# VESSEL MORPHOLOGY AND FUNCTION IN THE WEST JEFFERSON PHASE OF THE BLACK WARRIOR VALLEY, ALABAMA

by

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## ABSTRACT

This thesis is a morphological and functional analysis of pottery that explores whether technological changes in pottery reflect the transition from hunter-gatherer societies to complex agricultural ones that occurred circa A.D. 1070 in the Black Warrior Valley of Alabama. During the West Jefferson phase (A.D. 1020-1120) of the Late Woodland period, indigenous hunter-gatherer groups lived contemporaneously with, yet peripheral to, the earliest Mississippian agriculturalists and were beginning to adopt some Mississippian traits, including shell-tempered vessels of a shape known as the "standard Mississippian jar." Although it is well known that Mississippian lifeways gradually replaced those of hunter-gatherers, the processes by which this transition took place are largely unclear. By morphologically and functionally analyzing vessels of this transitional period, this study examines how, or if, technological changes in pottery reflect the adoption and intensification of agriculture by hunter-gatherers. Specifically, it examines whether West Jefferson pottery, the majority of which consists of cooking vessels, reflects a traditional nut-processing technology or if it instead indicates that indigenous groups were essentially copying Mississippian vessel forms and maize-processing technologies.

## LIST OF ABBREVIATIONS AND SYMBOLS

| | |
|---|---|
| $\overline{BD}$ | Distance between points B and D |
| $df$ | Degrees of freedom: number of values in the calculation of a statistic that are free to vary |
| $F$ | *F*-ratio: A ratio of explained variance to unexplained variance calculated during a one-way ANOVA test |
| $n$ | Number of cases |
| $p$ | *P*-value: Estimated probability associated with the occurrence under the null hypothesis of a test statistic as extreme as or more extreme than the observed value |
| $r$ | Pearson's product-moment correlation |
| $t$ | Student's *t*-statistic: Ratio calculated during a Student's *t*-test of the departure of an estimated parameter from its notional value and its standard error |
| $U$ | Mann-Whitney *U*-statistic: Tests the null hypotheses that two samples with non-parametric distributions originate from the same population |
| W | Shapiro-Wilk W statistic: Indicates whether or not a population is normally distributed |
| $\bar{x}$ | Mean: The sum of a set of values divided by the number of values in the set |
| $\chi^2$ | Chi-square value: Used to assess the goodness of fit between observed values and those expected theoretically |
| $z$ | *z*-score: Statistical measurement of a score's relationship to the mean in a group of scores |
| $<$ | Less than |
| $=$ | Equal to |

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# CHAPTER 1

## INTRODUCTION

It has long been acknowledged that changes in pottery styles and forms are good indicators of movements of people, ideas, and ways of life. As such, it is especially important to study pottery in societies undergoing major economic and social transitions. At approximately A.D. 1000, just such a transition occurred throughout the Southeastern United States: the emergence of Mississippian societies. The rise of complex agricultural societies in the Eastern United States is one of the most intensively studied transitions in American prehistory. It was at this time that shell-tempered ceramics, maize intensification, new architectural styles, complex community organization, and monumental mound and plaza architecture emerged.

Within the Black Warrior River Basin of Alabama, the local manifestation of the Late Woodland period just prior to the emergence of large-scale Mississippian societies is the West Jefferson phase, dating to approximately A.D. 1020 - A.D. 1120 (Figure 1). During this time, populations were transitioning to larger, agricultural societies in which maize would eventually replace nuts as the primary dietary staple. Coinciding with this transition, and despite the fact that both maize and nuts require similar cooking methods, new cooking vessels emerged that utilized shell as a tempering agent in place of grog. Smaller, hemispherical shell-tempered jars, termed “standard Mississippian jars” (Phillips 1939:38), became the primary cooking vessel, replacing traditional Late Woodland grog-tempered vessels. What is unclear, however, in the case of West Jefferson is the overall shape of these grog-tempered cooking vessels. In order to understand the emergence and spread of new vessel forms and technologies during this transitional period, one must also have an understanding of those that preceded them. It was for this reason that the present study was conceived.

The degree to which West Jefferson grog-tempered cooking jars morphologically resemble those of the shell-tempered vessels that eventually replaced them has been debated for years, as has the significance of this similarity, or lack thereof (DeJarnette and Wimberly 1941; Jenkins and Krause 2009; Welch 1990, 1994). There has only been one comparative study to date (Welch 1994), but it focused solely on rim forms and produced no new data on overall vessel body morphology. The present study involves the comparison not only of basic rim forms, but also of lower vessel body morphology, which has previously never been attempted. These

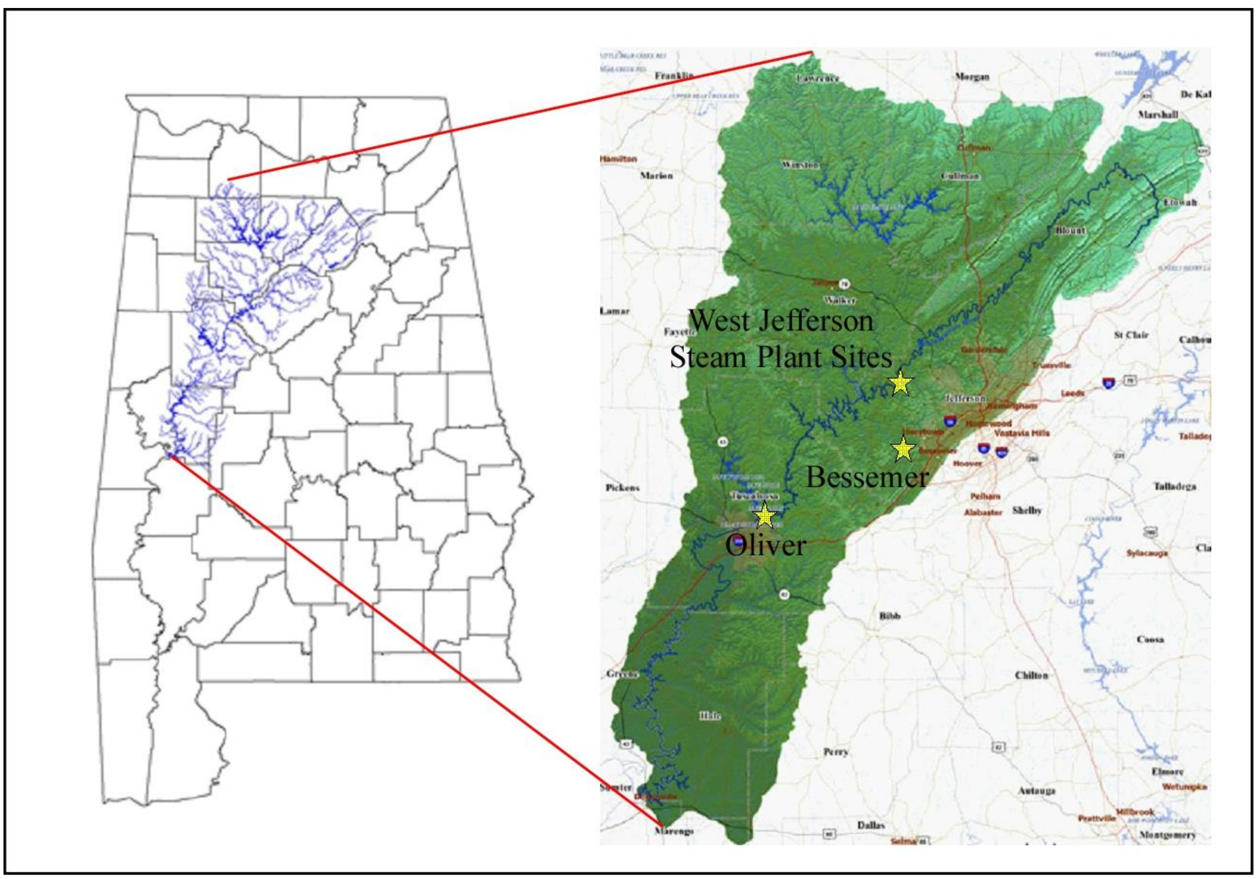


**Figure 1. Archaeological sites within the Black Warrior River Basin discussed in the text.**

data are then used to infer vessel function, specifically whether these two kinds of cooking pots were utilized in the same manner.

Central to the issue of pottery form and function in this transitional period are the debates concerning the process of Mississippianization and the coexistence of Late Woodland and Early Mississippian populations (Blitz and Lorenz 2002; Feathers and Peacock 2008; Phillips et al. 1951; Smith 1984, 1990; Willey 1953). It is generally agreed upon that West Jefferson and Early Mississippian cultures represent two culturally distinct groups with differing lifeways, the former primarily reliant on hunting and gathering for subsistence, and the other dependent on maize agriculture (Jenkins 2003; Knight and Steponaitis 1998:10-12; Scarry 1986). The disagreement lies in their chronological relationship to one another. Two prevailing theories regarding this transition have been posited: one that Mississippian societies developed locally and gradually out of the preceding Late Woodland (Peebles 1978; Schroedl et al. 1990); the other that Mississippian peoples migrated throughout the major river valleys of the Southeast, bringing the fully developed and intact Mississippian complex to regions already occupied by Late Woodland hunter-gatherers (Caldwell 1958:64-68; Jenkins and Krause 2009; Lewis and Kneberg 1946:9-10; Willey 1953). Within the archaeological record, the sudden appearance and spread of shell tempering, paired with other abrupt changes in cultural materials throughout the region at this time, do not support the former model of simultaneous in-place cultural evolution. It is instead becoming increasingly clear that models of coexisting, interacting Late Woodland and Early Mississippian populations are needed to account not only for the archaeological record in local contexts but also for uneven development of social and technological change throughout the region (Blitz and Lorenz 2002; Rice 1998; Steponaitis 2009:xxvi).

Such a model is warranted for the West Jefferson phase in the Black Warrior Valley. Evidence suggests that Mississippian peoples migrated southeastward from places like Shiloh, in western Tennessee, living contemporaneously and sometimes in very close proximity to Late Woodland West Jefferson populations (Jackson 2004; Jenkins 2003; Jenkins and Krause 2009:204-206). Statistical analyses of West Jefferson and Early Mississippian radiocarbon dates suggest that the two cultures likely overlapped for a period of at least 60 years (Knight et al. 1999). The presence of rectangular wall-trench Mississippian structures at otherwise single component Late Woodland sites (Ensor 1993; Thompson 2012; Thompson 2002) also suggests that some Mississippians may have even lived among West Jefferson peoples. The presence of other typical Mississippian artifacts and traits within Late Woodland contexts also supports this idea (Jenkins and Krause 2009:210). Additionally, thermoluminescence dating indicates that both grog-tempered and shell-tempered pottery were manufactured during the same time span (Feathers 2009:131). However, it must be said that all of the preceding evidence has also been used to argue that Mississippian cultures evolved gradually and locally out of the preceding Late Woodland (Peebles 1978; Steponaitis 1983, 1991; Welch 1990, 1994). In fact, the cases for and against contemporaneity could comprise a separate study by itself, but an analysis of this complex subject is not tackled here. Suffice it to say that this author is convinced by evidence that West Jefferson and Early Mississippian populations existed contemporaneously, a premise upon which the present study is built, and with that said, the debate will not be mentioned further.

With the above in mind, it is the purpose of this study to answer questions concerning the reactions of indigenous West Jefferson populations to intruding Mississippian groups. Did West Jefferson potters attempt to copy Mississippian jar forms using traditional grog-tempered clays?

Some researchers have suggested just that, speculating that indigenous West Jefferson groups adopted Mississippian pottery forms as a result of interaction (Jenkins and Krause 2009:207; O'Hear 1975:26; Seckinger and Jenkins 2000). To test this idea, it is necessary to determine how much actual similarity exists between the two pottery styles. Additionally, is there any evidence to suggest that West Jefferson potters were attempting to manufacture pottery with shell as a tempering agent, as was the practice of their Mississippian neighbors?

To answer these questions, it is first necessary to define the West Jefferson phase vessel assemblage, a task that has not been systematically attempted. As stated above, to determine the significance of an emerging technology, one must understand its precedent. West Jefferson vessel classes are herein defined, not only by overall vessel shape, but also by size classes within each vessel form. Functional attributes of vessels are loosely defined based on vessel morphology and direct evidence of use. Morphological characteristics of both West Jefferson phase and Early Mississippian shell-tempered wares are then compared statistically to determine their degree of similarity.

For this study, I hypothesize that the morphological characteristics of grog-tempered vessels differ significantly from those of contemporaneous Early Mississippian shell-tempered vessels. Evidence suggests that West Jefferson and Early Mississippian groups were in fact two cultures with distinct subsistence practices (Scarry 1986). As such, their pottery, which was used to process these foods, should reflect this functional dichotomy. Along the same line, I also hypothesize that grog-tempered West Jefferson phase jars will tend to have ovaloid forms resembling traditional Late Woodland vessel shapes, reflecting their function as nut-processing containers. I argue that Late Woodland potters were not copying Early Mississippian vessel styles, as was previously suggested, but were instead, for the most part, technologically conservative. Pottery form is inextricably tied to function, and because foodways did not significantly change within the Late Woodland, I argue that neither should the tools, i.e., cooking jars, utilized to process those foods.

The layout of this thesis is fairly straightforward. The following chapter provides background information on the West Jefferson phase and on morphological and functional analyses of pottery. Research objectives and methods are outlined in Chapter 3. Chapter 4 includes an analysis and definition of the West Jefferson vessel assemblage, including a discussion of functionality within vessel class and size. Chapter 5 presents the results of a statistical comparison of West Jefferson and Early Mississippian pottery morphology and function, and the final chapter is a discussion of the results and the conclusions of the study. I hope that this study contributes to the growing body of knowledge concerning emerging complex societies within the Black Warrior Basin and answers questions concerning how indigenous groups reacted technologically to intruding populations during this transitional period.

# CHAPTER 2

# BACKGROUND

## The West Jefferson Phase

Within the Black Warrior Valley, the local manifestation of the Late Woodland period just prior to the rise of Mississippian culture is the West Jefferson phase (A.D. 1020-1120). It was defined as a result of excavations of the West Jefferson Steam Plant sites (1Je31, 1Je32, and 1Je33) situated near the confluence of Village Creek and the Locust Fork of the Black Warrior River (Jenkins and Nielsen 1974) (Figure 1). Not counting the almost 300 post holes, a total of 112 features were excavated including hearths, bell-shaped pits, basins, irregular-shaped pits, and cylindrical pits. Most of these features are considered to have been used for cooking and/or storage (O’Hear 1975:104-105). Artifact assemblages at West Jefferson phase sites are dominated by undecorated grog-tempered ceramics (typologically Baytown Plain), small triangular projectile points, ground stone tools used for processing foods (e.g., mullers, mortars, and nutting stones), and ground stone discoidals. Also present are small amounts (approximately 1%) of shell-tempered pottery, a trait generally considered to be diagnostic of the Mississippian stage. Archaeological evidence and radiocarbon dating suggest that West Jefferson phase hunter-gatherers and Early Mississippian agriculturalists lived contemporaneously and experienced some degree of interaction (Jenkins 2003; Jenkins and Nielsen 1974; Jenkins and Krause 2009; Knight et al. 1999; Seckinger and Jenkins 2000). However, it is unclear how these peripheral Black Warrior Valley populations reacted to intrusive populations and their technologies (King and Meyers 2002). It is likely that West Jefferson populations were drawn into Mississippian lifeways through various mechanisms of acculturation (Jenkins and Krause 2009; Seckinger and Jenkins 2000:53), but exactly how this occurred remains unclear. The examination of pottery can aid researchers in developing models of acculturation within the Black Warrior Valley and within the region as a whole.

Prior to a discussion of pottery's role in answering questions concerning acculturation, it is first necessary to examine Late Woodland and Early Mississippian subsistence strategies and pottery forms. Late Woodland people traditionally relied on resources readily available in the environment including nuts, wild plants, large and small mammals, fish, birds, turtles, and shellfish. Throughout most of the West Jefferson phase, nuts, fleshy fruits, and small grain and oil seeds (e.g., maygrass and chenopod) dominate botanical remains (Scarry 1986:259). Subsistence strategies primarily involved the gathering of wild foods, mainly hickory (*Carya tomentosa*) and acorn (*Quercus* spp.) nuts, supplemented by small-scale garden horticulture (Scarry 1986:274, 2003:60-66). While some nuts can be eaten raw or ground and used for baking, the most commonly used nuts require some form of boiling to make them palatable. For example, hickory nuts are notoriously difficult to shell, as separating raw nutmeat from the hulls is virtually impossible. It is necessary to crack hickory nuts one at a time to prevent contamination, after which they can be pounded using a mortar and pestle, and then sifted and boiled. Ethnographic sources suggest that hickories were most valued for their oil and "milk", which was produced by placing pulverized nuts in boiling water for a short period of time (Adair 1775:409; Hariot 1893 [1588]:28). During boiling, the shells sink to the bottom, the oily part of the nutmeats rises to the surface, where it can be skimmed, and the remaining nutmeat (mostly protein) dissolves into a milky emulsion. The milk is then strained to remove shells, which can later be used as fuel (Fritz et al. 2001; Perry 1974:40; Talalay et al. 1984:352). The milk can be drunk or used as stock for soup, and the oil can be stored and used for a variety of purposes.

Red oak acorns, which are naturally very bitter due to high levels of tannic acid, also require some type of processing to make them palatable (Scarry 2003:65-66). Ethnographic sources indicate that the most common and efficient way to remove tannins from red acorns involves boiling the pounded nutmeat (Gilmore 1919:75; Smith 1907:90; Ragueneau 1899:99). They are boiled until the water turns brown, at which point the water is drained, and the process is repeated until the water remains relatively clear, which generally takes no more than three fairly short boiling episodes (for an approximate total cooking time of less than an hour). An alternative method involves only soaking them in water, also changing the water when it turns brown. However, the addition of heat likely speeds up the process significantly. Swanton (1918:58) notes that Choctaw groups historically used cold running streams to leach acorn meal placed in cane sieves. Experimental archaeology indicates that this leaching method takes up to 16 hours (Reidhead 1981:185). Once tannins are removed, acorn nutmeats can be used for baking or to make stock for stew. Boiling leached and pounded acorn nutmeat also produces a useful and delicious oil (Perry 1974:15-16). If processed for storage rather than immediate consumption, acorns must be parched, which involves exposing nuts to dry heat for a short period of time (Scarry 2003:66). Parching prevents germination, kills parasites, and reduces mold problems (Messner 2011:16-17).

Methods of processing nuts vary depending on the type of nut, but the most commonly used nuts (hickory and acorn) would have required vigorous boiling. Other foods that would have required boiling include stews, greens, and wild game, although a considerably briefer cooking time is assumed than that required for nut processing. Traditional Late Woodland pots used to cook these foods were large ovaloid forms. The cooking vessels of central and eastern Alabama tended to have tall, widely flaring rims with pointed bases (Mann and Krause 2009; Thompson 2012), while those in the Tombigbee drainage to the west tended to take the shape of large, deep bowls (Jenkins 1981:89-90). These large pottery vessels were likely placed directly in fire hearths and held upright, possibly by rocks (Linton 1944:371; Speck 1909:26). Caleb Swan's ethnographic account of an Upper Creek group describes conical-based vessels and their positioning during cooking: "These vessels are all without handles, and are drawn so nearly to a point at the bottom, that they will not stand alone. Therefore, whenever they are set for use, they have to be propped upon three sides with sticks or stones" (Swan in Schoolcraft 1855:692).

Beginning at approximately A.D. 1100, the subsistence strategies of many groups living in the Black Warrior River Valley transitioned from hunting and gathering to large-scale agriculture of domesticated crops, mainly maize (Scarry 1986, 1998). Roughly coinciding with this subsistence shift was the appearance of shell-tempered, globular jars, called "standard Mississippian jars" (Phillips 1939:38). These standard Mississippian jars were thin-walled, globular, and had short out-flaring necks, often with two handles (Phillips 1939:37-38). These qualities would have made the jar excellent for sustaining boiling over long periods of time (Linton 1944:370). Shell-tempered cooking jars have also been demonstrated to have high resistance to thermal shock (Steponaitis 1983:45), making them less likely to fail during sustained boiling. Instead of being placed directly in the fire, however, standard Mississippian jars were almost certainly suspended over fire or coals, which possibly explains the presence of handles. General changes in pottery size, temper, and shape from the Woodland to the Mississippian stage suggests an increasing demand for specialized boiling and cooking containers, presumably for starchy seed foods (Braun 1983:119). As such, it is possible that standard jars were developed as specialized vessels used to process maize. While maize can be roasted in its husk, Southeastern North American societies that were dependent upon it generally made some form of hominy. The hominy-making process involves soaking maize kernels in an alkaline solution, or nixtamalizing them, to enhance their nutritional value (Briggs 2014; Katz et al. 1974), and simmering them for at least three to four hours (Wright 1958:159, 162). It is important to note that making hominy involves extremely long periods of simmering, not short periods of vigorous boiling, as nut-processing does. This extended cooking time necessitates a cooking pot with thin walls that allow for high resistance to thermal shock and the efficient transfer of heat from the vessel exterior to its contents for extended periods, all without compromising the integrity of the vessel. The standard Mississippian jar is just such a vessel.

The linkage between the Late Woodland to Early Mississippian subsistence transition and changes in vessel forms is, however, poorly understood. The subsistence strategies of both West Jefferson phase and Early Mississippian peoples have been extensively studied (Scarry 1986), as have the pottery forms of Mississippian groups in the Black Warrior Valley (Steponaitis 1983; Taft 1996). However, many questions remain concerning the morphology and significance of West Jefferson phase cooking vessels. No whole vessels have ever been found at West Jefferson phase sites, so determination of vessel form has been based on the examination of relatively small rim sherds. And although much research has been conducted on many aspects of the West Jefferson phase (Brooms 1980; Ensor 1976, 1979; Jackson 1996; Jenkins and Nielsen 1974; Mistovich 1988, 2013; O'Hear 1975; Scarry 1986; Scarry and Scarry 1997; Thompson 2002), there have been no in-depth studies of West Jefferson phase pottery assemblages. This is fairly surprising, considering the ongoing debate concerning the origins of Mississippian culture in the region.

The earliest report from the Bessemer site (1Je16), a multiple mound site which produced approximately equal quantities of grog-tempered and shell-tempered ceramics, states that grog-tempered Late Woodland wares are almost identical to shell-tempered Mississippian wares with regard to shape and surface finish (DeJarnette and Wimberly 1941:92, 108). That is, according to this report, both grog-tempered and shell-tempered jars are globular, collared forms with handles, and, aside from temper, are exactly the same. This assertion was undisputed for decades, and has been repeated as fact in almost all subsequent West Jefferson studies (e.g., Jenkins 2003:18; Jenkins and Nielsen 1974:147; Mistovich 1988:24; Steponaitis 1983:80). Therefore, when the West Jefferson Steam Plant sites were excavated and their pottery assemblages analyzed, grog-tempered rim sherds were used to determine that the vessel assemblage consisted of globular bowls and jars (Jenkins and Nielsen 1974:147). The presence of globular grog-tempered vessels with handles was cited as evidence that West Jefferson peoples were essentially copying elements of Mississippian pottery, which supported the idea that the two groups were contemporaneous and interacted to some degree (Jenkins and Krause 2009:207; O'Hear 1975:26; Seckinger and Jenkins 2000).

Paul Welch's (1994:24) reanalysis of the original Bessemer site collection called into question DeJarnette and Wimberly's (1941) assertion that grog-tempered and shell-tempered vessels were similar in form, and he demonstrated instead that there is actually very little similarity between corresponding rim modes. Unfortunately, body sherds were not also reanalyzed at that time, so no new data on lower body vessel morphology was obtained. But his study raised doubts concerning the original data on West Jefferson vessel body morphology.

It should be noted that the nature of the Bessemer site itself remains unclear. Its pottery assemblage is unusual in that it is the only one of its kind, being comprised of approximately equal proportions of grog-tempered and shell-tempered wares. As such, it is unclear whether the site represents a West Jefferson phase occupation that was later inhabited by early Mississippian mound-builders (Welch 1994:217), evidence of site unit intrusion of Mississippian peoples into a West Jefferson population (Jenkins 1978, 2003), or an aggregation site utilized by both populations. The mixed contexts present at the site have not allowed for a settling of the issue (Welch 1994). Considering its uncertain chronology, its lack of subsistence data, and its relatively long duration of occupation, Bessemer is perhaps not the ideal site for the study of transitional processes. Instead, as the vast majority of West Jefferson sites consist of non-mound habitation areas, it is these locations, not multiple mound centers like Bessemer, that have the most potential to provide evidence of Mississippianization processes (Mistovich 1988). Studying peripheral locations is especially important in that they can provide clues as to the ways in which Mississippian culture spread throughout the Southeast (King and Meyers 2002). They represent not the bourgeoning mound center but the rural residence. These areas would have likely been "the last link in the recipient chain of technological innovation, and perhaps the most resilient to abrupt changes in lifestyle" (Mistovich 1988:26). As such, they are especially useful when studying the acculturation of Late Woodland peoples into Mississippian culture. Thus, the current study investigates whether or not there is any indication that peripheral groups of West Jefferson hunter-gatherers were adopting the pottery forms, and presumably also the maize-processing technologies, of their Mississippian neighbors.

**Pottery Morphology and Function**

Pottery is particularly useful in answering questions concerning the rise of Mississippian societies in the Southeast because it sheds light on issues of chronology, subsistence strategies, patterns of cultural diffusion, and technological shifts. While stylistic analyses of pottery aid in the development of site chronologies and provided insight into patterns of cultural influence and drift (Ford 1938), functional analyses of pottery are indispensable for gaining insight into the technology used by people in everyday life (Braun 1983; Hally 1984, 1986). Cooking pots are especially useful in that they are "integrated into the largely unconscious business of daily living and tend to persist untouched by contact with neighboring cultures or by changing fashions" (Linton 1944:369). That is, of course, unless foodways themselves change. Pots are tools, and as such, they were manufactured and utilized for specific functions (Braun 1983). Determining those functions is especially critical when studying transitional societies, as they can indicate fundamental changes in technologies, foodways, and cultural practices.

It has been demonstrated that the morphological attributes of vessels may be used to identify functional performance characteristics (Braun 1983; Hally 1986; Linton 1944; Mills 1985). Such attributes can and do largely determine the ways in which pots, as tools, can function (Braun 1983:108). For example, jars, having relatively large orifice diameters and slightly restricted necks are ideal for boiling liquids for long periods of time. This is because the large orifice allows for easy access for stirring and the slightly restricted neck aids in heat retention, reduces spillage, and limits evaporation (Linton 1944:370). And just as morphological characteristics can suggest function, fundamental shifts in morphology can indicate changes in dietary and subsistence practices (Braun 1983:125).

The West Jefferson phase ceramic assemblage is dominated by what Binford (1962:219) would term technomic, or utilitarian pottery. It is largely undecorated and was manufactured in relatively few forms. There are no elaborate decorative modes or surface treatments, traits generally thought to serve social or ideological functions (Schiffer and Skibo 1987). Therefore, variations in form are primarily the result not of stylistic preferences but of functional ones

(Phillips et al. 2003:220; Smith and Neiman 2007:49). Thus, the morphological vessel types present within this type of assemblage likely represent functionally distinct classes of vessels (Hally 1983a:181). It is for this reason that West Jefferson pottery is particularly conducive to functional analysis.

Considering that vessel morphology is inextricably tied to function, one would expect to find that forms tend to remain relatively unchanged over time unless accompanied by shifts in foodways. Although West Jefferson and Early Mississippian populations exploited similar foods, the proportions of those foods constituting their respective diets differed significantly (Scarry 1986:410). During the West Jefferson phase, evidence suggests that maize horticulture increased, most notably toward the end of the phase (Scarry 1986:290). Nonetheless, West Jefferson groups remained basically hunter-gatherers largely dependent on wild foods, while Mississippian groups were agriculturalists primarily dependent on maize (Scarry 1986:416).

With this in mind, I argue that fundamental differences between West Jefferson and Early Mississippian groups in regard to primary subsistence strategies and cultural traditions as a whole should be reflected by differences in their pottery forms. Previous researchers, in contrast, have suggested that the pottery forms of indigenous West Jefferson groups are similar to those of intrusive Mississippians, reflecting the acculturation of West Jefferson peoples. The presence of globular forms and handles in West Jefferson assemblages has been cited as evidence that these groups were perhaps adopting both the styles and food-processing technologies of contemporaneous Mississippian groups (Jenkins and Krause 2009:207; Jenkins and Nielsen 1974; O'Hear 1975:26; Seckinger and Jenkins 2000). However, the idea that West Jefferson potters were in essence "copying" the styles of Mississippian wares does not accord well with their continuing hunter-gatherer foodway. Ethnographic evidence also suggests that potters tend to be technologically conservative, most notably in regard to utilitarian wares (Rice 1984:244).

Therefore in this study, I hypothesize that grog-tempered vessels in West Jefferson phase ceramic assemblages will tend to be dominated by ovaloid forms of cooking vessels typical of traditional Southeastern North American nut-processing technologies rather than globular forms typical of contemporaneous early maize-producing Mississippian cultures. I also hypothesize that West Jefferson grog-tempered cooking vessels will differ significantly from standard Mississippian jars not only in lower body shape but in other qualitative and quantitative morphological characteristics including thickness, presence of sooting, transportability (presence of handles), rim shape, and manufacturing proportions. I further propose that functional differences account for these dissimilarities. If this is indeed the case, it will support the idea that West Jefferson peoples were not copying the pottery forms and technologies of their Mississippian neighbors, but were instead manufacturing traditional Late Woodland cooking pots that fully reflect their hunting and gathering subsistence strategies.

# CHAPTER 3
# RESEARCH OBJECTIVES AND METHODS

## Research Objectives

The primary goal of this study is to determine whether the pottery of West Jefferson phase groups reflects the fact that they were utilizing traditional nut-processing technologies or, by contrast, if they were in essence copying the pottery forms and maize-producing technologies of early agriculturalists. To explore this issue, my first research objective is to define the West Jefferson vessel assemblage, that is, to determine the vessel forms and size classes present in a typical West Jefferson ceramic assemblage. My second research objective is to provisionally identify the functional characteristics of West Jefferson vessels based on their overall morphology. My third research objective is to determine the degree of morphological similarity, or lack thereof, between West Jefferson and Early Mississippian cooking vessels. Because function is tied to form (Braun 1983; Linton 1944; Rice 1987:211), I assume that similarities between morphological characteristics indicate similar functions, and, by contrast, that morphological dissimilarities indicate functional differences. My final research objective is to determine the degree of influence, or lack thereof, of Mississippian groups on the pottery forms of West Jefferson peoples.

## Vessel Terminology

Prior to a discussion of methodology, it is first necessary to clarify terminology that archaeologists frequently use, but seldom define. For example, the terms “bowl” and “jar” are part of our colloquial vocabulary, and therefore their definitions, even when referring to prehistoric vessel forms, tend to be taken for granted. However, when conducting this sort of pottery analysis, it is imperative that our terminology is clearly defined.

The basic anatomy of a pottery vessel must first be addressed. There are three primary components of a simple vessel: orifice, body, and base (Rice 1987:212-214) (Figure 2). The orifice consists of the opening at the top of the vessel, and the base consists of the bottom of the vessel. While the base is easily distinguishable for flat-based vessels, its boundaries are less clear in round- and conical-based vessels. In this study, general base shapes were recorded, not their beginning or end points, so this distinction is not an issue. The body is that part of the vessel between the orifice and base. When the vessel has a restricted orifice, that portion of the vessel above the maximum diameter is called the upper body, or shoulder, and the portion below the

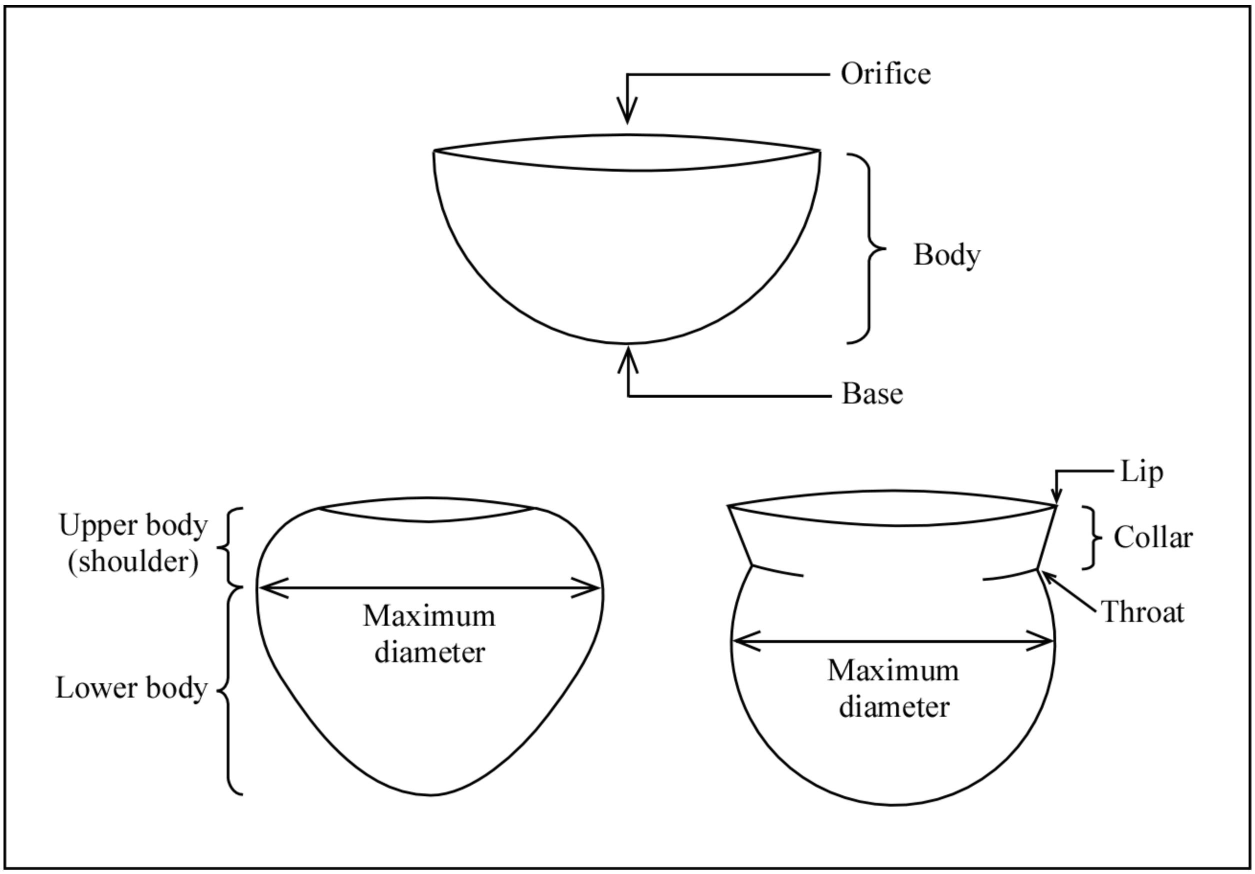


**Figure 2. The anatomy of a vessel (after Rice 1987: Figure 7.2).**

maximum diameter is called the lower body (Figure 2). Many vessels in the West Jefferson assemblage also have collars. Collars extend upward from the vessel body, beginning at the throat, which is a slight restriction in diameter near the upper shoulder (Figure 2). Collars do not significantly restrict the orifice diameter relative to the maximum vessel diameter (Rice 1987:212). All collars in this study are excurvate, i.e., they flare outward.

The vessel orifice is often described in regard to the rim and lip. The lip is the edge of the vessel opening, or the location at which the interior of the vessel meets its exterior (Figure 2). In this study, there were three lip types, each with a distinct cross-section shape: rounded, flattened, and folded/flattened (Figure 3). As the names suggest, rounded lips exhibit rounded cross-sections, and flattened lips appear squared, or flattened in cross section. Folded/flattened lips are

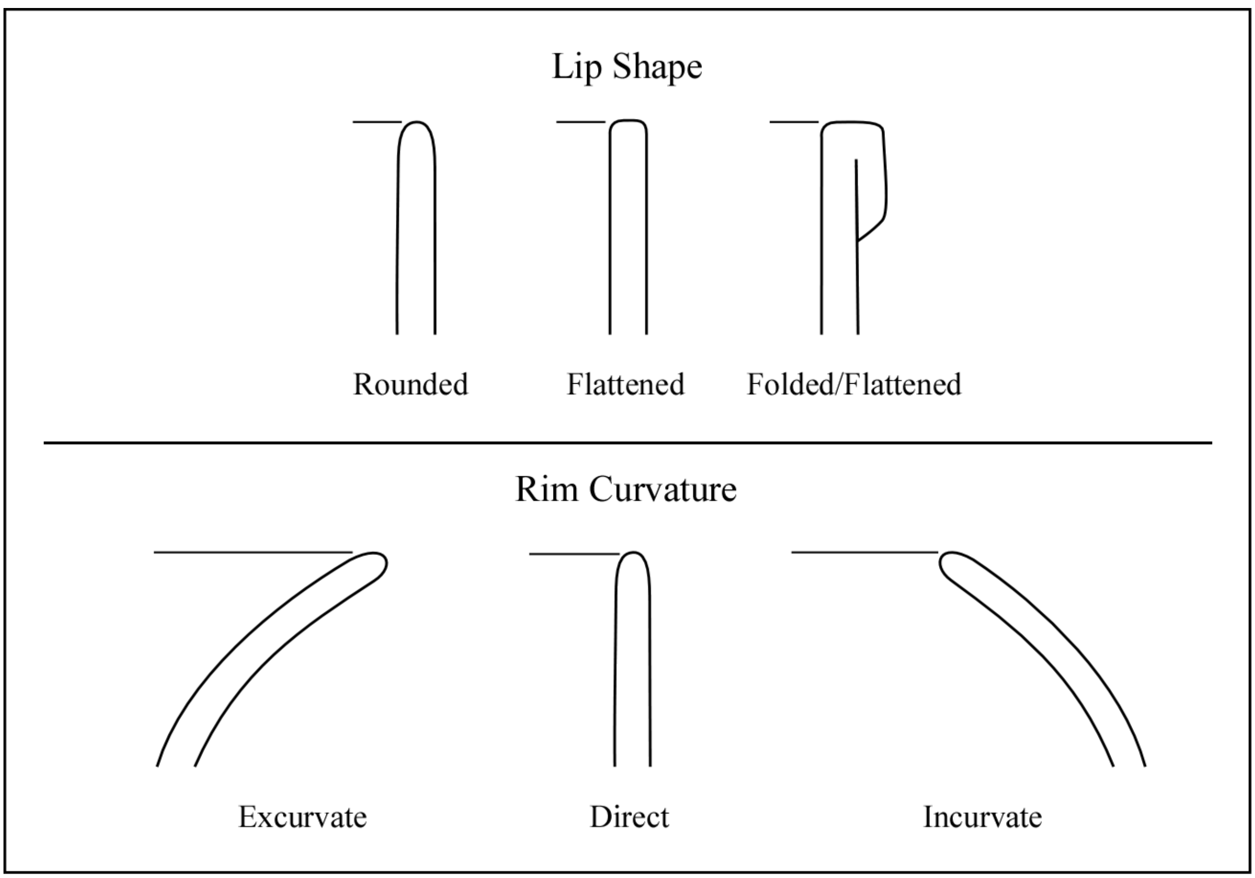


**Figure 3. Lip shape and rim curvature.**

formed when the upper portion of a vessel is folded outward and onto itself, and then flattened. It results in a thickened lip that has a distinctive cross-section in which the fold in the clay can easily be seen (Figure 3). Rims include that part of the vessel nearest the orifice, and rim sherds are distinguishable from body sherds in that the vessel lip is present on the former. Rim height can only be measured when there is a distinct inflection separating it from the vessel body, such as that of the throat on collared vessels. Rim height is defined in this study as the vertical height between the vessel lip and the point of vertical tangency on the vessel throat (the most constricted portion of the vessel neck) (Rice 1987:214; Shepard 1956:245). Thus, in this study, rim height can only be measured on collared vessels. The curvature of the rim is recorded for all rim sherds and includes three categories: excurvate, direct, and incurvate (Figure 3). Excurvate rims flare outward, direct rims are vertical, and incurvate rims curve inward.

With the above in mind, what follows are definitions of terms utilized in this study:

*Restricted vessel*: A vessel that has an orifice diameter less than the maximum vessel diameter (Shepard 1956:228).

*Unrestricted vessel*: A vessel that has its maximum diameter at the orifice (Shepard 1956:228).

*Jar*: A collared vessel with a slightly restricted throat having a diameter greater than 75 percent of the maximum body diameter. Previous researchers of Mississippian pottery have defined jars as having globular bodies (Johnson 2003:162; Steponaitis 1983:69), as no vessels with ovaloid bodies existed in their study collections. Other researchers have included restrictions on height rather than lower body shape (Rice 1987:216; Taft 1996:25). Because the present study collection contained no complete or even mostly complete vessels, determination of lower body shape and total vessel height was impossible for the vast majority of rim sherds. As such, jars include Late Woodland and Early Mississippian collared vessels with both globular and ovaloid body forms.

*Bowl* – A collarless vessel having a height ranging from one-third of its maximum diameter to equal its maximum diameter (Rice 1987:216). Bowls in this study are either restricted, having incurvate rims, or unrestricted, having direct rims.

**Research Methods**

A total of 352 sherds were examined during this study. Of these, the majority (n=282) originated from the West Jefferson Steam Plant sites (1Je31, 1Je32, and 1Je33). The entire collection, consisting of 80 curation boxes, was examined for sherds large enough for study. Size requirements for sherds are discussed below. Because Early Mississippian shell-tempered sherds were needed for the comparative aspect of the study, and because they do not occur in sufficient numbers at the above-mentioned sites, pottery sherds from the contemporaneous Oliver site (1Tu459) (n=70) were also examined. These collections were borrowed from the curation facility at the Office of Archaeological Research, Museum of Natural History, University of Alabama, located in Moundville, Alabama.

Many researchers have conducted studies of vessel morphology and function in North America (e.g., Braun 1983; Espenshade 2000; Hally 1984, 1986; Smith 1988; Wilson and Rodning 2002), and these studies were used as references and as guides in this study. The following are sixteen morphological variables that were recorded during the study. Some variables apply only to rim sherds, while similarly, some apply only to base or body sherds. Unless otherwise noted, all quantitative measurements were taken using digital calipers with a precision of 1 mm. Rim sherds selected for diameter measurements were required to have a chord length of at least 4 cm to reduce measurement error. Similarly, body sherds selected for curvature measurements were required to have vertical and horizontal lengths of no less than 4 cm.

1. *Rim shape*. Rim shape was used as an indicator of basic vessel shape. Rim sherds in the study were required to have a minimum vertical height of 3.0 cm to allow for a complete vertical cross-section of the rim. As stated, there were three categories of rim shape, including excurvate, direct, and incurvate (Figure 3). Excurvate rims curve outward from a restricted throat, and are indicative of jar forms. Direct rims are characteristic of simple unrestricted bowls. Incurvate rims curve inward along the upper vessel body, and are characteristic of restricted bowls.
2. *Temper*. Temper consists of nonplastic inclusions added to the paste during vessel manufacture. The inclusion of temper increases the workability of the clay and helps prevent cracking during and after firing (Rice 1987:407-408; Shepard 1956:25). The two types of temper used during the West Jefferson phase and Early Mississippian period were grog, which consists of ground pottery sherds, and burned and pulverized mussel shell.
3. *Rim height (mm).* This measurement is defined as the vertical height between the vessel lip and the vessel throat (the most constricted portion of the collar) (Rice 1987:214; Shepard 1956:245). For direct rims, this measurement is indeterminate, and was therefore not recorded.
4. *Lip shape.* The lip is the edge or margin of the vessel opening (Rice 1987:214). Each rim was categorized into one of three categories: flattened, rounded, or folded/flattened (Figure 3).

5. *Presence of handles.* Either handles (or handle scars from detached handles) are present on the rim or they are absent. If present, the width and thickness of the handle was measured.

6. *Percentage of total vessel rim present*. Using a standard diameter-measurement template, the percentage of the total rim circumference present was estimated (Figure 4).

7. *Estimate of orifice diameter using a template (cm)*. The orifice diameter was estimated by fitting the rim sherd on a standard diameter-measurement template (Figure 4). Within feature assemblages, sherds were examined to determine which, if any, sherds originated from common parent vessels. When this occurred, only one

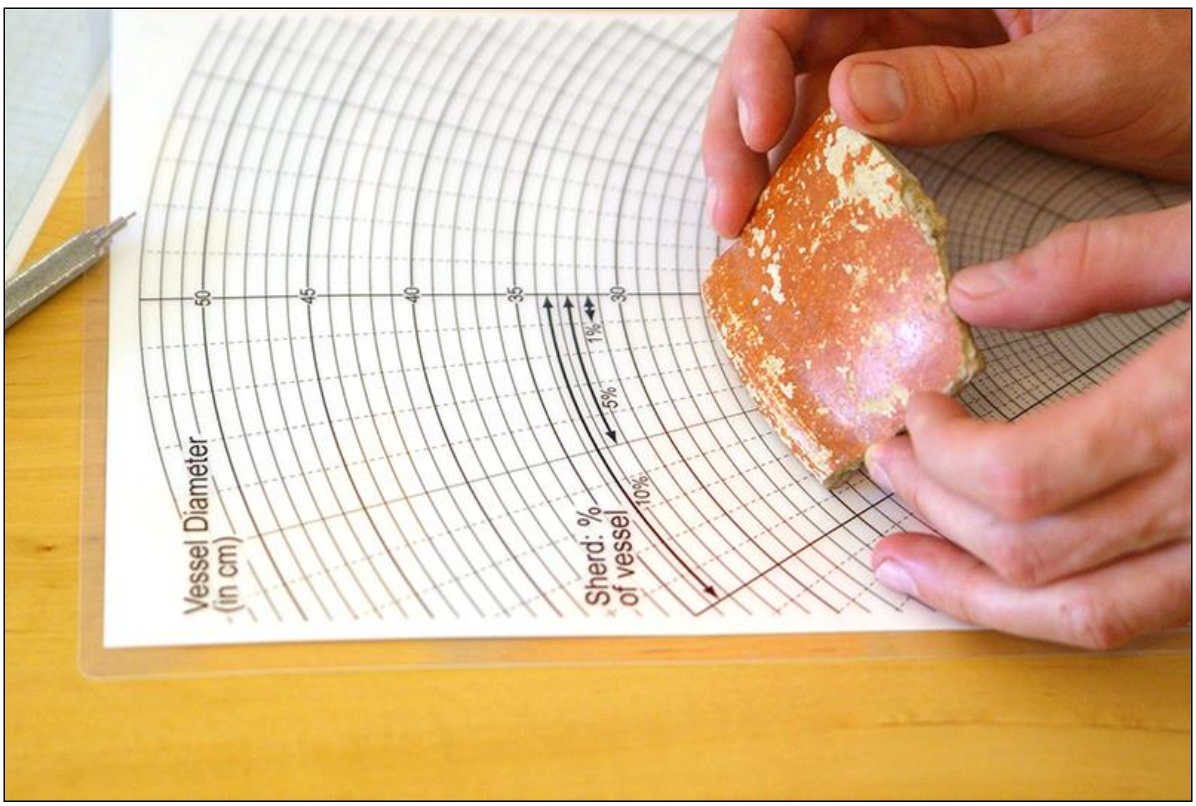


**Figure 4. Standard diameter-measurement template.**

diameter estimate was recorded for each vessel. Because it is almost impossible to estimate the diameters of very small rim sherds using this method, diameter estimates were only recorded for rim sherds that comprised at least 5 percent of the total vessel rim circumference.

8. *Estimate of orifice diameter using dial indicator (cm)*. Use of a dial indicator to precisely measure three points on a curve has been demonstrated to decrease error as compared to a diameter-measurement template, when used to estimate the diameter of rim sherds (Figure 5). Dial indicators can be used to estimate any diameter along the vertical profile for vessels that have circular horizontal cross-sections. Diameters are calculated based on the method and formula outlined by Plog (1985:245):

$$\text{Diameter} = \frac{(\overline{AC}/2)^2 + (\overline{BD})^2}{(\overline{BD})}$$

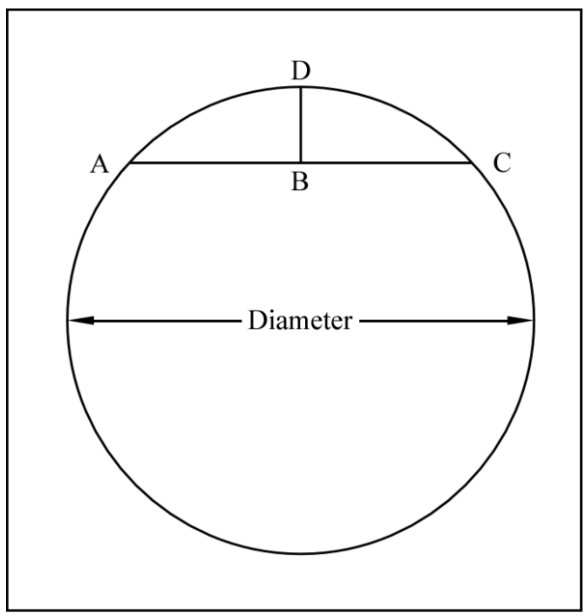


**Figure 5. Calculating vessel diameter for sherds (after Plog 1985: Figure 10.1).**

To reduce error, three measurements were taken on each rim sherd, and the averaged values were then used to calculate diameter. However, because prehistoric vessels were handmade and are therefore rarely perfectly circular on any horizontal plane, this type of measurement has the potential to include a great deal of error. To mitigate this error at least somewhat, measurements on the same sherds that differed significantly from one another were not used for the vessel size analysis in the following chapter. Additionally, a Wilcoxon signed ranks test was performed between the template orifice diameter estimates and those made using the dial indicator, and there were no significant statistical differences between the two ($z$=-.916; $p$=.36). This indicates that the diameter estimates using the dial indicator are consistent with those estimated with the template. As such, I assume that sherds that were too small to estimate diameter using the standard diameter-measurement template produced relatively accurate diameter estimates using the dial indicator.

9. *Estimate of throat diameter using dial indicator (cm).* A dial indicator was also used to estimate the diameter of vessel throats using the above formula and methods (Plog 1985:245).

10. *Profile curvature.* The profile curvature of large body sherds for which the orientation could be determined based on coil breaks was measured with a dial indicator at three points on the sherd (Figure 6). The profile curvature was calculated based on the above formula outlined by Plog (1985:245).

11. *Axial curvature.* Axial curvature was measured perpendicular to the three profile curvature measurements (Figure 6). The ratios of profile to axial curvature were calculated and then averaged to provide data on lower vessel body shape. A ratio near 1.0 indicates a globular shape, while a ratio with a value greater than 1.0

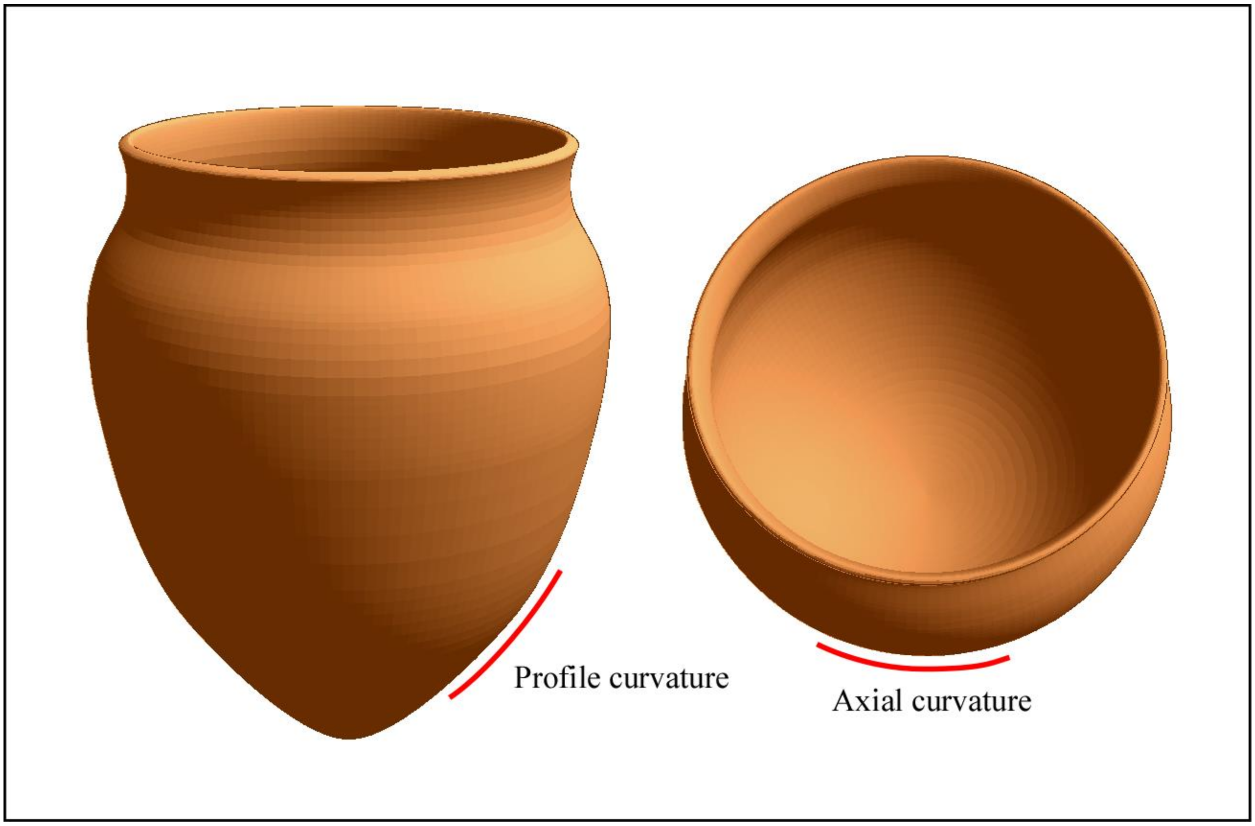


**Figure 6. Profile and axial curvature.**

indicates a flatter, more ovaloid shape. This two-curvature method for reconstructing vessel morphology was conducted as outlined by Hagstrum and Hildebrand (1983, 1990).

12. *Thickness of body (mm).* The thickness of each body sherd was measured (Hart 2012).
13. *Thickness of base (mm).* The thickest portion of the base, or bottom-most part of the vessel, was measured. The ratio of base to body thickness was then calculated. It was expected to be close to 1.0 on globular vessels, and closer to 2.0 on ovaloid vessels.

14. *Presence of extensive use-wear on base*. The presence or absence of extensive use-wear on base sherd exteriors was recorded. Extensive use-wear is characterized by the presence of abrasion or roughening on the vessel's exterior surface.

15. *Presence of sooting*. Sooting on sherd exteriors is caused by airborne particles emitted during wood combustion (Skibo 2013:89). This blackened deposit was either present or absent.

16. *Decoration.* The ceramic type/variety typology outlined by Jenkins (1981) was used to classify sherds. The most commonly found types at West Jefferson phase sites are Baytown Plain (undecorated grog-tempered) and Mississippi Plain (undecorated shell-tempered), although minority types are also present in the sample.

In addition to the above measurements, rim profiles were drawn of numerous large rim sherds, and additional curvature measurements were taken of large vessel fragments. These data were then entered into the computer-automated design program Canvas X (ACD Systems International 2015), which was used to produce 3-D visual renderings of the vessels and portions thereof.

Rim profiles were used to define the vessel shape classes present within the West Jefferson phase assemblage. Because orifice diameter is generally considered to be strongly correlated with vessel height and maximum diameter in the most common vessel forms, excluding bottles (Hally 1983a:167), orifice diameter has been assumed to be a good indicator of vessel size in this study and was therefore used to determine size classes within each vessel shape class. Size classes were chosen based on normality indicators including the Shapiro-Wilk W statistic (after Hally 1984), skewness and kurtosis values, frequency histograms, and normal quantile-quantile plots (Q-Q plots) for numerous test groupings of diameters.

With these variables collected, statistical analyses using SPSS version 21.0 (IBM Corp. 2012) were conducted to identify morphological and functional variation within the West Jefferson vessel assemblage, as well as between West Jefferson and Early Mississippian cooking vessels. Statistical tests included ANOVA, chi-square, and *t*-tests for normal data, as well as binomial, Mann-Whitney Rank Sum, Wilcoxon Signed-Rank, and Kruskall-Wallis tests for non-parametric data.

**Limitations of the Study**

The archaeological deposition of pottery is affected by a number of factors, particularly the duration of site occupation and vessel use-life (Mills 1989). Vessels that break more frequently, such as cooking pots, appear at higher rates in the archaeological record than those that have a longer use life, such as storage pots. In regard to duration of occupation, at short duration sites certain functional classes may be infrequent in the archaeological record, merely because their breakage rates are low. Similarly, artifact assemblages from sites occupied for longer durations are more likely to exhibit the full range of functional vessel classes originally present during occupation. Ethnographic evidence suggests that it can take between three and ten years for all functional classes of pottery to appear as potsherds in the archaeological record, and one to two years further for their proportions to stabilize (Mills 1989:141). The absence of deep midden accumulations at most West Jefferson phase sites indicates that site duration was likely rather short, possibly no more than a few decades (Scarry and Scarry 1997:19). The absence of midden accumulation at most West Jefferson sites might be attributed to short occupation duration, but is more likely a result of disturbances caused by historic agricultural practices. At the Lost Creek site (1Wa186) in Walker County, Alabama, a plowed, single-component West Jefferson phase site, a buried A-horizon midden approximately 20 cm in depth was encountered, indicating substantial site duration (Thompson 2002:32). Regardless, considering the sheer volume of sherds in the present study collection (approximately 10,000), it is felt that the sites' occupations were of sufficient duration to include representatives of all vessel classes. This is not to presume, however, that the proportions of vessel classes and sizes present in the collection are representative of actual proportions present during site occupation.

Vessel shape also plays a key role in the size of archaeologically deposited ceramic sherds, in that larger, thicker pots exhibiting less curvature are more likely to break into larger sherds, while smaller, thinner pots with higher degrees of curvature are more likely to break into smaller sherds. As larger sherds were required in this study, there is something of a statistical bias in the sample toward sherds with thick, relatively flat cross-sections originating from large ovaloid vessels. Thus, globular vessels are likely underrepresented. Despite this, I made general observations on lower vessel body shape for sherds that were too small for quantitative measurements. This issue is addressed further in Chapter 4.

As regards the functional analysis, this study attempts only to broadly infer the functions that were intended at vessel manufacture based on vessel morphology. However, I do not presume that each vessel had only one function throughout its use-life. There is no doubt that pots can function in many ways, and not all of them related to food preparation (Rice 1987:208-210). The study also does not take into account the repurposing of vessel fragments after breakage (Hally 1983a:176). There is little doubt that fragments could have, and likely were, used for purposes that cannot now be discerned. Moreover, sooting patterns, which were assumed in this study to result from cooking practices, admittedly could have originated after breakage, during manufacture in the firing process, or during non-dietary-related activities.

Despite these limitations, I feel that none of these factors preclude the quantitative and qualitative analysis of the data collected. Site duration is probably sufficient to gain a representative sample of morphological types. Overall impressions of lower body vessel curvature were made in addition to statistical analysis of large sherds. While repurposed fragment use was likely a common occurrence, the task at hand involves determining the purposes for which vessels were manufactured when new.

# CHAPTER 4

# WEST JEFFERSON PHASE VESSEL MORPHOLOGY AND FUNCTION

## The West Jefferson Vessel Assemblage

Examination of large rim sherds and reconstructed vessel rim profiles resulted in the identification of at least four distinct morphological vessel types within the West Jefferson assemblage, each of which were further broken down into size classes. These vessel types include flared-rim ovaloid jars, flared-rim globular jars, unrestricted hemispherical bowls, and restricted hemispherical bowls (Figure 7).

### *Flared-Rim Jars*

Flared-rim jars (n=77) account for approximately 61 percent of the assemblage, and include two vessel types: flared-rim ovaloid jars and flared-rim globular jars. Because it was generally not possible to determine lower body shape based on rim profiles, ovaloid and globular forms are discussed here together. The flared-rim ovaloid jar is characterized by an elongated lower body, slightly constricted neck, excurvate rim, and rounded (n=39) or flattened (n=35) vessel lip. Vessel wall thickness ranges from 4.0 to 8.7 mm, with a mean of 6.6 mm. Rims do not exhibit a distinct break or angle of inflection at the throat, but instead exhibit in cross section a gentle S-shaped curve from lip to throat to vessel body. Rim height varies from less than a centimeter to just over 5 cm, but this generally correlates with overall vessel size. Handles are present on jars in the sample but are somewhat rare, with only seven examples, indicating that most West Jefferson flared-rim jars did not have handles. Flared-rim globular jars differ from the

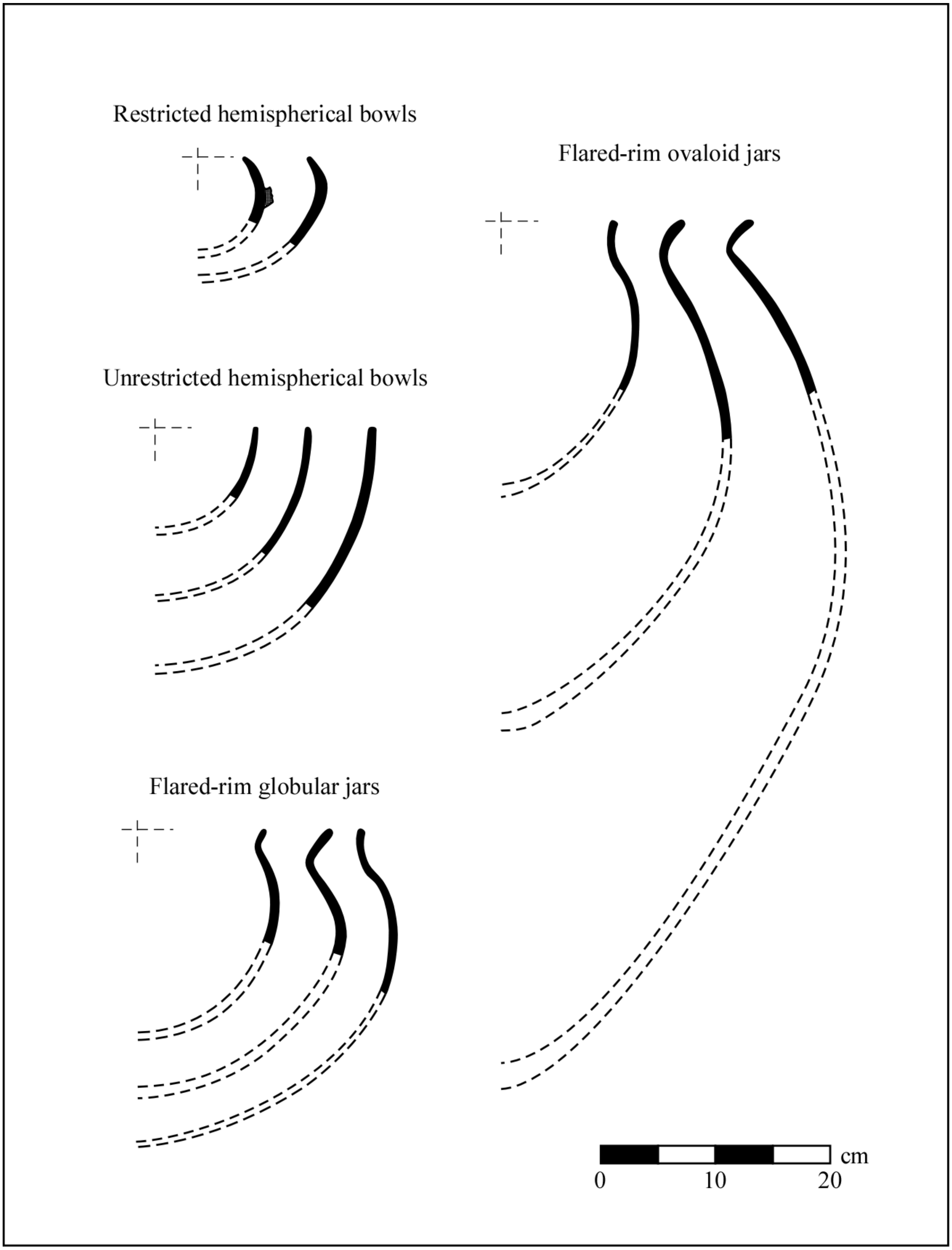


**Figure 7. West Jefferson phase vessel assemblage.**

ovaloid forms only in lower body shape, which is globular rather than ovaloid. Jars exhibit a fair amount of variability in regard to rim angle. The angle of the outward-flaring rim varies from 10 degrees to almost 45 degrees from the vertical axis. However, the majority of rims exhibit a flare of approximately 30 degrees.

Of the 77 jar rim sherds in the sample, 31 were sufficiently large to measure orifice diameter. These orifice diameter measurements were used to determine size classes of jars. The Shapiro-Wilk W statistic (SAS Institute 2011) indicates that the probability that the jar orifice diameter measurements are randomly sampled from a normally distributed population is only 8.1 percent (W=.940; $p$=.081). While this probability is not small enough to reject the null hypothesis of a normal population, the wide range of orifice diameters (16.8 cm to 48.0 cm) suggests that jars were indeed manufactured in multiple size classes (Figure 8). Previous studies have used the Shapiro-Wilk W statistic on numerous test sub-groups of size classes within vessel types to determine which have the highest normality indicators (Hally 1984:50-53). However, potential sub-group sample sizes in this study (with $n$ ranging from 7 to 13) are too small to produce meaningful conclusions concerning normality. Instead, visual indicators were utilized, and although visual methods are sometimes considered unreliable, in this case, they are deemed the most appropriate method considering sample size. As such, jar size classes were determined based on observable gaps and modes in the sample histogram, with boxplots aiding in determining cutoff points between size classes. Normal Q-Q plots, also frequently utilized as visual indicators of data normality, were inconclusive in this case, likely due to small sample size.

The histogram of jar orifice diameters shows a clear gap in the sample distribution between 24 cm and 27 cm, to either side of which occur two distinct modes (at 22 cm and 30 cm)

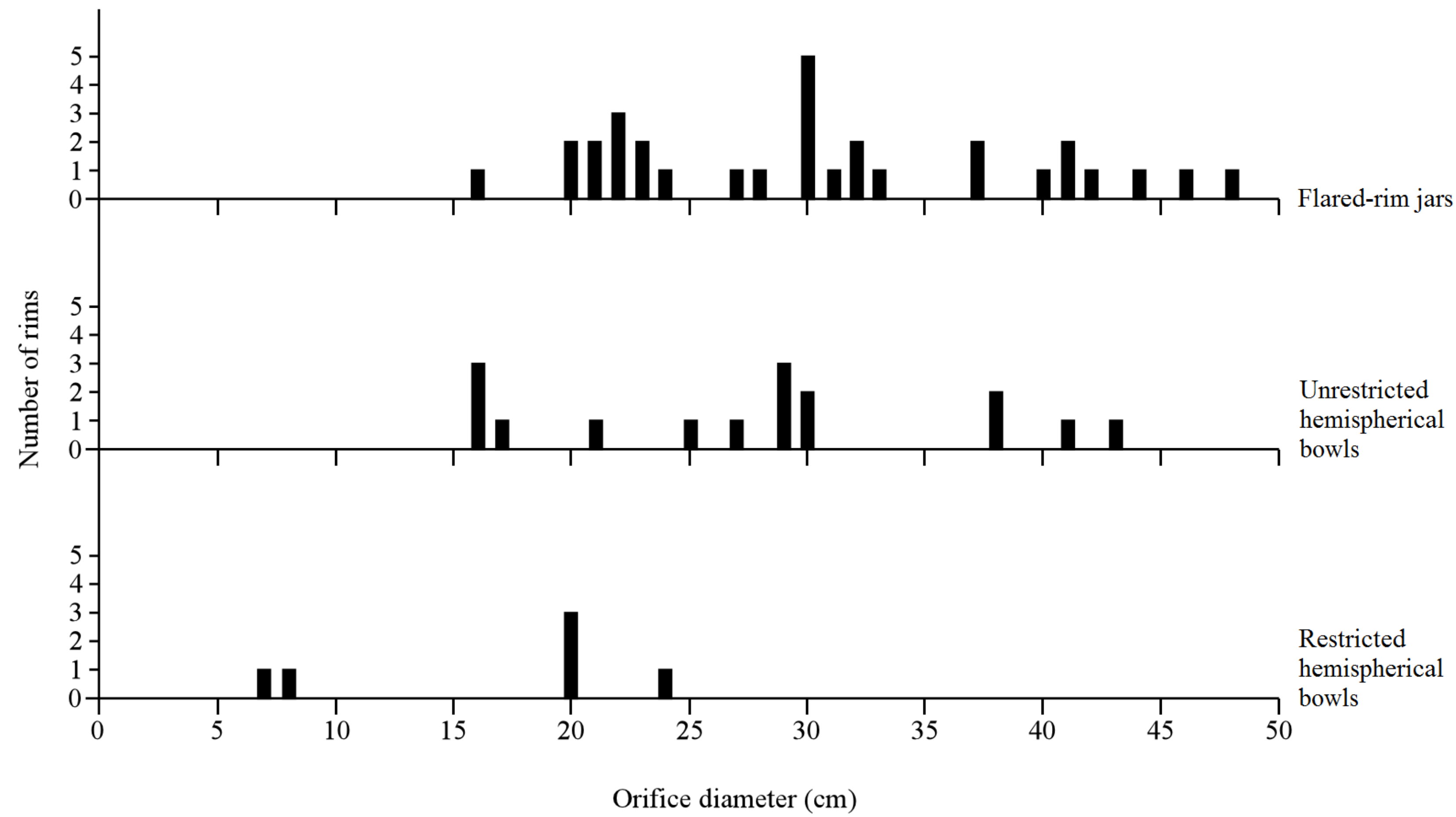


**Figure 8. Distribution of orifice diameter measurements by vessel shape class.**

(Figure 9). Jars having orifices ranging from 16.0 cm to 25.0 cm (with a median of 22 cm) were therefore classified as small jars. This places the lower limit of the medium size class at 25.1 cm, but its upper limit was somewhat unclear. Possibilities for this upper limit, based on gaps in the data, were 35.0 cm and 37.5 cm (Figure 8). Boxplots were utilized to determine which upper limit was more appropriate. A symmetric boxplot that has its median line at approximately the center of the box and symmetric whiskers that are slightly longer than the subsections of the center box suggest that the data are normally distributed (Elliot and Woodward 2007:28-29). In this case, boxplots that separate the medium and large size classes at 37.5 cm are suggestive of more normal distributions (Figure 10). The medium size class of jars is therefore defined as having orifice diameters ranging from 25.1 cm to 37.5 cm (with a median of 31 cm), while the large size class is defined as having orifice diameters ranging from 37.6 cm to 49.0 cm (with a median of 44 cm) (Figure 9).

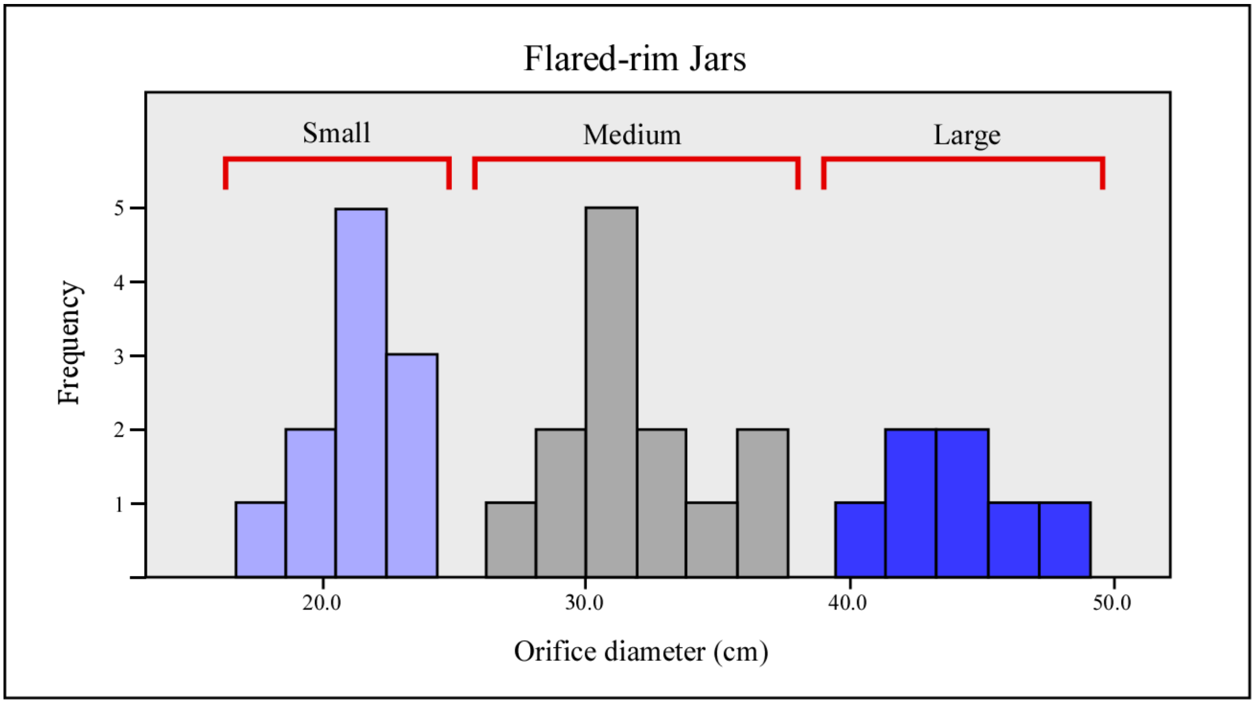


**Figure 9. Histogram of flared-rim jar size classes.**

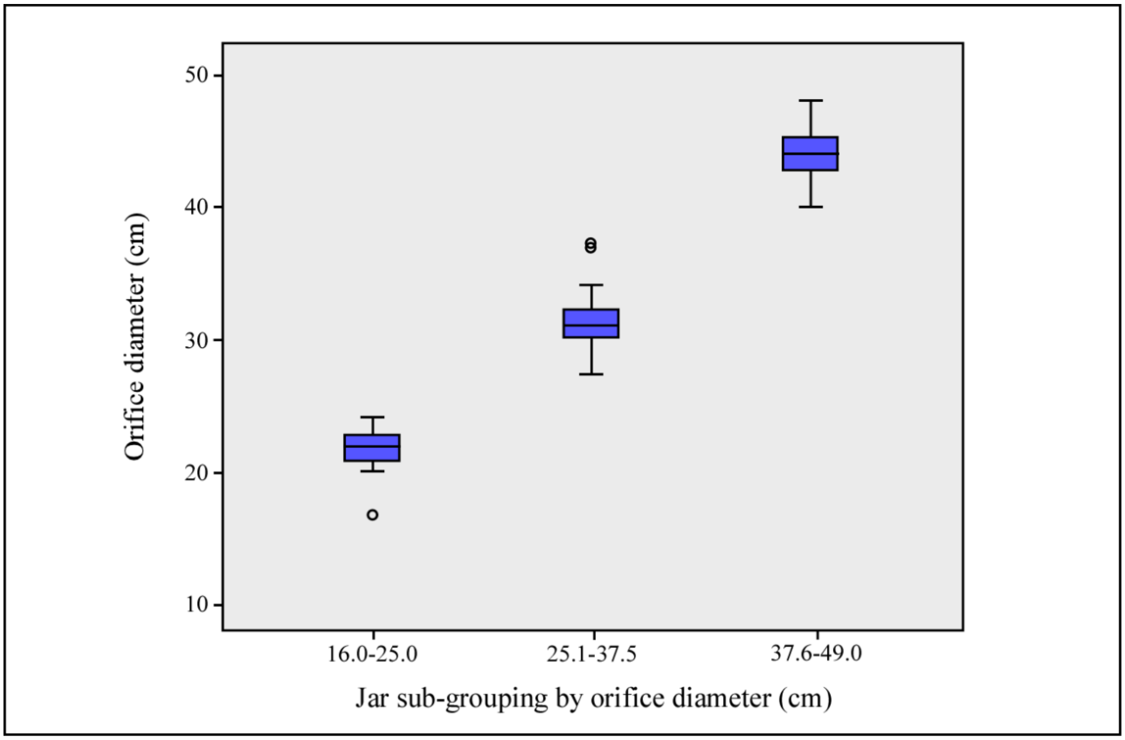


**Figure 10. Boxplot of flared-rim jar size class sub-groupings.**

These observations suggest that flared-rim jars were manufactured in three size classes: small, medium, and large (Figure 9). While it was not possible to determine percentages of each size class in regard to body shape (ovaloid or globular), there are some general observations that can be made. For example, most jars in the largest size class appeared to be ovaloid in shape, as evidenced by the presence of numerous thick conical bases and many large-diameter lower body sherds with relatively flat vertical profiles relative to their axial curvatures. A three-dimensional rendering of one such large lower body sherd clearly shows the conical lower body shape of a large ovaloid vessel (Figure 11). Comparatively fewer large-diameter lower body sherds with approximately equal vertical and axial curvature (indicative of globular pots) were observed. Medium-sized jars, the most numerous of the three size classes, had discernable body shapes that seemed to be fairly evenly split between ovaloid and globular forms. As for small-sized jars,

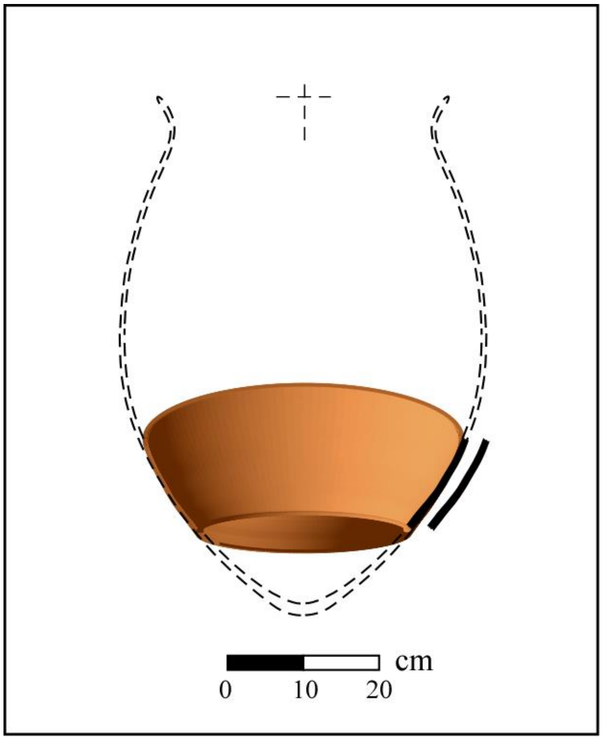


**Figure 11. Three-dimensional rendering based on lower body sherd of large ovaloid jar.**

both globular and ovaloid forms exist in West Jefferson phase assemblages, but I was unable to get a general impression of the relative percentages of each due to the small size of the sherds. Lower body shape is discussed further later in the chapter.

*Unrestricted Hemispherical Bowls*

Unrestricted hemispherical bowls (n=42), comprising 33.1 percent of the assemblage, have direct rims, hemispherical bodies, and rounded (n=25) or flattened (n=17) lips. Vessel wall thickness ranges from 4.7 mm to 9.5 mm, with a mean of 7.2 mm. Of the rims in this sample, only 16 were sufficiently large to measure orifice diameter. These diameter measurements were used to determine size classes of unrestricted bowls. The Shapiro-Wilk W statistic indicates that the probability is 16.6 percent that the observed jar orifice diameter measurements are randomly sampled from a normally distributed population (W=.920; $p$=.166). While this probability is rather large, estimated orifice diameters spanning a broad range (16.6 cm to 43.4 cm) indicate that this vessel class was likely manufactured in multiple size classes. Potential sub-group sample sizes within this vessel class (with *n* ranging from 4 to 7) are deemed too small to produce meaningful conclusions concerning normality using the Shapiro-Wilk W statistic and, therefore, visual indicators were utilized to define size classes. A histogram of orifice diameters of unrestricted bowls shows a large gap in the sample distribution between 31 cm to 38 cm, suggesting the presence of a large size class with orifice diameters ranging from 38.0 cm to 44.0 cm (with a median of 40.1 cm) (Figures 8 and 12). The presence of distinct small and medium size classes is proposed based on histogram modes near 16 cm and 29 cm, respectively, although admittedly this distinction is tentative considering small sample sizes. The small size class of unrestricted bowls is herein defined as having orifice diameters ranging from 15.1 cm to 25.0 cm

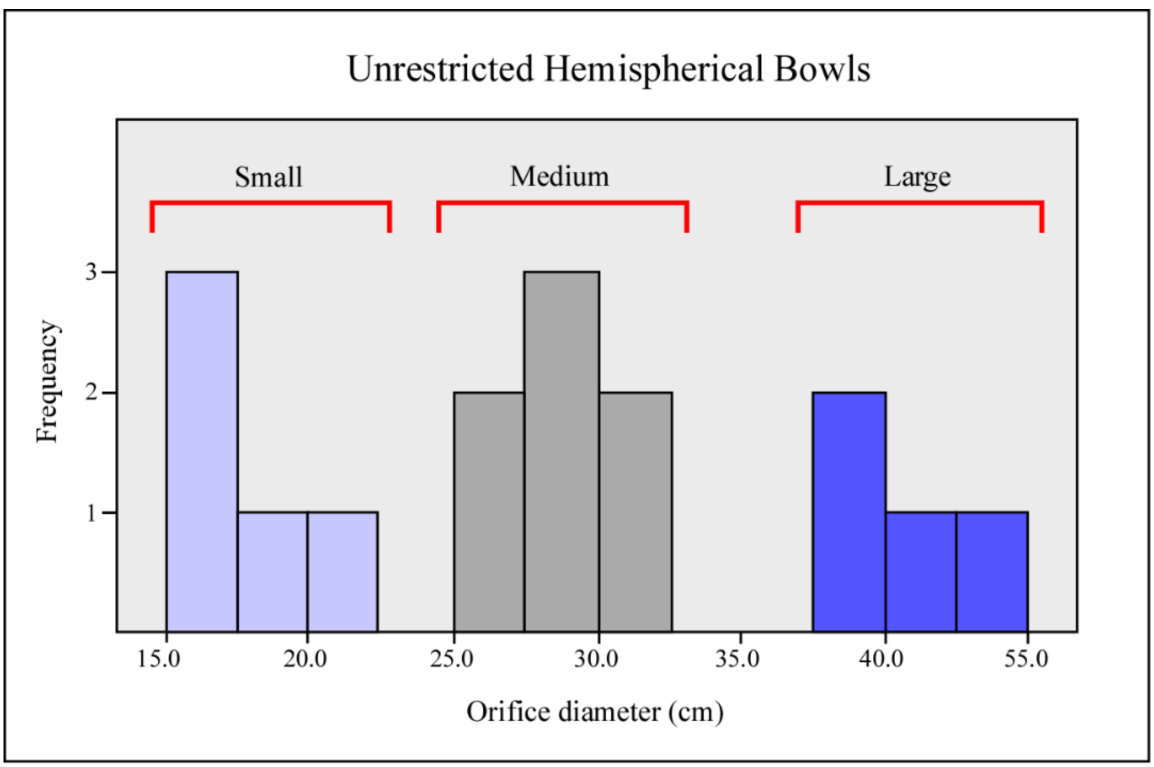


**Figure 12. Histogram of unrestricted bowl size classes.**

(with a median of 16.9 cm), while the medium size class is defined as having orifice diameters ranging from 25.1 cm to 35.0 cm (with a median of 29.5 cm). Of the three size classes, the medium size is most numerous (Figure 12).

*Restricted Hemispherical Bowls*

Restricted hemispherical bowls (n=8), comprising 6.3 percent of the assemblage, consist of simple globular bowls with restricted orifices and rounded (n=7) or flattened (n=1) lips. Vessel wall thickness ranges from 5.1 mm to 8.4 mm, with a mean of 6.9 mm. The Shapiro-Wilk W statistic indicates that there is only a 4.4 percent probability that the observed diameter measurements are randomly sampled from a normally distributed population (W=.768; $p$=.044). Admittedly, the small sample size likely precludes the ability of statistical indicators to determine normality. However, a histogram indicates that these bowls were manufactured in two size classes: small and medium (Figures 8 and 13). The small size class includes vessels with

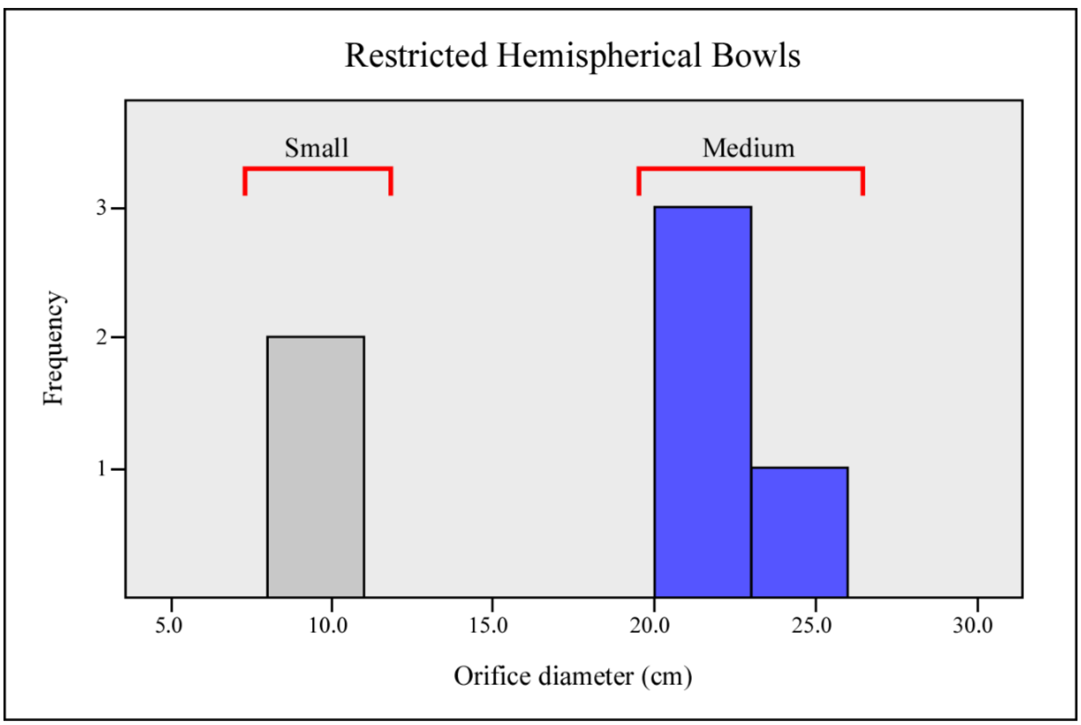


**Figure 13. Histogram of restricted hemispherical bowl orifice diameters.**

orifice diameters ranging from 7.0 cm to 9.0 cm, while the medium size class includes vessels having orifice diameters ranging from 15.0 cm to 25.0 cm. The smaller size class is only represented by two vessels, one with handles and one with small nodes, while the medium size class has no appendages.

*Summary*

The complete West Jefferson phase vessel assemblage – typologically Baytown Plain - consists of eleven distinct forms based on shape and size (Table 1; Figures 7 and 14). By comparison, Jenkins (1981:89-90) reports that the four primary grog-tempered Late Woodland vessel shapes in the Tombigbee River Valley to the west are the hemispherical bowl, flared-rim globular jar, flat-bottomed beaker, and bag-shaped bowl, or what Wallis (2011:154) refers to as an “open pot.” However, the results of this study suggests that the Late Woodland vessel repertoire of the upper Black Warrior Valley is different from that found in the Tombigbee Valley. The deep, unrestricted vessels and flat bases typical of the Late Woodland Miller III phase in the Tombigbee River Valley do not appear at all in West Jefferson phase assemblages.

Table 1. The West Jefferson Phase Vessel Assemblage.

| Vessel Type | Orifice Diameter (cm) |
|---|---|
| Small flared-rim globular jar | 16.0-25.0 |
| Medium flared-rim globular jar | 25.1-37.5 |
| Large flared-rim globular jar | 37.6-49.0 |
| Small flared-rim ovaloid jar | 16.0-25.0 |
| Medium flared-rim ovaloid jar | 25.1-37.5 |
| Large flared-rim ovaloid jar | 37.6-49.0 |
| Small unrestricted hemispherical bowl | 15.1-25.0 |
| Medium unrestricted hemispherical bowl | 25.1-35.0 |
| Large unrestricted hemispherical bowl | 38.0-44.0 |
| Small restricted hemispherical bowl | 7.0-9.0 |
| Medium restricted hemispherical bowl | 15.0-25.0 |

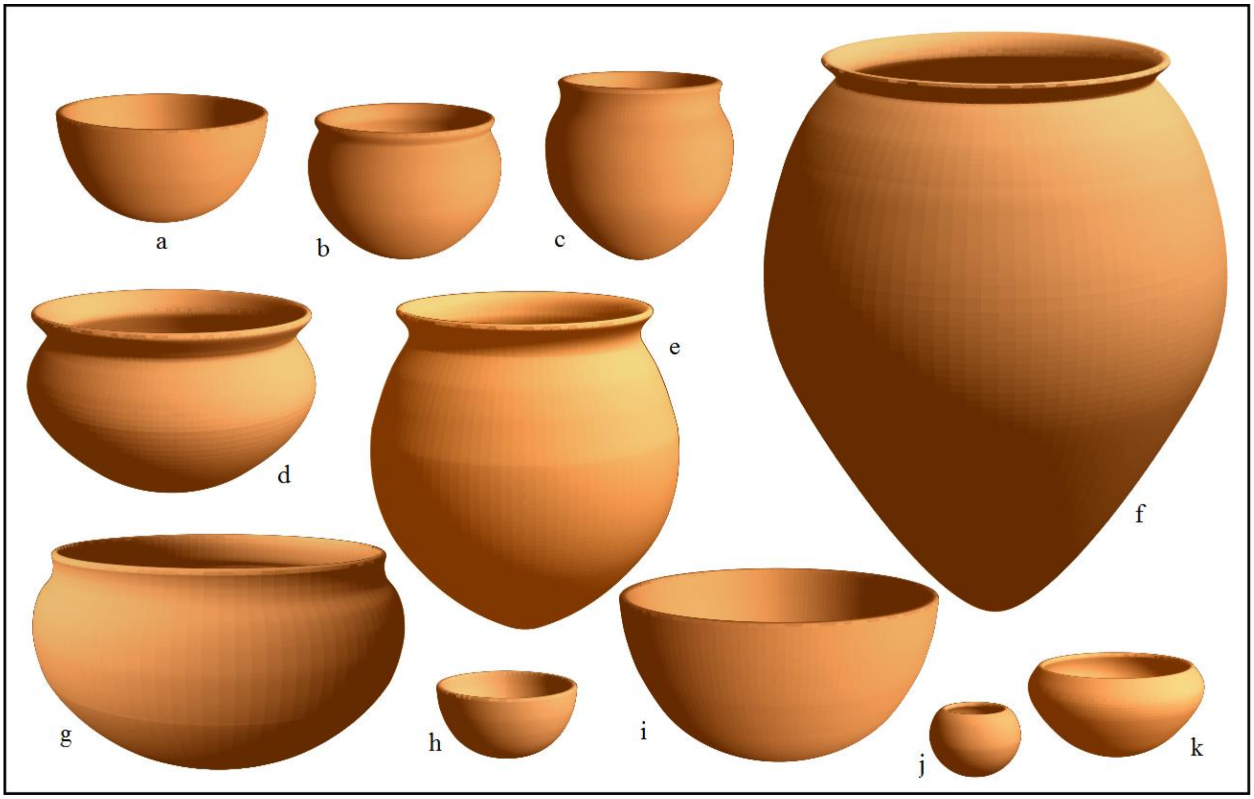


**Figure 14. Three-dimensional rendering of the West Jefferson phase vessel assemblage: a. medium unrestricted hemispherical bowl; b. small flared-rim globular jar; c. small flared-rim ovaloid jar; d. medium flared-rim globular jar; e. medium flared-rim ovaloid jar; f. large flared-rim ovaloid jar; g. large flared-rim globular jar; h. small unrestricted hemispherical bowl; i. large unrestricted hemispherical bowl; j. small restricted hemispherical bowl; k. medium restricted hemispherical bowl.**

## Morphological Variability and Use-Alteration within the West Jefferson Vessel Assemblage

Because function is closely related to form, morphological differences among the West Jefferson vessel types and size classes were analyzed to assess functional variability. In particular, lower body curvature and vessel wall thickness were examined. Use alteration of vessels, in this case consisting of sooting, was also examined to help determine West Jefferson phase vessel function.

*Lower Body Shape*

Profile to axial curvature ratios were calculated to obtain information concerning the lower body shapes of West Jefferson vessels. Globular vessels are expected to exhibit ratios close to 1.0, while elongated, ovaloid vessels are expected to exhibit higher ratios. The median profile to axial curvature ratio for grog-tempered vessels is 1.9, suggesting that lower bodies tended to be conical in shape. Admittedly, as previously stated, the sample of grog-tempered body sherds is likely biased toward large, thick conical vessels, which are more likely to break into sherds large enough for this type of measurement. Thus the measured sample is presumed to consist primarily of medium to large size ovaloid jars, with globular vessels represented to a lesser degree. However, I did observe definite examples of both ovaloid and globular West Jefferson jars during analysis.

*Vessel Wall Thickness*

Vessel wall thickness has been demonstrated to greatly affect mechanical strength, heat transfer, and thermal shock resistance (Rice 1987:227). Thick vessel walls provide a high degree of mechanical strength, but they do not conduct heat as efficiently as thin walls. Because thin walls are efficient heat conductors, they both decrease cooking time and save fuel. Most importantly, thin vessel walls increase a vessel's resistance to thermal shock (the strain caused by rapid heating and cooling and by long-term exposure to high temperatures). Resistance to thermal shock is especially important in pots used for sustained boiling.

Vessel wall thickness was compared among jars (n =69), unrestricted bowls (n=42), and restricted bowls (n=8). A one-way ANOVA test was performed to test the null hypothesis that the mean wall thicknesses of grog-tempered jars, unrestricted bowls, and restricted bowls within West Jefferson assemblages are equal. Descriptive statistics suggest that there exist small differences among mean wall thicknesses ($\bar{x}_J$ = 6.6 mm; $\bar{x}_U$ = 7.2 mm; $\bar{x}_R$=6.9 mm), and the ANOVA test indicates that these differences are statistically significant ($F$=3.70; $df$=2; $p$=.028). To determine where the significance lies within the data, a Tukey HSD test was performed. It indicates that significant differences exist between the mean wall thicknesses of flared-rim jars and unrestricted bowls ($p$=.021). Flared-rim jars are thinner than unrestricted bowls by an average of 0.56 mm. Despite the statistical determination of significance, it is unlikely that such a small difference in thickness appreciably affects the qualities of heat transfer and thermal resistance. It is further doubtful that West Jefferson potters intentionally manufactured cooking jars, on average, half a millimeter thinner than bowls. This suggests that West Jefferson cooking pots were not likely manufactured for long-term boiling.

Wall thickness data were also examined to determine whether or not a correlation exists between thickness and profile to axial curvature ratio. In other words, do globular vessels tend to be thinner or thicker than ovaloid ones? A Spearman correlation test indicates a weak positive correlation ($r$=0.164), suggesting that ovaloid vessels tend to have slightly thicker vessel walls than do globular ones. However, this weak correlation is not significant ($p$=.097), and explains only 2.69 percent of the total variance. This result suggests that there is likely very little relationship between wall thickness and lower body shape.

*Sooting*

Soot, or carbon, is deposited on pottery vessel exteriors as a result of wood combustion. There are three types of sooting that occur during cooking (Hally 1983b:7-8; Skibo 2013:90-92). When a vessel is placed over a fire, the entire vessel exterior from the base to the shoulder quickly becomes covered in a light, thin layer of soot. This soot is not permanent and can easily be washed off after use. The second type of soot occurs when airborne resin emitted during wood combustion adheres to a comparatively cool vessel surface. It is black in color, has a lustrous quality, and builds up over the use-life of a vessel. As such, it is the most common type of soot encountered in archaeological contexts. Because its deposition requires a relatively cool surface, it generally occurs on vessels that are used to cook liquids, as liquids keep the temperature of the vessel walls much lower than do solids. The third type of vessel surface alteration resulting from cooking is actually the *lack* of soot, or oxidation. This occurs when a pottery vessel reaches a temperature of 300-400° C, at which existing soot is burned away and no new soot can adhere to the surface. This most commonly occurs on pots placed directly on coals and on vessels in which liquids are boiled away, causing the vessel walls to reach this critical temperature. While all of these types of sooting deposits can occur on vessels as a result of processes not related to cooking, like firing pottery or the burning of a structure (Skibo 1992:147), in this study I assume that the majority are a result of cooking activities unless otherwise noted.

It is the second type of soot discussed above, the resin-like soot, that is the subject of this analysis. The patterns of soot deposition on vessel exteriors can indicate how vessels were positioned relative to heat sources and what types of heat sources were used. When organic material is burned, carbonized matter becomes airborne, enabling it to adhere to nearby exposed surfaces (Hally 1983b:8; Skibo 2013:88). Because these airborne particles travel upward, vessels situated on or over fires generally only exhibit sooting in a pattern extending up the vessel profile to the point of greatest diameter. Sooting may also appear on restricted rims because of skewed placement over fire or because of close proximity to flames. Vessels situated directly in fire on a bed of ash do not tend to exhibit sooting on the bottommost portions of the vessels, as these partially covered areas are minimally exposed to airborne particles emitted during wood combustion (Skibo 2013:92) (Figure 15a). By contrast, vessels suspended over fires tend to exhibit sooting on all portions of lower vessel exteriors, including bases (Skibo 2013:90) (Figure 15b). Sooting is generally absent on vessels suspended over coals, as coals emit no carbon-heavy particles (Figure 15c). Thus, the original research design was to note the presence and locations of sooting patterns along vessel profiles, specifically whether they occur on bases, lower bodies, upper bodies, or rims. However, in practice, this was generally not feasible, with the exception of rim and base sherds, owing to the fact that it was rarely possible to determine a sherd's exact placement along the vessel profile. The analysis of sooting patterns, therefore, was simplified into noting the presence or absence of soot on sherd exteriors.

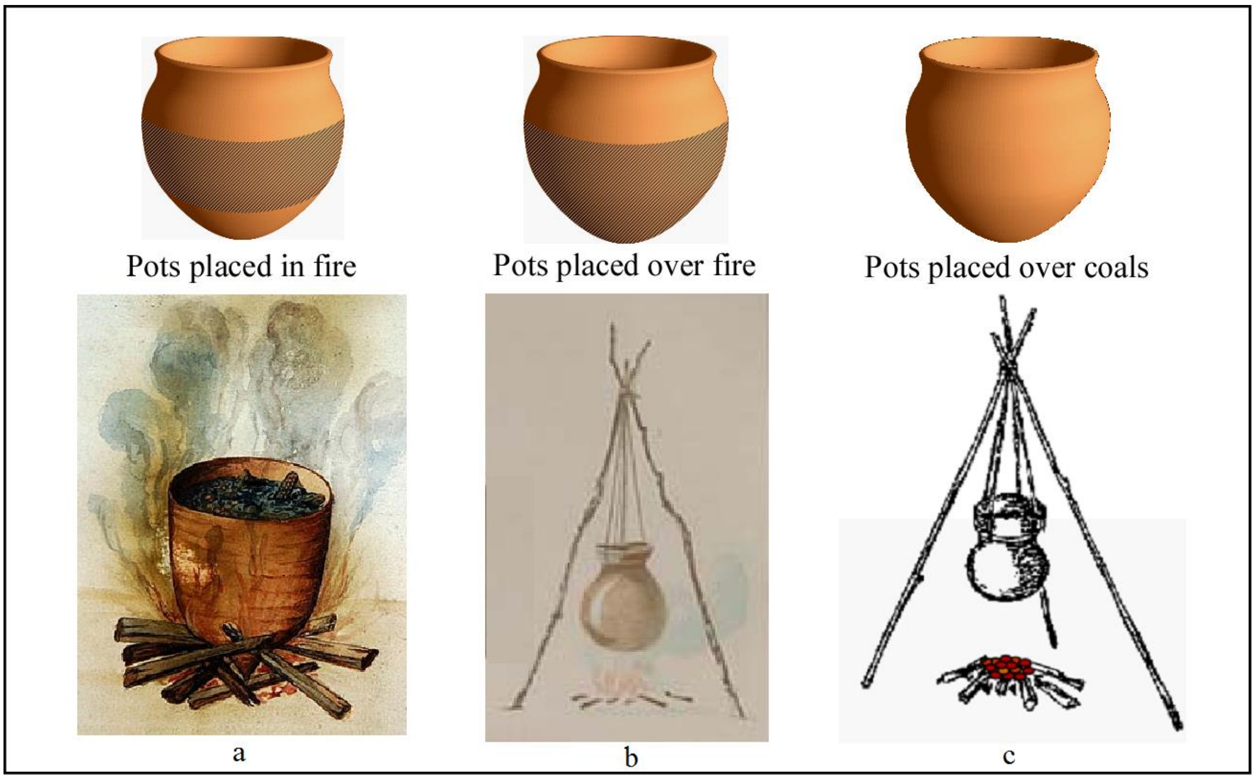


**Figure 15. Sooting patterns resulting from various cooking methods: a. John White watercolor detail, Cooking in a Pot, 1585-1586 (Lorant 1946); b. Seth Eastman watercolor detail, Indian Cooking Pots, 1847; c. detail after Wilbur (1996).**

Of the 241 grog-tempered sherds in the study, soot was observed on 64 specimens (26.6%). Statistical analysis of the presence or absence of sooting residue with regard to vessel type was only analyzed for rim sherds (n=122), as body sherds could not be classified into vessel types (Table 2). Despite the fact that sooting generally does not occur on jar rims during any type of cooking method (Figure 15), mitigating factors that can cause soot to adhere to rims during cooking include skewed placement in hearths, wind, and close proximity to fire. The presence of soot on jar rims is thought to result primarily from cooking activities, although admittedly, it could be a result of non-cooking-related activities. There were no significant differences in the proportions of vessel types with and without sooting ($\chi^2$=5.03; *df*=2; *p*=.081). However, much different results would be expected were the data based on whole vessels, as sooting is most often deposited on the lower bodies of vessels rather than on rims. Unfortunately, though, no whole vessels exist in the study collection.

Flared-rim jars (n=73) exhibited a relatively low percentage of sooting (16.4%). While this may seem surprising, in that these forms are ethnographically most associated with cooking, it actually makes sense when considering just how soot is deposited on vessel exteriors (Figure 15). Jar rims, which are restricted, have orifice diameters smaller than their maximum vessel diameters and are therefore infrequently exposed to these airborne emissions. However, some rims will inevitably exhibit sooting as a result of wind and/or skewed placement of vessels in or over fires (or due to other factors unrelated to cooking). Despite relatively low percentages of sooting on jar rims, cooking was likely one of the primary functions of jars. Small and medium classes of jars exhibited more sooting than larger ones, indicating that they were more frequently used for cooking, or this could just be a result of their closer proximity to fire due to their overall height (Table 3). Of the twelve bases originating from ovaloid jars, only two (16.7%) exhibited

Table 2. Presence/Absence of Sooting of West Jefferson Vessel Forms.

| | | | Vessel Forms | | | |
|---|---|---|---|---|---|---|
| | | | Flared-Rim Jars | Unrestricted Bowls | Restricted Bowls | Total |
| Sooting | Present | Count | 12 | 14 | 2 | 28 |
| | | % within vessel form | 16.4% | 34.1% | 25.0% | 23.0% |
| | Absent | Count | 61 | 27 | 6 | 94 |
| | | % within vessel form | 83.6% | 65.9% | 75.0% | 77.0% |
| | Total | Count | 73 | 41 | 8 | 122 |
| | | % within vessel form | 100% | 100% | 100% | 100% |

Table 3. Presence/Absence of Sooting within Flared-Rim Jar Size Classes.

| | | | Size Classes of Flared-Rim Jars | | | |
|---|---|---|---|---|---|---|
| | | | Small | Medium | Large | Total |
| Sooting | Present | Count | 3 | 4 | 1 | 8 |
| | | % within size class | 27.3% | 30.8% | 14.3% | 25.8% |
| | Absent | Count | 8 | 9 | 6 | 23 |
| | | % within size class | 72.7% | 69.2% | 85.7% | 74.2% |
| | Total | Count | 11 | 13 | 7 | 31 |
| | | % within size class | 100% | 100% | 100% | 100% |

sooting. This suggests that ovaloid forms were likely placed directly in fire hearths during cooking, not suspended over fire.

Unrestricted bowl forms (n=41) exhibited the highest occurrence of sooting (34.1%), suggesting that these forms were at least sometimes utilized for cooking in or over fire. This is somewhat surprising in that unrestricted bowls are commonly assumed to have been serving vessels or vessels used to prepare and manipulate food without heat (Espenshade 2000:7-8; Hally 1984:62; Henrickson and McDonald 1983:632; Pauketat 1987:11). However, there is evidence (basal oxidation and horizontal patterns of thermal alteration) that unrestricted bowls were at least sometimes prehistorically used over fire, presumably to reheat and/or warm foods (Boudreaux 2010:20). Based on the relatively high occurrence of sooting on West Jefferson phase unrestricted bowls, it is not unreasonable to conclude that these bowls were used not only for food manipulation and preparation but also at least occasionally for short-term cooking or warming viscous or solid foods. This is not to say that the primary function of West Jefferson unrestricted bowls was to heat food. Rather, they were used occasionally for this purpose. It is doubtful that they were used to boil liquids for long periods of time, as unrestricted openings allow for spilling, do not retain heat, and allow for rapid evaporation of vessel contents (Hally 1986). Unrestricted bowls such as these could have also served as effective nut parching vessels, although ethnographic sources indicate that most Native American cultures used flat baskets for parching. My sample data suggest that the small and medium size classes were more often used over fire than the large size class (Table 4).

Of the eight restricted bowls in the West Jefferson assemblage, two exhibited sooting. However, the soot on these sherds was located along the vessel lips, making it highly unlikely

Table 4. Presence/Absence of Sooting within Unrestricted Bowl Size Classes.

| | | | Size Classes of Unrestricted Bowls | | | Total |
|---|---|---|---|---|---|---|
| | | | Small | Medium | Large | |
| Sooting | Present | Count | 2 | 2 | 1 | 5 |
| | | % within size class | 40.0% | 28.6% | 25.0% | 31.3% |
| | Absent | Count | 3 | 5 | 3 | 11 |
| | | % within size class | 60.0% | 71.4% | 75.0% | 68.8% |
| | Total | Count | 5 | 7 | 4 | 16 |
| | | % within size class | 100% | 100% | 100% | 100% |

that it resulted from cooking over a fire. Instead, this sooting most likely occurred during firing or during post-depositional events.

## Functional Variability within the West Jefferson Phase Vessel Assemblage

There are four primary morphological properties that affect vessel function: capacity, stability, accessibility, and transportability (Rice 1987:225). Capacity, which depends on the size and shape of the vessel, indicates, in regard to cooking and serving vessels, the number of anticipated users and/or the amount of food prepared. In regard to storage vessels, capacity indicates the potential volume of stored goods. The stability of a vessel refers to its resistance to being tipped over. Vessels with rounded or conical bases are relatively unstable, although this shape may be advantageous when pouring liquid contents. The accessibility of a vessel is determined by its orifice diameter, or its throat diameter if it is a collared vessel. Vessels with highly restricted orifices affording little access to contents are most often used for storing, serving, or transporting liquids, as this form reduces spillage and facilitates the pouring out of vessel contents. By contrast, unrestricted orifices allow ready access to vessel contents and can spill liquid contents quite easily. Slightly restricted orifices, such as those of flared-rim jars, allow access for stirring, adding, or removing contents while decreasing the likelihood of spillage. This design is well-suited for boiling containers, as it retains heat, helps prevent boiling over, and reduces evaporation (Rice 1987:239-240). Transportability refers to the ease of moving a vessel, and is largely dependent on size, weight (when empty and when full), and graspability. Appendages such as lugs and handles can increase a vessel’s portability, and may be especially useful for moving hot cooking pots. Certain types of surface alterations (e.g., cord-marking, brushing) roughen the exterior of pots, creating more graspable surfaces, although surface modification is rare in West Jefferson phase assemblages.

Vessel function is also greatly affected by mechanical and design properties such as mechanical strength, resistance to thermal stress, and vessel curvature. Mechanical strength, or the ability to resist breakage and deformation upon impact and under tension and compression, is essential to all vessels, as broken pots are not pots at all. Vessels with very high mechanical strength tend to have thick walls and no sharp wall contours. Sharp angles are structurally weaker than the surrounding walls, which is why vessels ultimately tend to break at these locations. Straight or gently curving profiles are desirable when mechanical strength is a priority, such as for vessels utilized for processing, transportation, and storage. Resistance to thermal stress, or the ability of a pot to withstand sustained exposure to heat as well as rapid heating and cooling, all without spalling and cracking, is especially important for cooking pots. Many factors influence resistance to thermal stress including temper, vessel wall thickness, and body shape. As vessels are heated and cooled, the clay comprising the walls expands and contracts. Tempers such as grog or crushed, burned shell within the clay reduce stress on walls, as these inclusions have comparatively lower coefficients of thermal expansion (Rice 1987:229). Vessel wall thickness also affects thermal stress resistance, as thinner walls lessen the thermal gradient and hence the stress (Rice 1987:229). Both mechanical strength and thermal stress resistance are needed for cooking vessels to function properly and without failure. Thin-walled pots are effective cooking vessels, but some degree of mechanical strength is sacrificed for this quality, which is evidenced by the sheer number of cooking vessel fragments that end up in the archaeological record as compared to other functional classes of vessels. There is, in effect, a trade-off in that as thermal stress resistance increases, mechanical strength decreases, and vice-versa. A delicate balance must be struck in the case of cooking vessels. Thermal stress resistance, like mechanical strength, is also affected by body shape in that curved walls are more stress resistant than sharply angled ones. Sharp breaks in vessel contours are points of thermal weakness, so cooking pots tend to have curved bases, not flat ones with sharp corner points. Curved bodies also allow for maximum surface area exposure to heat sources and even distribution of heat to vessel contents.

While vessel function is often inferred by archaeologists based solely on mechanical properties, design, and morphological characteristics, direct evidence of vessel use is invaluable to functional analyses (Hally 1983b; Rice 1996:140; Skibo 2013). Residue on vessel interiors, use-wear, and sooting patterns provide direct evidence as to how vessels were actually used in daily life (Hally 1983b: Rice 1987:232-236). Residue analysis, which can indicate the former contents of vessels, was not feasible in this study due to monetary constraints. Sooting patterns, as evidence of cooking practices, were recorded, and are discussed above. Pitting of interior vessel surfaces can indicate that caustic substances were once contained within, and various patterns of interior abrasions can indicate stirring, boiling, mixing, grinding, or pounding of contents. Interior abrasions were not recorded in this study, as this type of analysis is most suited to complete vessels. However, exterior use-wear on vessel bases was recorded in this study. I assume that cooking vessels placed directly in rocky hearths tend to exhibit extensive abrasions on vessel bases, while vessels suspended over fire or coals do not. However, abrasions also can result from maneuvering pots on ground surfaces and during non-cooking related activities, so inferences of use based on basal abrasions are speculative at best. Vessel mending, another direct indicator of use, is conspicuously absent in West Jefferson assemblages. Within the Eastern United States, Woodland vessels were commonly mended by drilling small holes on either side of a crack, allowing for it to be laced together with leather, twine, or sinew (Young and Nagrant 2004:54; Wallis 2011:171-172). However, West Jefferson pottery never exhibits these types of repairs, supporting the idea that jars were indeed to be used primarily for boiling, as such a mended pot would likely be an ineffective boiling container.

With the above considerations in mind, I make an attempt in the following pages to tentatively identify the primary functions of West Jefferson vessel classes by combining the data concerning morphological characteristics, mechanical properties, and direct evidence of use. There is little doubt that there were multiple uses for any given vessel and size class, so these are not meant to be exclusive functional categories. Rather, they are meant to present a general idea of how West Jefferson vessels were likely used in daily life.

*Large flared-rim ovaloid jar* (Figure 14f): The presence of sooting on lower vessel body sherds from the largest size class of ovaloid jar (Figure 11) suggests that at least some of these jars were utilized for cooking large quantities of food. Qualities such as the moderately thin walls, curved bases, and relatively wide orifices providing access for stirring contents, would have made them good containers for boiling. Because of their large capacities, they were ideally suited for boiling nuts, massive quantities of which would have been required to extract sufficient amounts of nutmeats and oils. These large-capacity vessels would have also been useful when serving large numbers of people. The presence of extensive abrasions on 44 percent (n=4) of large conical base exteriors could suggest that they were placed within stone hearths. Admittedly, abrasions could also result from merely maneuvering these unwieldy, large vessels. No handles were observed on this largest class of ovaloid vessels. The portability of these jars would have been fairly low, and they would have been nearly impossible to move when full. As such, if they were used for cooking nuts, they were probably placed in hearths, propped up with rocks, filled with water, and fires were built around them (Linton 1944:371; Schoolcraft 1855:692; Speck 1909:26). The relatively flat lower vessel body wall would have provided a large surface area in direct contact with fire, which is ideal for heat transfer to vessel contents and for reduction of the time it takes for boiling to begin. However, they would have necessitated substantial external stabilization considering their conical bases and relatively high centers of gravity.

*Medium flared-rim ovaloid jar* (Figure 14e): These jars were used for cooking moderate portions of a wide variety of foods including nuts, stews, soups, and greens. For similar reasons as discussed above, they would have served as good acorn-boiling containers, and sooting patterns and basal abrasions suggest they were also placed directly in fire hearths. It is unclear whether or not vessels of this class were manufactured with handles.

*Small flared-rim ovaloid jar* (Figure 14c): These jars, on some of which handles are present, were used to cook or warm relatively small portions of a wide variety of liquid foods including stews, soups, starchy seeds, and greens. They would not have been used to process nuts, as the amount of nutmeat and oil that could be extracted from such a small quantity of nuts would likely not be worth the effort.

*Large flared-rim globular jar* (Figure 14g): These jars are similar to large flared-rim ovaloid jars in all respects except lower body shape. There is no evidence to suggest that these forms were manufactured with handles. They were sometimes used for general purpose cooking of large quantities of food as evidenced by sooting. Their somewhat restricted orifices would have prevented spillage and reduced evaporation while allowing ready access to contents. Their large size would have made them difficult to move when full, but their globular bodies and lower centers of gravity would have made them more stable than large ovaloid jars.

*Medium flared-rim globular jar* (Figure 14d): These jars were used for all-purpose cooking of moderate amounts of liquid foods. At least one vessel of this shape and size class in the study collection has handles, increasing its portability, a quality especially useful when vessel surfaces are hot.

*Small flared-rim globular jar* (Figure 14b): These jars, some of which have handles, were commonly used for cooking and heating small quantities of liquid foods. They, like the small ovaloid jar forms, were not likely used to process nuts because of their limited capacities.

*Large unrestricted hemispherical bowl* (Figure 14i): These bowls were occasionally used to heat foods, as evidenced by the presence of sooting on one large bowl, but were more often used to manipulate and serve large quantities of viscous or solid food. They would have been particularly suited to parch large quantities of nuts for later storage, and they would have also served as excellent all-purpose containers for non-dietary related functions.

*Medium unrestricted hemispherical bowl* (Figure 14a): These bowls were used to heat, manipulate, and serve moderate amounts of viscous or solid foods. They would have also been utilized as all-purpose containers.

*Small unrestricted hemispherical bowl* (Figure 14h): These bowls were used to manipulate, serve, and heat small amounts, perhaps individual portions, of viscous or solid foods.

*Medium restricted hemispherical bowl* (Figure 14k): These bowls were used to manipulate and serve small quantities of liquid food. Their slightly restricted orifices allowed for utensil access but prevented liquid contents from spilling easily. They were not used for cooking, as evidenced by the absence of sooting. Their low frequencies at the sites suggests that they were not common to all households.

*Small restricted hemispherical bowl* (Figure 14j): These small bowls were storage containers for small objects or dry goods such as seeds. Nodes and handles on these bowls served as either grips for transport or locations around which to wrap twine that secured flexible covers. These bowls were also rare at the sites (n=2), indicating that they, too, were not common to all households.

# CHAPTER 5

## WEST JEFFERSON AND EARLY MISSISSIPPIAN VESSEL MORPHOLOGY AND FUNCTION

I have established that within typical West Jefferson phase assemblages, there are eleven distinct shape and size classes of grog-tempered vessels. However, West Jefferson sherd assemblages also include a very small percentage, usually about one percent, of coarse shell-tempered wares. These globular jars, termed “standard Mississippian jars,” appeared during the Early Mississippian period and were possibly developed as specialized vessels used to process maize (Briggs 2015) (Figure 16). So how do West Jefferson and Early Mississippian cookware compare morphologically and functionally? If West Jefferson grog-tempered cooking pots actually represent “copies” of Early Mississippian forms, as has been suggested, at least some of the typical morphological characteristics of the standard Mississippian jar would be expected to occur in West Jefferson cooking vessels. These characteristics include globular vessel bodies, thin vessel walls and bases, handles, similar lip shapes, and similar proportions. Additionally, if West Jefferson groups were actually adopting Mississippian cooking technologies, one would expect similar sooting patterns, reflecting similar cooking practices.

Ethnographic and archaeological evidence suggest that vessel morphology is at least partly determined by food choice and preparation techniques (Mills 1985; Pavlů 1997:84). While West Jefferson groups were hunter-gatherers largely dependent on wild foods, Mississippian groups were agriculturalists primarily dependent on maize. I have hypothesized that fundamental differences between West Jefferson and Early Mississippian groups with regard to primary


**Figure 16. Standard Mississippian jar from the Moundville site (Photo courtesy of Rachel Briggs).**

subsistence strategies and cultural traditions as a whole should be reflected in their pottery forms. Thus, I expected significant differences between the morphologies of West Jefferson and Early Mississippian cooking vessels.

Of the morphological characteristics examined in this study, there are very few similarities between West Jefferson and Early Mississippian cooking vessels (Table 5). To begin, mean vessel wall thickness of grog- and shell-tempered sherds differ significantly ($t$=10.5; $df$=155.9; $p$<.001), as grog-tempered vessels are, on average, 1.6 mm thicker (Figure 17). Shell-tempered Mississippian jars, with their thinner walls, had higher resistance to thermal stress than did their grog-tempered counterparts, indicating the functional need for long-term boiling and simmering containers. Base thickness to wall thickness ratios are also significantly different, as

Table 5. Morphological Attributes of West Jefferson and Early Mississippian Vessels.

| Attribute | | West Jefferson | Early Mississippian | Statistical Significance |
|---|---|---|---|---|
| Wall thickness (mm) | | 6.9 | 5.3 | *t*=10.5; *df*=155.9; *p*<.001 |
| Base to wall thickness ratio | | 1.64 | 1.0 | *z*=-3.06; *p*=.002 |
| Orifice diameter to rim height ratio | | 12.0 | 17.9 | *U*=41; *z*=-3.6; *p*<.001 |
| Lip shape | Rounded | 56.8% | 21.7% | |
| | Flattened | 43.2% | 4.3% | $\chi^2$=104.9; *df*=2; *p*<.001 |
| | Folded/Flattened | 0% | 73.9% | |
| Handle width to thickness ratio | | 1.7 | 2.4 | *U*=2.0; *z*=-1.96; *p*=.05 |
| Profile to axial curvature ratio | | 1.9 | 0.91 | *U*=36.0; *z*=-2.8; *p*=.005 |
| Presence of sooting | | 27.0% | 4.6% | $\chi^2$=23.2; *df*=1; *p*<.001 |

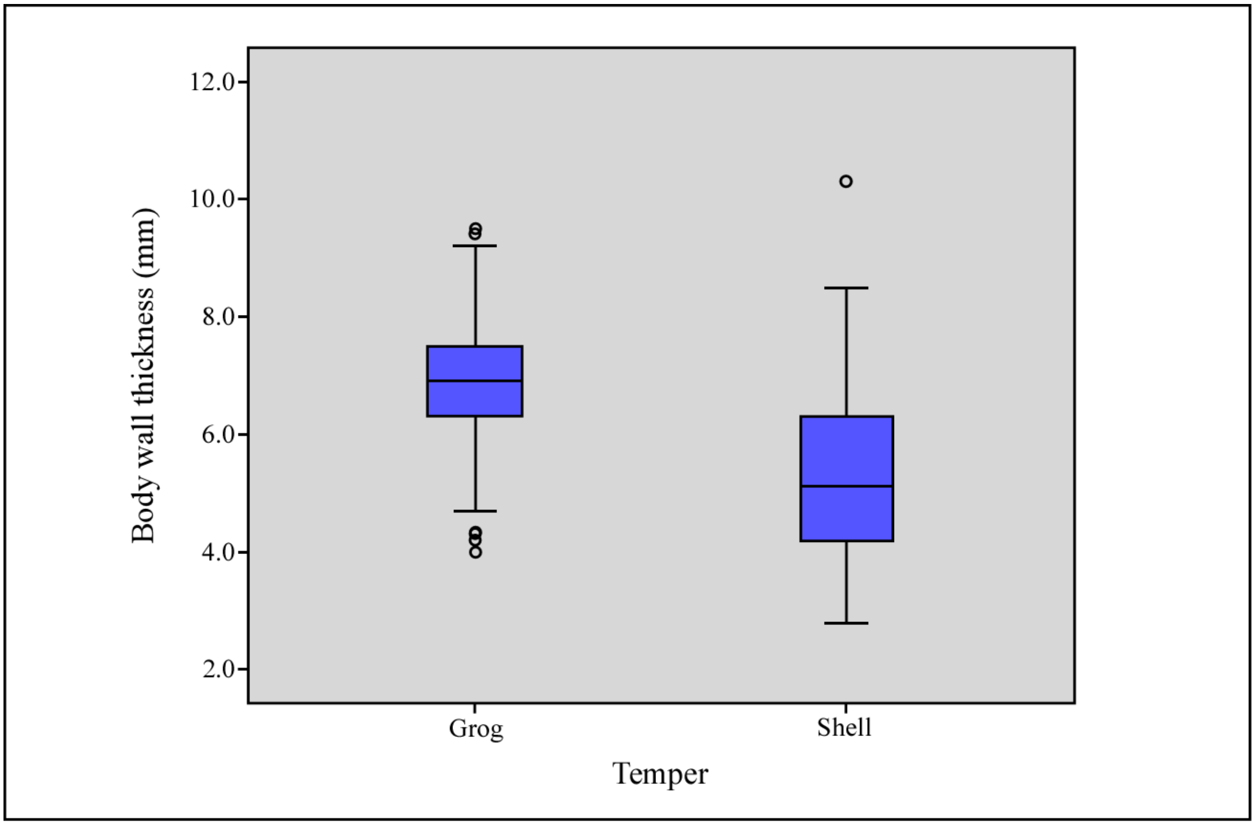


**Figure 17. Boxplot of grog-tempered and shell-tempered body wall thickness.**

shell-tempered vessels typically have ratios near 1.0, while grog-tempered vessels in the sample have a median ratio of 1.64 ($z$=-3.06; $p$=.002). This difference indicates that West Jefferson vessels more often had conical bases, while those of the Early Mississippian were rounded. Orifice diameter to rim height ratios on jars also differ significantly ($U$=41.0; $z$=-3.6; $p$<.001), indicating that the two types of cooking pots were not manufactured using similar proportions. Lip shape (i.e., rounded, flattened, or folded/flattened) of grog- and shell-tempered rims differ significantly ($\chi^2$=104.9; $df$=2; $p$<.001). Most notable about this is that while folded/flattened lips occur on almost 74 percent of shell-tempered rims, they do not occur at all on grog-tempered rims in the sample. Significant differences also exist between handle width to thickness ratios between grog-tempered and shell-tempered vessels, with median values of 1.7 and 2.4, respectively ($U$=2.0; $z$=-1.96; $p$=.05) (Figure 18). This indicates that Early Mississippian handles

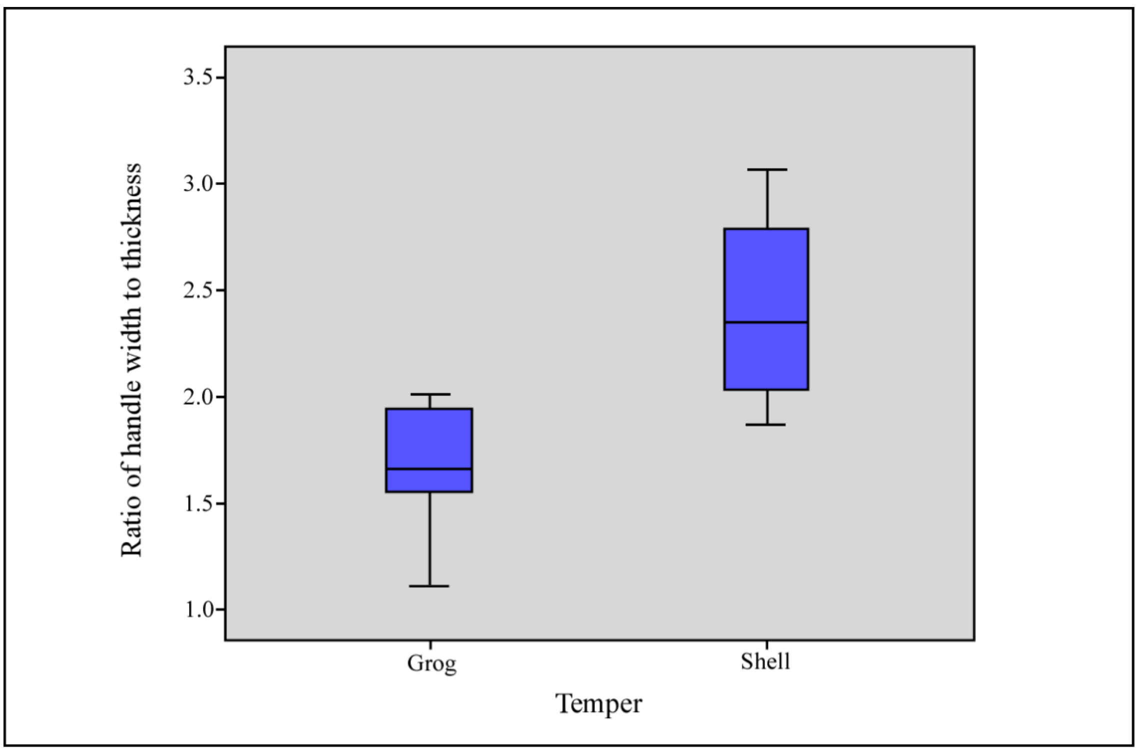


**Figure 18. Boxplot of grog- and shell-tempered handle width to thickness ratios.**

are much thinner in cross section than those of the West Jefferson phase. Also notable is that West Jefferson jars only rarely exhibit handles, while Early Mississippian jars almost always do. The final variable indicating morphological differences regards the shape of lower vessel bodies. The median profile to axial curvature ratio of grog-tempered vessels is 1.9, while that of shell-tempered vessels is 0.91, a difference which is also statistically significant ($U$=36.0; $z$=-2.8; $p$=.005). This suggests that grog-tempered vessels have, on average, much more ovaloid body shapes than shell-tempered vessels. Admittedly, as previously stated, the sample of grog-tempered body sherds may be biased toward large, thick conical-based vessels. That said, there are definite examples of both ovaloid and globular West Jefferson vessels in the sample, while Early Mississippian vessels are never ovaloid in shape.

There are, however, two aspects of West Jefferson pottery that are not typical of Late Woodland vessels but rather are characteristic of Early Mississippian wares. These include the presence of globular jar forms and the presence of riveted handles on jars. Jar handles, which are rare in West Jefferson assemblages, could indeed be evidence of the adoption of Mississippian pottery elements by West Jefferson potters (Jenkins and Nielsen 1974:142). Alternatively, they could be the continuation of a Woodland pottery tradition, as examples of riveted handles have been found on earlier, Middle Woodland vessels in the Tennessee Valley to the north (Futato 1998:220). Handles no doubt aided in the manipulation of vessels in some way, but it is not clear whether or not they functioned to suspend vessels over fire during cooking. Nonetheless, the rare occurrence of handles does not necessarily indicate the adoption of Mississippian cooking technologies. The presence of globular vessels, however, is a different matter. It could suggest that on some basic level, the adoption of Mississippian vessel forms and/or technology was occurring. As this study has shown, though, other than the basic globular form, the similarity ends there. The morphological differences between the two types of cooking jars indicate that while potters may have imitated to some degree the Mississippian jar form, its primary cooking function remained that of a Late Woodland vessel.

As for the adoption of Mississippian cooking technologies reflected in grog-tempered wares, this was tested primarily using sooting patterns. While vessels placed directly in fire are expected to exhibit sooting on the lower portions of vessel bodies excluding bases, sooting is expected to be absent on vessels suspended over coals, as no carbon-heavy particles are emitted from coals (Figure 15). No soot was observed on any shell-tempered bases, and only 4.6 percent of all shell-tempered sherds exhibit sooting, as opposed to 27.0 percent of grog-tempered sherds, a difference that is also highly significant ($\chi^2$=23.2; *df*=1; *p*<.001). This difference in sooting frequency suggests that West Jefferson and Mississippian cooking pots were utilized in fundamentally different ways. Specifically, West Jefferson cooking vessels were most often placed directly in fires, while Mississippian cooking vessels were probably most often suspended over coals.

This result is supported by ethnographic evidence, which indicates that conical-based vessels tend to be placed directly in fires for cooking, while globular vessels tend to be placed or suspended above fires or coals (Linton 1944:371; Mills 1985:7). The correlation between conical-base vessels and hunter-gatherer subsistence suggests that this form is somehow better adapted to preparing wild plant and animal resources (Helton-Croll 2010:165; Linton 1944:372; Mills 1985). One possibility is that building a fire around a vessel decreases the time it takes to begin a rolling boil, but to sustain it for long periods of time would require large amounts of fuel. Perhaps this ovaloid form is well suited to the cooking of wild resources and especially to nut-processing, which requires vigorous but short boiling episodes. By contrast, Early Mississippian vessels were likely more suited for long-term boiling or simmering. Shell tempering, especially in comparison to grog, increases resistance to thermal stress, as do thinner walls (Steponaitis 1983:45). Their rounded bases also allow for maximum vessel surface area exposure to heat emitting from the underlying coals. The primary difference in cooking methods is that suspension over coals allows for simmering and, in particular, sustained simmering over a long period of time, while placement within fire does not. Important to note is that Late Woodland subsistence strategies and food preparation techniques did not necessitate a simmering vessel. Early Mississippian groups, however, did have a need for such a vessel, as they were largely dependent on cultigens, which often require longer cooking times than wild resources (Crown and Wills 1995:246). In particular, the Early Mississippian primary food source was hominy, which requires simmering for an extended period of time. The evidence in this study suggests that not only are there major differences in West Jefferson and Early Mississippian pottery morphology, but also that they are most likely attributable to differences in their respective diets and cooking strategies.

# CHAPTER 6

# DISCUSSION AND CONCLUSIONS

The purpose of this project was to examine whether the pottery of West Jefferson phase groups indicates that they were utilizing traditional nut-processing technologies or that these groups were in essence copying the pottery forms and subsistence technologies of intrusive early maize-producing agriculturalists. To do this, I first defined the West Jefferson vessel assemblage, which is comprised of eleven distinct shape and size classes. Using both morphological characteristics and direct evidence of use, I then inferred the functions of each vessel class. Cooking vessels, i.e., jars, were afforded the most attention because they, more than any other functional class of vessel, indicate the ways in which foods were processed. Next, the morphological and functional characteristics of grog-tempered West Jefferson phase and shell-tempered Early Mississippian cooking vessels were statistically compared to determine their degree of similarity, or lack thereof. What I found is that the basic cooking vessels of the two groups differ in almost all morphological and technological aspects. Overall, the West Jefferson assemblage is dominated by traditional Late Woodland vessel forms that fully reflect their traditional hunting and gathering foodways. Thus, West Jefferson peoples were not engaging in the wholesale copying of Mississippian pottery styles and food processing technologies as previously suggested, but were for the most part technologically conservative. This study additionally indicates that the primary functional difference between Late Woodland ovaloid forms and Early Mississippian globular ones is that the former are well suited for vigorous, short-term boiling within fire hearths, which is sufficient for processing most wild foods, while the latter are more suited for sustained simmering over coals, a process required of many cultigens, most notably maize.

I have demonstrated that West Jefferson potters were not commonly manufacturing grog-tempered jars in Mississippian forms. If, however, grog- and shell-tempered cooking pots are indeed functionally distinct forms, pure functionalists might suggest that the presence of shell-tempered jars is not evidence of contact with intrusive populations, but rather innovative ceramic technology developed by Late Woodland people in response to a functional need, i.e., the need for maize-processing vessels. This argument assumes that Late Woodland potters, who were accustomed to making thick, grog-tempered, flared-rim cooking jars, began making thin-walled, shell-tempered, standard Mississippian jars. If this were the case, and if these potters were to attempt to manufacture a new style of pot with a completely unfamiliar temper, one would expect to find evidence of sloppy, perhaps failed attempts. Switching from grog to shell tempering is not as simple as it might seem; shell has very different chemical properties and, if allowances are not made throughout numerous steps in the manufacturing process, the resulting vessels are spalled and weak-walled (Feathers 2006:92; Feathers and Peacock 2008:290). This is not to say that no Late Woodland potters ever attempted to copy Mississippian forms. At the Pride Place site (1Tu1), located along the lower Black Warrior River in Tuscaloosa, there is one example of a fairly unsuccessful attempt to make a Mississippian-style jar with grog-tempered clay (Vernon J. Knight, personal communication). However, evidence of such failed attempts does not occur at the vast majority of West Jefferson phase sites, nor did it occur at the sites in this study.

If West Jefferson potters were manufacturing both kinds of cooking pots, one would additionally expect to find at least some degree of overlap in regard to manufacturing techniques and forms. For example, in northwest Georgia, during the Late Woodland/Early Mississippian transition, there are myriad examples of grit-tempered and shell-tempered vessels of similar forms, indicating that potters in the South Appalachian region manufactured vessels using both temper types (David J. Hally, personal communication). However, we do not find that this is the case in the upper Black Warrior Valley. In fact, no morphological similarities exist even in characteristics that only minimally affect function, such as surface decoration and lip shape. Lip forms of the earliest Mississippian jars are predominantly folded and flattened, while those of West Jefferson vessels rarely exhibit this lip shape. Additionally, the most common decorative treatment on local Early Mississippian cooking jars is the Moundville Incised arch motif, which never occurs on West Jefferson vessels.

In short, West Jefferson potters were not manufacturing shell-tempered pots, nor were they copying the styles and technologies of shell-tempered pots. It is important to remember that not all pottery present within archaeological deposits was made by local potters, as imported trade goods are common at archaeological sites. It seems likely, then, that the presence of this very small minority of technologically innovative shell-tempered pottery at West Jefferson sites is the result of trade or some other form of interaction with Mississippian groups (e.g., the integration of Mississippian women into West Jefferson groups), not the efforts of Late Woodland potters.

There is one question in particular concerning West Jefferson pottery that remains unanswered. There appears to be a relationship between vessel shape and subsistence during this time period, but it is unclear just how globular grog-tempered vessels were utilized in regard to Late Woodland subsistence. It is evident that they were at least sometimes used as cooking vessels, but it is unclear which foods were cooked within them, and sooting evidence was insufficient to determine the precise manner in which they were used. Residue analyses and further studies of use-wear patterns on these types of vessels could address this issue.

While this study answers questions concerning the reactions of indigenous potters to intrusive Mississippian groups, it does not resolve the debate surrounding the process by which shell-tempered pottery became widespread throughout the region, a process that generally coincided with the complete abandonment of Late Woodland forms and tempers. This study suggests that Late Woodland potters made technological choices that maximized the functional efficiency of vessels relative to subsistence strategies. Thus, it is reasonable to assume that a major contributing factor to the spread of shell-tempered utilitarian pottery was the adoption of a maize-based foodway, which required cooking vessels that could manage sustained boiling or simmering for long periods of time. However, choices about what types of pots to make were not made in a cultural vacuum. Many factors influence ceramic stability and change, including environmental resources (e.g., fuels, clay, and settlement location), diet, ritual behavior, value systems, and organization of pottery production (Rice 1984:242-243). Thus, historical and cultural contexts must be taken into account when explaining this technological change (Sassaman 1995:235). This is especially true during the transition to the Mississippian stage, in which major shifts in subsistence, settlement patterns, architecture, and social organization occurred. Perhaps the integration of both functional and historical explanations can shed light on this complex issue. An important next step in this research is to develop models of the adoption of shell-tempered pottery by indigenous groups, determine what these models would look like in archaeological contexts, and compare them to archaeological cases throughout the region.

There are many additional avenues of research that can be explored in regard to West Jefferson phase groups. For example, West Jefferson and Early Mississippian hearth shapes and profiles should be compared to further examine variation in cooking practices. Experimental archaeology can help identify specific ways in which Late Woodland and Early Mississsippian foods were processed and determine the functional properties of their respective cooking vessels (Briggs 2015). Additionally, the dichotomy between West Jefferson populations north and south of the Fall Line can be studied, as pottery shifts may have occurred differently in these areas (Meredith 2011; Scarry 1986). Similarly, future research can also explore the uneven development of social and technological change among various Late Woodland groups and settlement types (Mistovich 1988).

The issue of the Mississippianization of the Southeastern United States is a complex one, and one that must take into account numerous factors. There is little doubt that this process occurred in historically unique ways throughout the Southeast. This study contributes to the growing body of knowledge about this important transitional period within the Black Warrior Valley, and in particular it sheds some light on West Jefferson phase pottery morphology and function.

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