesí was the head figure respected by multiple communities whose caddices and canahas revered allegiance to and maintained a sacred perpetual fire at their temple alongside a subunit of assistants (Wyckoff and Baugh 1980:239). At the individual village level, a head caddí served the distinguished role of village leader and was responsible for leading village decisions alongside the canahas and maintaining relations with other villages (Hatcher 1927:216; Wyckoff and Baugh 1980:234–235). Caddí were supported by the tanmas who helped enforce their decisions (Wyckoff and Baugh 1980:237). The canahas are a similar ranking position to that of the caddí composed of elected and achieved village elders who are assisted by the chayas (Hatcher 1927:216; Wyckoff and Baugh 1980:234). Other notable positions were the amayxoya, who were distinguished warriors, and the connas, who were shamans that played a major role in sickness, divination, and rituals (Wyckoff and Baugh 1980:237, 241). The political organization of the Caddo during the seventeenth and eighteenth centuries as defined by the Spanish in reference to the Hasinai clearly depicts varying levels of broader regional and village specific authorities. Altogether these positions help depict a story of autonomous villages that were loosely integrated together through the religious and cultural responsibilities of the xinesí (Regnier et al. 2019).

Caddo Structural Architecture

Different patterns of house structures were utilized by the Caddo spatially and temporally. Most of this diversity is differentiated archaeologically between two regions referred to as the northern and southern Caddo areas (Perttula 2009:27). Circular extended entryway structures in the southern Caddo region as opposed to more square or rectangular shaped structures lacking typically lacking extended entryways in the northern Caddo region generally shape this diversity (Perttula 2009:31; Trubitt 2009a). Orientation of structure entranceways is also of cosmological importance as it can speak towards an “architectural grammar” (Perttula 2009:32). Structures in the northern Caddo area with westward facing entryways potentially convey meanings of death and may have served as charnel houses during the Harlan Phase (Kay and Sabo 2006). Those facing eastwards likely symbolize life instead. The Caddo also carried out a practice of burning structures and subsequently burying them, a process that led to the creation of structural mounds across many Caddo sites (Trubitt 2009a).

Specialized buildings of Arkansas River Valley's Harlen Phase are mostly square with four interior support posts (Rogers 1982:87). These structures are also quite large at over 9x9 meters square and an area of 85m^2 (Rogers 1982:87). Walls of these buildings are constructed with vertical posts interwoven with cane and plants covered by clay. Roofs of these buildings are composed of grass or thatching on cane beams (Bell 1972:181). Harlan Phase specialized buildings typically exhibit an extended wall-trenched entryway and lack a central hearth. Entryways had posts set into their trenches (Kay and Sabo 2006:29). These specialized buildings are also diagnostic for their detailed decommissioning. Many buildings were intentionally dismantled or burned down, a practice well documented by the Caddo and Mississippians (Trubitt 2009b). Some were later capped by a dome surface of soil to create what today is known as a buried structure mound (Brown 1996:115–122). Rogers (1982:89) suggests that specialized buildings of the Harlan Phase were utilized as a combination of mortuaries, meeting halls, temples, or residences presumably for the elite.

Structure 24 is roughly 6x6 meters square giving an area of 36m^2 (Hammerstedt et al. 2026:51). We find the remains of the structure's walls archaeologically in the form of daub, of which 1197 pieces weighing 1763 grams were found from the 2022 and 2024 excavations of Structure 24 (Hammerstedt et al. 2026:51). Evidence of roofing material is not present. Four post-molds made up part of the extended entranceway of Structure 24 (Figure 2.5). No central hearth is present. Charcoal is present in the assemblage although it is not suggestive of structural burning and dismantling. Structure 24 is also one of the few excavated nonmound structures of the upper terrace at Spiro.

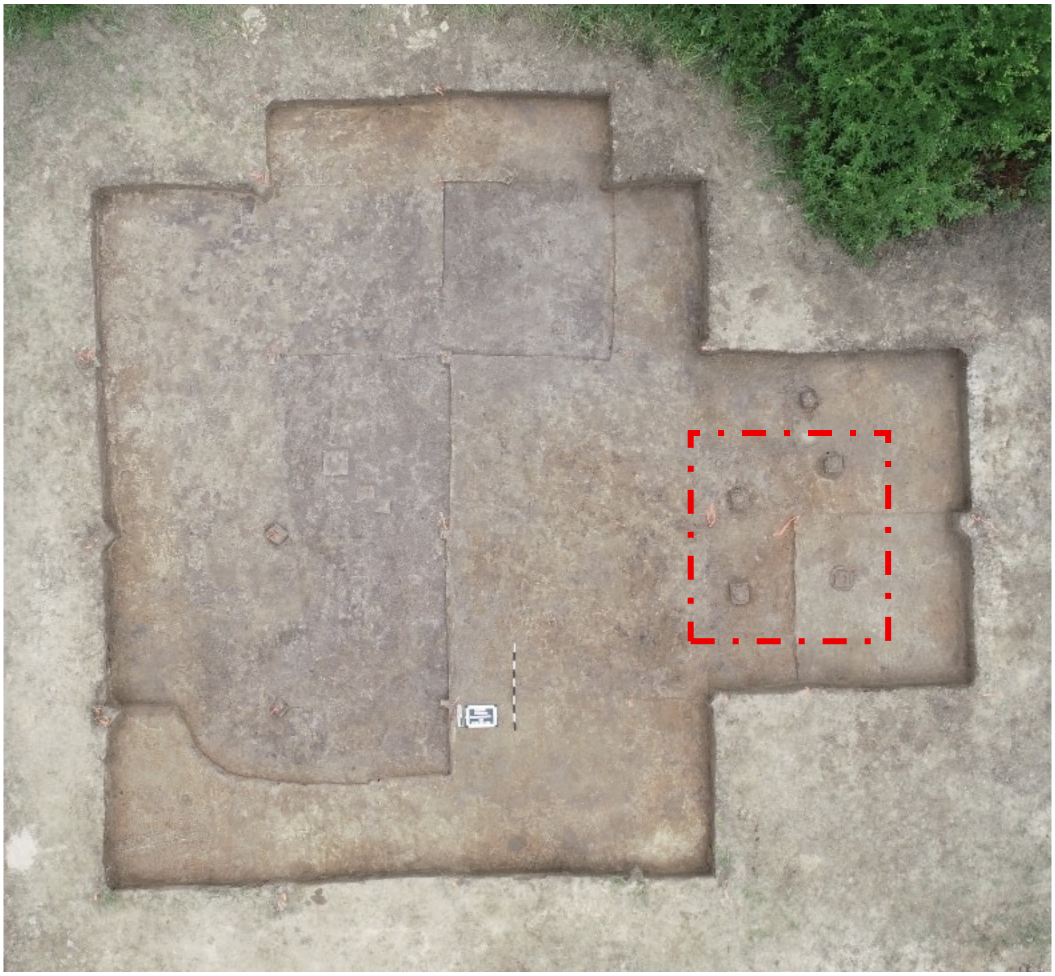

Figure 2.5: Drone Photograph of Structure 24 Highlighting Eastern Entryway. From Dr. Scott Hammerstedt.

Evidence outlined above shows that Structure 24 would not be identified as a specialized building by Rogers (1982). Differences in size alone present one of the main reasonings. A 6x6 meter structure has an area nearly 45m^2 smaller than that of a 9x9 meter structure. The lack of a major burning and burial event of the structure coincides with the fact that Structure 24 is a nonmound building. However, other researchers have defined specialized buildings or special-purpose buildings differently. Regnier et al. (2019:321) define special-purpose buildings for their study as “all buildings found in mounds and nonmound buildings dating prior to AD 1450 with extended entryways and no internal features.” By this definition Structure 24 can be considered a special-purpose building with its Harlan dates of arrow points and ceramics. To support the recent literature on archaeological structures in the Arkansas Valley mentioned above, I recognize Structure 24 as a special purpose building.

Long parallel trenched entryways are a feature of indigenous architecture found across the southeast in the Late Mississippian structures (Steere 2017:35–36). Functionally, these extended entryways can prevent rain and wind from damaging a structure’s interior (Steere 2017:36). Extended entryway buildings in the Caddo region are also not just long paths into a house. These entrances are partial subterranean features that force entrants to duck and crawl as they enter and leave. This obscures the inside of the structure from outsiders. Rogers (1982) provides an illustration of one of House Mound 5’s extended entryway buildings (Figure 2.6). Structure 24’s extended entryway is also not facing the larger open plaza to its south that House Mounds 1-6 surround. Instead, the entryway faces Copple Mound to the east which further obscures the contents of Structure 24 from visitors on the plaza and suggests a symbolic connection between the mound and structure. A pedestal blocking the entryway was not recovered, as argued to be found by Kay and Sabo (2006) at Harlan-style charnel houses. Along with the entryway facing east with no human remains being found, it is not likely that Structure 24 played the type of role in burial practices at Spiro that Harlan-style charnel houses are argued to have played at other Arkansas Valley Caddo sites (e.g. Kay and Sabo 2006). I encourage readers to remember the implications of an extended entryway at Structure 24 throughout the rest of this analysis, especially when spatial patterns of artifacts are discussed.

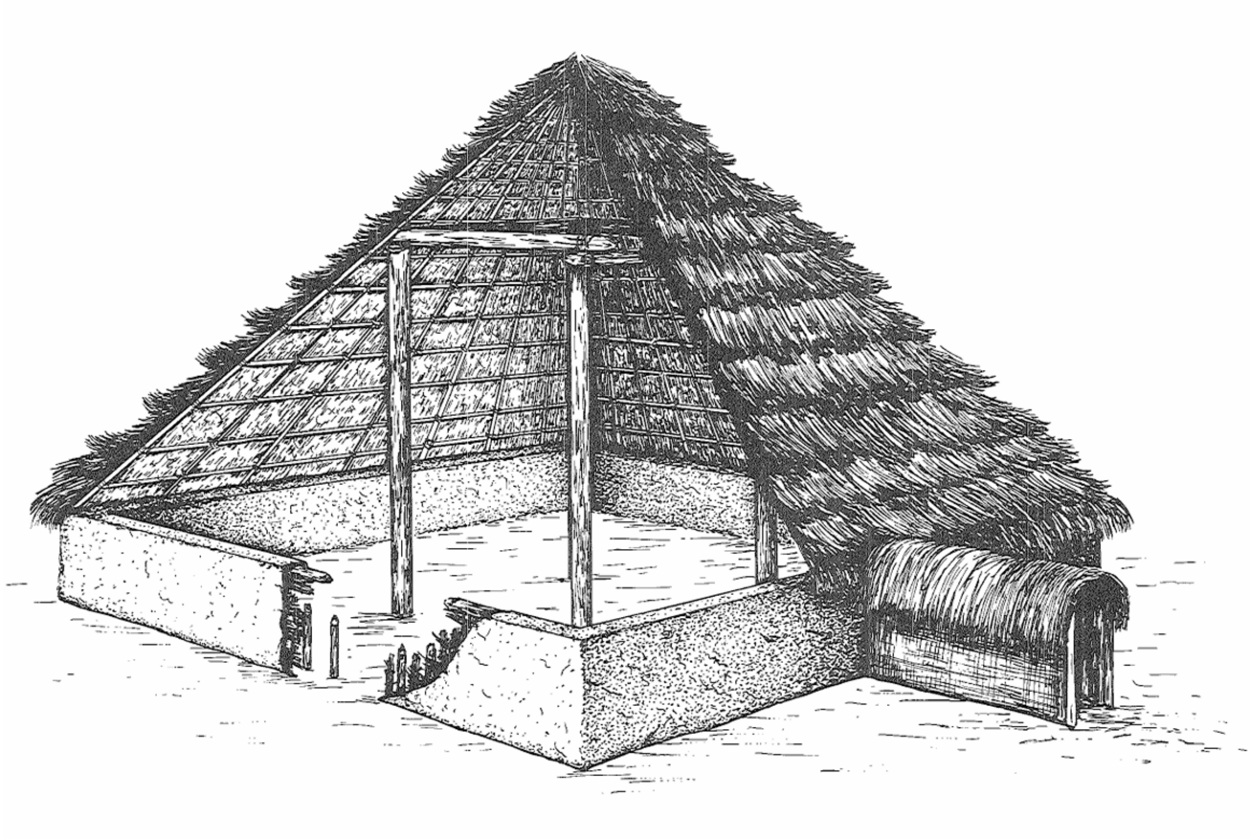

Figure 2.6: Illustrated Reconstruction of House Mound 5's Building. From Rogers 1982:46.

Caddo and the Arkansas River Basin Chronologies

The term Caddo has so far been used to describe a particular geographical cultural region of people. The term Caddoan more broadly speaks to the linguistic family of the Caddo, Wichita, Pawnee, and Arikara which is no longer used in archaeological descriptions to avoid confusion unless in reference linguistically (Perttula and Cast 2011). Caddo, however, is also utilized by archaeologists as a demarcation of a time equivalent to the Mississippian period. The Caddo chronology is broken into five periods, I-V, known as the Formative Caddo from A.D. 900-1050, the Early Caddo from A.D. 1050-1200, the Middle Caddo from A.D. 1200-1400, the Late Caddo from A.D. 1400 to 1680, and the Historic Caddo from A.D. 1680-1860 (Davis 1970; Story 1990). These cultural periods do not perfectly represent concurrent events that happen across the entire

Caddo area, but they are utilized nonetheless by archaeologists in the Caddo literature to communicate more specific regional phases to one another.

The northern Caddo area is now argued to share the same cultural chronology as opposed to just the Fort Coffee archaeological region as previously practiced (Hammerstedt and Savage 2021). The ceremonial center of Spiro is located within this region and utilizes its defined cultural phases (Figure 2.7).

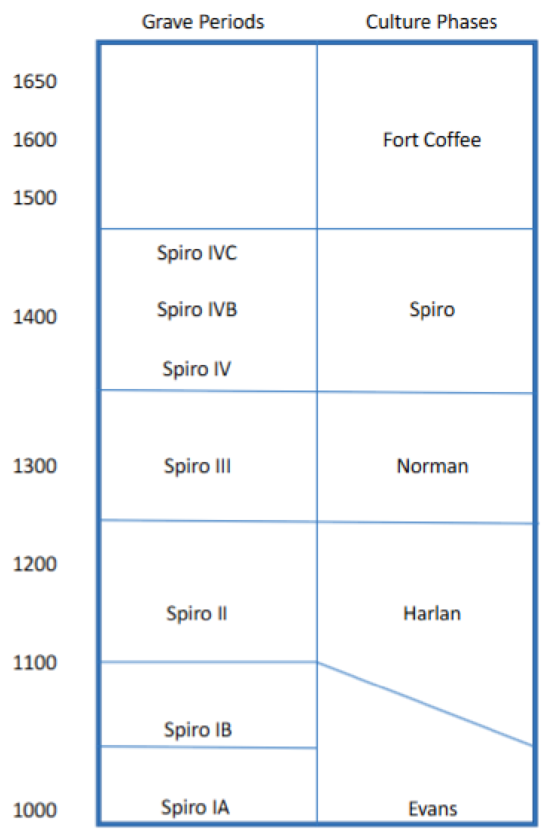

Figure 2.7: Cultural Chronology of Spiro. From Brown 1996:161, adapted by Regnier et al. 2020:21.

The beginning **Evans Phase** from A.D. 950 to 1100 suggests connections with the Plum Bayou culture of central Arkansas through the presence of Coles Creek Incised pottery in early assemblages at Spiro (Brown 1996:161; Regnier et al. 2020:21). Ceramics of this time period used grog tempering to produce signature types such as very thick examples of Williams Plain pottery that displayed a transitional period between Fourche Maline Woodland and Caddo ceramics (Sievert and Rogers 2011:2).

Next in the **Harlan Phase** from A.D. 1100 to 1250, the construction of burial, platform, and house mounds began to intensify (Regnier et al. 2020:21). Most outlying mound sites in the Arkansas River Basin are established during this period. Production and introduction of more shell-tempered wares alongside finely made ceramic wares such as Holly Fine and Hickory Engraved are also attributed to this time (Regnier et al. 2020:21). Harlan Phase architecture is best represented by square and sometimes rectangular houses, most commonly found with four center posts or less commonly with two from houses later in the phase (Rogers 1995:85). Extended entryways are also commonly found on structures of this phase. Hearths and storage pits are less commonly found inside or around structures from this phase (Rogers 1995:86).

The **Norman Phase** from A.D. 1250 to 1350 saw more usage of shell tempering than previous phases in domestic contexts and burials along with the introduction of stamped-sheet copper artifacts (Regnier et al. 2020:21–23). The Norman Phase contains an assemblage that is typically transitional from the Harlan Phase and was previously understood in the literature as belonging solely to the later Spiro Phase (Brown 1996:163). Many burial goods from the Norman site (34WG2) are believed by Brown (1996:163) to represent the Spiro III grave lot period. Later occupation of the Norman site and other regional sites with similar temporal occupations contribute the most to our knowledge of this phase (Finklestein 1940; Regnier et al. 2019:120–153; Rogers et al. 2000).

The **Spiro Phase** from A.D. 1350-1450 is recognized by the shell art and activities of mortuary rituals involving the Craig Mound’s Spirit Lodge at Spiro (Rohrbaugh 2012 [1982];

Sievert and Rogers 2011:7). Large bison scapulae hoes are also found in domestic contexts (Regnier et al. 2020:23). Other regional centers from previous phases become abandoned at this time, leaving Spiro as the epicenter of religious practices in the Arkansas River Basin (Livingood et al. 2020:49). Smaller rectangular houses with two roof supports and a simple entryway are more common in the Spiro phase than in the Harlan phase (Rogers 1995:88). Houses also begin to cluster less at mound sites in the Arkansas River basin, instead shifting outwards into the surrounding vicinity of these sites with examples like the Bowman house sites related to the Spiro mounds (Rogers 1995:89).

The final **Fort Coffee Phase** from A.D. 1450 to 1660 represents a major cultural shift as artifacts begin reflecting groups of people that living in the Plains region (Rohrbaugh 1984, 2012 [1982]). Bison hunting and maize cultivation become predominant during this period as well (Regnier et al. 2020:23). Most of the Arkansas River Basin experiences decreasing population sizes over the course of this phase until the region's abandonment into the contact period (Sievert and Rogers 2011:11). Examples of mound construction appear to cease by the Fort Coffee phase while smaller structure styles similar to that of the previous Spiro phase persists, though with fewer examples currently identified (Rogers 1995:89–91).

Relevant Locations of Spiro

A proper at-length overview of Spiro can be found by Brown (1996) and the edited volume of Singleton and Reilly (2020). Spiro served as a religious and ceremonial epicenter for groups of Caddo peoples living across the Arkansas River Valley following the end of the Woodland Period up until the Fort Coffee Phase (A.D. 1450 to 1660). It is argued that Spiro did not serve as a type of capital to a broader chiefdom as previously thought of across many such mound sites in the southeast (Brown 1996; Rogers 1982; Singleton and Reilly 2020). As discussed in the ethnographic organization of the Caddo above, the Arkansas River Valley is archaeologically understood to contain autonomous villages that were loosely integrated together through the religious and cultural practices that were conducted at major mound centers such as Harlan, Norman, and Spiro (Bell 1972; Brown 1996, 2012; Regnier et al. 2019). A brief overview of House Mound 5 will be provided as it contains the largest assemblage of lithic debitage recovered at Spiro, necessitating comparisons with the nonmound Structure 24. Copple Mound will also be described due to its closeness to Structure 24, its beginning in the Harlan Phase, and due to Structure 24's extended entryway facing directly towards it.

House Mound 5

House Mound 5 is the best recorded buried structure mound of Spiro's upper terrace and the first to be excavated with modern excavation techniques using meshed screens. This buried structure mound went undetected by looters and the WPA. House Mound 5 contains three superimposed special purpose buildings, Structures 15, 16, and 17 (Rogers 1982). These structures were built, maintained, then ceremonially burned and capped over by earth prior to the construction of the next building (Rogers 1982:45). Structure 15, the pre-mound building at House Mound 5, was a square 9x9m extended entryway building argued to have been constructed around A.D. 890, early or even prior to the Evans Phase (Rogers 1982:45). This building was maintained for some time then eventually burned down with debris being removed before the construction of Structure 16 began at nearly the same spot. The same process was then repeated as Structure 17 was later constructed on top of the previous buildings (Rogers 1982:45). Entryways of Structures 15, 16, and 17 all faced southeast. Following the decommissioning of Structure 17, a small circular earthen mantle was placed over the area of the buildings capping it to become what we now refer to as House Mound 5 (Rogers 1982:45).

The original interpretation of Rogers (1982:47) was that House Mound 5's buildings were used as "meeting halls, mortuaries, and residences for the leaders of the society." Human remains were inserted into the buildings of House Mound 5, a practice noted at other special purpose buildings that were mounded in the Arkansas River basin (Rogers 1982:49). Usage of structures at House Mound 5 likely spanned from the Evans Phase (A.D. 950 to 1100) to the Harlan Phase (A.D. 1100 to 1250) though a house was not concurrently being utilized at every moment across those phases (Rogers 1982:47). Instead, periods of use and maintence were followed by periods of disrepair and decommissioning. House Mound 5 was no longer in use by the Norman and later Spiro Phases.

Rogers (1982:47) hypothesizes that ceremonial objects and furnishings were removed from the structures of House Mound 5 prior to decommissionings leaving only small items of little value. This is an important attribute to remember later in the spatial discussions of Structure 24. Concentrations of lithic debitage tended to occur in the eastern areas of the structures of House Mound 5's excavations (Rogers 1982:40). Lithic debitage moved to the eastern portions of the structures is argued to represent a dump from its usage within the building or as part of a periodical dismantling process (Rogers 1982:40). Waste sandstone was found to concentrate in the eastern portion, groundstone was found focused along the southern walls, and baked clay was fixated around the outlines of the structures at House Mound 5 (Rogers 1982:40). Similarly to Structure 24, no hearth was found at House Mound 5 across its three super imposed structures. This likely suggests that it was either carefully removed as part of the decommissioning process or was never present (Rogers 1982:40).

Copple Mound

Copple Mound is a small platform mound located on the northeastern edge of the upper terrace of Spiro. Copple contains Structures 18 and 19. Copple Mound was first excavated by the WPA in 1938 following destruction by looters that created a 20 foot-wide pit one yard into the mound (Brown 1996:112). The WPA excavations on the southern edge of the mound recorded that a two-stage construction process had occurred (Orr 1939). Copple Mound was revisited for excavations in 1982. Leonhardy (1989) reports the existence of four separate stages of mounding. Structure 18 was identified as the sole pre-mound building on which the first mounding stage layer covered. On top was Structure 19 which was covered much further by stage two. Stages three and four complete the mound with no other structures being identified. A feature of Structure 18 returned a range of archaeomagnetic dates from A.D. 1180-1190, placing it well within the Harlan Phase occupation shared by Structure 24 (Peterson 1989:38). Construction of the upper stages continued at Copple Mound throughout the Norman Phase into the Spiro Phase (Peterson 1989:41). Brown (1996:113) argues the dating method is not absolute but agrees with a Harlan Phase start of Structure 18 and Copple Mound. Finally, it is important to note that archaeologists in the 1980's were not aware of other structures near Copple Mound. Leonhardy (1989:23–24) states that "there is presently no evidence for domestic habitation in the immediate vicinity of Copple Mound."

Overview of Spiro Post-Contact

Spiro is located today in Le Flore County, Oklahoma (Figure 2.8). The first archaeological excavations of Spiro were conducted in 1916 and 1917 by Joseph Thoburn of the University of Oklahoma (Brown 1996; Regnier et al. 2019). Thoburn's research provided crucial information for later Works Progress Administration (WPA) archaeologists who carried out salvage excavations of Criag Mound following its extensive destruction by looters under the guise of the Pocola Mining Company (Hammerstedt and Regnier 2023:15; La Vere 1998). The Pocola Mining Company obtained leases from 1933 to 1935 from landowners via intimidation to dig artifacts out of Craig Mound for profit (Hammerstedt and Regnier 2023:19). Forrest Clements, chair of the Department of Anthropology at the University of Oklahoma, failed to convince the looters to cease digging so he turned to the state legislature to pass a law that forbade archaeological work in the state without a permit from the chair of the Department of Anthropology (Hammerstedt and Regnier 2023:19). The Pocola Mining Company was forced to halt their operations before the end of their lease due to the new law. However, Clements would soon leave for California to teach a class which gave way to the Pocola Mining Company illegally resuming their activities at Craig Mound until they discovered the hollow chamber of the Spirit Lodge. The Spirit Lodge held "the largest concentration of ritual artifacts ever found in North America" containing "engraved whelk shell cups, ornamental copper, human effigy pipes, basketry textiles, thousands of shell beads, and other objects" (Hammerstedt and Regnier 2023:19). The task of salvaging what remained of Craig Mound fell to the statewide WPA archaeological program overseen by Clements (Hammerstedt and Regnier 2023:29). Excavations by WPA crews began in 1936 led by University of Oklahoma undergraduates with little archaeological experience and staffed by local unskilled laborers (Regnier et al. 2020:29). Excavations were carried out at Spiro and across numerous sites in Oklahoma by the WPA until the 1940s with the start of WWII drawing away funds and workers.

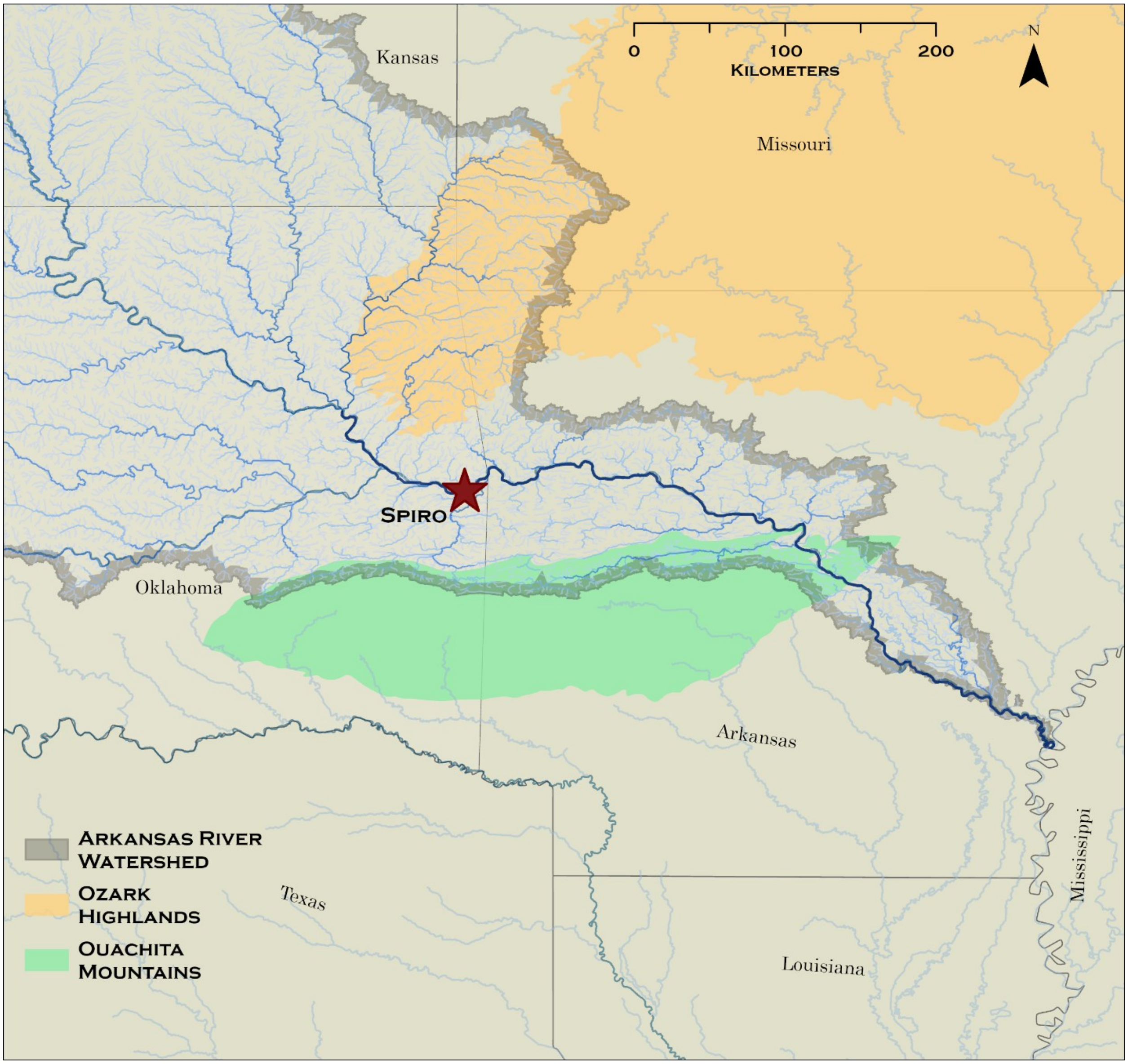

Figure 2.8: Map of the Arkansas River Watershed with Spiro.

Archaeological work at Spiro did not return until 1970. Don Wyckoff led efforts to trace the original locations of the Ward Mounds and Craig Mound for reconstruction prior to the opening of the site as a state park (Wyckoff 1970). In 1979, Dan Rogers conducted the first major research excavations at Spiro since the WPA utilizing modern excavation standards with screening, flotation, and proper field notes (Rogers 1980). The proceeding series of excavations also uncovered the previously unknown location of House Mound 5 which hosted three superimposed specialized structures on the upper terrace of Spiro (Rogers 1982). Geophysical survey was later conducted from 2011 to 2016 to help guide subsequent sessions of field school excavations by the University of Oklahoma (Hammerstedt et al. 2017).

Lithic Procurement Strategy

Lithic raw materials were obtained through multiple different methods by people in the past. The primary assumption of this thesis is that a vast majority of lithic raw materials obtained for day-to-day activities in domestic contexts at Spiro were obtained directly from the nearby Arkansas River. Early geographical exploration of Le Flore County, Oklahoma, made good mention of the Arkansas River's economic potential to provide quality gravel to mining companies in the region (Knechtel 1949:33–34). There is a large range of lithic raw material types from the Ozark mountains, Ouachita mountains, and other regions that can by obtained at the Arkansas River near Spiro's location. As part of this thesis, a trip was taken to collect samples of gravel below the W.D. Mayo Lock and Dam. Preliminary evidence from this excursion suggests that most Ozark raw material types (e.g. varieties of Reeds Spring, Keokuk, Tahlequah, etc.) and generic Antlers Gravel should be easily obtainable. It is particularly possible to purposefully select for varieties of Reeds Spring over other types of raw materials due to its leopard patterned mottles of cortex (Figure 2.9). It is less understood at the current moment to what extent Ouachita raw material types (e.g. Arkansas Novaculite, Woodford, Big Fork, etc.) naturally erode into streams located near Spiro. I theorize that many of these raw materials should be at least available in streams connected to the Poteau River that potentially captures some primary outcrops of these material types upstream. However, until research validates this sentiment it cannot be fully assumed to be true and may have consequences on assumptions of the localness of raw materials in this thesis. A more in-depth discussion of each raw material type present in Structure 24's lithic assemblage will be offered in the methods chapter of this thesis.

Figure 2.9: Gravels Collected Near the W.D. Mayo Lock and Dam. Four Reeds Spring Gravels with 'Leopard Mottling' Cortex (Left) Compared to Two Other Chert Cobbles (Right).

CHAPTER 3: Methods

The goal of this chapter is to provide readers with a comprehensive overview of the methodological approaches of this thesis. The analytical approach of this thesis is three-fold. First, lithic mass analysis was performed by undergraduate volunteers on all lithic materials obtained from the University of Oklahoma field school excavations at Spiro from 2022 and 2024. Second, I conducted a macroscopic analysis on a random sample of 2,032 pieces of debitage from the overall collection to classify debitage completion and record flake attributes. Finally, I visualized a spatial exploratory analysis to search for spatial trends in lithic distributions at the structure. The archaeological collection at the time of this writing was housed at the Oklahoma Archeology Survey in Norman, OK, under permit from the U.S. Army Corps of Engineers.

Lithic Mass Analysis

Stanley Ahler (1989) published a comprehensive overview of years of attempts to apply flake aggregate analysis to archaeological and experimental assemblages. Ahler's conclusion of mass analysis was that size grading, counting, recording cortex percentages, and weighing lithic debitage would allow archaeologists to adequately derive technological and behavioral data. The benefits of Ahler's arguments to the archaeological community suggested it was possible to derive the same information from large artifact assemblages usually obtained by gruelingly recording a set of attributes flake by flake. Critics such as William Andrefsky Jr. (2007) pointed out that mass analysis is too coarse and best used for broad explanatory and comparative questions, not fine-grained behavioral inferences. Individual knapping styles have a major impact on flake sizes produced and raw material type introduces variability in package size and quality that must be accounted for. Archaeological assemblages typically witness a multitude of technological strategies in reduction alongside centuries of reduction events that compile upon each other. This makes mass analysis less suitable to be used in isolation as a method of lithic analysis. Bradbury and Carr (2009) agree with Andrefsky's arguments but maintain that a critical application of mass analysis can still provide useful results for archaeologists. I personally believe that mass analysis should be utilized alongside other analytical techniques, but it does well in providing a broad overview of any lithic assemblage.

Mass analysis on lithic debitage from the University of Oklahoma's archaeological excavation field schools in 2022 and 2024 were conducted in the Laboratory of Southeastern Archaeology at the Oklahoma Archeological Survey. The mass analysis was performed on the entire Structure 24 lithic debitage assemblage with a count of 8218. Many flakes were changed in their classification from debitage to various stone tool types resulting in the total counts of debitage reported in Hammerstedt et al. (2026) to be different than that found in this thesis. Work conducted by undergraduate volunteers on the mass analysis was completed before I began analyzing my sample of the assemblage of Structure 24 in Summer 2025. The steps of the mass analysis are as follows:

1.) Sort by material type.

2.) Sort by size grade (1=0.5 inches, 2=0.25 inches, or 3= 0.125 inches) within each material type.

3.) Weigh (in grams) each piece while checking for cortex percentage (0=0%, 1=1-50%, 2=51-99%, or 3=100%) and utilization. Any potential tools, bifaces, or debitage with utilization are set aside and analyzed separately.

Flake Completion Typology

The traditional typological approach for categorizing lithic debitage was first outlined by Anta White (1963:5) and has since witnessed numerous variations by archaeologists. Most familiar of this typological approach is the identification of primary, secondary, and tertiary decortication flakes. This analytical approach is defined as the "triple cortex typology" by Andrefsky (2005:115–118). Previous research on Spiro lithic debitage (Rogers 1980, 1982; Rogers et al. 1982; Brooks 1989) has utilized the traditional typological approach of primary, secondary, blank, and blocky debris as outlined by Rogers (1980:159). This typology runs on the assumption that flakes with more cortex are removed earlier in the overall reduction process. However, it is possible to remove a flake with cortex at any stage of reduction, not just at the beginning. Complete decortication of lithic materials is not a universal priori to all lithic reduction strategies. Since the cortex percentage of a flake is a subjective observation by the recorder, it cannot be used to grant knowledge of reduction strategies based on cortex percentage present alone (Bradbury and Carr 1995:112).

After the excavation hiatus at Spiro between the 1980's and 2010's, recent literature by Hammerstedt et al. (2019) has utilized a different lithic debitage typology at the site. This typology, created by Alan Sullivan and Kenneth Rozen (1985), does not rely on the presumed technological origins of individual artifacts as a basis for debitage classification. The objectivity of this typology derives from its usage of a hierarchical flow chart that asks the recorder to answer yes and no questions about individual debitage pieces (Figure 3.1).

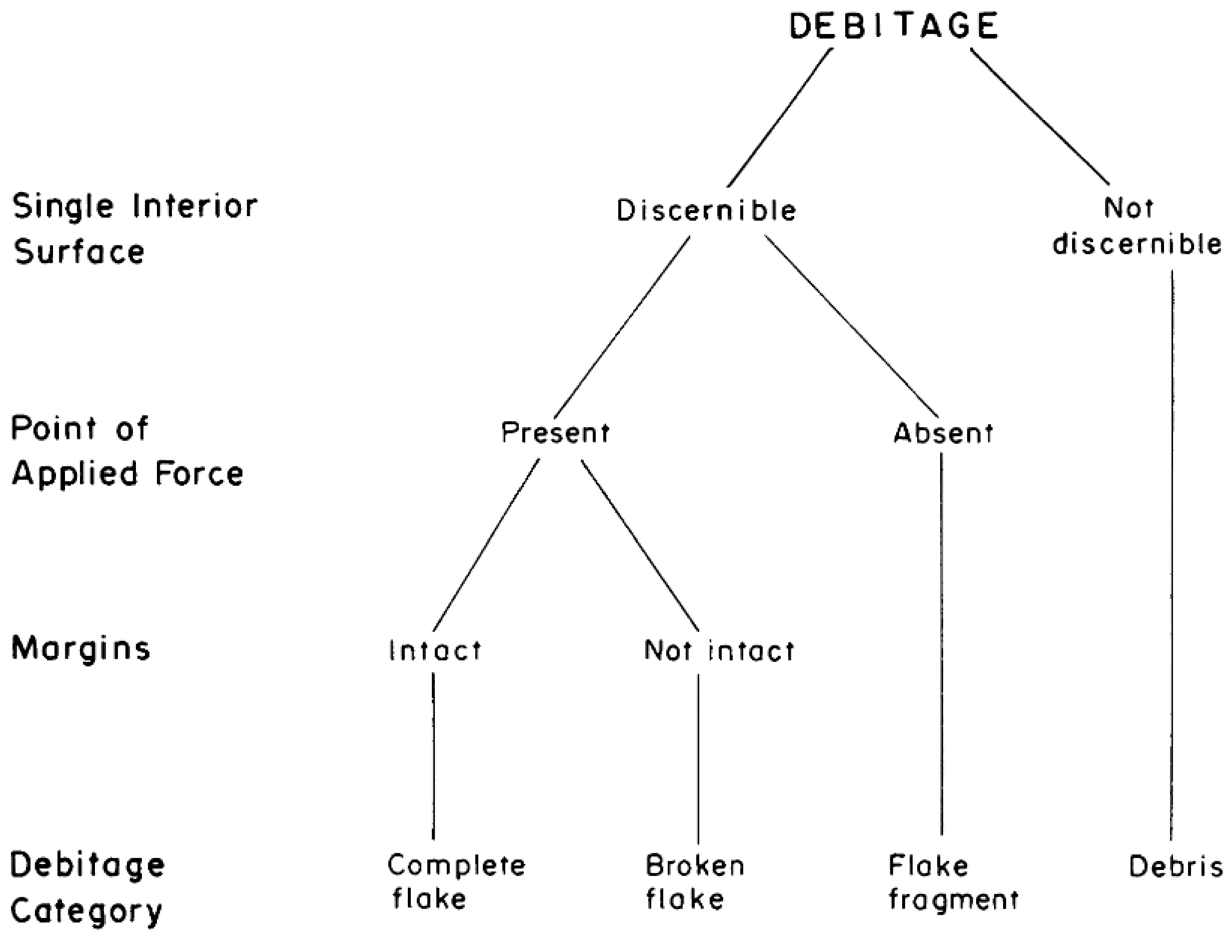

Figure 3.1: Flake Completion Attribute Key. From (Sullivan and Rozen 1985:759).

I have chosen to utilize this typology thanks to its replicability across recorders and to stay in line with its recent usage at Spiro. A fundamental understanding of flake attributes is required to use this typology but does not represent a major learning curve that practitioners cannot achieve. I also believe the hierarchical approach of this typology offers an easy way for newcomers of lithic studies to accurately describe lithic archaeological assemblages. All lithic debitage I recorded for the sample of the Structure 24 assemblage received a categorical description from this typology.

A single caveat to my usage of the Sullivan and Rozen (1985) typology that I felt needed to be addressed is that it is difficult to distinguish broken flakes from complete flakes when a single step fracture termination is present. Sullivan and Rozen (1985:759) state that "debitage margins are intact if the distal end exhibits a hinge or a feather termination and if lateral breaks or snaps (if present) do not interfere with accurate width measurements." A flake missing its lateral end (furthest from platform) causes the recorder to have to discern if the width measurement is limited or not by this occurrence. A common way for a flake to be missing its lateral end is if it contains a single step fracture. The requirement of intact margins, however, lies in the recorder's own judgement. This is similar to the flaw of cortex percentage needing to be subjectively determined to call a flake primary, secondary, or tertiary in the triple cortex typology. In cases where I felt any hesitation that margins may not be fully intact I declared the flake to be broken instead of complete. This may result in more step termination broken flakes to be present in my sample.

Individual Flake Attribute Analysis

Alongside categorizing flakes in my sample of Structure 24's lithic debitage assemblage by typology, I also identified twenty other independent attributes of each flake. The selection of each attribute was attributed to recommendation by Dr. Asa Randall alongside considerations for their potential replicability by other analysts in the future. Pargeter et al. (2023:181) recommend seventeen potential attributes that were reliably replicated analysts, of which eleven are used in my own study. Each attribute used will be outlined below in the way it was quantified and qualified. Refitting techniques were not used in this analysis; however, four instances were identified by the author and are listed in Appendix A at the end of this thesis.

Material Type

This attribute was determined by undergraduate students as part of the mass analysis process. Lewis (n.d.) was used by students alongside supervision by Dr. Scott Hammerstedt and

Dr. Amanda Regnier. The Oklahoma Archeological Survey also has its own lithic comparative collection covering Oklahoma's archaeological lithic sources and those of nearby states. Minimal changes to raw material type were made by myself for the sampled dataset. Refer to the lithic raw material sections for more information.

Weight

All lithic debitage in both mass analysis and sampled dataset were measured on scales using grams (g) as the unit of mass.

Bipolar

This was the only reduction strategy purposefully recorded in the sampled dataset. Lithic debitage produced via bipolar reduction was determined by myself. Refer to the bipolar reduction overview section for more information.

Maximum General Dimension

Measured in millimeters (mm). This attribute was measured by recording the longest possible dimension present on all pieces of lithic debitage in the sampled dataset.

Technological Length

Measured in millimeters (mm). Technological length refers to the measurement recorded straight from a flake's point of impact to its distal end. According to the typology used for the sampled dataset, flake fragments and debris lack a "point of applied force" or a platform surface (Sullivan and Rozen 1985:758). Therefore, only complete and broken flakes had their technological length recorded. Flakes were measured by viewing their interior surface (i.e. ventral side, portion of the flake originally attached to the objective piece prior to its removal) and recording from their platform down to the longest straight distance to the distal end. I also recorded technological length for flake fragments if I felt it was possible to tell where the platform was located. Flake fragments have a single interior surface which in some cases is enough to help the recorder locate where the missing platform would have been located by reading ripple marks and other indicators.

Technological Width

Measured in millimeters (mm). Technological width occurs perpendicular to technological length and was also only recorded on complete and broken flakes. Flake fragments able to be recorded via technological length were also given technological width measurements.

Maximum General Thickness

Measured in millimeters (mm). Thickness was only recorded on flakes that had single ventral surfaces (i.e complete, broken, and flake fragments). Thickness in this case served as the maximum measurement of the vertical axis of applicable flakes. This measurement can occur off the technological horizontal grid and usually occurs on the platform, bulb, mid-section, or termination of most flakes.

Cortex Percentage

Complete, broken, and flake fragments were recorded as follows: 0% means there was no cortex present on the dorsal surface or anywhere other than the platform; 1-50% means that there was half or less cortex present on the on the dorsal surface or anywhere other than the platform; 51-99% means that there was more than half cortex present on the dorsal surface or anywhere other than the platform; 100% means that the entire dorsal surface of the flake had cortex present. All debitage categorized as debris had cortex recorded as an overall percentage of the entire piece rather than just its dorsal surface or area other than the platform.

Platform Presence

All platform related attributes are only recorded on complete and broken flakes. A platform is identified as the proximal section of a flake where the point of applied force is present.

Cortex on Platform

Presence was recorded if the platform on a complete or broken flake has cortex present.

Platform Type

Three types of platforms were recorded: cortical platforms completely display cortex across the entire platform, flat platforms have a single facet removal across the platform, and complex platforms have two or more facet removals across the platform. Andrefsky (2005:94–98) provides more details on these types of platforms. Abraded platforms were not recorded as a platform type because abrasion to prepare a platform can occur on all three platform types listed above.

Number of Platform Facets

A facet is a flake removal present on the platform. This can be identified if the platform lacks cortex which indicates a removal occurred. All cortical platforms have zero facets, all flat platforms have one facet, and complex platforms can have two or more facets.

Platform Crushing

Crushing can occur on cortical, flat, and complex platforms. Physical appearance of crushed platforms can vary but typically a destroyed portion of the platform nearest the point of impact is present. Crushing can also be noticed on battered areas of cortex typically suggestive of hard-harmer percussion. Presence or absence was recorded.

Platform Maximum General Dimension

Measured in millimeters (mm). Longest dimension recordable on the axis of the platform.

Platform Technological Length

Measured in millimeters (mm). Distance from the point of impact nearest the ventral surface following along the axis of the flake's technological length, recorded earlier, to the dorsal side of the platform.

Platform Technological Width

Measured in millimeters (mm). Distance perpendicular to the platform technological length.

Bulb of Percussion

Recorded as present or absent on complete and broken flakes. Bulbs of percussion are distinguished by a bump area on the ventral surface of a flake under its platform (see Andrefsky 2005:Figure 2.7).

Platform Lipping

Recorded as present or absent on complete and broken flakes. Lipping displays itself as a small bulge on the furthest proximal end of the ventral surface of a flake and is typically indicative of soft hammer percussion (see Andrefsky 2005:18–20).

Flake Termination Type

Four types of flake terminations of distal ends were recorded: feathered terminations represent clean gradual edges that come to a pointed end, stepped terminations contain broken 90-degree ends, hinged terminations display rounding from the ventral side curving away from the objective piece, and plunged terminations (i.e. overshot flakes) display an opposite hinge where the ventral surface rolls back onto itself removing a larger portion of the objective piece with the flake's distal end. Andrefsky (2005:87–89) also discusses the attributes of flake terminations further. Flake termination type was recorded on complete, broken, and flake fragments.

Crazing and Pot Lids (Dorsal/Ventral/Debris)

Webbing cracks that appear on lithic debitage because of thermal alteration and cooling are known as crazing. Concavities that appear on the surface of lithic debitage from firing are known as potlids. Absence or presence of crazing and potlids was recorded on complete, broken, and flake fragments on both dorsal and ventral surfaces. Debris had absence or presence of crazing and potlids that occurred anywhere on the entire piece.

Number of Flake Removals (Dorsal/Ventral)

The total number of previous flake removals on both ventral and dorsal sides of complete, broken, and flake fragments was recorded. All three of these flake types by default have a single ventral surface which was never counted as a flake removal unless other removals were displayed. Potlids on either surface were not counted as flake removals either. Debris did not have removals recorded.

Lithic Raw Material Types: Ozark Sources

Siltstone

Banks (1990:30–31) notes Webbers Falls siltstone from the Atoka Formation of the Boston Mountains in northern Arkansas and northeastern Oklahoma to be one of the most commonly knapped non-chert materials in the region. Ray (2007:7–8) argues this material of the Boston Mountains should be referred to as argillite due to its higher clay content and toughness than siltstone. What is archaeologically referred to as siltstone was utilized to make the chipped stone hoes, axes, and ground stone celts commonly found at Caddo sites (Wyckoff 1980:387). Siltstone, or argillite, of this region is a dark gray color, textured with wispy darker fine-grained inclusions.

Boone

The term "Boone" refers to all of the Osagean formations found in the Ozark Mountains of northeastern Oklahoma, northwestern Arkansas, and southern Missouri. This makes "Boone" a wide geographic catch-all term for knappable materials of the Burlington-Keokuk, Reeds Spring, St. Joe, Pierson, and Elsey formations (Huffman 1958:40–41; Ray 2007:213). The Boone Formation represents the Upper Osagean series of cherts and limestones in northeastern

Arkansas. Confusingly, this same strata is referred to as the Keokuk Formation in northeastern Oklahoma and the Burlington-Keokuk Formation in southern Missouri (Banks 1990:15). Ray (2007:213–225) separates "Boone" from his classification of Springfield Osagean and Salem Osagean cherts of the Undifferentiated Osagean (UO) chert type. This separation was made because many varieties of western Ozark cherts are indistinguishable from each other making it harder for archaeologists to accurately identify material types in mixed assemblages. I am in agreeance with Ray (2007) and Mofidi (2024) that "Boone" should be abandoned as a general descriptive chert type to avoid further confusion. Boone identified at Structure 24 follows Lewis (n.d.) and ranges in matrix color from white, brown, gray, and black while also exhibiting extreme mottling and microscopic pyrite.

Reeds Spring

The Reeds Spring Formation is composed of thin-bedded limestone and chert located in the Ozarks of northeastern Oklahoma, northwestern Arkansas, and southeastern Missouri (Huffman 1958:43–44). Variability is prevalent in Reeds Spring cherts. Ray (2007:169–188) most recently simplified this variability into three main varieties: Lower Reeds Spring, Middle Reeds Spring, and Upper Reeds Spring; and five additional varieties: Green Reeds Spring, Blue-centered Reeds Spring, Biogenic Reeds Spring, Speckled Reeds Spring, and Banded Reeds Spring. All Reeds Spring varieties were listed singularly as Reeds Springs chert at Structure 24. Banks (1990:22) notes that geologists struggle distinguishing Reeds Spring limestone from Keokuk limestone but that both formations have unique cherts. Reeds Springs chert typically lacks fossils and contains healed fractures composed of calcite, pyrite, quartz crystals, or chalcedony (Ray 2007:172–174). Matrix colors commonly consist of a blue-gray hue that ranges to black, gray, brown, and yellowish brown.

Keokuk

Keokuk chert is found in northeastern Oklahoma, northwestern Arkansas, and along the boundary of the Ozarks across Missouri. The Keokuk and Burlington Formations consist of limestones and cherts with identical characteristics leading to geologists to refer to a singular Keokuk-Burlington Formation in areas where they are coterminous (Ray 2007:192). The chert is a coarsely crystalline to highly fossiliferous limestone (Huffman 1958:44–45; Ray 2007:192–212). Keokuk chert is commonly interbedded with irregular stingers and masses of blue-gray dense limestone (Huffman 1958:44). Color of the chert matrix is typically a white-gray to tan.

Tahlequah

Tahlequah is a member of the Moorefield Formation of the Ozarks in northeastern Oklahoma, existing also in northwestern Arkansas and southwestern Missouri. The Tahlequah member overlies the Keokuk Formation and contains pebbles of Osagean cherts and limestones (Huffman 1958:49–51). Tahlequah is a medium-crystalline glauconitic limestone (Huffman 1958:49). Banks (1990:28) notes that Tahlequah chert displays a grainy quality that is “deceptively chalky.” Matrix color is typically white to light-gray interbedded with crinoid stem fragments. Tahlequah can be easily mistaken for Peoria or Keokuk/Burlington/Boone cherts.

Peoria

This chert type is poorly understood due to its existence near only one indigenous quarry site, formerly referred to as the “old Spanish mines”, in Ottawa County of northeastern Oklahoma (Dickson 1997; Ray 2007:225). Banks (1990:27–29) associated Peoria chert with the Tahlequah member of the Moorefield Formation of northeastern Oklahoma. Ray (2007:225–230, 2013) argues Peoria chert to be a variety of Warsaw chert from the Warsaw Formation, a chert bearing formation adjacent to the Moorefield Formation in southwestern Missouri. Peoria chert typically lacks fossil inclusions. Unique to specimens of Peoria's main quarry is that they exhibit elongated narrow streaks of dark mottling. These linear patterns run parallel to each other being surrounded by thin white borders (Ray 2007:226). Color of Peoria chert matrix is white to light gray.

Cotter Dolomite

The Cotter Formation of the Ozarks in northeastern Oklahoma, northern Arkansas, and southwestern Missouri contains gray dolomite with sandstone, shale, and chert (Huffman 1958:18–20). Portions of this formation include intraformational conglomerates of durable dolomite chert or beds of large finely crystalline dolomite containing masses of concentric patterned vitreous chert (Huffman 1958:19). Banks (1990:17) notes that Cotter Dolomite is one of the most difficult materials of the Ozarks to flintknap. Cotter Dolomite commonly displays prominent colored banding with gray-white to tan matrix colors.

Lithic Raw Material Types: Ouachita Sources

Quartz

Crystal quartz is found throughout the Ouachita Mountains of Oklahoma and Arkansas (Banks 1984:92; Miser 1943). Quartz crystals possess a symmetrical hexagonal shape with six prisms and six pyramid faces though shape is diverse with different tabular shapes and sizes. Quartz crystals from the Ouachita Mountains are typically milky-white or clear, with some specimens displaying both attributes (Miser 1943:92–93).

Johns Valley

This chert type is found in the western portion of the Ouachita Mountains that lie mostly in southeastern Oklahoma. Johns Valley chert is a uniquely challenging material type for archaeologists to identify in assemblages that contain mixed Ozark and Ouachita chert types (Ray 2016:326). What archaeologists refer to as Johns Valley chert exists geologically as a portion of the limestone and chert exotics embedded within the Johns Valley Shale formation ranging in sizes from pebbles to large 40 foot-wide boulders (Cline 1960:63). Cherts in this formation have been argued to come from the Arbuckle Mountains, Ozark Mountains, and the Ouachita Mountains (Shideler 1970:794–797). Processes of the Ouachita orogeny caused Arkansas Novaculite, Woodford chert, Pinetop chert, Bigfork chert, and various quartzites to become removed from their parent beds and redeposited into the Johns Valley Shale formation (Banks 1984:91, 1990:46). Cherts redeposited into the Johns Valley Shale formation are of higher quality and size than their parent origins due to the shale serving as a buffer to fracturing that the parent beds lacked (Banks 1984:91, 1990:46). It is very likely that indigenous communities directly sourcing cherts from the Ouachita Mountains did so from this formation. Lewis (n.d.) argues the presence of deeper red hues banded into the normally dark gray to brown chert can help distinguish Johns Valley cherts from their parent outcrops.

Bigfork

This chert type is the oldest sedimentary rock found in the Ouachita Mountains with outcrops at Block Knob Ridge, Potato Hills, and in McCurtain County, Oklahoma (Goldstein and Hendricks 1953:425). Bigfork stratigraphically consists of “thinly bedded, dark gray, cryptocrystalline chert interbedded with differing amounts of siliceous black shale, calcareous siltstone, and dense bluish gray limestone” (Chick 2020:12). Bigfork chert also commonly displays numerous fractures. The chert matrix is typically a pale-black that is usually homogenous in its color throughout the rock but can contain reddish brown hues near its cortex.

Arkansas Novaculite

This chert type is found in the Ouachita Mountains from southeastern Oklahoma into west-central Arkansas. Arkansas Novaculite has an extensive history of being quarried by indigenous communities since Paleoindian times (Etchieson and Trubitt 2013; Trubitt et al. 2004; Wyckoff and Bartlett 1995). This rock is comprised mostly of microcrystalline quartz that is heavily rich in silica and displays a waxy to dull luster (Johnson and Russell 1978). The appearance of Arkansas Novaculite can vary depending on its outcrop's location (Goldstein and Hendricks 1953:428–431). Matrix colors are normally white with translucent edges while also occurring in gray, black, brown, yellow, green, pink, and red colors (Ray 2016:326).

Woodford

This chert type is found in the Ouachita and Arbuckle Mountains of southeastern Oklahoma. Geologists term this chert's formation as Woodford Shale, occurring in upper Devonian layers partially coeval with Arkansas Novaculite (Cardott and Comer 2021:4). Woodford chert is typically "fractured and veined with fissure-fillings of quartz, chalcedony, and black asphaltic material" (Goldstein and Hendricks 1953:435). The heterogeneous nature of this chert appears to make it challenging to flintknap with as most specimens display patchy distributions of inclusions and fractures. Matrix colors can vary heavily from a white shale to a dark reddish-brown that approaches a black hue.

Chickachoc

This chert type is found in the western portion of the Ouachita Mountains in Oklahoma with outcrops south of the town of Pittsburg stretching southwest into Atoka County (Taff 1901). The caramel color present in specimens of Chickachoc chert at the Oklahoma Archeological Survey's lithic comparative collection are similar to that of a brown chalcedony. Goldstein and Hendricks (1953:436) describe Chickachoc chert as a "very finely cryptocrystalline, fossiliferous, siliceous limestone" that can contain visible pyrite and calcareous or silicified sponge spicules. Matrix colors range from a red to tannish light brown exterior with a darker brown or black interior like big fork chert. Examples of this chert type may be misclassified in Structure 24's assemblage under chalcedony due to its slight transparency.

Lithic Raw Material Types: Non-local or Mixed Sources

Antlers Gravel

The Antlers Formation is located near the Red River in southeastern Oklahoma and northern Texas. This formation contains silicified sands and gravels eroded from the Ouachita, Arbuckle, and Wichita mountains (Hobday et al. 1981). Antlers Gravel contains various chert and quartzite cobbles that are distributed unevenly across the modern formation (Wyckoff 2005:94; Wyckoff et al. 2017). Color is typically light gray or yellowish brown. The overabundance of Antlers Gravel at Structure 24 is not due to direct trade from the Red River region. Archaeologists in the Arkansas River Valley lump similar looking river gravel cherts with the Antlers Gravel type as a catchall when they do not conform with other common raw material types from the area.

Red River Jasper

This material type erodes as an exotic material out of the Johns Valley Formation of the Ouachita Mountains into the Kiamichi River of southeastern Oklahoma (Dowd 2011). Red River Jasper exists almost entirely as a small alluvial gravel. It is unclear whether this material is being brought into Spiro from the Red River region or if a similar looking jasper also erodes into the gravel bars of the Arkansas River drainage. Red River Jasper cobbles typically display a mottled interior and range in matrix color from brown to reddish yellow or pink, with some specimens showing darker gray tones (Dowd 2011:91).

Chalcedony

Chalcedony is commonly found alongside chert and quartz producing regions of the world. As water dissolves silica rich quartz and cherts, the dissolved silica is deposited in fractures of the rocks where chalcedony crystals can slowly form. Chalcedony is a microcrystalline variety of quartz that is mostly translucent and exhibits a fibrous texture that is tougher to fracture (Ray 2007:6). Chalcedony present at Structure 24 was likely sourced from stream cobbles containing partial or whole amounts of chalcedony within the cobble. Matrix color is typically light to dark grey, ranging into a tannish orange.

Alibates

Alibates, an agatized dolomite, outcrops in Potter County of the Texas panhandle. Tributaries of the Canadian River cut through the Alibates Formation bringing the material eastward into Oklahoma as a stream-worn cobble where it persists in gravel beds (Wyckoff 1993). Cobbles of Alibates have been found as far east as Eufaula Dam in Haskell County, Oklahoma, roughly 100 km (62 miles) upstream from Spiro (Kraft 1997:107–108). Alibates found in western Oklahoma archaeological contexts can coexist alongside similar looking materials such as Tecovas jasper or Day Creek dolomite (Wyckoff 2005:99–100). Alibates typically range in matrix color with beautiful red-banding and gray to white hues mixed in. The material is slightly translucent to opaque.

Quartzite

Quartzite is found in the Ouachita (Cline 1960; Honess 1923), Ozark (Huffman 1958), Wichita (Hoffman 1930; Taff 1928), and Arbuckle (Reeds 1910; Taff 1928) mountains. Quartzite is also commonly found alongside chert nodules in the Antlers Formation of southeastern Oklahoma (Banks 1990:114; Wyckoff 2005:94–96) Quartzite is a coarse-grained durable rock displaying interlocking quartz crystals. Stream cobbles of various types of quartzite are common below the W.D. Lock and Dam within a single kilometer of Spiro. Colors range from dark grey to reddish brown. No further attempt was made to distinguish the actual type of a particular quartzite in Structure 24's assemblage.

Florence A

Also known as Kay County Chert, Florence A is a unique raw material type that outcrops in the southern Flint Hills region of southeastern Kansas and the Osage Hills of northeastern Oklahoma (Banks 1990:96–101; Gattis 1998). Florence A is typically a narrowly banded tan or brown chert prior to heat treatment (Ray 2007:326). Geologically, Florence A outcrops horizontally alternated with limestone and shales along exposures amply present across the southern Flint Hills region (Banks 1990:101). The chert is also exposed by tributary streams that cut through limestone layers that contain long, narrow stretched deposits of chert (Vehik et al. 2021:320). Florence A is well documented archeologically to be traded from the Southern Plains region across to neighboring regions alongside bison resources (Vehik 1988, 1990).

Projectile Point Typology

Seventeen projectile points were found at Structure 24. Only four of these points were recovered nearly undamaged. Sixteen of the projectiles are arrows, while one represents an undetermined hafted biface fragment. The only other bifacial tools at Structure 24 were three scrapers, numerous cores, and a small drill potentially reworked from a Morris style point. Five typological specimens make up the projectile assemblage of Structure 24: Rockwall, Scallorn, Alba, Hayes, and Haskell. All of the projectile point types fall within the Harlan phase occupation of Structure 24 argued by Hammerstedt et al. (2026).

Typological information for the arrow points of Structure 24 suggests that all are commonly found throughout the broader Caddo region. Age information for each point type is derived using Brown's (1996:161) gravelot periods from Spiro. Many of the points may be found earlier and later than the dates suggested across the Caddo region but chronologically occur at Spiro at the dates given. Ray (2016) and Justice (1987) provide spatial distribution maps of some point types while other references that are listed verbally describe their distribution. I have included additional information regarding the common notching, length, base, stem, and blade characteristics of each point (Figure 3.2). Multiple references were used for each point's attributes and are listed at the end of each description.

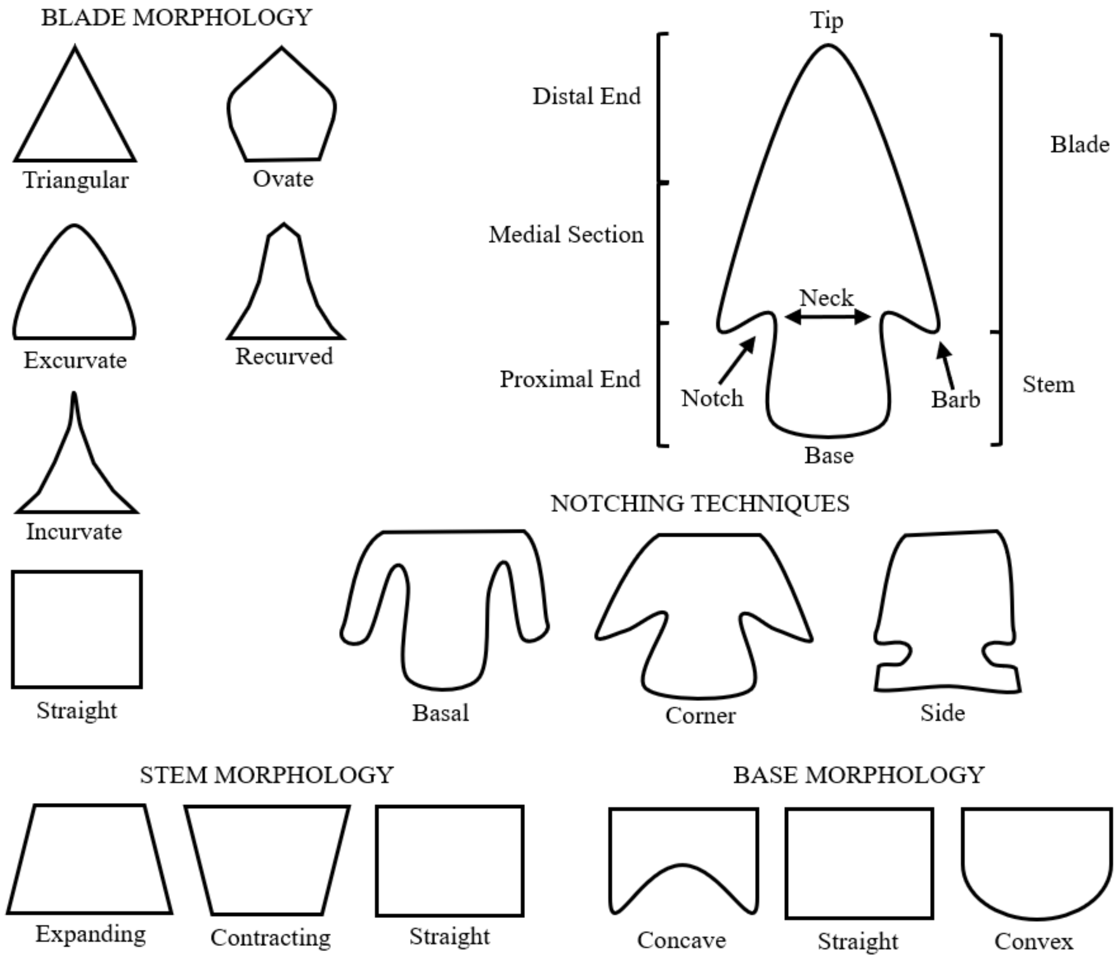

Figure 3.2 Projectile Point Attributes. Adapted from Ray (2016:5).

Rockwall

Age: Evans-Harlan Phase (A.D. 1000-1250). Brown (1996:441) lists provenience of Rockwall points from Spiro IA through Spiro II.

Distribution: Southeast Oklahoma into the southern Caddo region.

Morphological Notes: Corner notched arrow similar to a scallorn with serrated wide blade and long barbs (Ray 2016:31). Average length at 28.4 mm (20-39.5 mm). Base is straight or concave with a 8.32 mm average basal width (5-12 mm). Stem is expanding. Blade is convex, triangular, and/or straight with a 17.11 mm average blade width (14.2-21.4 mm; typically located at shoulders).

References: (Brown 1996:441; Duncan et al. 2007:104–108; Perino 1971:84–85; Sievert and Rogers 2011:83)

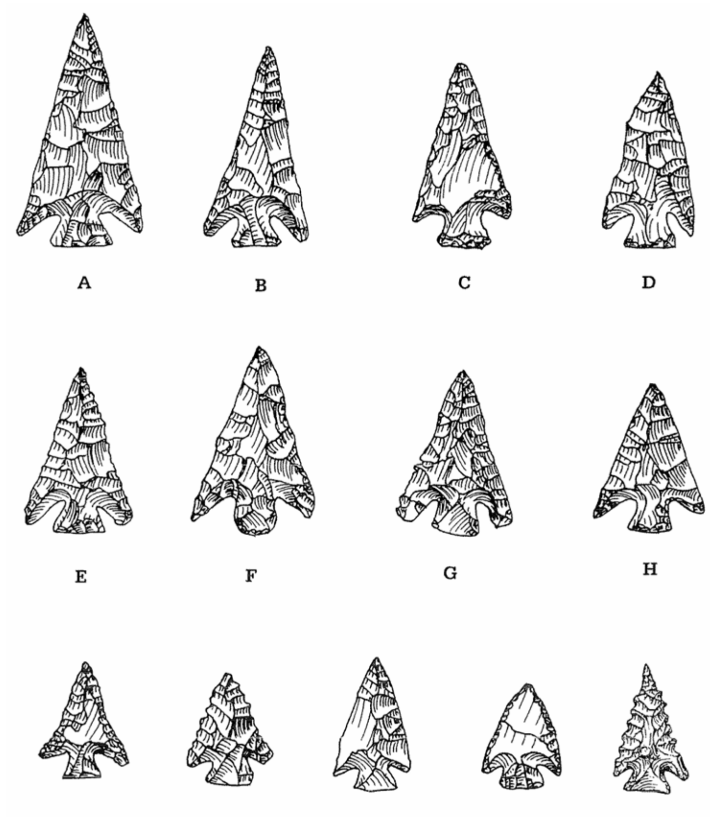

Figure 3.3: Illustrations of Rockwall Points. From Duncan et al. (2007:108).

Scallorn

Age: Late Evans-Norman Phase (A.D. 1050-1350). Brown (1996:442) lists provenience of Scallorn points from Spiro IB through Spiro III.

Distribution: Across Caddo area from Texas into southwestern Missouri.

Morphological Notes: Corner-notched arrow with deep haft openings and barbed shoulders with expanding tangs. Average length at 35.8 mm (27.8-43.8 mm). Base is straight, convex, and/or concave with a 9 mm average basal width (7-13 mm). Stem is expanding and/or straight. Blade is excurvate, incurvate, straight, and/or triangular with a 12 mm average blade width (10-20 mm; typically located at shoulders).

References: (Bell 1960:84–85; Brown 1996:442; Duncan et al. 2007:113–118; Justice 1987:220–223; Ray 2016:30–32; Sievert and Rogers 2011:85)

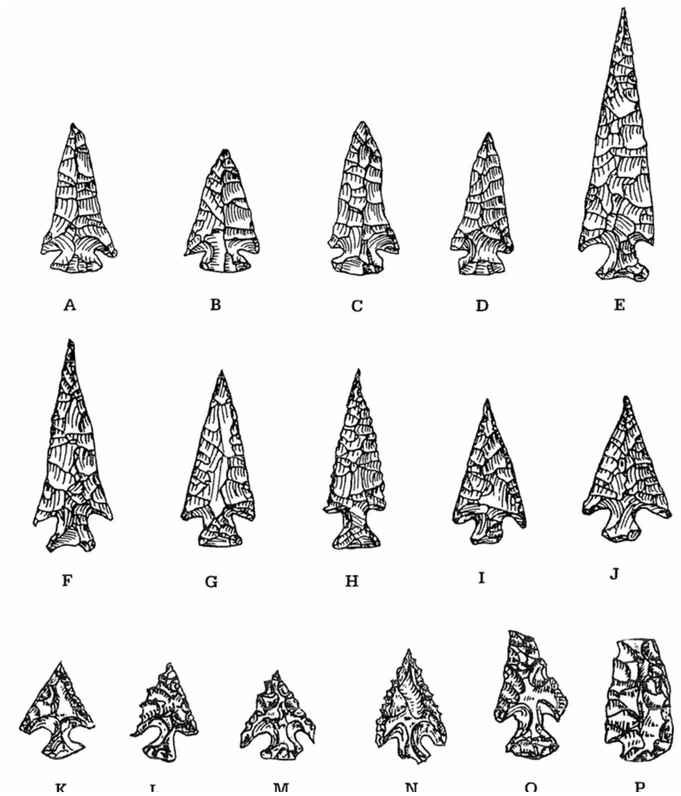

Figure 3.4: Illustrations of Scallorn Points. From Duncan et al. (2007:118).

Hayes

Age: Harlan Phase (A.D. 1050/1100-1250). Brown (1996:440) lists provenience of Hayes points within the Spiro II.

Distribution: Ozarks into the Caddo region and northward through Missouri.

Morphological Notes: Corner-notched arrow with wide haft openings, tangs that are relatively broad pointed, and a diamond-shaped stem. Average length is 35.8 mm (27.8-43.8 mm). Base is convex with a 9.84 mm average basal width (8.9-10.8 mm). Stem is expanding and/or contracting which is roughly diamond shaped but can be more rounded out. Blade is recurved, concave, and/or straight with a 19.66 mm average blade width (16-27 mm; typically located at shoulders).

References: (Bell 1958:32–33; Brown 1996:440; Duncan et al. 2007:63–68; Sievert and Rogers 2011:79–83)

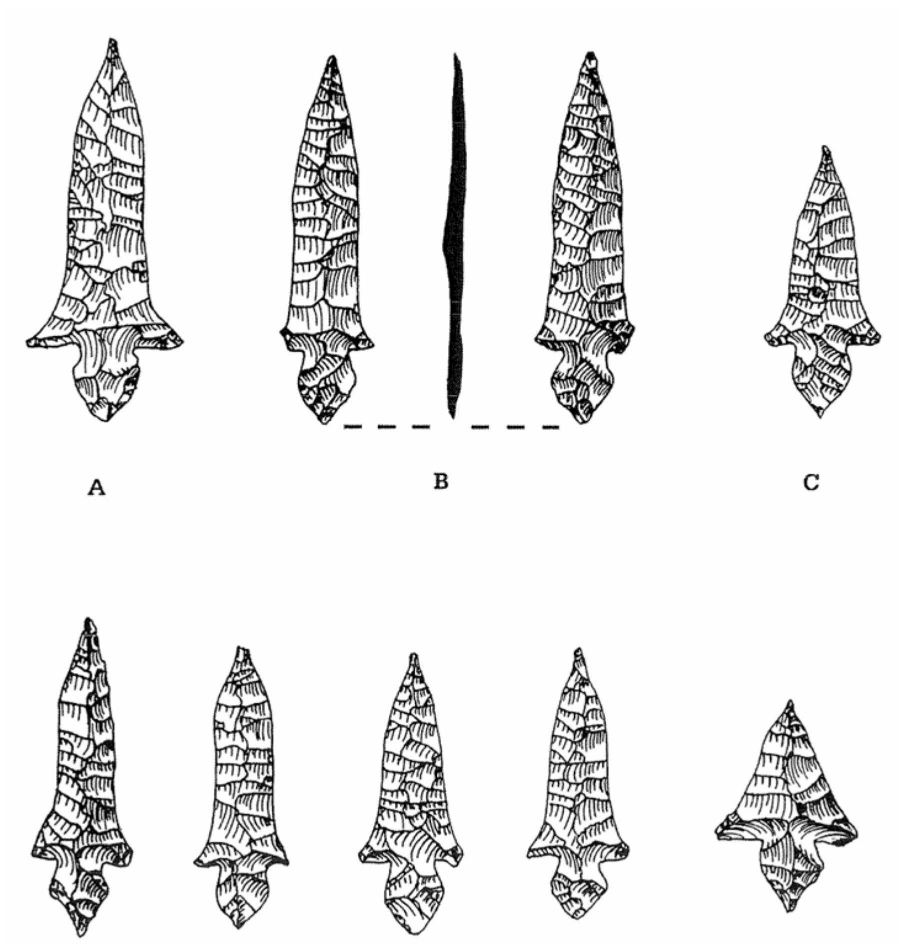

Figure 3.5: Illustrations of Hayes Points. From Duncan et al. (2007:66).

Haskell

Age: Harlan-Norman Phase (A.D. 1050/1100-1350). Brown (1996:444) lists provenience of Rockwall points from Spiro II through Spiro III.

Distribution: Arkansas River Valley of eastern Oklahoma and western Arkansas.

Morphological Notes: Extreme proximal side-notched arrow with angular corners. Average length is 25.59 mm (20.4-30.8 mm). Base is concave with a 10.42 mm average basal width (6-13.4 mm). Stem is expanding and/or straight. Blade is ovate and/or straight with a 19.4 mm average blade width (14-25.5 mm; typically located at shoulders or base).

References: (Brown 1996:444; Duncan et al. 2007:59–62; Perino 1971:32–33; Sievert and Rogers 2011:87)

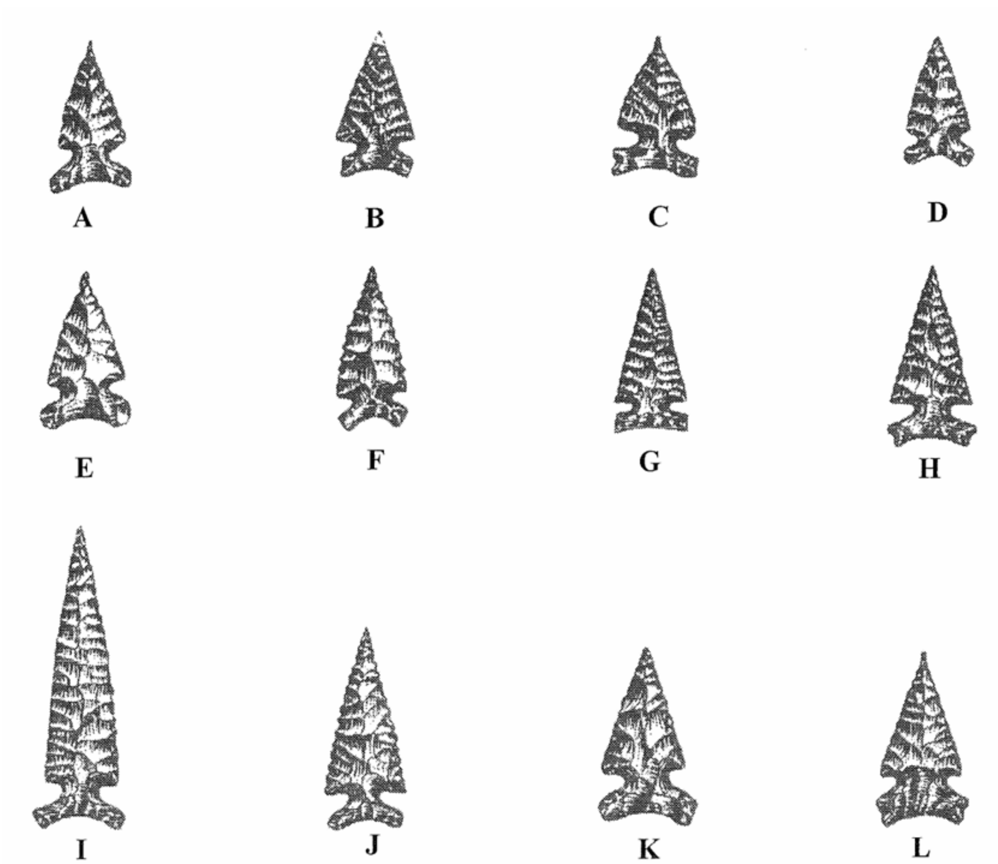

Figure 3.6: Illustrations of Haskell Points. From Duncan et al. (2007:61).

Other Lithic Flake, Tool, and Reduction Terminologies

Debitage Versus Flake

I try in this thesis to describe all the products of lithic reduction other than tools as "debitage" instead of "flakes" or "waste." I take particular care in this matter due to the flake typology utilized in this study. Complete flakes, broken flakes, flake fragments, and debris as outlined by Sullivan and Rozen (1985) are collectively referred to as "debitage" when discussed in their entirety as being products of lithic reduction. When the term "flake" is used in this thesis it is particularly referring to lithic debitage that have platforms present or a singular ventral surface (i.e. complete flakes, broken flakes, and flake fragments).

Utilized Flake

A utilized flake shows evidence of further modification following its removal as evidence of usage. Microflaking can occur on utilized portions of flakes, often requiring a hand lens to identify. No further in-depth usewear analysis was conducted on flakes identified as utilized. The writer went through the entire Structure 24 assemblage identifying utilized flakes following the initial mass analysis.

Retouched Flake

A retouched flake differs from a utilized flake. A retouched flake shows additional pressure flaking or percussion following its initial removal. These flakes can be unimarginal or bimarginal depending on how they were worked. Examples need to exhibit intentional flintknapping modification following initial removal, beyond just post-depositional breakage, to be considered retouched. Retouched flakes were identified by students conducting mass analysis.

Scraper

A scraper is a lithic tool with a steep retouched edge. Scrapers were identified by students conducting mass analysis.

Microdrill

A microdrill is a flake tool used in a rotary motion to perforate another material. The single microdrill found was identified by the writer.

Core

A core is an objective lithic piece that was used to produce further flakes from. Cores were conservatively identified by students during the mass analysis and likely underrepresent the total number of cores other lithic analysts might identify in the same assemblage. Cores from Structure 24 mostly consist of an unambiguous multidirectional technique employing local stream cobbles. Many pieces of chipped stone debitage that fall into the debris category of Sullivan and Rozen's (1985) flake completion typology are candidates for being recorded as cores by other lithic analysts.

Bipolar Reduction

This reduction technique utilizes an objective piece being placed upon an anvil and then struck with a hard hammerstone. The first percussion force from the hammerstone is assisted by a second percussion force rippling upwards from the anvil to knap the objective piece (Figure 3.7). When the opposite directions of bipolar forces meet, the force typical surpasses the elastic limit of the objective piece, shattering it into recognizable wedged shape pieces like an orange slice (Crabtree 1972:10–11). Bipolar reduction is commonly used to split or shear pebbles with off-centered blows. Shearing can radiate force waves from both ends together which typically does not leave a bulb of percussion. Instead, rippled force wave scars are commonly present near the point of least contact with signs of crushing on the opposing side. This shearing strategy is also described differently as a unique flake initiation type known as wedging. The initiation of force used in wedging is typical focused on the center of the objective piece to begin a crack (Andrefsky Jr. 2005:26–27).

Figure 3.7: Illustration of Bipolar Reduction. From (Crabtree 1972:40).

Paloma de la Peña (2015:318–319) outlines some very helpful attributes from their experimental study of producing bipolar cores: 1.) Hammered and opposite edges become smooth, blunted, and rectilinear with fissures; when rotated the core becomes quadrangular, 2.) Flake removals often have dramatic overlaps, 3.) Core size dramatically decreases with knapping, 4.) Step and hinge termination scars on cores are most common, and 5.) Pronounced percussion waves or ripples are produced onto the surface of the core. Paloma de la Peña (2015:320) also lists attributes of debitage produced via bipolar reduction: 1.) A wide range of blank types are produced like flakes, bladelets, and chunks, 2.) Broken or linear butts are present with fissures on their terminations, 3.) Points of impact are not easily discernable, and 4.) Ripples on ventral surface are visible and close together. Closely situated ripples as an outcome of bipolar reduction however can vary heavily with raw material type and quality (Jeske and Lurie 1993:140). Factors listed above alongside experience flintknapping with the bipolar technique guided the writer in their identification of debitage from Structure 24 as being produced via bipolar reduction or another technique.

Spatial Exploratory Analysis

Summary statistics gathered from the mass analysis were used to produce choropleth maps of Structure 24's lithic assemblage. ArcGIS Pro was used to identify potential work areas and spatial patterns in the lithic data.

Each flake's bag number is recorded on the mass analysis, which I matched with its northing, easting, level, and unique unit ID numbers. I assigned these unique ID numbers for each vertical excavation unit in order of their physical entries (Figure 3.8). Converting archaeological coordinate grided excavation units to ArcGIS is possible using the ASCII 3D to Feature Class tool. This tool requires a text file containing each polygon's number, the XYZ coordinates of each corner point in a repeated order, followed by an end delimiter command (Figure 3.9). I matched the mass analysis summary statistics to each of their respected excavation unit IDs on Microsoft Excel. This Excel sheet could then be joined as a data table onto the polygons that represent the excavation units on ArcGIS Pro. All data is finally normalized by two-dimensional shape area, measured in meters. This means that “density” refers to artifacts per meter squared, and the counts of each unit’s area are normalized to each other before displaying the final output. This process is repeated on all distribution maps within this thesis. To gauge counts, multiply the legend’s value displayed for the excavation unit by its area (either 4 or 2).

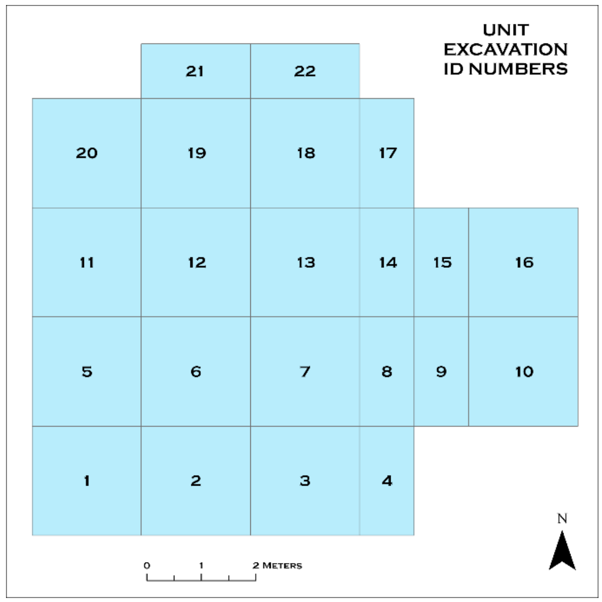

Figure 3.8: Unit ID Numbers Assigned in Preparation for ArcGIS.

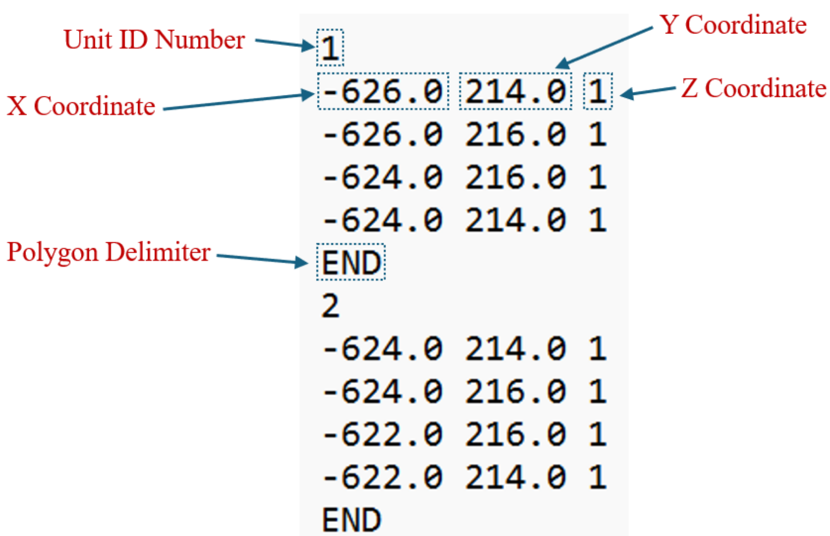

Figure 3.9: Formatting of Text File for ASCII 3D to Feature Class Tool.

In this spatial analysis I made the decision to display artifacts in each unit across all their stratigraphic levels. Maps produced in the following chapters will show every artifact found on every stratigraphic level of each unit. This decision was made because the plow zone intersected with portions of Structure 24 rendering its floor horizons difficult to identify in places. The floor surface was also difficult for excavators to identify due to heavy summer rains. Prior studies at Spiro also included all stratigraphic levels in their distribution maps of artifacts making comparisons more straightforward for future readers (Brooks 1989; Rogers 1980, 1982; Rogers et al. 1982).

Conclusion

In this chapter I presented the methodology utilized in the mass analysis, the individual flake attribute analysis, and the spatial exploratory analysis. Lithic debitage at Spiro has never received as detailed of a study as this. The consequence is that a strong description giving readers an understanding of the study is required. I encourage future lithic analysts to use similar approaches as those used by myself and others at Spiro for comparisons while also advancing research into new areas.

CHAPTER 4: Results

This chapter will illustrate the results of the analysis conducted from the previous methods chapter. 2032 total pieces of debitage were measured along with 16 hafted biface arrows, 2 small biface fragments, 38 cobble blades, 1 microdrill, 1 hafted drill, 3 scrapers, and 1 retouched flake. 199 pieces of debitage were further identified as utilized.

Biases and Limitations

The mass analysis was performed by undergraduate volunteers and overseen by Dr. Hammerstedt prior to the author's work. Spiro is uniquely situated in eastern Oklahoma to capture raw material types from the Ozark Mountains, Ouachita Mountains, and other regions upstream on the Arkansas River. This leads to at least 20 raw material types that are found at Structure 24. Identifying this many raw material types and their different attributes is an enormous challenge for newcomers to the region and for archaeologists in general. Data collected by new students for the mass analysis is possibly limited in its accuracy, but supervisors guided students throughout the data collection process. All data for the sample debitage population description was gathered by the author and any mistakes in recording are their own.

Hafted Bifaces

Hafted biface arrows consisted of 7 unknown, 5 Rockwall, 2 Scallorn, 1 Hayes, and 1 Haskell (Figures 4.1-4.3). There was also a 1 hafted drill (Figure 4.4). Ages for the projectile points were determined using Brown's (1996:439–456) seriation of Craig Mound. All the projectile points suggest the Harlan Phase to be the most likely cultural phase of Structure 24 (Table 4.1).

Figure 4.1: Rockwall and Scallorn Points from Structure 24. (a-c) Rockwall, (d) Scallorn.

Figure 4.2: Hayes Point from Structure 24.

Figure 4.3: Haskell Point from Structure 24.

Figure 4.4: Drill from Structure 24.

Table 4.1: Hafted Bifaces of Structure 24.

Artifact Type	**Count**	**Age**
Unknown	7	N/A
Rockwall	5	Evans-Harlan Phase A.D. 1000-1250
Scallorn	2	Late Evans-Norman Phase A.D. 1050-1350
Hayes	1	Harlan Phase A.D. 1050/1100-1250
Haskell	1	Harlan-Norman Phase A.D. 1050/1100-1350
Drill	1	N/A

Antlers Gravel and Chalcedony were found to be the most common raw material type of hafted bifaces at Structure 24 with counts of 4 for each (Figure 4.5). Tahlequah chert, potentially Peoria, was found to be the next most common raw material type with 3 specimens. Two hafted bifaces were determined to be made of Reeds Spring while a single hafted biface was found for Johns Valley, Boone, Quartzite, and Woodford.

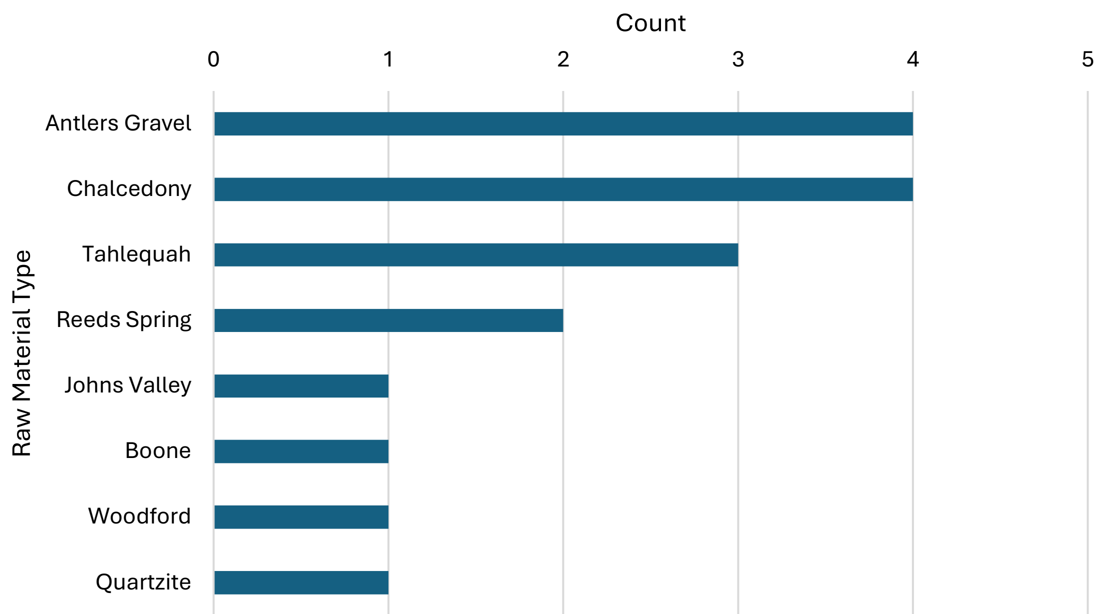

Figure 4.5: Raw Material Types of Hafted Bifaces.

Bifacial Fragments

Two bifacial fragments were identified at Structure 24. One heat treated Florence A biface fragment with a barb was present along with an Arkansas Novaculite biface fragment (Figure 4.6). The Florence A specimen contains an unusual breakage pattern that has split the biface medially from top to its bottom side edge, and again from this edge to the bottom of the remaining barb. The specimen likely contained a hafting element but is listed separately as a fragment due to its unusual breakage patterns obscuring its previous form. The novaculite specimen appears to be a reworked flake with heavy retouching on its unifacial surface. It may have been a drill, similar to the specimen pictured in Figure 4.4.

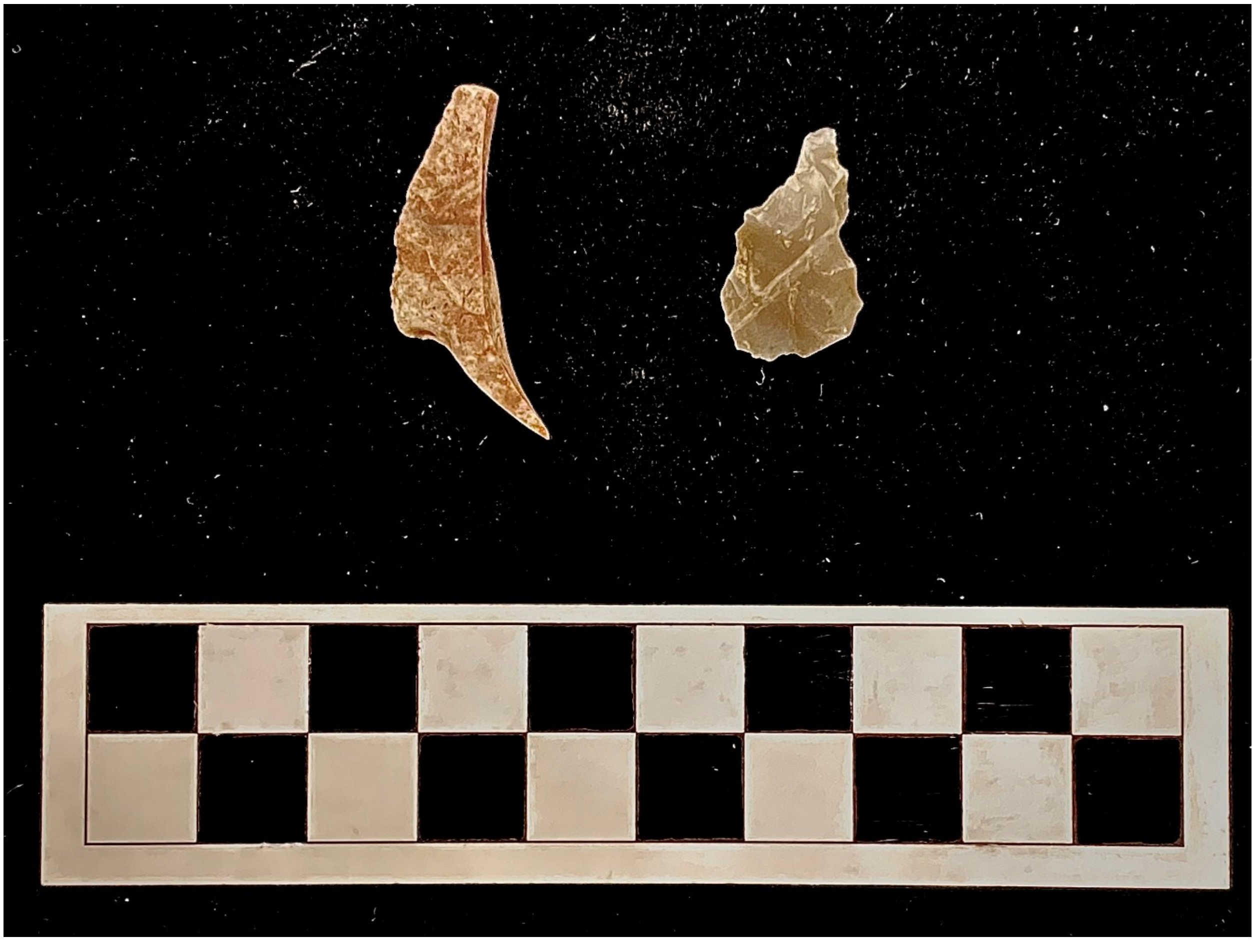

Figure 4.6: Bifacial Fragments of Structure 24. Florence A Biface with Barb (Left) and Arkansas Novaculite Biface (Right).

Mass Analysis

A preliminary analysis of Structure 24 has already been published by Hammerstedt et al. (2026) which provides information on the of assortment of raw material types at the structure. As mentioned in the methods chapter, flake count totals in this thesis are different from the preliminary report. Results of the mass analysis will be compared against the sampled debitage population in the discussion chapter.

8218 total pieces of debitage were recorded during the mass analysis. 199 pieces of debitage displayed evidence of utilization while 1 was retouched. The assemblage predominately consists of size grade 2 debitage with a count of 4474 (54.44%), followed by size grade 3 at 1983 (24.13%), and size grade 1 at 1761 (21.43%) (Tables 4.2 and 4.3). The total weight of size grade 1 debitage at 10344.74 is considerably larger than the other size grades combined because each piece of debitage in size grade 1 is at least twice as large as the next two sizes. The smallest size grade debitage were the most likely to have the least amount of cortex while the largest size grade debitage were more likely to have cortex remaining. 2556 pieces of debitage were heat treated, over 31% of the entire assemblage.

Table 4.2: Mass Analysis Debitage by Size Grade in Counts.

Size Grade	Number of Debitage	Total Weight (g)	Cortex 0 (0%)	Cortex 1 (1-50%)	Cortex 2 (51-99%)	Cortex 3 (100%)	Heat Treatment
1 (0.5in)	1761	10344.74	263	1261	213	24	479
2 (0.25in)	4474	3101.63	1623	2561	248	42	1488
3 (0.125in)	1983	688.64	986	878	90	29	589
Total	8218	14135.01	2872	4700	551	95	2556

Table 4.3: Mass Analysis Debitage by Size Grade in Percentages.

Size Grade	Number of Debitage	Total Weight (g)	Cortex 0 (0%)	Cortex 1 (1-50%)	Cortex 2 (51-99%)	Cortex 3 (100%)	Heat Treatment
1 (0.5in)	21.43%	73.19%	3.2%	15.34%	2.59%	0.29%	5.83%
2 (0.25in)	54.44%	21.94%	19.75%	31.16%	3.02%	0.51%	18.11%
3 (0.125in)	24.13%	4.87%	12%	10.68%	1.1%	0.35%	7.17%
Total % of Assemblage	100%	100%	34.95%	57.19%	6.7%	1.16%	31.1%

Debitage Description

Flake Completion Typology, Material Type, Bipolar Reduction

Complete flakes were the most numerous of the flake completion typology in the assemblage with a count of 627 seconded by debris at 597 (Figure 4.7). All 2032 pieces of debitage measured were successfully assigned to the flake completion typology.

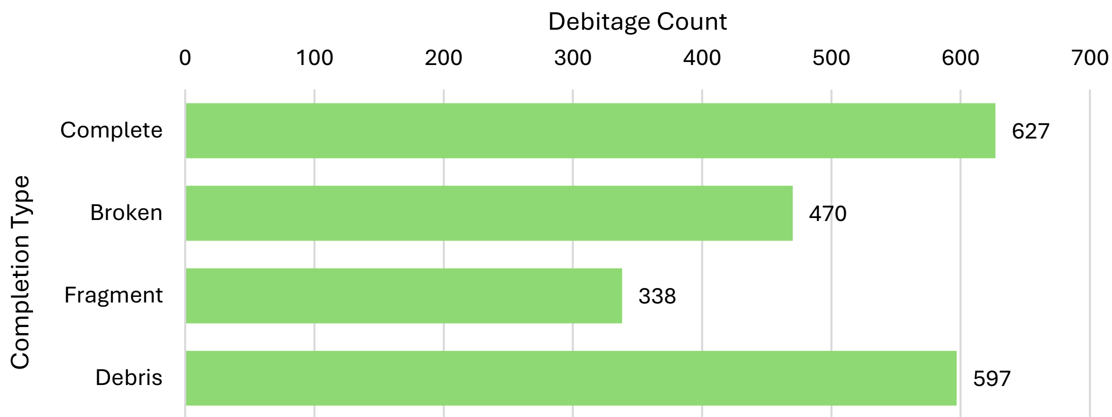

Figure 4.7: Distribution of Flake Completion Types in Sampled Assemblage.

Reeds Spring chert was the most common material type in the assemblage with a count of 1172, followed by Antlers Gravel at 322 (Figure 4.8). Bipolar reduction was identified as the reduction technique for 398 (19.59%) pieces of debitage with the remainder resulting from other unidentified techniques (Table 4.4). Debitage produced via bipolar reduction weighed more on average at 3.4g while all other techniques averaged less at 1.39g. Bipolar reduction also averaged a larger average maximum dimension than other techniques.

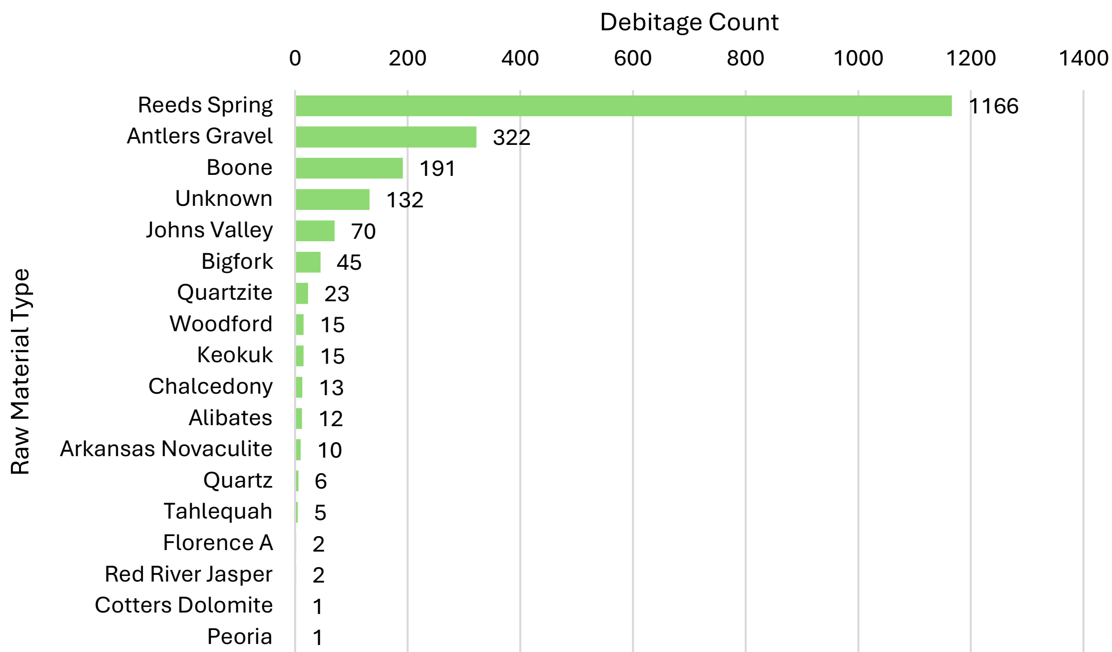

Figure 4.8: Raw Material Count Distribution in Sampled Assemblage.

Table 4.4: Bipolar Reduction Versus Other Techniques from Sampled Assemblage.

	Count	**Average Weight**	**Average Maximum Dimension**
Bipolar Reduction	398	3.4g	21.75mm
Other Techniques	1634	1.39g	17.21mm

Cortex Percentage

The percentage of cortex was measured on all flake types. Complete, broken, and flake fragments had 0% cortex remaining on 666 flakes, 1-50% cortex remaining on 614 flakes, 51-99% cortex remaining on 102 flakes, and 100% cortex remaining on 53 flakes (Tables 4.5 and 4.6). The cortex percentage of debris is displayed separately from complete, broken, and flake fragments because its cortex was determined as a percentage of the entire specimen instead of just on the dorsal surface or areas other than the platform (Table 4.7). In the entire sampled assemblage, 899 pieces of debitage (44.24%) had no cortex present, 874 pieces of debitage

(43.01%) had 1-50% of cortex remaining, 188 pieces of debitage (9.25%) had 51-99% of cortex remaining, and only 71 pieces of debitage (3.49%) had all its cortex remaining.

Table 4.5: Counts of Cortex on Complete, Broken, and Flake Fragments.

Completion Type	Cortex 0 %	Cortex 1-50%	Cortex 51-99%	Cortex 100%
Complete	252	310	46	19
Broken	234	195	26	15
Fragment	180	109	30	19
Total	666	614	102	53

Table 4.6: Percentages of Cortex on Complete, Broken, and Flake Fragments.

Completion Type	Cortex 0%	Cortex 1-50%	Cortex 51-99%	Cortex 100%
Complete	12.4%	15.26%	2.26%	0.94%
Broken	11.52%	9.6%	1.28%	0.74%
Fragment	8.86%	5.36%	1.48%	0.94%
Total % of Sample Assemblage	32.78%	30.22%	5.02%	2.61%

Table 4.7: Count and Percentage of Cortex on Debris.

Completion Type	Cortex 0%	Cortex 1-50%	Cortex 51-99%	Cortex 100%
Debris	233	260	86	18
Total % of Sample Assemblage	11.47%	12.8%	4.23%	0.89%

Flake Dimension Measurements

Weight and maximum general dimension were recorded on all flake completion types. Technological length, technological width, and maximum general thickness were only recorded on complete, broken, and flake fragments. The average weight of all debitage was 1.81g while the maximum general dimension was 18.09mm (Table 4.8). The average technological length was 14.24mm, average technological width was 12.45mm, and maximum general thickness was 4.52mm (Table 4.9).

Table 4.8: Average Measurements of Weight (g) and Maximum General Dimension (mm).

Attribute	Complete	Broken	Fragment	Debris	Total
Weight (g)	1.93	1.28	0.72	2.68	1.81
Maximum General Dimension (mm)	20.74	17.55	15.43	17.55	18.09

Table 4.9: Average Measurements of Technological Length (mm), Technological Width (mm), and Maximum General Thickness (mm).

Attribute	Complete	Broken	Fragment	Total
Technological Length (mm)	16.26	13.77	11.16	14.24
Technological Width (mm)	14.00	11.61	10.77	12.45
Maximum General Thickness (mm)	5.00	4.52	3.61	4.52

Flake Platform Attributes

Only complete and broken flakes exhibit identifiable platforms. Cortical platforms were the most abundant platform type with a count of 889 followed by flat platforms at 185 (Figure 4.9). Platform crushing was evident on 374 pieces of debitage (Figure 4.10). The average platform maximum general dimension was 9.66mm, average technological length was 3.39mm, and average technological width was 8.99mm (Table 4.10).

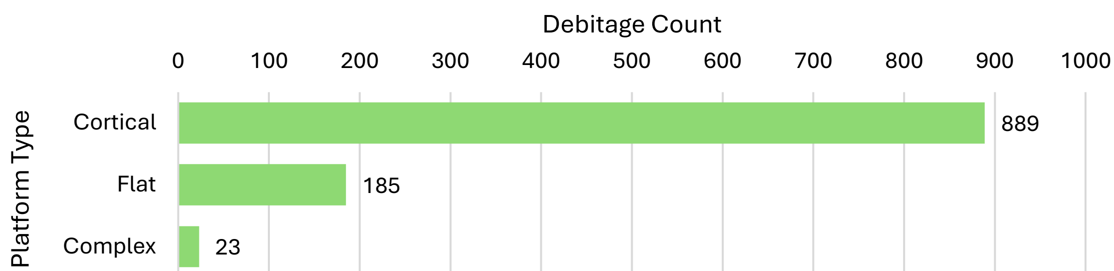

Figure 4.9: Platform Type Frequency.

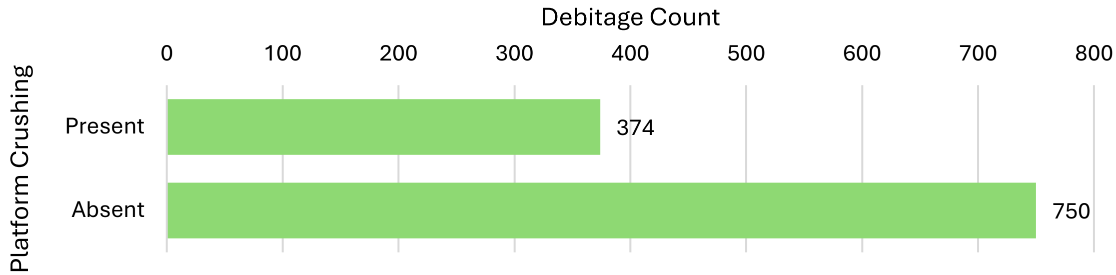

Figure 4.10: Evidence of Platform Crushing.

Table 4.10: Flake Platform Attribute Measurements.

Flake Platform Attribute	**Average (mm)**	**Standard Deviation (mm)**
Maximum General Dimension	9.66	5.09
Technological Length	3.39	2.32
Technological Width	8.99	4.78

Bulb of Percussion, Platform Lipping, and Flake Termination Type

The presence of a bulb of percussion and platform lipping were only identified on complete and broken flakes. 604 flakes demonstrated a bulb of percussion while 493 did not (Figure 4.11). I have chosen to display this attribute by its flake completion type due to potential recorder bias causing some broken flakes to be more difficult to distinguish bulbs of percussion on if the specimen is broken near its percussion bulb. Platform lipping was identified on 229 flakes with the remaining 868 flakes not exhibiting lipping (Figure 4.12).

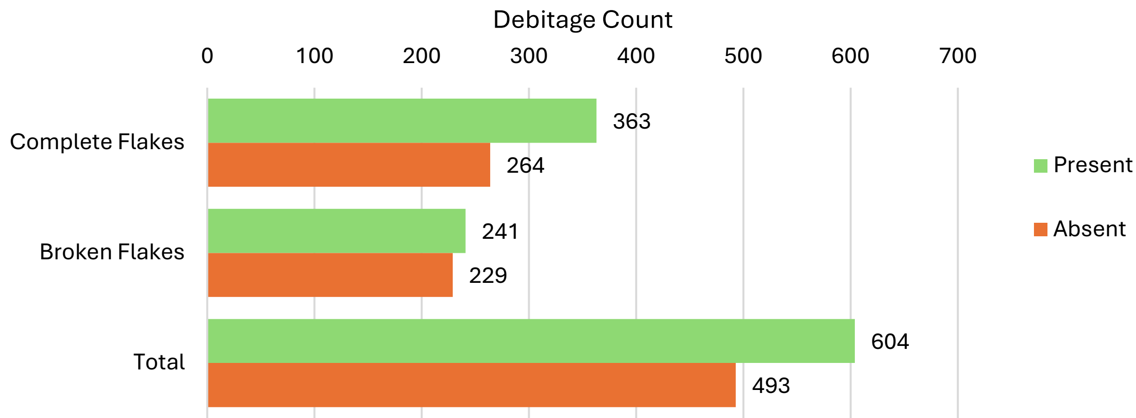

Figure 4.11: Bulb of Percussion by Flake Completion Type.

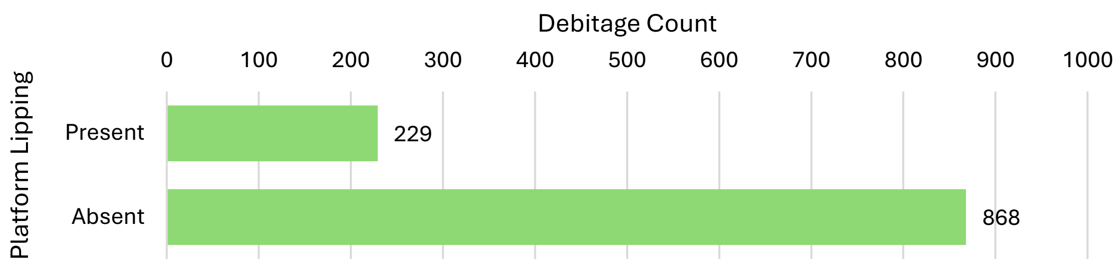

Figure 4.12: Occurrence of Platform Lipping.

Flake termination type was recorded on complete, broken, and fragment flakes. Feathered terminations were the most common flake termination type with a count of 903 followed by hinges with 347, step with 171, and plunges with only 14 (Figure 4.13). I have displayed flake termination by flake completion type due to broken flakes and flake fragments potentially having a higher likelihood of displaying step terminations.

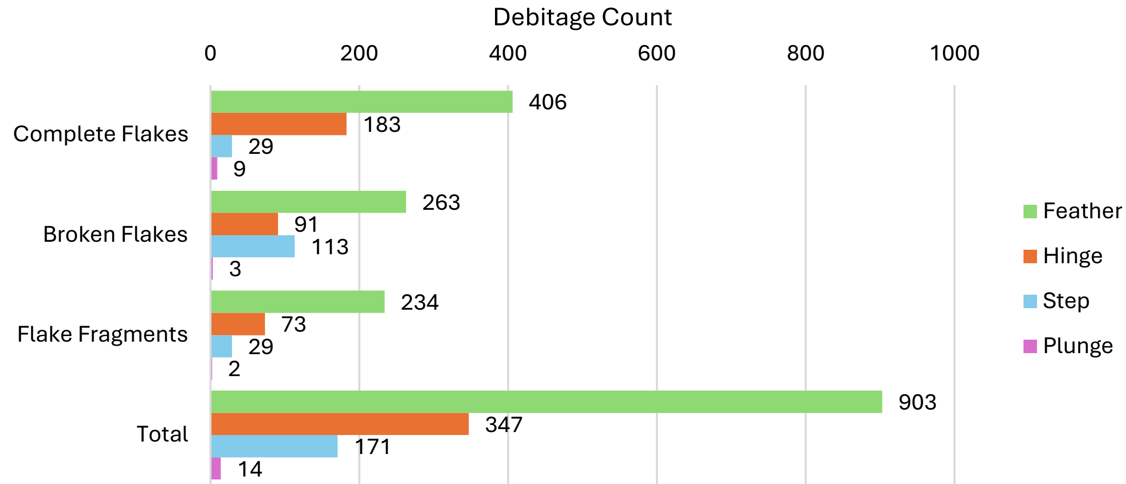

Figure 4.13: Flake Termination Type by Flake Completion Type.

Number of Flake Removals

The number of flake removals were recorded on both dorsal and ventral sides of complete, broken, and flake fragments. Dorsal side flake removals ranged from 0 to 11 with 2 (n=433) being the most common number of removals (Figure 4.14). Ventral side flake removals ranged from 0 to 4 with 0 (n= 1266) being the most common number of removals (Figure 4.15).

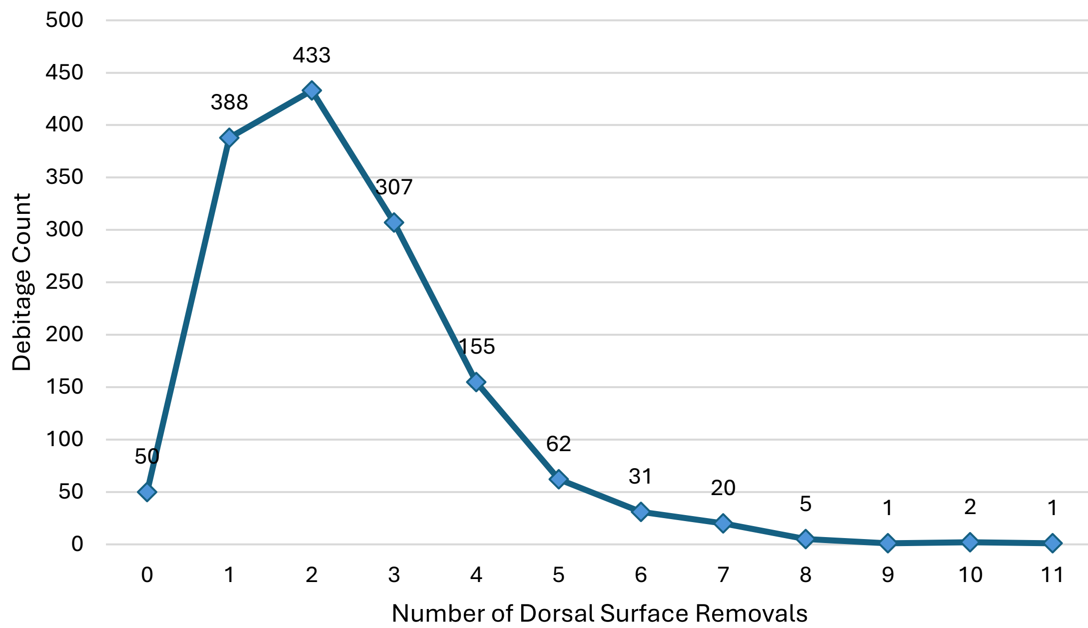

Figure 4.14: Distribution of Dorsal Surface Removals.

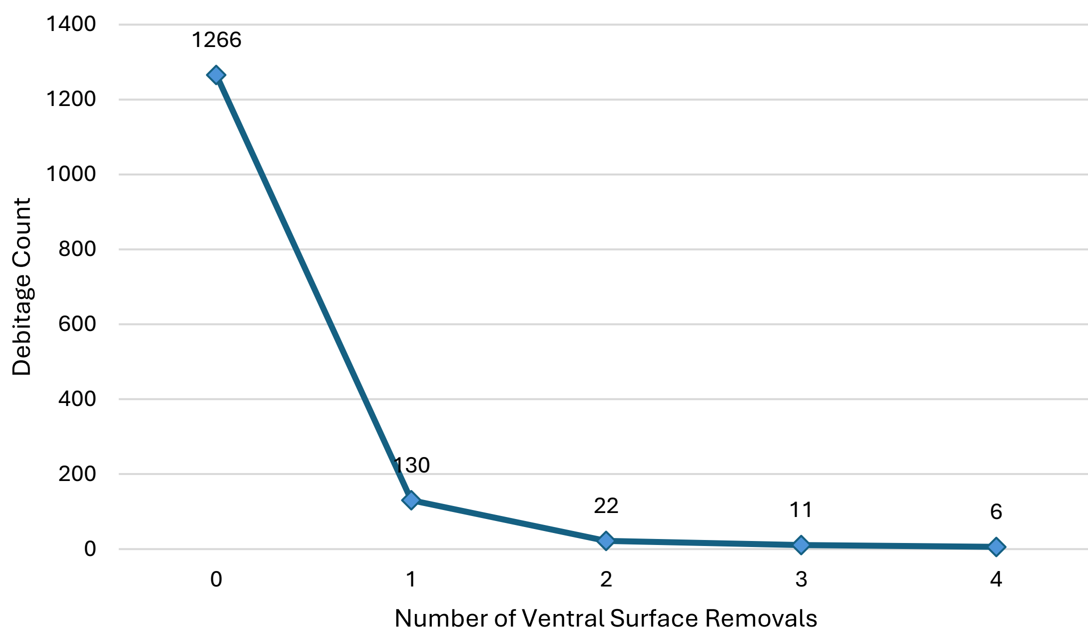

Figure 4.15: Distribution of Ventral Surface Removals.

Post-Thermal Alteration

Examples of potlids and crazing were recorded on the dorsal and ventral surfaces of complete, broken, and flake fragments. Potlids and crazing were also recorded separately on any portion of debris. There were potlids on the dorsal surface of 93 flakes, crazing on 13 flakes, and 14 flakes with both attributes occurring together. There were also potlids on the ventral surface of 93 flakes, crazing on 1 flake, and 6 flakes with both attributes occurring together. Potlids occurred on 127 pieces of debris, crazing on 14 pieces of debris, and 27 pieces of debris with both attributes occurring together (Figure 4.16).

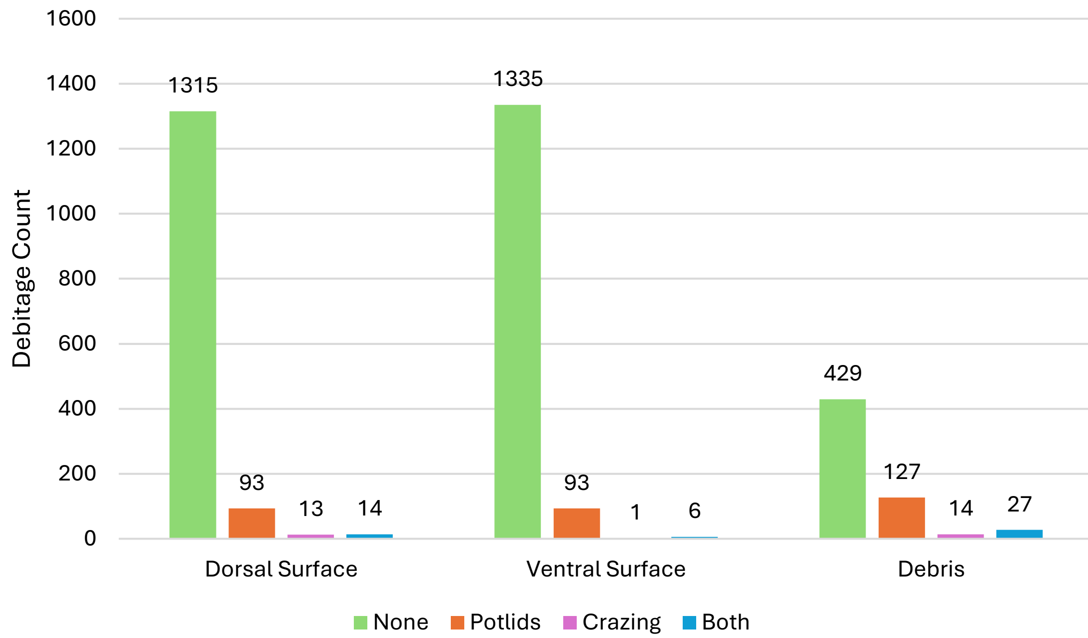

Figure 4.16: Evidence of Post-Thermal Alteration Attributes.

Spatial Results

Lithic debitage is concentrated across the central portion of Structure 24. Maps of total debitage count and total weight by excavation unit both reveal a similar story: lithic debitage is located within the structure as opposed to being located outside of or around it (Figures 4.17 and 4.18). Hafted bifaces are located within the central portion of the structure as well (Figure 4.19).

Ceramics, though not the focus of this thesis, are also concentrated within the boundaries of Structure 24 near its eastern edge (Figure 4.20). Density is displayed as the normalization of each unit's area by artifacts per meter squared.

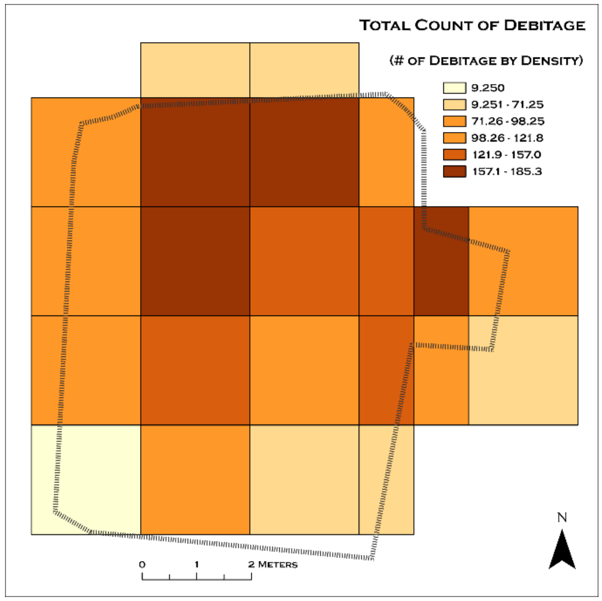

Figure 4.17: Total Count of Debitage by Artifacts per Meter Squared.

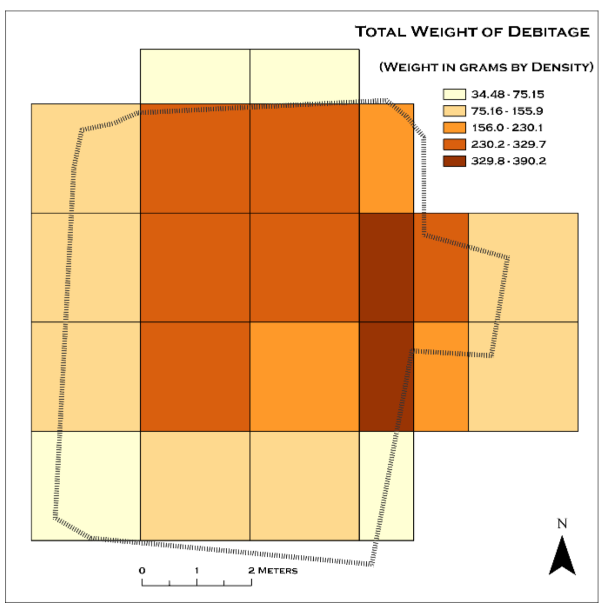

Figure 4.18: Total Weight of Debitage by Artifacts per Meter Squared.

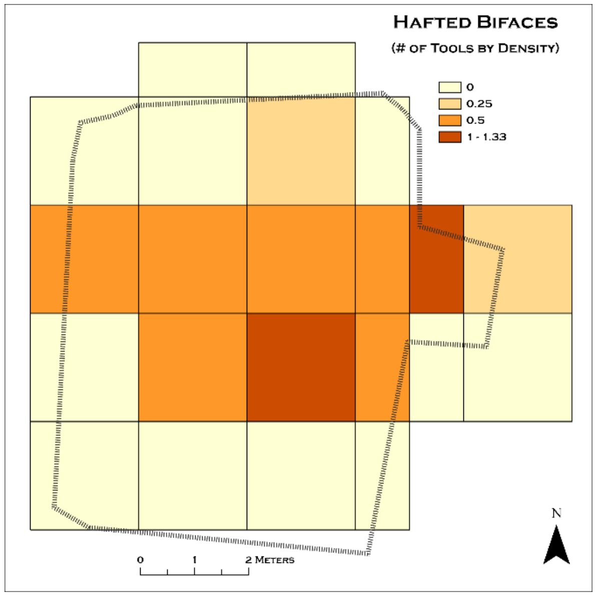

Figure 4.19: Total Count of Hafted Bifaces by Artifacts per Meter Squared.

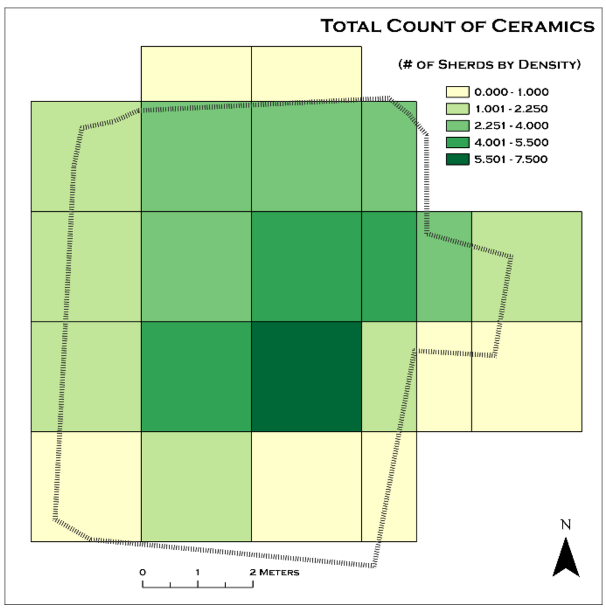

Figure 4.20: Total Count of Ceramics by Artifacts per Meter Squared.

When the lithic debitage and ceramic assemblages are viewed through their average weights, however, a different story is revealed. The heaviest lithic debitage at Structure 24 is clearly concentrated around the edges and eastern extent of the structure's outline (Figure 4.21). The heaviest ceramics corroborate this occurrence near the eastern extent and northern edge

(Figure 4.22). Together, lithic debitage and ceramics support a trend across artifact types for the heaviest artifacts to be located around the structure despite most artifacts being concentrated within the structure along its eastern and northern portions.

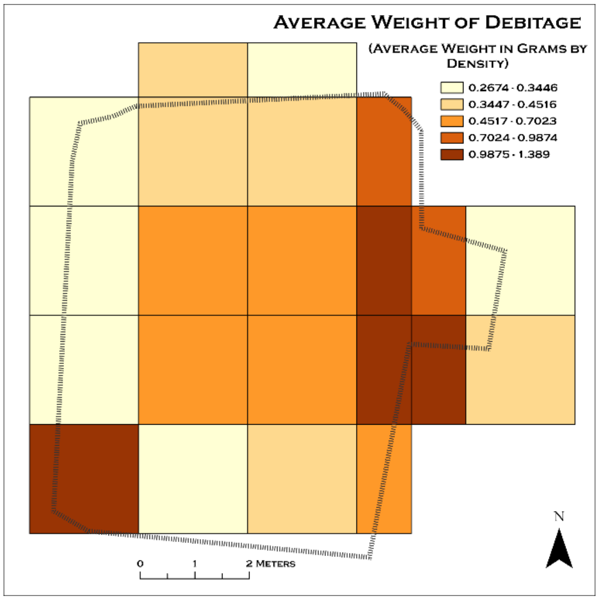

Figure 4.21: Average Weight of Debitage by Artifacts *per* Meter Squared.

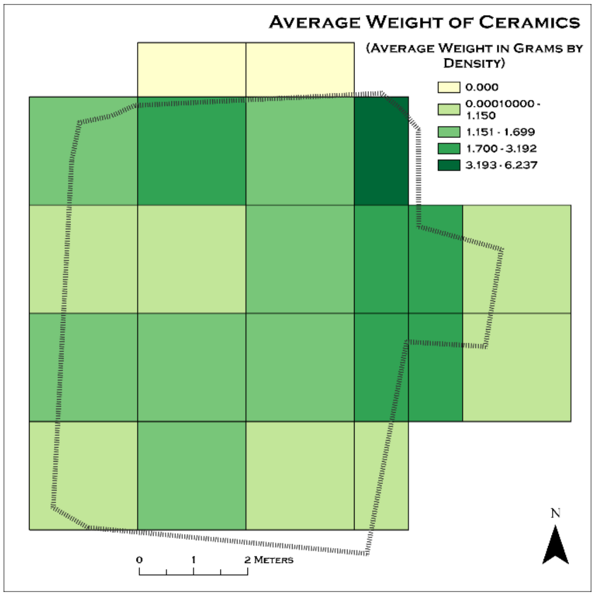

Figure 4.22: Average Weight of Ceramics by Artifacts *per* Meter Squared.

Spatial Results: Mass Analysis Combination

Cortex percentages and size grades were combined to produce rough areas of early, middle, and late-stage reduction of lithic debitage. Early-stage reduction, with the largest sized debitage and the most remaining cortex, is concentrated on the east-central portion of the structure closest to the entrance (Figure 4.23). Middle-stage reduction, with the second largest sized debitage and half or less remaining cortex, is concentrated on the north-central portion of the structure (Figure 4.24). Late-stage reduction, with the smallest sized debitage and no remaining cortex, is concentrated on the northwest edge and east entrance of the structure (Figure 4.25).

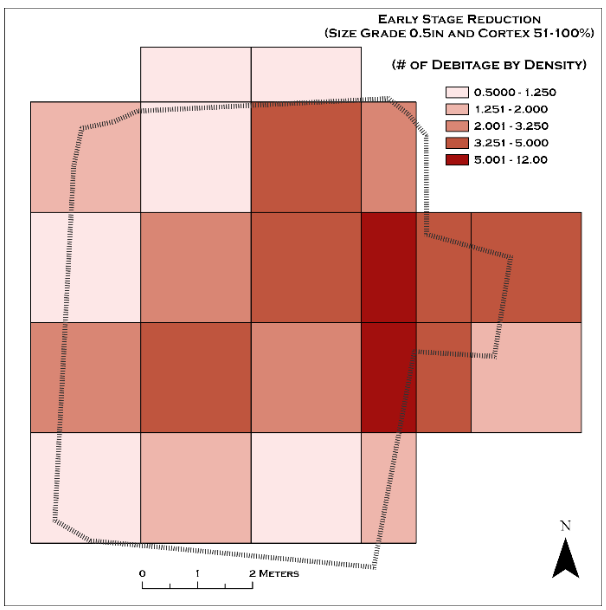

Figure 4.23: Early-Stage Lithic Reduction.

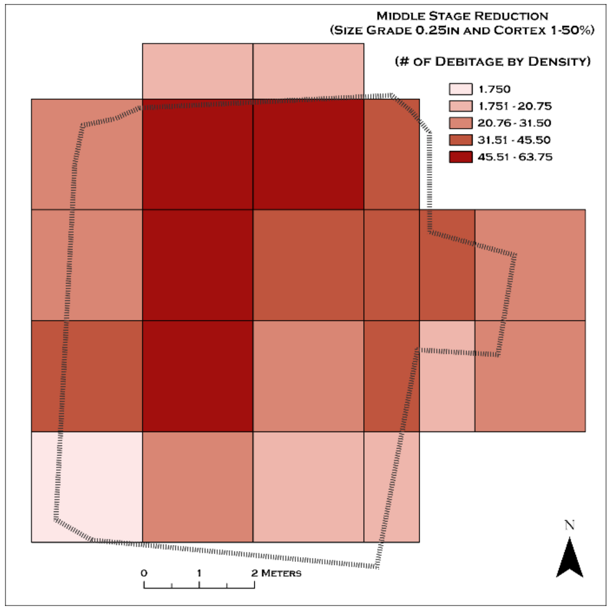

Figure 4.24: Middle-Stage Lithic Reduction.

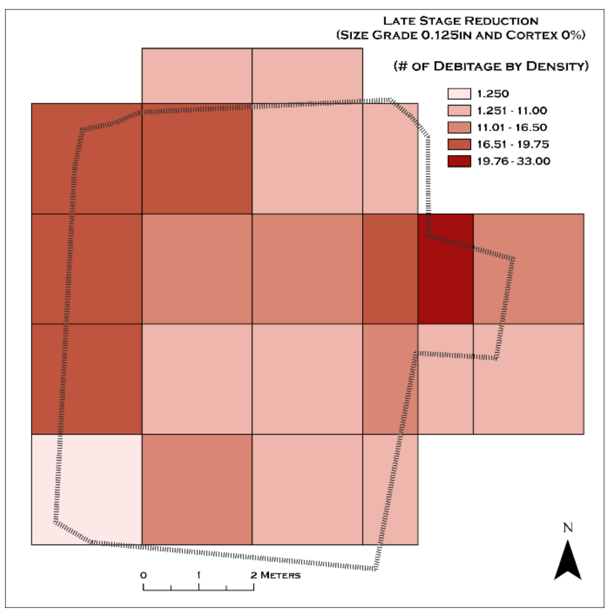

Figure 4.25: Late-Stage Lithic Reduction.

Spatial Results: Raw Material Types

All raw material types with a count of over 20 in the entire assemblage are presented below by source region. Distributions of the raw materials suggest a mostly random patterning.

Some raw materials have a low sample size and may not be as useful for comparison in future research.

Ozark Sources

Reeds Spring, Boone Chert, and Keokuk are the raw material types with counts over 20 from the Ozark region. Reeds Spring is concentrated on the northern and eastern portion of the structure (Figure 4.26). Boone Chert is distributed unevenly across the interior of the structure (Figure 4.27). Keokuk is concentrated heavily at the eastern entrance and broadly across the northern half of the structure (Figure 4.28).

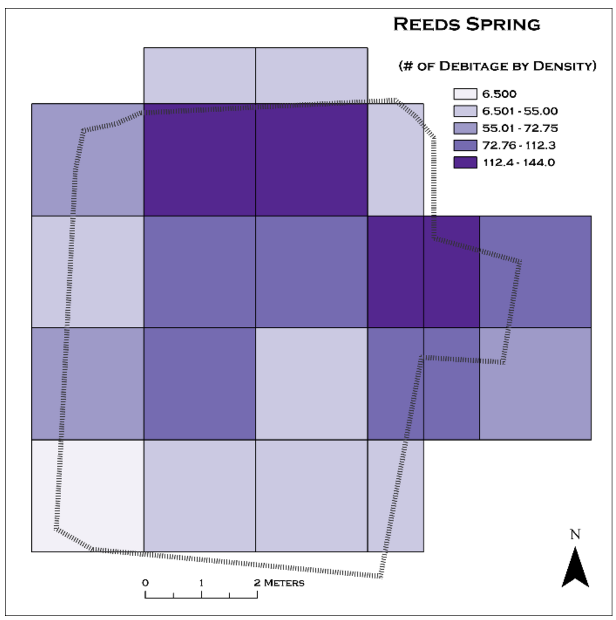

Figure 4.26: Reeds Spring Distribution.

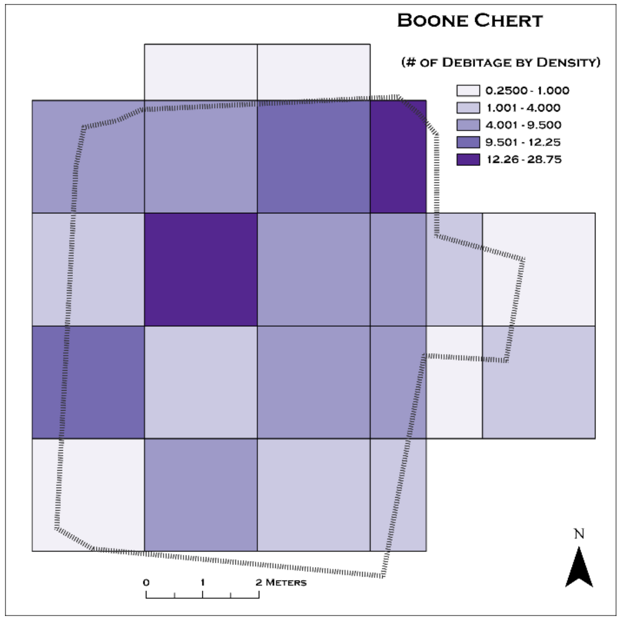

Figure 4.27: Boone Chert Distribution.

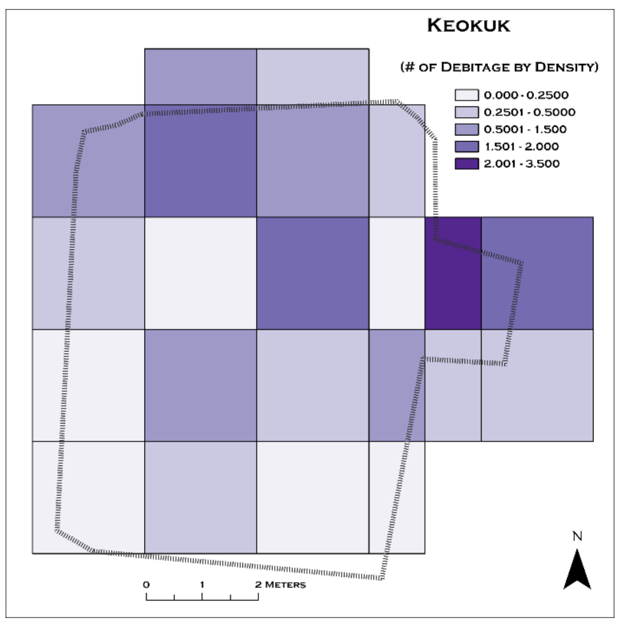

Figure 4.28: Keokuk Distribution.

Ouachita Sources

Johns Valley Chert, Bigfork Chert, Woodford Chert, Arkansas Novaculite, and Quartz are the raw material types with counts over 20 from the Ouachita region. Johns Valley Chert is distributed unevenly around the structure's outline with concentrations near the eastern entrance and northern end (Figure 4.29). Bigfork Chert is also distributed unevenly around the structure's outline with concentrations on the eastern and northern edges of the structure (Figure 4.30). Woodford Chert is concentrated on the central southwestern section of the structure (Figure 4.31). Arkansas Novaculite is distributed lightly across the center of the structure with a larger concentration in the northeast corner (Figure 4.32). Quartz is distributed lightly across the outline of the structure with small concentrations on the northwest corner and eastern entrance (Figure 4.33).

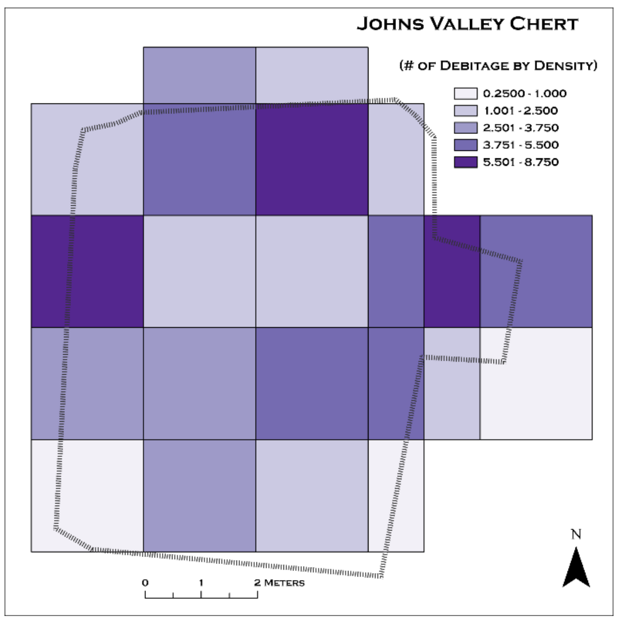

Figure 4.29: Johns Valley Chert Distribution.

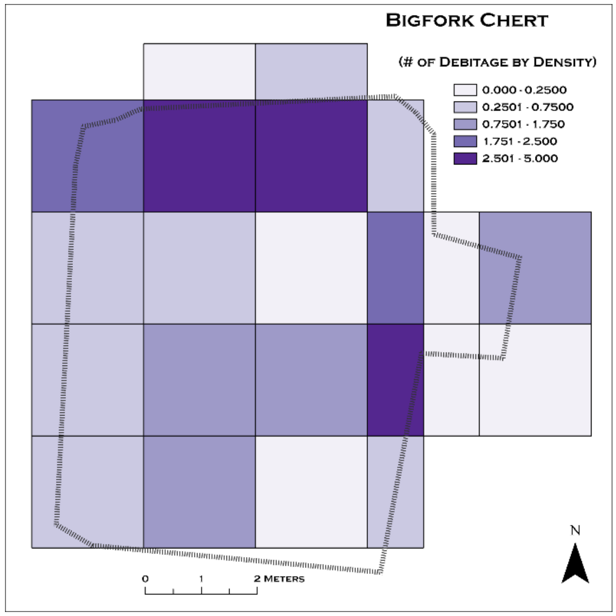

Figure 4.30: Bigfork Chert Distribution.

Figure 4.31: Woodford Chert Distribution.

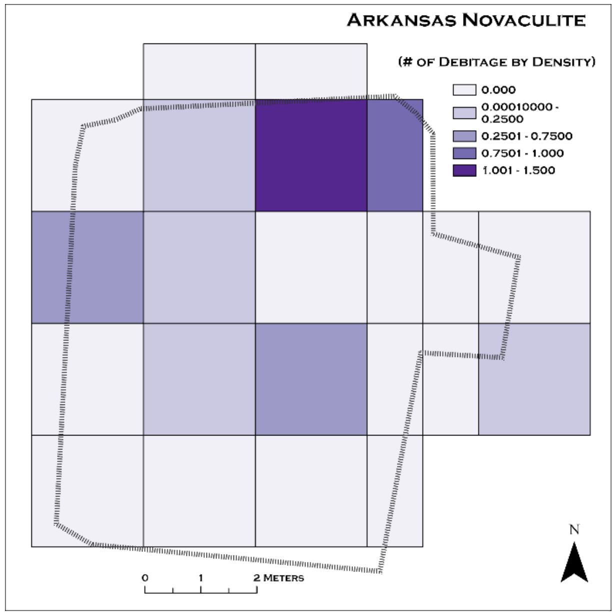

Figure 4.32: Arkansas Novaculite Distribution.

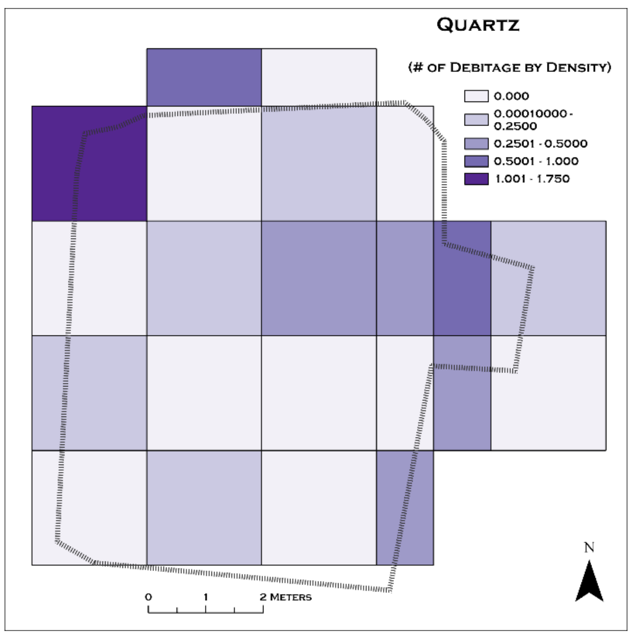

Figure 4.33: Quartz Distribution.

Non-local or Mixed Sources

All unknown material types, Antlers Gravel, Quartzite, Chalcedony, and Alibates are raw material types with counts over 20 from non-local or mixed sources. Material types listed as "unknown" have an intensifying concentration towards the western edge of the structure (Figure 4.34). Antlers Gravel is distributed across the center of the structure with concentrations towards the northeastern portion (Figure 4.35). Quartzite is concentrated across the central portion of the structure stretching from the eastern entrance towards the western outline edge (Figure 4.36). Chalcedony is unevenly distributed across the central-western, northern, and eastern areas of the structure (Figure 4.37). Alibates are unevenly distributed across the central and northern portions of the structure (Figure 4.38).

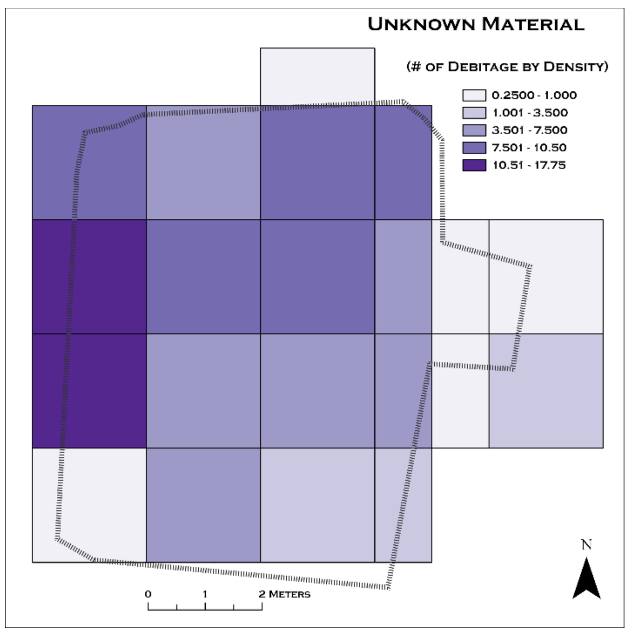

Figure 4.34: Unknown Material Distribution.

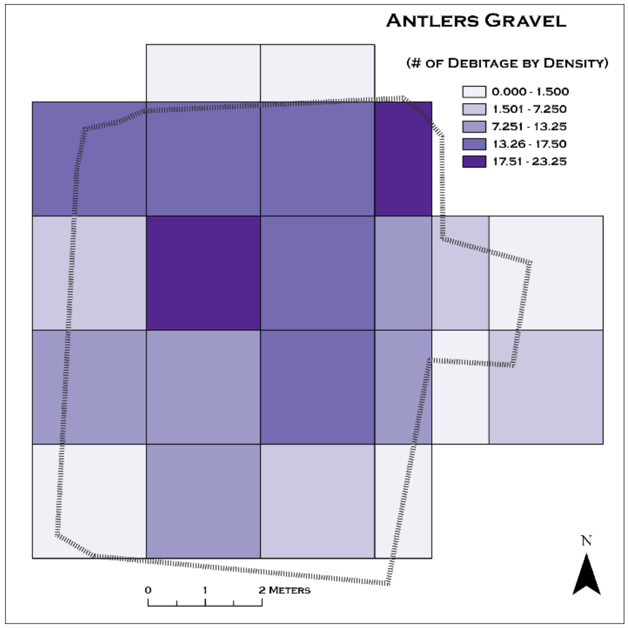

Figure 4.35: Antlers Gravel Distribution.

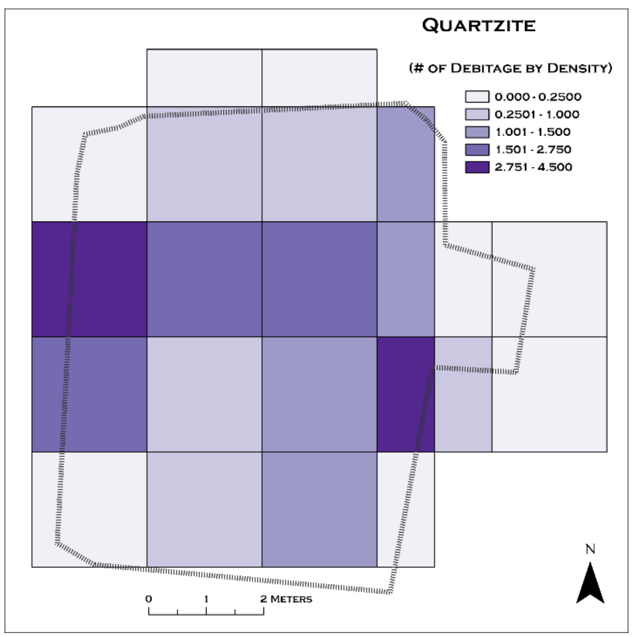

Figure 4.36: Quartzite Distribution.

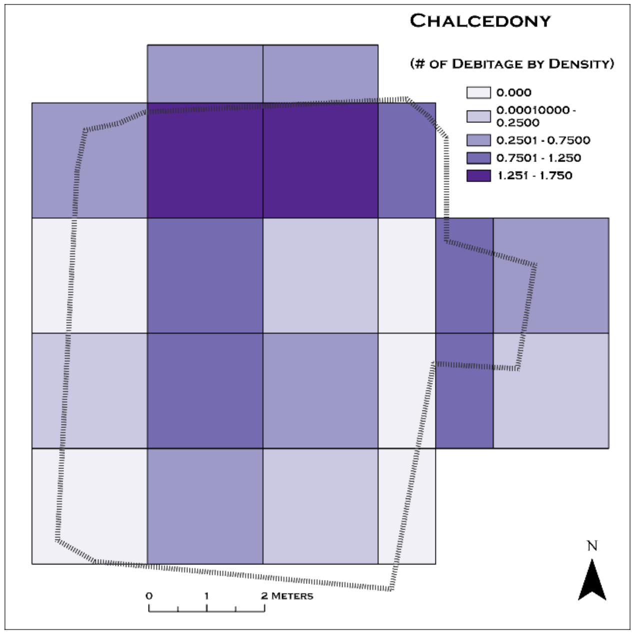

Figure 4.37: Chalcedony Distribution.

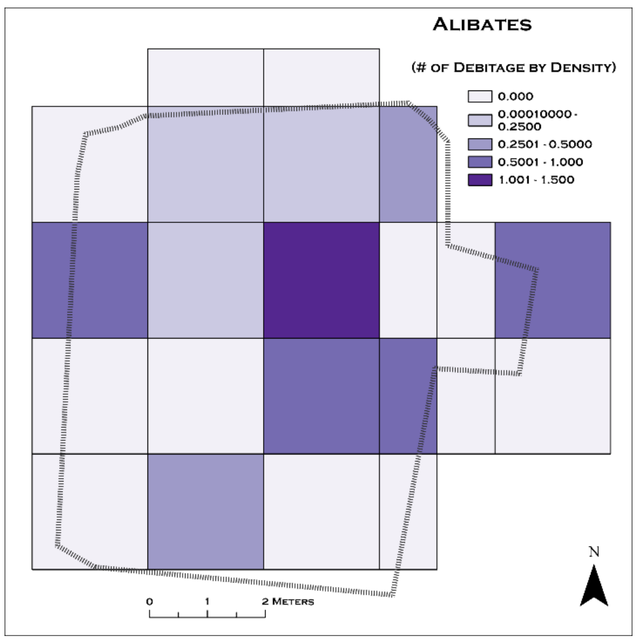

Figure 4.38: Alibates Distribution.

Conclusion

The lithic debitage assemblage of Structure 24 contains 8218 pieces of debitage. An initial mass analysis was conducted on the assemblage by student volunteers. From this assemblage I conducted an individual flake attribute analysis on 2032 pieces of debitage

(24.73%). In addition to these measurements, a spatial exploratory analysis was conducted to identify distribution patterns within the structure. The findings suggest that bipolar reduction occurred at Structure 24. Lithic debitage and projectile points were heavily concentrated randomly within the structure's walls as opposed to around them or in a particular portion.

CHAPTER 5: Discussion

Given the results of the different analyzes outlined in the previous chapter, how should interpretations of lithic debitage production at Spiro change? In this chapter, I will explain my interpretations of the results and compare my findings to existing literature. I also highlight a new lithic tool at the site that should be considered as a valid type moving forward.

Theoretical Implications of Lithic Debitage

A model of interpreting political practices archaeologically has been practiced under dual-process theory. Under dual-process theory two separate strategies for societies are outlined by Blanton et al. (1996): network strategy and corporate strategy. Network strategy follows hierarchical societies that focus on individual leaders and elite lineages. Elite accumulate power and authority through personal relationships, long-distance trade, and displays of wealth. Archaeologically we might interpret a society to follow the network strategy if evidence of exotic goods, large monuments, and burials appear to reinforce elite status. Corporate strategy follows a shared, collective power structure that integrates larger segments of society. Leadership has to build authority through communal rituals, public works, and collective identity rather than accumulating personal wealth. Archaeologically we might see a society following the corporate strategy to be more equally spatially distributed, utilize locally sourced materials, and lack the social stratification seen in burial practices of the network strategy. Blanton et. al (1996) suggest under dual-process theory that both strategies were practiced in a changing fashion because the evolution of leadership and power is nonlinear. The dichotomy of these strategies provides a way to picture how people in the past performed political activities daily as seen through their material remains.

I believe that the lithic debitage assemblage of Structure 24 speaks heavily to these theorical concepts when correlated with cooperation between autonomous groups and familiarity of local resources. Carballo (2013) argues that cooperation is vital to the way that humans interact as social beings and that we practice it daily to manage resources and maintain social stability. Cooperation can be observed archaeologically through the built environment people in the past created to culturally identify each other (Carballo 2013:20). At Spiro we see this through iconography on artifacts, house structure composition, burial practices, and ritual goods (Brown 1996; Schwarz Jr. 2023; Singleton and Reilly 2020). Caddo peoples living in the Arkansas River Valley also shared a common swath of Ozark raw material types such as varieties of Reeds Spring, Keokuk, and Tahlequah cherts. Procurement strategies may have subtly varied depending on site proximity to primary deposits or gravel streams, but nonetheless Caddo people undoubtedly shared similar, and familiar, local raw materials. I hypothesize that the chipped stone industry thus far understood at Spiro represents a contradiction to the exotic artifacts of Craig Mound because daily life at Spiro required a form of cooperation with regional residents of the Arkansas River Valley. Clearly activities conducted at Spiro allowed a large swath of exotic goods to pour in from across the North American continent. However, at the domestic level of the site we see that whoever lived at Spiro was very much involved with using familiar local resources in their day-to-day activities (Rutecki 2018). By not over utilizing exotic and unfamiliar resources despite being capable of obtaining them, a level of regional social stability was possible thanks to a fair usage of resources across different levels of social roles. This balance allowed Spiro to maintain a central role in ceremonial practices across many centuries while respecting the autonomy of people not living at the site.

Hafted Bifaces

There are 16 arrows and 1 drill reworked from an arrow present in the Structure 24 biface assemblage. Usage of bow and arrow technology is the probable cause. The bow and arrow has been present across the Arkansas River Valley since the Late Woodland Period. Rogers (1982:93–116) concluded from an experimental study utilizing a core-flake approach that most lithic production at House Mound 5 was the byproduct of manufacturing small projectile points. All reduction stages were argued to be present except for latter stages which were believed to be removed to another location. I believe that the removal hypothesis is possible, but it seems more likely that the entire process of producing an arrow could occur in the same location. Microdebitage much smaller than the size of archaeologists' screen meshes would be the byproduct of late-stage arrow production via antler pressure flaking. The only way to collect data on such debitage is through flotation practices and mentioning of microdebitage from flotation is not mentioned by Rogers (1982) for House Mound 5 but it is archived. Microdebitage from flotation termed "final flaking debris" was reported from the 1982 excavations of Copple Mound, Brown Mound, and the plaza (Brooks 1989:204).

Structure 24 has a higher debitage-to-biface ratio than House Mound 5. 8218 pieces of debitage were recovered from Structure 24 with only 1 bifacial drill and 16 projectile points. 15453 pieces of debitage were recovered from House Mound 5 with 1/4in meshes yet only 10 bifaces and 11 projectile points were recovered (Rogers 1982:130–144). This means that at House Mound 5 roughly 736 pieces of debitage were found for every 1 biface while at Structure 24 there were 483 pieces of debitage found for every 1 biface (Figure 5.1). Rogers' (1980:125–128) argued that the debitage-to-biface ratio from the 1979 excavations suggests "horticulturalists who lived at Spiro had less use for projectiles and knives than their hunting and gathering predecessors. It may also be that Spiro's status as a ceremonial center involved people such as priests who used non-typical tool sets." Higher counts of debitage per biface also suggest a higher degree of production occurring at a location. It is convincing when seeing the 1981 plaza excavations having the lowest debitage to biface ratio to claim that production of debitage is most likely being centered at or within structures on site. Future comparisons with debitage-to-biface ratios at habitational sites outside of Spiro and other structures within Spiro could provide additional insight into this phenomenon.

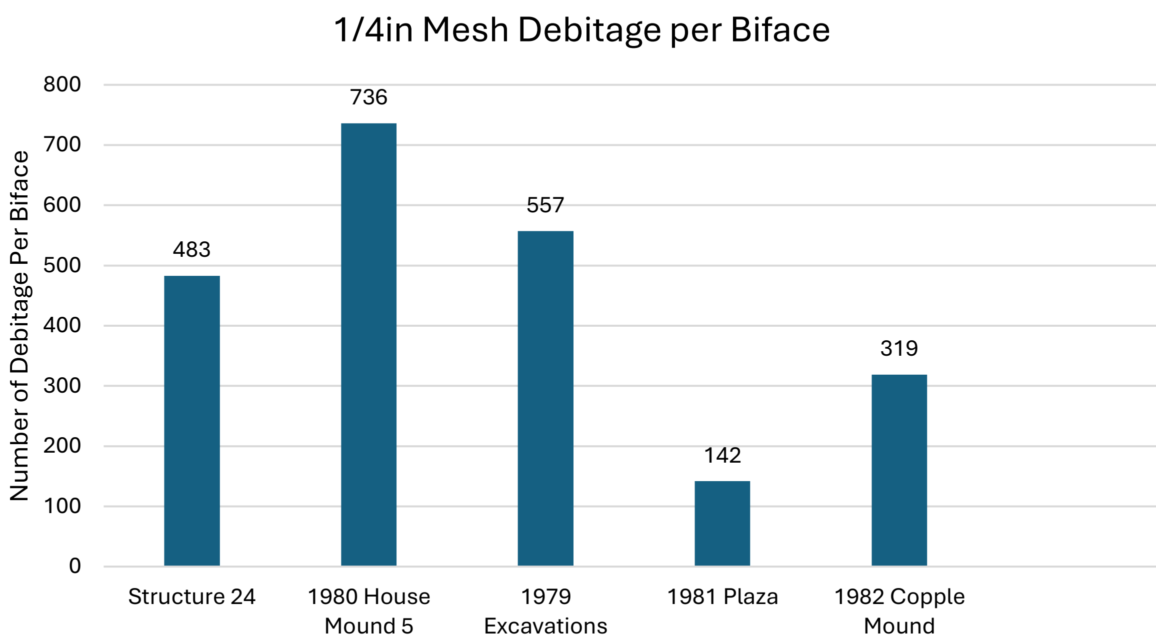

Figure 5.1: Number of Debitage per Biface Recovered. Spiro Archaeological Excavation Locations with at Least 1000 Pieces of Debitage. Microdebitage from Flotation or 1/16in Mesh Not Included.

Full Assemblage

Mass Analysis

Results of the mass analysis reveal that lithic production is similar to experimental projects utilizing small stream cobbles with a possibility of bipolar reduction taking place. The main experimental comparison with similarities to Structure 24's assemblage can be found in experiments two and four from Ahler's (1989:Figure 5) seminal work on mass analysis. Percentages of cumulative weights of size grades distribute differently depending on the technique, package size, and product of lithic production. Ahler's (1989) size grades were slightly different than those used for Structure 24. In Ahler's study, size grade 1 was 1in while size grades 2-4 were the same used in Structure 24's study using 0.5in, 0.25in, and 0.125in respectively. This results in Structure 24 having a higher size grade 2 cumulative weight percentage of 73.19% compared to Ahler (1989). Debitage of the >1in size grade were not calculated and thus automatically fell into the next largest size grade of 0.5in.

Data collected for the mass analysis of lithic debitage at Structure 24 show a similar cumulative weight distribution of size grades compared to what was found by Ahler (1989) in experimental studies utilizing stream cherts and small cobble bipolar flake production (Figure 5.2). This is not a surprising find compared to my assumptions prior to my work: lithic debitage excavated from Structure 24 clearly demonstrates a heavy usage of mixed quality stream gravel cherts that likely came directly from the Arkansas River. Bipolar reduction is also one of the common ways to split small stream cobbles for usable flakes.

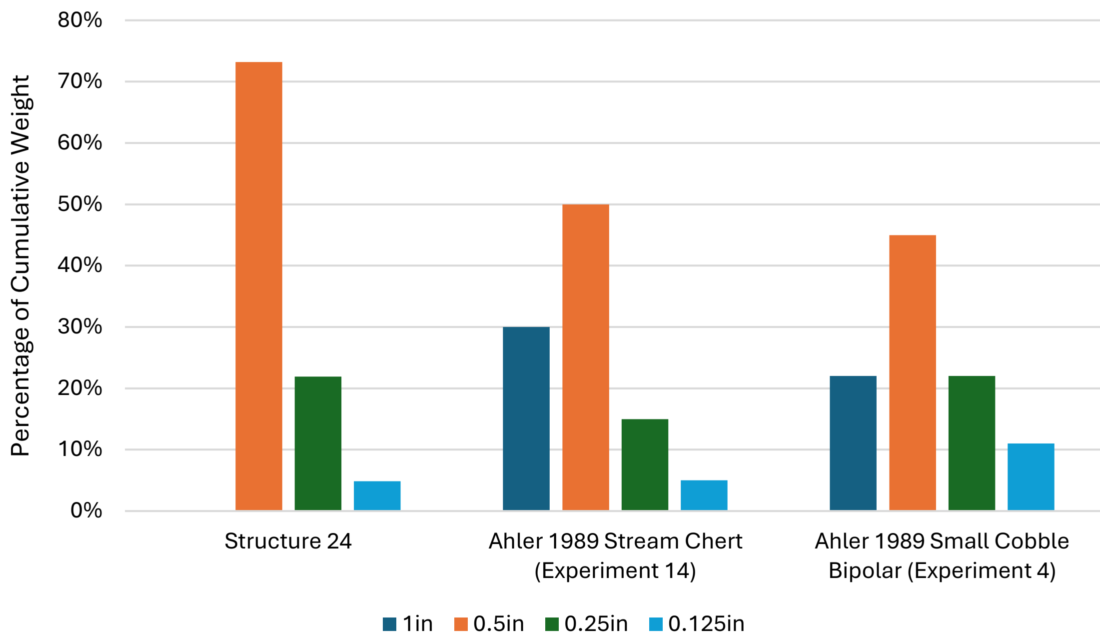

Figure 5.2: (Left) Size Grade Percent Distribution by Weight from Structure 24. (Middle and Right) Size Grade Percentage Distributions by Weight for Flaking Experiments 14 and 4, Adapted from Ahler (1989:107).

The mass analysis also showed that 65.05% of the entire debitage assemblage had at least some percentage of cortex remaining. This speaks heavily to the fact that the package size of river cobbles at Structure 24 is very small and that removing cortex from river cobbles made up a majority of the flintknapping work at the structure. Nearly 1 in 3 pieces of debitage were heat-treated. I assume this proves a purposeful investment was put into controlling the variable quality of stream cobbles for easier knapping. The most common raw material types of Reeds Spring, Antlers Gravel, and Boone are all very heterogeneous with mottled interiors in their cobble forms. Heat treatment of these materials likely allowed occupants of Structure 24 to successfully produce their intended flakes despite working with mix-quality stones.

Modified Flakes

Structure 24 has a lower debitage-to-modified flake ratio than House Mound 5. In this comparison, the term "modified flake" comprises a total of both utilized and retouched pieces of debitage from an excavation. Of the 8218 pieces of debitage found at Structure 24, 201 pieces of debitage were modified. 15453 pieces of debitage were found from 1/4in meshes at House Mound 5 with 168 modified flakes. House Mound 5 has 92 pieces of debitage per modified flake while Structure 24 has 41 pieces of debitage per modified flake (Figure 5.3). 1.09% of House Mound 5's debitage was modified while 2.4% of Structure 24's debitage was modified.

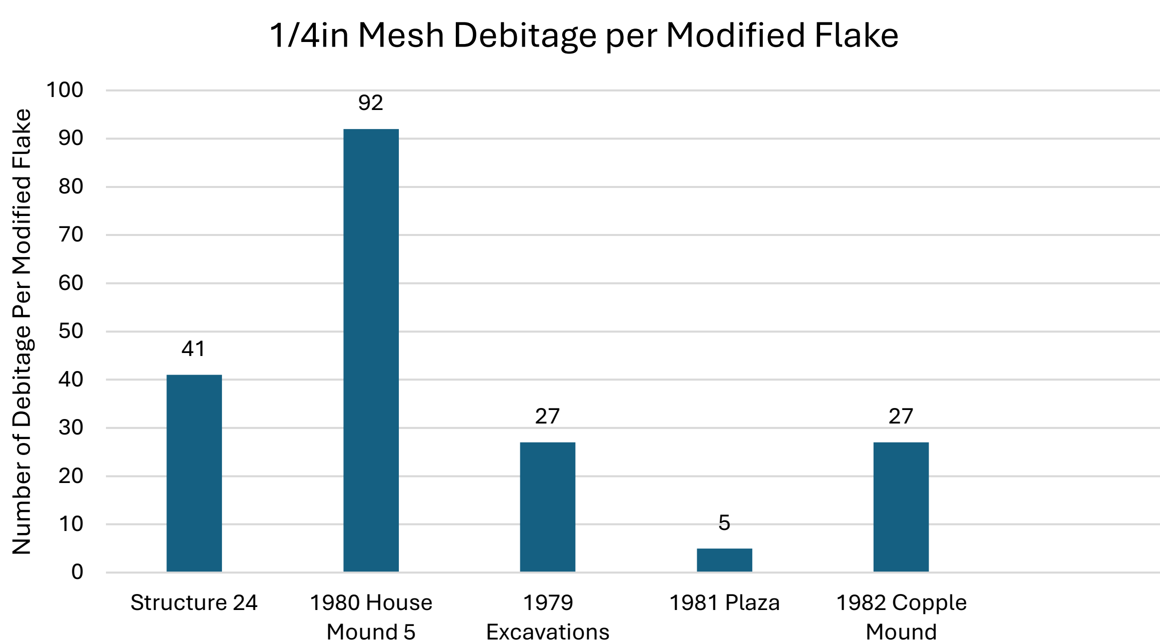

Figure 5.3: Number of Debitage per Modified Flake Recovered. Spiro Archaeological Excavation Locations with at Least 1000 Pieces of Debitage. Microdebitage from Flotation or 1/16in Mesh Not Included.

Utilization is a difficult attribute to determine on debitage, often requiring a hand lens or a microscope alongside prior identification experience. Determining retouch is typically less difficult but still requires the researcher to understand how flakes detach and become pressure flaked. It is likely the case that we are severely overlooking the actual number of flakes that were utilized. Since a use-wear analysis was outside of the scope of this thesis, future lithic research at Spiro is required to further highlight this area of lithic assemblages.

Debitage Description

Raw Material

The most common raw materials found at Structure 24 are the exact same raw materials that can be easily found in the Arkansas River as gravel (Figure 5.4). Locally available river gravels have been well documented as the source of most of Spiro's lithic raw material outside of Craig Mound (Brooks 1989; Brown 1996; Hammerstedt et al. 2019, 2026; Rogers 1980, 1982; Rogers et al. 1982). The most notable aspect of this fact is that a broad array of raw material types are available in the Arkansas River. Each raw material type varies in its final aesthetic appearance, and many are highly variable in quality in their gravel form. Many of these raw material types such as Reeds Spring have identifiable cortical attributes that help clearly distinguish them from other raw material types without the need for testing.

Figure 5.4: Gravel Bar Downstream of the WD Mayo Lock and Dam. Located on the Arkansas River, Less Than a Kilometer from Spiro.

Due to the low number of unmodified cobbles larger than the average maximum dimension of debitage, it is apparent that whatever gravel was brought to Structure 24 was reduced there or removed elsewhere prior to the structure's decommissioning. I argue that this suggests that the occupants of Structure 24 had a clear understanding of the type of raw materials they wanted brought onto the site from the river for reduction. There are over 18 raw material types at Structure 24 but a heavy fixation on Ozark sources (Reeds Spring and Boone) and generalized river cobbles (Antlers Gravel) is apparent.

Structure 24 lacks "exotic" chert. Alibates have been well proven to exist much further downstream the Canadian River away from the Texas Panhandle and within the periphery of Spiro (Kraft 1997; Wyckoff 1993). This eliminates the likelihood of Alibates representing trade between the Caddo of the Arkansas River Valley and western Plains communities (Carney 1993:166). Mining activities for novaculite are well documented for several millennia in the Ouachita Mountains (Etchieson and Trubitt 2013). It is not fully understood however if novaculite exists in river gravels near Spiro. Future research utilizing geochemical analysis and local stream bed surveying is likely required to answer where the novaculite at Spiro is sourced.

Bipolar Reduction

Bipolar reduction was identified in 19.59% of the sampled debitage population. When compared to the percent of the entire assemblage that is heat treated due to poor quality and the small package size of stream gravels available, it makes sense that bipolar reduction occurred at Structure 24. Preparation of cobbles prior to reduction commonly took place and bipolar reduction also played a partial role in the reduction sequence that followed. Bipolar reduction on average produced larger and heavier debitage than other techniques in the sampled assemblage. The fact that smaller flakes are being produced by other techniques could also suggest that those techniques were more intensive in nature than bipolar reduction was. Bipolar reduction then may have been a strategy for initially fracturing cobbles in half, extracting the largest possible flakes from exhausting cores, bashing small cobbles into sharp flakes, or for salvaging cobbles with variable material quality.

Individual Attributes

For the sampled debitage population, 55.76% of debitage had at least some cortex remaining. This is lower than the 65.05% of debitage with cortex found in the mass analysis. Both points suggest that package size at the site was small. It is difficult to produce a flake that lacks cortex when working with a small package size. Producing projectile points from small river cobbles has been proven experimentally to result in a higher proportion of debitage displaying dorsal cortex remaining than the same projectiles being produced from large flake blanks (Tomka 1989). Another aspect of viewing this phenomenon is that removing cortex made up most of the lithic reduction sequence at Structure 24.

The sampled debitage population also overwhelmingly consisted of cortical platforms as opposed to flat or complex platforms. Platform crushing was also present on at least a third of all flakes with platforms. Only a fifth of flakes with platforms displayed lipping while over half displayed a bulb of percussion. These attributes suggest that the technique of reduction at Structure 24 mostly involved objective pieces being reduced from cortex areas with hard hammer percussion. Soft hammer percussion via antler occurred less often. Andrefsky (2005:118) shows that soft hammer percussion typically produces lipping as opposed to hard hammer percussion though experimental studies vary in results.

I do not intend on using dorsal flake removal counts to prove reduction stages although some general statements can be made. Most flakes have 3 or less dorsal flake removals. Experimental studies have shown that the count of dorsal flake removals typically increases later in the reduction sequence (Magne 1983:94–129). Because a broad range of 0 through 11 dorsal flake removals exists at Structure 24, it is likely that the entire sequence of lithic reduction is occurring within the structure. Research in the future measuring dorsal flake removals should categorizing this attribute by using an ordinal scale approach instead of an interval scale if the number exceeds three, four, or five removals (Andrefsky Jr. 2005:109). It is difficult for multiple analysts record the same number of dorsal removals on flakes with more than five removals (Shott 1994:80).

Post-thermal alteration of lithic debitage is present at Structure 24. Debris was the most abundant flake completion type to have post-thermal alteration at 28.14%. All other flake types showed post-thermal alteration on 8.36% of dorsal surfaces and 6.97% of ventral surfaces. This is a striking difference between categories. Post-thermal alteration is reliably determined to be present if the ventral surface of a flake displays pot lid fractures. The ventral surface of a flake only exists after the flake was removed from its objective piece, meaning the pot lid was produced after initial human alteration of the stone. Debris does not have a ventral surface because by definition a single interior surface is not discernable (Sullivan and Rozen 1985:758–759). The low portion of the assemblage with post-thermal alteration could speak to the fact that no hearth was identified at Structure 24. Fire however was clearly involved in lithic production because of the portion of the total assemblage that was heat-treated. The phenomenon of Harlan Phase structures being decommissioned, burnt, and buried does not seem to have occurred in the same manner at Structure 24. This may result in fewer flakes experiencing post-thermal alteration over the life history of the location after the structure's decommissioning.

Spatial Distributions and Evidence of Floor Cleaning

Lithic debitage is heavily concentrated within Structure 24. The total weight of debitage is even more constricted inside of the structure. Hafted bifaces are also strictly concentrated within the structure. Such a congregation of artifacts leads to a few interpretations that each could be true or false independently of another. First is simply that lithic production occurred within the structure as opposed to occurring outside of it. Reduction was completed inside of the closed walls and extended entryway of the structure. The occupants of the structure, or whoever was allowed within, were the people responsible for the lithic debitage excavated. The nature of extended entryways secludes the inside contents of structures as mentioned in Chapter 2. This would mean that domestic activities at Structure 24 were not meant to be seen by those outside of the structure on the plaza. A second interpretation is that any potential plowing that occurred from modern agricultural practices did not move lithic debitage far. An assemblage of 8218 pieces of debitage fit within the outline of the structure despite plowing disturbing some features of the structure. A final interpretation is that lithic debitage was disposed of at the decommissioned site of Structure 24. This interpretation however seems to be the least likely explanation. There are no heavily diagnostic lithic dumps within Spiro's excavated structures. It appears more probable that lithic reduction simply occurred within structures as opposed to outside of them. Rogers' (1982:35–40) found similar spatial distribution trends of lithic debitage at House Mound 5 with debitage being pushed towards the eastern half of structures 15, 16, and 17 (Figures 5.5-5.8). Structure 24 shares some similarities with a majority of its debitage being located near the entrance portion of the interior structure though more northern bias is also present. The findings of this thesis alongside comparisons to earlier work at Spiro suggest lithic reduction was a domestic activity occurring within individual structures, not an open space collective practice. I hypothesize that lithic reduction also occurred closer to entryways inside of the structure were light assumingly was more present to reduce lithics without injury.

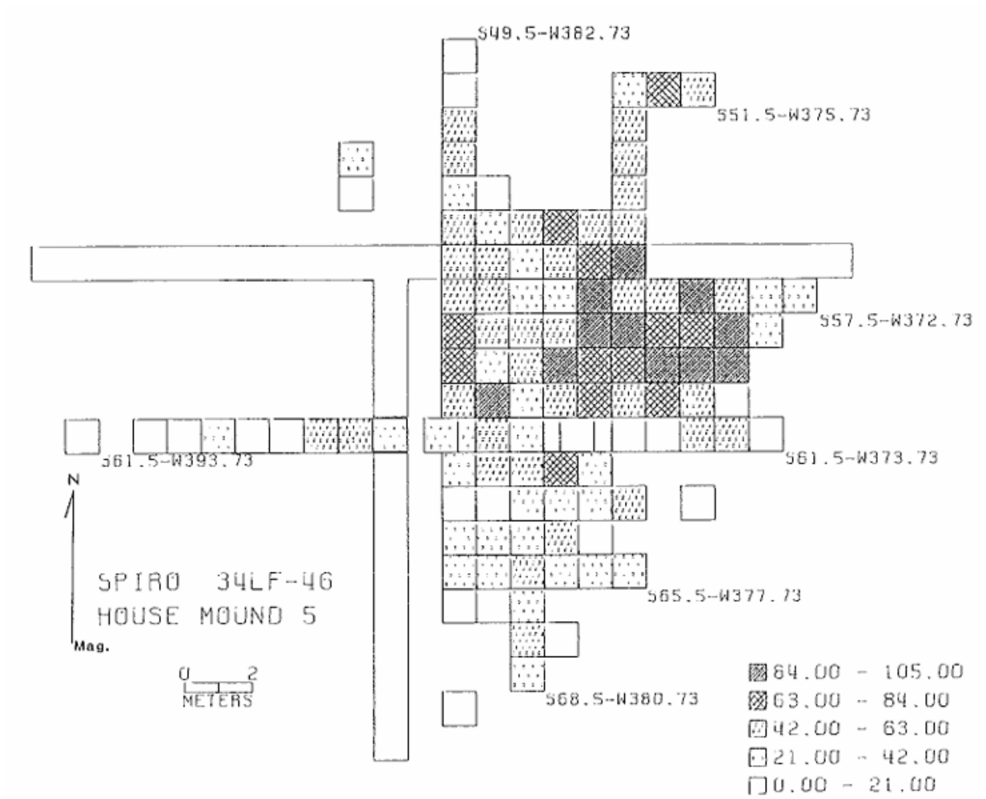

Figure 5.5: Primary Flake Concentration of House Mound 5, From (Rogers 1982:38).

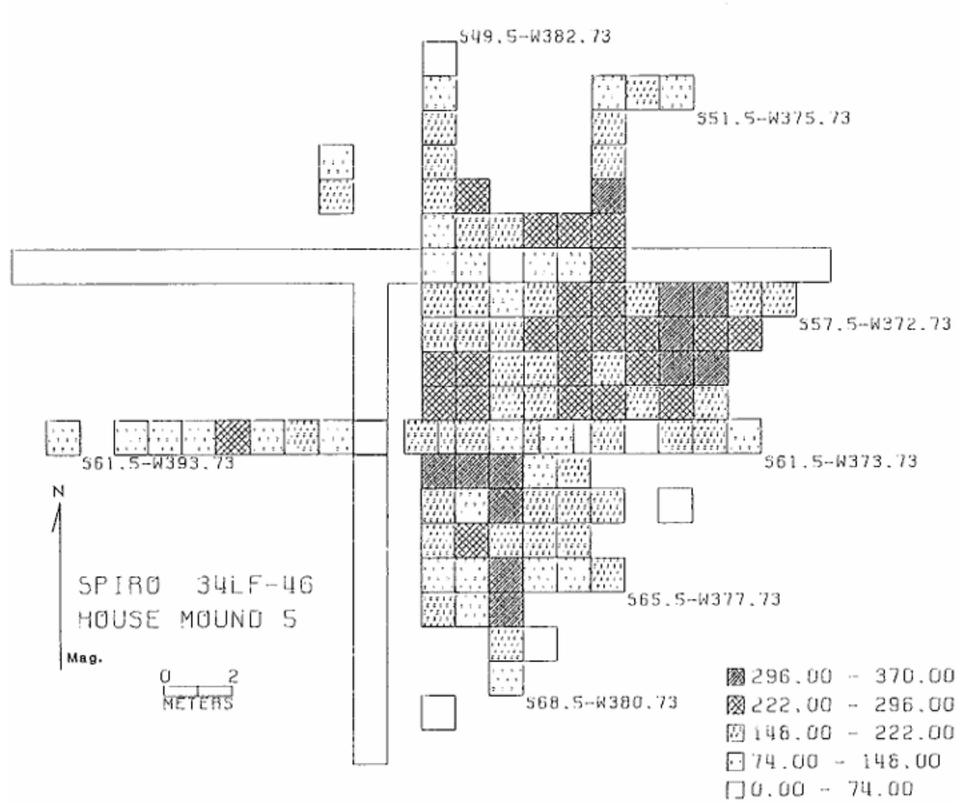

Figure 5.6: Secondary Flake Concentration of House Mound 5, From (Rogers 1982:38).

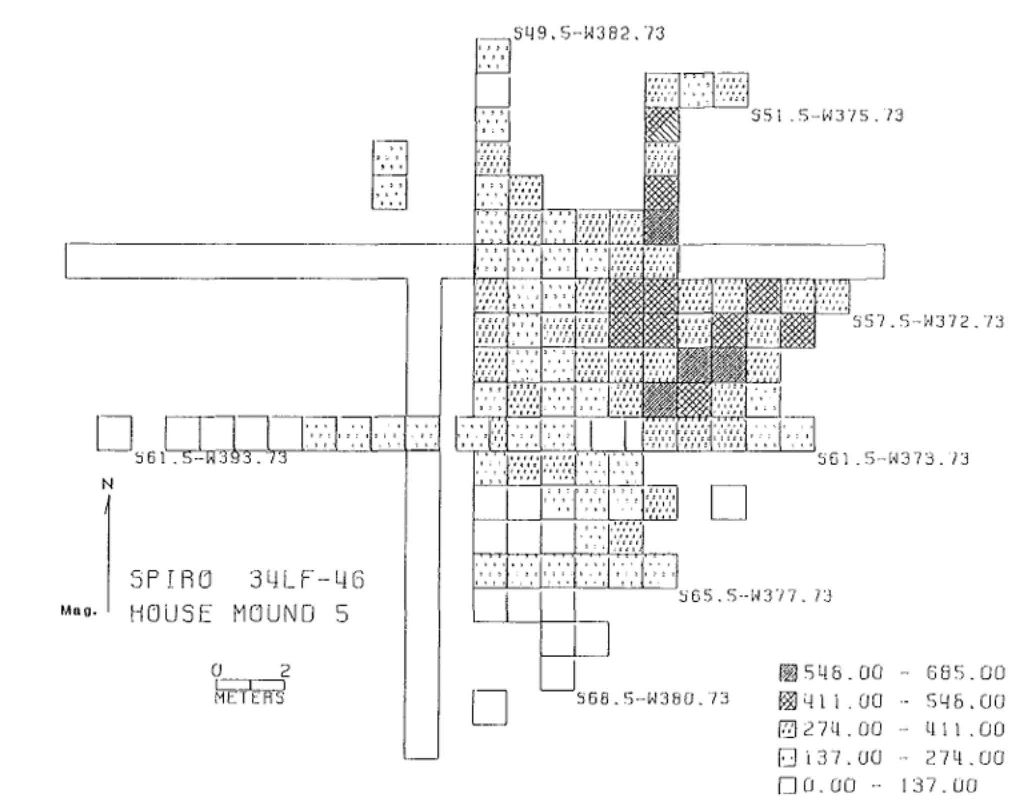

Figure 5.7: Blank Flakes Concentration of House Mound 5, From (Rogers 1982:39).

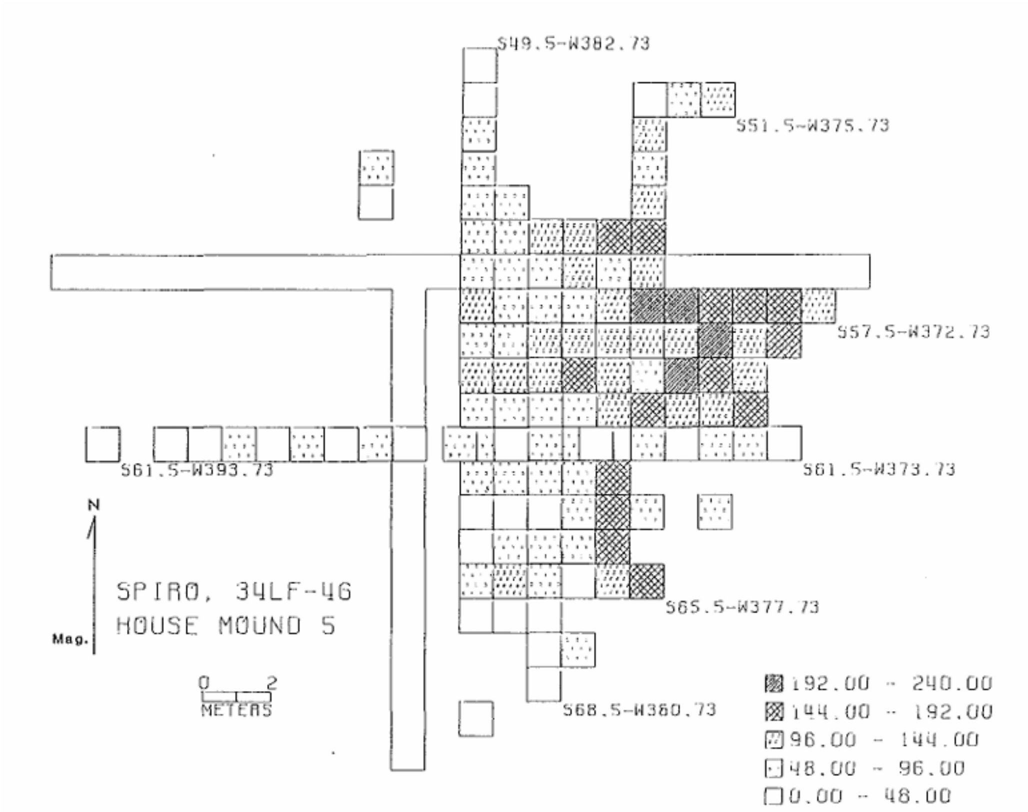

Figure 5.8: Blocky Debris Concentration of House Mound 5, From (Rogers 1982:39).

Different lithic raw material types are distributed randomly across the interior of Structure 24. No single raw material type however is most found on the southernmost excavation units. The attempt to distinguish reduction stages by combining attributes of the mass analysis speaks more to the types of flakes that are found in certain areas of the structure rather than the actual reduction sequence. Large flakes with more cortex are concentrated at the eastern entrance, smaller flakes with little cortex are concentrated in the center, and the smallest flakes with no cortex are distributed across the edges of the structure.

I argue that cleaning of the floor surface is evident by the heaviest lithic debitage and ceramics being located on the perimeter of Structure 24's outline. This is not a revelational finding but heavily supports prior excavations that found similar occurrences in special purpose buildings at Spiro (e.g. Rogers 1982). As mentioned earlier in Chapter 2, Rogers (1982:40) found that trash debris was moved away from the interior portion of the structure towards the margins or outside of the building. Both Structure 24 and House Mound 5's three superimposed buildings display that a majority of lithic debitage is located within the structure as opposed to outside of it. However, the heaviest artifacts being consistently removed to the margins of the structures across artifact types suggest people purposefully cleaned the floor of larger debris. How this process occurred during the usage of the structure as opposed to its decommissioning may never be known, however.

Cobble Blades

Structure 24 contained 38 specimens of what I have determined to be best described as "cobble blades" (Figure 5.9-5.12). Cobble blades are unifacial flakes that exhibit utilization along portions of their lateral edges and are longer distal to proximal end than they are wide edge-to-edge. Examples with prior removals on their dorsal surface commonly have one or more scars that run parallel along the length of the flake. Evidence of utilization is very common though most examples are not heavily utilized across all cutting-edge surfaces. Retouching is less common and typically only occurs in a small portion of the flake. Cobble blades are a flake tool similar morphologically to a bladelet or scraper.

Figure 5.9: Dorsal Surface of Cobble Blades. (a-d) Reeds Spring, (e) Woodford Chert, and (f) Antlers Gravel.

Figure 5.10: Ventral Surface of Cobble Blades. (a-d) Reeds Spring, (e) Woodford Chert, and (f) Antlers Gravel.

Figure 5.11: Dorsal Surface of More Cobble Blades. (g-j, l) Reeds Springs and (k) Johns Valley Chert.

Figure 5.12: Ventral Surface of More Cobble Blades. (g-j, l) Reeds Springs and (k) Johns Valley Chert.

Cobble blades are concentrated at the northwestern corner along with a second concentration at the eastern entrance of the structure (Figure 5.13). Weight and maximum length, width, and thickness measurements were recorded for all specimens (Table 5.1). Of the 38 specimens, 37 are produced from common raw materials found easily in the Arkansas River adjacent to Spiro (Figure 5.14). The single Alibates specimen is not argued to represent long-distance trade.

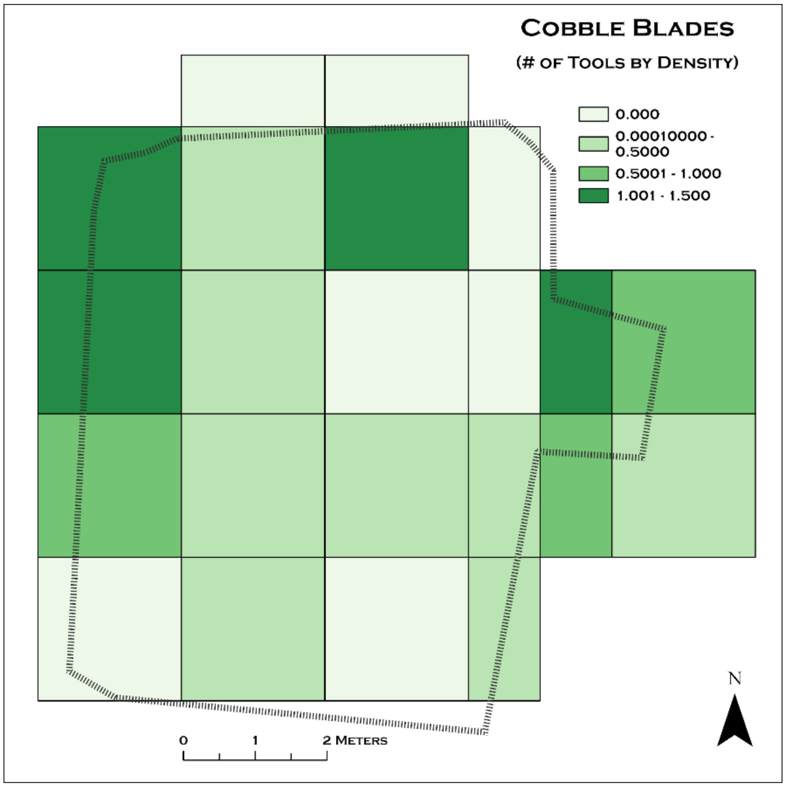

Figure 5.13: Distribution Map of Cobble Blades from Structure 24.

Table 5.1: Measurements of the 33 Cobble Blades from Structure 24.

	Weight (g)	**Maximum Length (mm)**	**Maximum Width (mm)**	**Maximum Thickness (mm)**
Average	4.95	34.88	18.88	6.74
Standard Deviation	3.26	6.8	4.6	1.94

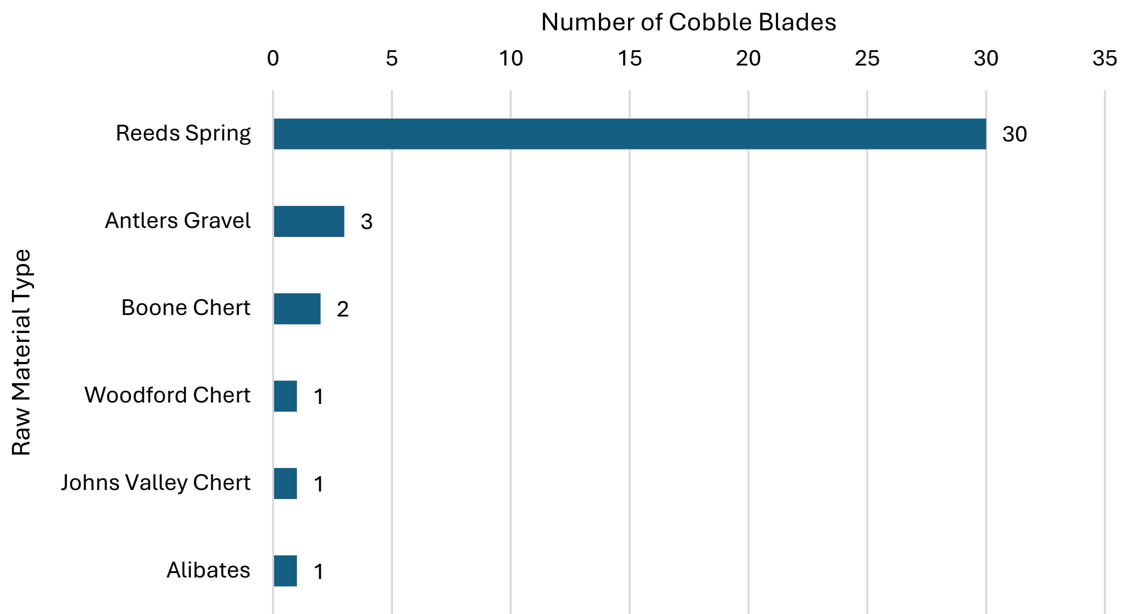

Figure 5.14: Raw Material Types of Cobble Blades from Structure 24.

Cobble blades are produced through a fundamentally different process than prismatic blades made using blade-core technology. Despite containing evidence of one or more prior removals in similar length directions, most cobble blades also exhibit scars from previous multidirectional core reduction. These blades were not repetitively produced on the same objective piece more than a few times. The geometry of small river cobbles presents a tighter working area for producing the greatest number of usable flakes. Blade core technology involves a process of designing cores by removing surface irregularities and preparing a large flat platform area (Andrefsky Jr. 2005:146–147). The process of removing cortex from river cobbles typically reduces the objective piece into a thin preform, not a large working area for the removal of dozens of long blades.

Cobble blades were likely an option in the reduction sequence as opposed to a predetermined goal. Expedient lithic production lacks certain end-product goals like formal bifacial tools. Producing sharp flakes as needed was certainly the goal of flintknappers at Structure 24, but other lithic tools were likely needed in a variety of domestic activities. Cobble blades have two long sharp edges ideal for utilization. In analyzing the 1979 lithics from Spiro, Rogers (1980:125–128) argued that

> “Cobbles were being broken entirely as sources for usable flakes. If true, then the cobbles should exhibit a pattern of flake removal selecting those flakes most useful for direct modification or utilization. Alternatively, flakes removed for small point manufacture would be produced more systematically.”

Previous removals on a cobble blade’s dorsal surface provide evidence that the tool was produced as needed. Multidirectional patterned scarring on most cobble blades is evidence of prior expedient flaking. Long scars along the length of the dorsal surface likely resulted from preparing the cobble blade’s removal. The edges produced from these removals act as guides that lead percussion forces to the distal end of the next flake struct in a parallel fashion (e.g. Whittaker 1994:105). Cobble blades thus required minor preparation before they could be successfully removed from a multidirectional core.

The production technique of cobble blades is undetermined. Antler punch, bipolar reduction, or free-hand techniques all produce similar resulting flakes as cobble blades though no technique is argued to produce them solely. Preliminary experimentation conducted by the author has shown all three techniques reliably produce cobble blades. The current spatiality of cobble blades is limited to Spiro with temporal ranges unknown until further research is conducted.

Cobble blades that I argue exist at Spiro are different from practices in the Toyah area of central Texas neighboring the southern Caddo region. The lithic toolkit of the Toyah region utilizes blade core technology and flake blanks that are well documented to be directly associated with the production of Perdiz points (Brownlow 1998; Jennings and Smallwood 2018; Ricklis 1994; Selden Jr. et al. 2021). Due to a lack of projectile preforms being found at Structure 24, it does not seem evident at this time that cobble blades serve as blanks to produce small arrows. The possibility of cobble blades serving as blanks for arrows should remain open, however. True flake-blade technology exists also in the sphere of Cahokia to the northeast of Spiro. Microblades and blade cores related to Cahokia have been recorded archaeologically in nearby Arkansas (Morse 1971). Such technological practices are not as evident in the Caddo world though a single blade core was recorded at Spiro by Hammerstedt et al. (2019:66).

Conclusion

Archaeological literature has explored a correlation between expedient lithic technologies and sedentism (Parry and Kelly 1987), the bow and arrow (Railey 2010), and gender (Sassaman 1993). I do not argue in favor of any singular one of these theories nor for an evolutionary approach to lithic technology. Instead, I believe that each of these theories partially played a role in shaping the lithic technology of Structure 24. The overall picture of lithic production at Structure 24 is a similar story found by Rogers (1980:128), it has little to do with the elaborate artifacts of Spiro's burial mounds. Lithic debitage recovered from Structure 24 was produced within the structure in an expedient nature from local river cobbles the size of a fist. Lithic production was focused on producing small flakes ready for utilization as needed. Large bifaces are not present in the assemblage. Both mass analysis and individual flake analysis suggest the usage of bipolar reduction along with freehand techniques were used.

CHAPTER 6: Conclusion

In this thesis I laid out contextual information relevant to the Caddo region and Spiro to frame an approach that could help answer my original research questions. I outlined previous literature that contributes to our current understanding of lithic production at Spiro while also introducing my own findings. Bipolar reduction was found to be an apparent lithic reduction technique utilized at Structure 24. The procurement strategy of sourcing raw materials involved collecting small fist-sized cobbles from the Arkansas River and further heat treatment of nearly a third of the assemblage to improve the poor knapping qualities of heterogenous gravels. This study utilized mass analysis, individual flake analysis, and spatial exploratory analysis to answer the research questions laid out in Chapter 1.

The first research question asked: Does lithic reduction at Structure 24 display similar patterns to other lithic debitage assemblages on the upper terrace and at Spiro? The answer to this question is yes. Structure 24 does display similar expedient flake technology of locally sourced raw materials as found by other excavated non-Craig Mound locations of Spiro that screened for lithic debitage (Brooks 1989; Hammerstedt et al. 2019; Rogers 1980, 1982; Rogers et al. 1982). Evidence of multidirectional cores, a lack of large bifacial tools, and bipolar debitage all speak towards an expedient toolkit being utilized. This finding has been typically seen as a surprise due to the exotic grave artifacts originally looted out of Craig Mound that suggested craft specialists might be present at Spiro. Although recent literature has changed our perspective on this phenomenon (e.g. Brown 2012), I believe lingering notions of Mississippian economic practices where craft specialization research has been conducted (e.g. Koldehoff and Brennan 2011; Pauketat 1997; Wilson 2001; Yerkes 1983, 1989) still dictates our expectations of Spiro.

A partial shortcoming of this thesis is that it failed to answer Rogers' (1982:40) hope of future excavations providing evidence that undoubtedly segregates domestic activity areas in households. House Mound 5 faced problems in identifying these anomalies due to the superimposed nature of the structures and plow disturbance. Structure 24 does not have superimposed buildings clouding its assemblage. I hypothesize that we need to consider a few things to move forward on the topic. How do we theoretically envision what activity areas are and what do they mean? How many individuals are living at, or allowed inside special purpose buildings at Spiro? Do cleaning episodes such as those seen at Structure 24 and House Mound 5 impede our ability to ever approach this topic? Do the excavation methods conducted thus far at the site adequately allow evidence of activity areas to be revealed? Questions such as these along with comparisons from Caddo sites across the Arkansas River Valley might help future researchers in addressing this issue.

The second research question of this thesis asked: What was the goal of lithic reduction at Structure 24? I suggest that random flake production is the primary focus of lithic reduction at Structure 24. 199 pieces of debitage (2.42%) from the entire assemblage show evidence of utilization. Very few flakes show further evidence of retouching, and there are no projectile preforms present in the assemblage. The true number of utilized flakes is also likely to increase should a thorough use-wear analysis be conducted on the assemblage. Identifying utilization with a hand lens is a time-consuming process that can easily miss evidence only found with microscope technology. As mentioned in the introduction of this thesis, Brown (1996:489) perfectly encapsulates my analysis of Structure 24's debitage as matching the chipped stone industry at Spiro. Although random flake production is the primary focus of lithic reduction at Structure 24, I identified the production of a specific lithic flake tool herein termed as a "cobble blade." Of the 38 cobble blades identified, 34 are utilized (89%) and 11 show evidence of retouching (29%). I argue that cobble blades represent an optional tool that can be produced from multidirectional cores with minor preparation. Due to the size constraints of the small package sized raw materials at Spiro, each gravel reduced can only produce a few cobble blades. In general, it is more efficient to produce random sharp flakes than it is to produce a specific tool type if the task at hand only requires a sharp cutting edge. This heavy usage is likely explained by daily tasks at Structure 24 typically only required sharp cutting edges. However, a more diverse toolkit was required that could produce longer dual-edged blades. Cobble blades were used as special cutting tools and possibly served as blanks to produce arrows after their initial usage.

Future research is still required on lithics at Spiro. An in-depth use-wear analysis has never been conducted at the site to determine what lithics were being used on. The production of arrows appears to come from small flake blanks, but Structure 24 lacked evidence of preforms to support this hypothesis. Analysis of microdebitage from flotation samples offers a wonderful avenue for studying this realm of lithic reduction at the site. Future excavations or analysis of archived collections with unanalyzed floatation samples may reveal more information on this topic. Raw material sourcing needs to be conducted to determine the source of novaculite at Spiro and whether it is being sourced from rivers to the south or traded in. Finally, a perspective that combines aspects of lithic technology and ceramic technology at the site could reveal more about daily processes at Spiro that this thesis was not able to talk about.

References

Ahler, Stanley A. 1989. Mass Analysis of Flaking Debris: Studying the Forest Rather Than the Tree. *Archaeological Papers of the American Anthropological Association* 1(1):85–118.

Andrefsky Jr., William. 2005. *Lithics: Macroscopic Approaches to Analysis*. 2nd ed. Cambridge University Press.

Andrefsky, William. 2007. The Application and Misapplication of Mass Analysis in Lithic Debitage Studies. *Journal of Archaeological Science* 34(3):392–402.

Banks, Larry D. 1984. Lithic Resources and Quarries. In *Prehistory of Oklahoma*, edited by Robert E. Bell, pp. 65–96. New World Archaeological Record No. Academic Press Inc, Orlando.

Banks, Larry D. 1990. *From Mountain Peaks to Alligator Stomachs: A Review of Lithic Sources in the Trans Mississippi South, the Southern Plains, and the Adjacent Southwest*. Memoir No. 4. Oklahoma Anthropological Society, Norman.

Bell, Robert E. 1958. *Guide to the Identification of Certain American Indian Projectile Points*. Special Bulletin No. 1. Oklahoma Anthropological Society, Oklahoma City.

Bell, Robert E. 1960. *Guide to the Identification of Certain American Indian Projectile Points*. Special Bulletin No. 2. Oklahoma Anthropological Society, Oklahoma City.

Bell, Robert E. 1972. *The Harlan Site, Ck-6, A Prehistoric Mound Center in Cherokee County, Eastern Oklahoma*. Memoir No. 2. Oklahoma Anthropological Society, Oklahoma City.

Blanton, Richard E., Gary M. Feinman, Stephen A. Kowalewski, and Peter N. Peregrine. 1996. A Dual-Processual Theory for the Evolution of Mesoamerican Civilization. *Current Anthropology* 37(1):1–14.

Bradbury, Andrew P., and Philip J. Carr. 1995. Flake Typologies and Alternative Approaches: An Experimental Assessment. *Lithic Technology* 20(2):100–115.

Bradbury, Andrew P., and Philip J. Carr. 2009. Hits and Misses When Throwing Stones at Mass Analysis. *Journal of Archaeological Science* 36(12):2788–2796.

Brooks, Pamela Barker. 1989. Lithic Materials Recovered During the 1982 Excavations. In *Contributions to Spiro Archaeology: Mound Excavations and Regional Perspectives*, edited by J. Daniel Rogers, Don G. Wyckoff, and Dennis A. Peterson, pp. 203–228. Studies in Oklahoma's Past No. 16. Oklahoma Archaeological Survey, Norman.

Brown, James A. 1976. *Spiro Studies: The Artifacts*, Vol. 4. Second Part of the Third Annual Report of Caddoan Archaeology - Spiro Focus Research No. University of Oklahoma Research Institute, Norman.

Brown, James A. 1996. *The Spiro Ceremonial Center: The Archaeology of Arkansas Valley Caddoan Culture in Eastern Oklahoma*, Vol. 1 & 2. Memoirs No. 29. Museum of Anthropology, University of Michigan, Ann Arbor.

Brown, James A. 2012. Spiro Reconsidered: Sacred Economy at the Western Frontier of the Eastern Woodlands. In *The Archaeology of the Caddo*, edited by Timothy K. Perttula and Chester P. Walker, pp. 117–138. University of Nebraska Press.

Brownlow, Russell Kent. 1998. Evaluating Late Prehistoric Arrow Point Co-Occurrences in South Texas: Archaeological Investigations at the Batot-Hooker Site (41ME34), Medina County, Texas. M.A., University of Houston.

Carballo, David M. 2013. Cultural and Evolutionary Dynamics of Cooperation in Archaeological Perspective. In *Cooperation and Collective Action*, edited by David M. Carballo, pp. 3–34. Archaeological Perspectives No. University Press of Colorado.

Cardott, Brian J., and John B. Comer. 2021. *Woodford Shale (Upper Devonian to Lower Mississippian): From Hydrocarbon Source Rock to Reservoir*. Oklahoma Geological Survey Bulletin 152, Norman.

Carney, Gary M. 1993. The Evidence and Character of Exchange Between Arkansas Basin Caddoans and Plains Villagers : A.D. 900-1450. M.A., University of Oklahoma, Norman.

Chick, Jonathan. 2020. Comparative Geochemical Analysis of Ordovician and Mississippian Cherts in Relation to the Northern Arkansas and the Tri-State Mississippi Valley-Type Ore Districts. M.S., University of Arkansas.

Cline, L. M. 1960. *Stratigraphy of the Late Paleozoic Rocks of the Ouachita Mountains, Oklahoma*. Oklahoma Geological Survey Bulletin 85, Norman.

Crabtree, Don E. 1972. *An Introduction to Flintworking*. No. 28. Occasional Papers. Idaho State University Museum.

Davis, E. Mott. 1970. Archeological and Historical Assessment of the Red River Basin in Texas. In *Archeological and Historical Resources of the Red River Basin: Louisiana, Texas, Oklahoma, and Arkansas*, edited by Hester A. Davis, pp. 27–65. Research Series No. 1. Arkansas Archeological Survey, Fayetteville.

Dickson, Don R. 1997. Extractive Strategies at Peoria Quarry, Ottowa County, Oklahoma. *Caddo Archaeology Journal* 8(1):17–27.

Dowd, Elsbeth Linn. 2011. Sourcing Red River Jasper: An Archeological and Geological Investigation of a Gravel Chert in the Red River Drainage. *Caddo Archaeology Journal* 21:89–106.

Duncan, Marjorie, Larry Neal, Don Shockey, Don G. Wyckoff, Michael Sullivan, and L. M. Sullivan. 2007. *Southern Plains Lithics: The Small Points*. Special Bulletin No. 26. Oklahoma Anthropological Society, Norman.

Early, Ann M. 2000. The Caddos of the Trans-Mississippi South. In *Indians of the Greater Southeast: Historical Archaeology and Ethnohistory*, edited by Bonnie Gair McEwan, pp. 122–141. University Press of Florida, Orlando.

Early, Ann M. 2012. Form and Structure in Prehistoric Caddo Pottery Design. In *The Archaeology of the Caddo*, edited by Timothy K. Perttula and Chester P. Walker, pp. 26–46. University of Nebraska Press.

Etchieson, Meeks, and Mary Beth Trubitt. 2013. Taking It to the River: Arkansas Novaculite Quarrying and Archaic Period Tool Production. *North American Archaeologist* 34(4):387–407.

Finklestein, J. Joe. 1940. The Norman Site Excavations Near Wagoner, Oklahoma. *Oklahoma Prehistorian* 3(3):2–15.

Gattis, Paul Kevin. 1998. Florence-A Chert and the Economic Controls of a Mississippian Chiefdom. M.A., University of Oklahoma, Norman.

Girard, Jeffrey S., Timothy K. Perttula, and Mary Beth D. Trubitt. 2014. *Caddo Connections: Cultural Interactions within and beyond the Caddo World*. Issues in Eastern Woodlands Archaeology No. Rowman & Littlefield Publishers, Lanham.

Goldstein, August, Jr., and Thomas A. Hendricks. 1953. Siliceous Sediments of Ouachita Facies in Oklahoma. *Bulletin of the Geological Society of America* 64(4):421–442.

Hammerstedt, Scott W., Patrick C. Livingood, Amanda L. Regnier, Jami J. Lockhart, Tim Mulvihil, Geroge Sabo III, and John Samuelsen. 2019. Archaeological Mitigation of Four Precontact Buildings at Spiro Mounds, 2013-2014.

Hammerstedt, Scott W., Jami J. Lockhart, Patrick C. Livingood, Tim Mulvihill, Amanda L. Regnier, Geroge Sabo III, and John R. Samuelsen. 2017. Multisensor Remote Sensing at Spiro: Discovering Intrasite Organization. In *Archaeological Remote Sensing in North America: Innovative Techniques for Anthropological Applications*, edited by Duncan P. McKinnon and Bryan S. Haley. University of Alabama Press, Tuscaloosa.

Hammerstedt, Scott W., and Amanda L. Regnier. 2023. *Spiro Mounds and WPA Archaeology in Oklahoma*. Arcadia Publishing, Charleston.

Hammerstedt, Scott W., Amanda L. Regnier, and Patrick C. Livingood. 2026. Preliminary Analysis of Structure 24 at Spiro Mounds. *Caddo Archaeology Journal* 36:50–56.

Hammerstedt, Scott W., and Shelia Bobalik Savage. 2021. Caddo Ceramics in the Arkansas River Basin in Eastern Oklahoma. In *Ancestral Caddo Ceramic Traditions*, edited by Duncan P. McKinnon, Jeffrey S. Girard, and Timothy K. Perttula, pp. 93–115. Louisiana State University Press, Baton Rouge.

Hatcher, Mattie Austin. 1927. Descriptions of the Tejas or Asinai Indians, 1691-1722, I. *The Southwestern Historical Quarterly* 30(3):206–218.

Hobday, David K., C. M. Woodruff Jr., and Mary W. McBride. 1981. Paleotopographic and Structural Controls on Non-Marine Sedimentation of the Lower Cretaceous Antlers Formation and Correlatives, North Texas and Southeastern Oklahoma. In *Recent and Ancient Nonmarine Depositional Environments: Models for Exploration*, edited by Frank G. Ethridge and Romeo M. Flores, pp. 71–87. SEPM Society for Sedimentary Geology Special Publication 31.

Hoffman, Malvin G. 1930. *Geology and Petrology of the Wichita Mountains*. Oklahoma Geological Survey Bulletin 52, Norman.

Honess, C. W. 1923. *Geology of the Southern Ouachita Mountains of Oklahoma. Part 1: Stratigraphy, Structure, and Physiographic History*. Oklahoma Geological Survey Bulletin 32, Norman.

Horton, Delaney E. 2025. An Analysis of Red Slipped Ceramics from Clement (34MC8): A Multi-Mound Center in Southeastern Oklahoma. Unpublished Master's Thesis, University of Oklahoma, Norman.

Huffman, George G. 1958. *Geology of the Flanks of the Ozark Uplift: Northeastern Oklahoma*. Oklahoma Geological Survey Bulletin 77, Norman.

Jennings, Thomas A., and Ashley M. Smallwood. 2018. Clovis and Toyah: Convergent Blade Technologies on the Southern Plains Periphery of North America. In *Convergent Evolution in Stone-Tool Technology*, edited by Michael J. O'Brien, Briggs Buchanan, and Metin I. Eren, pp. 229–252. The MIT Press, Cambridge.

Jeske, Robert J., and Rochelle Lurie. 1993. The Archaeological Visibility of Bipolar Technology: An Example from the Koster Site. *Midcontinental Journal of Archaeology* 18(2):131–160.

Johnson, Kenneth S, and Judy A. Russell (editors). 1978. Arkansas Novaculite - A Silica Resource. In *Thirteenth Annual Forum on the Geology of Industrial Minerals*, pp. 51–58. Oklahoma Geological Survey Circular 79, Norman.

Justice, Noel D. 1987. *Stone Age Spear and Arrow Points of the Midcontinental and Eastern United States: A Modern Survey and Reference*. Indiana University Press, Bloomington.

Kay, Marvin, and George Sabo. 2006. Mortuary Ritual and Winter Solstice Imagery of the Harlan-Style Charnel House. *Southeastern Archaeology* 25(1):29–47.

Knechtel, M. M. 1949. *Geology and Coal and Natural Gas Resources of Northern Le Flore County, Oklahoma*. Oklahoma Geological Survey Bulletin 68, Norman.

Koldehoff, Brad, and Tamira Brennan. 2011. Exploring Mississippian Polity Interaction and Craft Specialization with Ozark Chipped-Stone Resources. *Missouri Archaeologist* 71:131–164.

Kraft, Kenneth C. 1997. The Distribution of Alibates Silicified Dolomite Clasts Along the Canadian River. *Current Research in the Pleistocene* 14:106–109.

La Vere, David. 1998. *The Caddo Chiefdoms: Caddo Economics and Politics 700-1835*. University of Nebraska Press, Lincoln.

Leonhardy, Frank C. 1989. Physical Stratigraphy of Copple Mound. In *Contributions to Spiro Archaeology: Mound Excavations and Regional Perspectives*, edited by J. Daniel Rogers, Don G. Wyckoff, and Dennis A. Peterson, pp. 15–26. Studies in Oklahoma's Past No. 16. Oklahoma Archaeological Survey, Norman.

Lewis, Jeffery T. n.d. Lithic Raw Materials in Eastern Oklahoma. *Unpublished Manuscript in Possession of the Author*.

Livingood, Patrick, Amanda L. Regnier, and Scott Hammerstedt. 2020. Spiro and the Surrounding Sites. In *Recovering Ancient Spiro: Native American Art, Ritual, and Cosmic Renewal*, edited by Eric D. Singleton and F. Kent Reilly. National Cowboy & Western Heritage Museum, Oklahoma City.

Magne, Martin Paul Robert. 1983. Lithics and Livelihood: Stone Tool Technologies of Central and Southern Interior B.C. Ph.D., University of British Columbia.

Milon, Josh. 2026. A Ceramic Analysis of a Multi-Mound Center in Southeastern Oklahoma: Stylistic Variation at the Clement Site (34MC8). Unpublished Master's Thesis, University of Oklahoma, Norman.

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

Mofidi, Ethan. 2024. A Lithic Analysis of School Land I (34DL64) A Northern Caddo Village in the Foothills of the Ozarks. M.A., University of Oklahoma.

Morse, Dan F. 1971. Two Recent Microblade Core Discoveries in Mississippi County, Arkansas. *The Arkansas Archeologist* 12(1):1–8.

Orr, Kenneth G. 1939. The LeFlore County Archaeological Project. Daily Notes of the Archaeologists-in-Charge from Feb. 8, 1938, to Aug. 29, 1938. Ms. on File in the Oklahoma Museum of Natural History, Norman.

Orr, Kenneth G. 1946. The Archaeological Situation at Spiro, Oklahoma; A Preliminary Report. *American Antiquity* 11(4):228–256.

Pargeter, Justin, Alison Brooks, Katja Douze, Metin Eren, Huw S. Groucutt, Jessica McNeil, Alex Mackay, et al. 2023. Replicability in Lithic Analysis. *American Antiquity* 88(2):163–186.

Parry, William J., and Robert L. Kelly. 1987. Expedient Core Technology and Sedentism. In *The Organization of Core Technology*, edited by Jay K. Johnson and Carol A. Morrow, pp. 285–304. Westview Special Studies in Archaeological Research. Westview Press, Boulder.

Pauketat, Timothy R. 1997. Specialization, Political Symbols, and the Crafty Elite of Cahokia. *Southeastern Archaeology* 16(1):1–15.

de la Peña, Paloma. 2015. A Qualitative Guide to Recognize Bipolar Knapping for Flint and Quartz. *Lithic Technology* 40(4):316–331.

Perino, Gregory. 1971. *Guide to the Identification of Certain American Indian Projectile Points*. Special Bulletin No. 4. Oklahoma Anthropological Society, Muskogee.

Perttula, Timothy. 2008. Caddo Agriculture on the Western Frontier of the Eastern Woodlands. *Plains Anthropologist* 53:79–105.

Perttula, Timothy, Jeffrey S. Girard, Duncan P. McKinnon, and David G. Robinson. 2021. Approaches to the Study of Ancestral Caddo Ceramics. In *Ancestral Caddo Ceramic Traditions*, edited by Duncan P. McKinnon, Jeffrey S. Girard, and Timothy K. Perttula, pp. 3–16. Louisiana State University Press, Baton Rouge.

Perttula, Timothy K. 1997. *The Caddo Nation: Archaeological and Ethnohistoric Perspectives*. Texas Archaeology and Ethnohistory Series. University of Texas Press, Austin.

Perttula, Timothy K. 2009. Extended Entranceway Structures in the Caddo Archaeological Area. *Southeastern Archaeology* 28(1):27–42.

Perttula, Timothy K., and Robert L. Cast. 2011. The Term "Arkansas River Basin Caddoan" Has Outlived Whatever Usefulness It Had as a Cultural Taxonomic Term. *Plains Anthropologist* 56(220):365–367.

Peterson, Dennis A. 1989. Interpreting the Copple Mound Findings. In *Contributions to Spiro Archaeology: Mound Excavations and Regional Perspectives*, edited by J. Daniel Rogers, Don G. Wyckoff, and Dennis A. Peterson, pp. 27–42. Studies in Oklahoma's Past No. 16. Oklahoma Archaeological Survey, Norman.

Railey, Jim A. 2010. Reduced Mobility or the Bow and Arrow? Another Look at "Expedient" Technologies and Sedentism. *American Antiquity* 75(2):259–286.

Ray, Jack H. 2007. *Ozarks Chipped-Stone Resources: A Guide to the Identification, Distribution, and Prehistoric Use of Cherts and Other Siliceous Raw Materials*. Special Publications No. 8. Missouri Archaeological Society, Springfield.

Ray, Jack H. 2013. An Archaeological Survey and Assessment of Chert Extraction Sites in the Vicinity of Peoria Quarry, Ottoawa County, Oklahoma. *Center for Archaeological Research, Report No. 1485*.

Ray, Jack H. 2016. *Projectile Point Types in Missouri and Portions of Adjacent States*. Special Publication No. 10. Missouri Archaeological Society, Springfield.

Reeds, Chester Albert. 1910. *A Report on the Geological and Mineral Resources of the Arbuckle Mountains, Oklahoma*. Oklahoma Geological Survey Bulletin 3, Norman.

Regnier, Amanda L. 2017. The Relationship Between Becoming Caddo and Becoming Mississippian in the Middle Red River Drainage. In *Mississippian Beginnings*, edited by Gregory D. Wilson, pp. 178–202. University of Florida Press, Gainesville.

Regnier, Amanda L., Patrick Livingood, and Scott Hammerstedt. 2020. The History of Spiro. In *Recovering Ancient Spiro: Native American Art, Ritual, and Cosmic Renewal*, edited by Eric D. Singleton and F. Kent Reilly III. National Cowboy & Western Heritage Museum, Oklahoma City, Oklahoma.

Regnier, Amanda Leigh, Scott W. Hammerstedt, and Sheila Bobalik Savage. 2019. *The Ritual Landscape of Late Precontact Eastern Oklahoma: Archaeology from the WPA Until Today*. The University of Alabama Press, Tuscaloosa.

Ricklis, Robert A. 1994. Toyah Components: Evidence For Occupation in the Project Area During the Latter Part of the Late Prehistoric Period. In *Archaic and Late Prehistoric Human Ecology in the Middle Onion Creek Valley, Hays County, Texas*, pp. 207–316. Studies in Archeology No. 19. Texas Archeological Research Laboratory, University of Texas at Austin, Austin.

Rogers, J. Daniel. 1980. *Spiro Archaeology: 1979 Excavations*. Studies in Oklahoma's Past No. 6. Oklahoma Archaeological Survey, Norman.

Rogers, J. Daniel. 1982. *Spiro Archaeology: 1980 Research*. Studies in Oklahoma's Past No. 9. Oklahoma Archaeological Survey, Norman.

Rogers, J. Daniel. 1995. Dispersed Communities and Integrated Households: A Perspective from Spiro and the Arkansas Basin. In *Mississippian Communities and Households*, edited by J. Daniel Rogers and Bruce D. Smith, pp. 81–98. The University of Alabama Press, Tuscaloosa.

Rogers, J. Daniel, Lois E. Albert, and Frank Winchell. 2000. Chronometrics at the Norman Site. *Caddoan Archaeology* 11(1–2):61–68.

Rogers, J. Daniel, Michael C. Moore, and Rusty Greaves. 1982. *Spiro Archaeology: The Plaza*. Studies in Oklahoma's Past No. 10. Oklahoma Archaeological Survey, Norman.

Rogers, J. Daniel, and Geroge Sabo. 2004. Caddo. *Handbook of North American Indians* 14:616–631.

Rohrbaugh, Charles L. 1984. Arkansas Valley Caddoan: Fort Coffee and Neosho Foci. In *The Prehistory of Oklahoma*, edited by Robert E. Bell, pp. 265–286. Academic Press Inc, Orlando.

Rohrbaugh, Charles L. 2012 [1982]. *Spiro and Fort Coffee Phases: Changing Cultural Complexes of the Caddoan Area*. Memoir No. 16. Oklahoma Anthropological Society.

Rutecki, Dawn M. 2018. Religious Foodways: Intertwined Subsistence and Religious Practices at Spiro Mounds, OK. Ph.D., University of Indiana, Bloomington.

Sassaman, Kenneth E. 1993. Lithic Technology and the Hunter-Gatherer Sexual Division of Labor. *North American Archaeologist* 13(3):249–262.

Schwarz Jr., Raphael Allan. 2023. Dancing with the Spirit Realm: An Iconographic Analysis of Renewal Imagery on the Engraved Shells from Craig Mound at Spiro, Oklahoma. M.A., University of Oklahoma.

Selden Jr., Robert Z., John E. Dockall, C. Britt Bousman, and Timothy K. Perttula. 2021. Shape as a Function of Time + Raw Material + Burial Context? An Exploratory Analysis of Perdiz Arrow Points from the Ancestral Caddo Area of the American Southeast. *Journal of Archaeological Science: Reports* 37:102916.

Shideler, Gerald L. 1970. Provenance of Johns Valley Boulders in Late Paleozoic Ouachita Facies, Southeastern Oklahoma and Southwestern Arkansas1. *American Association of Petroleum Geologists Bulletin* 54(5):789–806.

Shott, Michael J. 1994. Size and Form in the Analysis of Flake Debris: Review and Recent Approaches. *Journal of Archaeological Method and Theory* 1(1):69–110.

Sievert, April K., and J. Daniel Rogers. 2011. *Artifacts from the Craig Mound at Spiro, Oklahoma*. Smithsonian Contributions to Anthropology No. 49. Smithsonian Institution Scholarly Press, Washington, D.C.

Singleton, Eric D., and F. Kent Reilly. 2020. *Recovering Ancient Spiro: Native American Art, Ritual, and Cosmic Renewal*. National Cowboy & Western Heritage Museum, Oklahoma City.

Steere, Benjamin A. 2017. *The Archaeology of Houses and Households in the Native Southeast*. Archaeology of the American South No. University of Alabama press, Tuscaloosa.

Story, Dee Ann. 1990. Culture History of the Native Americans. In *The Archeology and Bioarcheology of the Gulf Coastal Plain*, 1 & 2:pp. 163–366. Research Series No. 38. Arkansas Archaeological Survey, Fayetteville.

Sullivan, Alan P., and Kenneth C. Rozen. 1985. Debitage Analysis and Archaeological Interpretation. *American Antiquity* 50(4):755–779.

Taff, Joseph A. 1901. *Coalgate Folio, Indian Territory*. Geologic Atlas of the United States Folio GF-74. United States Geological Survey, Washington, D.C.

Taff, Joseph A. 1928. *Preliminary Report on the Geology of the Arbuckle and Wichita Mountains in Indian Territory and Oklahoma*. Oklahoma Geological Survey Bulletin 12, Norman.

Tomka, Steven A. 1989. Differentiating Lithic Reduction Techniques: An Experimental Approach. In *Experiments in Lithic Technology*, edited by Daniel S. Amick and Raymond P. Mauldin, pp. 137–162. BAR International Series No. 528. B.A.R, Oxford, England.

Trubitt, Mary Beth. 2009a. Burning and Burying Buildings: Exploring Variation in Caddo Architecture in Southwest Arkansas. *Southeastern Archaeology* 28(2):233–247.

Trubitt, Mary Beth. 2009b. Burning and Burying Buildings: Exploring Variation in Caddo Architecture in Southwest Arkansas. *Southeastern Archaeology* 28(2):233–247.

Trubitt, Mary Beth, Thomas Green, and Ann M. Early. 2004. A Research Design for Investigating Novaculite Quarry Sites in the Ouachita Mountains. *The Arkansas Archeologist* 43:17–62.

Vehik, Susan C. 1988. Late Prehistoric Exchange on the Southern Plains and Its Periphery. *Midcontinental Journal of Archaeology* 13(1):41–68.

Vehik, Susan C. 1990. Late Prehistoric Plains Trade and Economic Specialization. *Plains Anthropologist* 35(128):125–145.

Vehik, Susan C., Richard R. Drass, Stephen M. Perkins, and Sarah Trabert. 2021. Florence-A Chert End Scrapers from the Lasley Vore (34TU65), Deer Creek (34KA3) and Longest (34JF1) Sites and the Eighteenth-Century Southern Plains Hide Trade. *Plains Anthropologist* 66(260):313–347.

White, Anta M. 1963. Analytic Description of the Chipped-Stone Industry from Snyders Site, Calhoun County, Illinois. In *Miscellaneous Studies in Typology and Classification*, pp. 1–70. University of Michigan Press.

Whittaker, John C. 1994. *Flintknapping: Making and Understanding Stone Tools*. University of Texas Press, Austin.

Wilson, Gregory D. 2001. Crafting Control and the Control of Crafts: Rethinking the Moundville Greenstone Industry. *Southeastern Archaeology* 20(2):118–128.

Wyckoff, Don G. 1970. *A Preliminary Report on 1970 Field Research at the Spiro Site, Le Flore County, Oklahoma*. Oklahoma Archaeological Survey.

Wyckoff, Don G. 1980. Caddoan Adaptive Strategies in the Arkansas Basin, Eastern Oklahoma. Ph.D., Washington State University.

Wyckoff, Don G. 1993. Gravel Sources of Knappable Alibates Silicified Dolomite. *Geoarchaeology* 8(1):35–58.

Wyckoff, Don G. 2005. Current Research: Recent Lithic Technological Studies on the Southern Plains and Adjacent Regions Part I: Identifying and Sourcing Raw Materials. *Lithic Technology* 30(2):89–105.

Wyckoff, Don G., and Robert Bartlett. 1995. Living on the Edge: Late Pleistocene-Early Holocene Cultural Interaction Along the Southeastern Woodlands-Plains Border. In *Native American Interactions: Multiscalar Analyses and Interpretations in the Eastern Woodlands*, edited by Michael S. Nassaney and Kenneth E. Sassaman, pp. 27–72. University of Tennessee Press, Knoxville.

Wyckoff, Don G., and Timothy G. Baugh. 1980. Early Historic Hasinai Elites: A Model for the Material Culture of Governing Elites. *Midcontinental Journal of Archaeology* 5(2):225–288.

Wyckoff, Don G., George B. Morgan, Bernard A. Schriever, and Michael R. Waller. 2017. Knappable Silcrete in the Cretaceous Antlers Formation of Oklahoma and Texas. *Journal of Archaeological Science: Reports* 15:514–527.

Yerkes, Richard W. 1983. Microwear, Microdrills, and Mississippian Craft Specialization. *American Antiquity* 48(3):499–518.

Yerkes, Richard W. 1989. Mississippian Craft Specialization on the American Bottom. *Southeastern Archaeology* 8(2):93–106.

Appendix A: Refits

Refit #1:

Unit 13, Level 2: 2 pieces of Alibates; core-flake refit.

Refit #2:

Unit 20, Level 3: 2 pieces of Antlers Gravel; core-flake refit.

Refit #3:

Unit 14, Level 3: 2 pieces of Big Fork; post-thermal alteration splitting refit.

Refit #4:

Unit 14, Level 3: 2 pieces of Reeds Spring; fractured flake refit.