THE CIVIL COOKING POT: HOMINY AND THE MISSISSIPPIAN STANDARD JAR IN THE BLACK WARRIOR VALLEY, ALABAMA

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Although the Mississippian standard jar, a specific vessel form found in many parts of the Mississippian cultural world, has long been recognized as a utilitarian cooking pot, the important connection between this ceramic form and maize has largely been overlooked. By focusing on the Mississippian site of Moundville located in the Black Warrior valley of west-central Alabama, I propose that the Mississippian standard jar was not simply a general cooking pot, but instead a specialized culinary tool used to nixtamalize maize. As such, both the vessel and the plant were part of a cohesive ancestral hominy foodway. This relationship is demonstrated in two ways: first, by articulating both the hominy foodway and the antecedent nut foodway practiced between A.D. 1020–1260; and, second, by exploring changes in the morphology and use-alteration patterns of the Moundville Mississippian standard jars recovered from contexts dating to the Moundville I-III phases (A.D. 1120–1520). The relationship between vessel and food demonstrated here suggests a practice- and taste-based model for the synergistic relationship long recognized between maize and the emergence of the Mississippian civic-ceremonial center of Moundville.

Aunque la vasija estándar misisipiana, una forma específica de recipiente ubicua en el mundo cultural misisipiano, ha sido reconocida por mucho tiempo como una olla utilitaria, la importante conexión entre esta forma cerámica y el maíz ha sido ignorada en gran parte. Desde la perspectiva del sitio misisipiano de Moundville, en el valle de Black Warrior en el centro-oeste de Alabama, aquí propongo que la vasija estándar misisipiana no era simplemente una olla de cocina de uso genérico, sino una herramienta culinaria especializada utilizada en la nixtamalización del maíz. En conjunto, tanto el recipiente como la planta formaron parte de un hábito culinario del mote, cohesivo y ancestral. Esta relación se demuestra de dos maneras: primero, en la articulación de tanto el hábito culinario del mote, y el precedente hábito culinario de frutos secos practicado entre d.C. 1020–1260; y segundo, a través de la exploración de los cambios en la morfología y los patrones de alteración por uso en las vasijas estándar misisipianas de Moundville recuperadas en contextos de las fases Moundville I-III (d.C. 1120–1520). La relación entre recipiente y alimento demostrada aquí sugiere un modelo basado en prácticas y gustos para la largamente reconocida relación entre maíz y el surgimiento del centro cívico-ceremonial misisipiano en Moundville.

As Ralph Linton defined them, cooking pots are vessels suited for boiling foods, and those vessels best suited for boiling "have a mouth large enough to prevent explosive boiling over and to permit of stirring its contents, but at the same time small enough, relative to the pot's capacity and heating surface, to prevent it from boiling dry every few minutes" (Linton 1944:370). Cooking pots can be tall, squat, thick- or thin-walled, conical, or globular. They may have handles, a constricted neck, straight or insloping walls, or a comparatively thick or thin base.

As archaeologists, we have historically recognized these differences as stylistic, manifesting as part of a general homogeneous class of "cooking pots." However, for those who used them, cooking pots were first and foremost tools, and, like all tools, they came in a variety of designs best suited for particular activities (Braun 1983; Linton 1944). As such, cooking pots are adapted technologies that are integral parts of foodways, or the socially patterned activities, rules, and meanings that include foods, the culinary preparations, and the sociality that encompass them (Gumerman 1997; Twiss 2007; Weismantel 1988). They are the necessary utensils of a craft, used to achieve particular dishes with distinct flavors and textures and, as such, along with other culinary

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American Antiquity 81(2), 2016, pp. 316–332

DOI: 10.7183/0002-7316.81.2.316

tools, sit at the center of the everyday meal, those quotidian practices that foster shared traditions, identities, and ideologies (Hastorf and Weismantel 2007:310).

Although it is clear that food choices are conservative elements of social systems, what is often overlooked is that how foods are prepared is, in many cases, more important than the food itself (Atalay and Hastorf 2006; Gumerman 1997). Cooking pots play an important role in the transformation of raw food products into culturally significant dishes. They also play a key role in rendering what are otherwise difficult or even inedible products into nutritionally rich foods. Starchy carbohydrates are the most common primary dietary foods eaten throughout the world, but only a handful of these may be consumed raw (McGee 2004:610–612). Some, like cassava and other members of the arrowroot family, are poisonous, whereas others, like many cereals and pseudocereals, are indigestible to humans in their raw state. Cooking molecularly transforms starchy plants—heat breaks down the weaker granules that compose their cellular structure, resulting in a softer, partially gelatinized, edible product. This extraordinary relationship between starchy carbohydrates and cooking is part of what led primatologist Richard Wrangham and his colleagues to postulate that cooking was one of the greatest achievements in human physiological evolution (Wrangham et al. 1999).

It is a glaring oversight, then, that the most prolific form of cooking pot found throughout many parts of the Mississippian cultural world, the Mississippian standard jar, has rarely been considered for the culinary advantages it afforded over other contemporaneous and antecedent cooking technologies (Hally 1983, 1984, 1986), especially for preparing maize. Fragments of Mississippian standard jars are consistently among the most prolific artifact class in the majority of Middle Mississippian assemblages (which includes the central Mississippi River valley; the lower Ohio River valley; and the Mid-South area composed of west and central Kentucky, western Tennessee, and northern Alabama and Mississippi), as well as Mississippian Fort Walton assemblages in Florida and Georgia. Indeed, both the Mississippian standard jar and the advent of maize agriculture are commonly cited as hallmarks of Mississippian culture. Yet the unmistakable relationship that existed between the two (Hally 1983, 1986; Myers 2006) has been examined only in a cursory manner.

I propose that in the Black Warrior valley of west-central Alabama, beginning around A.D. 1020, the Mississippian standard jar was not simply a new ceramic technology, but was instead a tool specially used to nixtamalize maize. As such, this tool was part of an ancestral hominy foodway, first adopted by local populations as a way to augment the locally entrenched nut foodway that served as the carbohydrate base for Woodland populations in the area, but which was eventually eclipsed by hominy in dietary and social importance.

Mississippian Foodways

At its broadest, the Mississippian cultural stage in the North American Southeast (ca. A.D. 1050–1600) can be defined as a set of material and ideological traits that include intensive maize horticulture; fortified communities with large earthen mounds and artificially leveled plazas; social and political ranking; and a religious and ritual corpus centrally concerned with fertility, war, and ancestors (Anderson and Sassaman 2012:152–153; Blitz 2010; Knight 1986). In practice, though, few Mississippian communities exhibit all of these aspects; instead, researchers have identified local and regional variations, resulting in the articulation of distinct Mississippian cultures. Accordingly, historically centered, agent-based models of Mississippianization are currently favored, in which the dissemination of Mississippian cultural traits during the latter portion of the prehistoric period represents the adoption of various aspects of a Mississippian lifeway, either through the spread of materials or people, into endemic Late Woodland traditions and histories (e.g., Anderson and Sassaman 2012; Blitz and Lorenz 2006; Jenkins 2003; Pauketat 2003).

Adhering to this definition, Mississippian cannot be considered as a singular, cohesive cultural package, but as a loose set of materials and ideas that were differentially adopted by local traditions. Consequently, Mississippian foodways studies have largely treated the components of food procurement and preparation, including maize, shell-tempering, standard jars, and cooking features

(such as cooking pits or hearths) as separate cultural traits that were actively manipulated in different ways to different ends. The result is two fairly common foci in Mississippian foodways studies. First is the identification of feasting activities (e.g., Blitz 1993; Boudreaux 2010; Jackson and Scott 2003; Yerkes 2005). Feasting played a valuable role in the construction and maintenance of the Mississippian worldview (Blitz 1993; Maxham 2000; Pauketat et al. 2002). By focusing on these "special" dining events, feasting studies are largely concerned with how food remains and vessel forms differ from the everyday experience. Domestic vessel and food assemblages are treated as a baseline, and feasting events are evaluated in terms of how they compare and differ from the everyday (Welch and Scarry 1995).

In a second, yet congruent, approach, foodways are also commonly used to assess status differences between segments of Mississippian societies (Knight 2010; Pauketat et al. 2002; Welch and Scarry 1995). These studies follow the premise that, within complex social systems, foodways provide a window into the structure of social relationships. Such studies commonly utilize the ratios of vessel forms and food remains to assess differences in serving and preparation activities, along with kinds and portions of food prepared by different social segments. Vessel utility and preparation do play a role in these studies, but only insofar as to determine what foods are being prepared, by whom, and, importantly, for whom. Again, the relationship between vessel form and food is seldom central.

Though not as prominent, several studies have focused on everyday food preparation and culinary activities in Mississippian societies. These include analyses of ceramic vessel function that focus on how Mississippian ceramics were used in various contexts and on reconstructing the overall vessel assemblage that comprised various Mississippian contexts (Boudreaux 2010; Hally 1983, 1986; Miller 2015; Pauketat 1987). While such studies have been extraordinarily valuable, a prerequisite for this kind of analysis is a large sample of either whole or sufficiently reconstructable vessels to make meaningful statements about the overall assemblage, substantially limiting the number of sites and assemblages that qualify.

Other studies focused on domestic activities include those that explicitly explore foodways, thereby incorporating ceramics, foods, and food-related activity areas. However, most of the functional information that could have been generated by these studies has been impeded by agent-based approaches emphasizing elements of the Mississippian culinary package that were actively adopted or rejected by a local tradition (Bardolph 2014). Again, the relationship between food, tool, and preparation technique is largely overlooked. Emphasis is less on everyday culinary practices and more on how deviations from the general Mississippian cultural model demonstrate political and social resistance (Bardolph 2014; Jenkins and Krause 2009).

While it is clear that elements of the Mississippian lifeway were differentially adopted or rejected within local histories, it is not always appropriate to separate Mississippian standard jars from the foods they were used to prepare. David Hally (1986) noted that, based on mechanical and morphological features, the Mississippian standard jar likely represented a new form of cooking compared to earlier Woodland traditions, and one that served as a specialized tool for boiling. Importantly, during the historic period, Hally notes that boiling was one of the most fundamental culinary techniques employed by native cooks (1986:269–270). Boiling, though, was not a new culinary technique; several studies demonstrate that both Woodland and Late Archaic stage ceramics were more than sufficient for bringing foods to a boil (Braun 1983:115–117; Sassaman 1993). As such, cooking food in water was likely a culinary tradition with deep historical roots throughout eastern North America.

Despite the antiquity of boiling, there are clear morphological differences between the Mississippian standard jar and Woodland stage ceramic cooking forms that certainly indicate shifts in culinary practices. To determine what kind of culinary tool the Mississippian standard jar was, it is important to examine not only the vessel form, but also the antecedent culinary technology the jar replaced, as well as the foods that both traditions principally utilized. In other words, an appropriate case study would be based on a well-developed archaeological record of a Mississippian society and its immediate Late Woodland background, including a comprehensive record of ceramic and

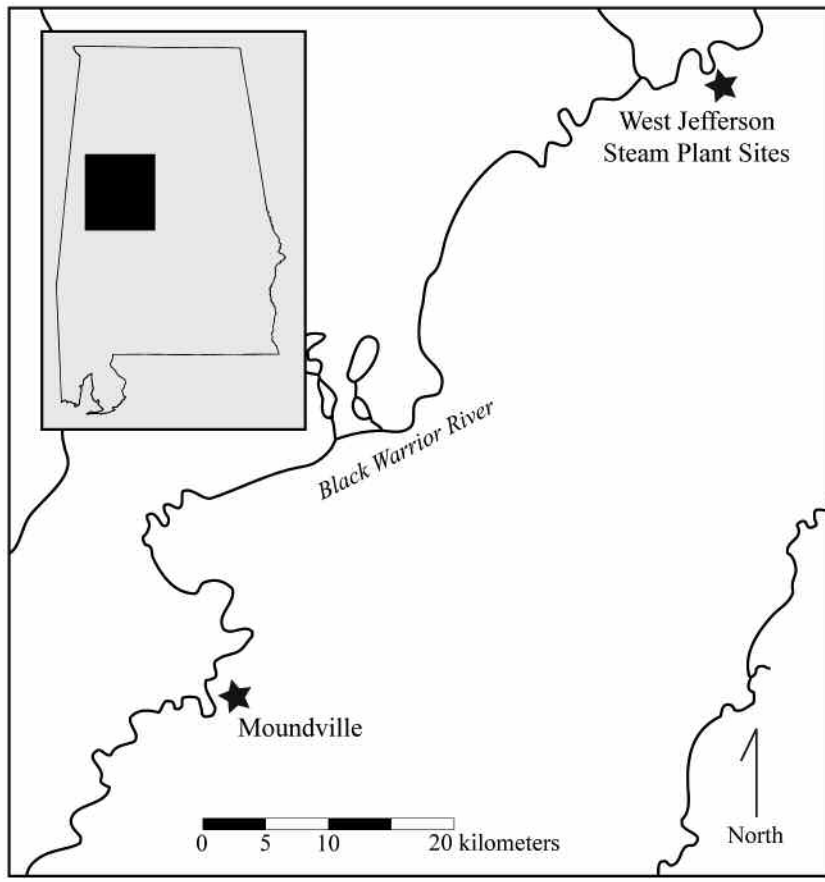

Figure 1. Map of subject area and primary sites.

dietary change. The Black Warrior valley of west-central Alabama provides just such a case study (Figure 1).

Although archaeological research in the Black Warrior valley had its beginnings in the late nineteenth and early twentieth centuries, the dietary and ceramic information important to this research was not collected until the 1970s. First, Steponaitis (1983) produced a comprehensive ceramic chronology and vessel assemblage for the site based on stratigraphic data as well as the extensive mortuary vessel assemblage. Next, Scarry (1986) produced a complementary paleoethnobotanical study for the local Late Woodland West Jefferson phase (cal. A.D. 1020–1120) and Moundville I phase (cal. A.D. 1120–1260) components (calibrated dates are from Knight and Steponaitis [2007]). Her research demonstrated a clear shift in maize and nut utilization beginning in the Late Woodland and continuing through the Early Mississippian: while Late Woodland West Jefferson phase groups supplemented their wild plant resource-based diet with maize, later West Jefferson (post-A.D. 1100) and Mississippian Moundville I phase groups, in contrast, supplemented their maize-based diet with wild plant resources (Scarry 2007:88–90). This shift in food procurement was accompanied by a shift in ceramic technology. Although shell-tempered jars first appear in late West Jefferson assemblages that are otherwise dominated by thick grog-tempered jars, by the Moundville I phase, ceramic assemblages are overwhelmingly composed of shell-tempered jars (Scarry 1986).

Few other dietary changes are evident during this interval in the faunal or bioarchaeological records for the Black Warrior valley. Both West Jefferson and Moundville peoples utilized some chenopod and maygrass, as well as wild foods such as persimmon, blackberry, blueberry, and el-

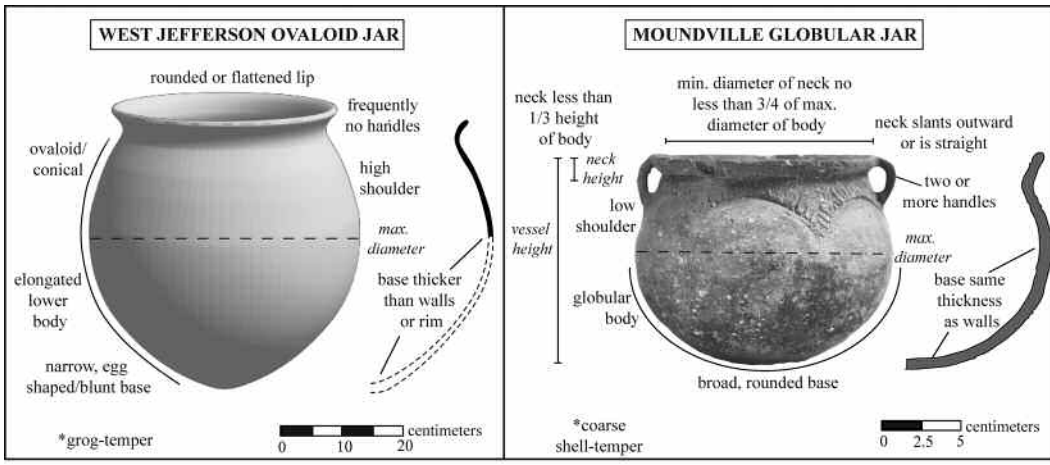

Figure 2. Morphological features of West Jefferson phase ovaloid cooking jar and Moundville Mississippian standard jar. (Ovaloid cooking jar composite courtesy of Kareen Hawsey, Moundville Mississippian standard jar is vessel lot SD 365.)

derberry (Scarry 1993a), in addition to both terrestrial and aquatic sources of protein (Schoeniger and Schurr 2007). Thus, the only dietary change detected during this time is a shift in maize and nut procurement.

Black Warrior Valley Cooking Pots and Foodways

Although archaeologists have paid far less attention to the Woodland stage in the Black Warrior valley, it is clear that Woodland-period cooking vessels were morphologically different from their Mississippian successors (Jenkins and Krause 2009; Jenkins and Nielsen 1974) (Figure 2). Hawsey (2015) reanalyzed ceramics from three West Jefferson phase sites to more accurately characterize the terminal Late Woodland assemblage and identified two forms of grog-tempered jars: ovaloid, which represent the overwhelming majority, and globular. Hawsey identified flaring-rim ovaloid jars as "characterized by an elongated lower body, slightly constricted neck, excurvate rim, and rounded or flattened vessel lip" (Hawsey 2015:31). Ovaloid jars have relatively high shoulders and a base thickness greater than their wall or rim thickness (a ratio of 1.64) (Hawsey 2015:58). They also have a conical, at times even blunt pointed base, which not only carries implications for how such vessels were used with a heat source, but also for how heat was distributed to the vessel contents. Flared-rim globular West Jefferson jars differ only in the lower body shape—instead of an elongated lower body with a conical base, they are globular, with broad, wide bases (Hawsey 2015:31–33, 58).

Based on both form and use alteration analysis, ovaloid cooking pots were likely placed directly in hearth fires, either supported by hearth stones or wood. Caleb Swan provided an ethnohistoric description of how an eighteenth-century Upper Creek group used ovaloid cooking pots: "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).

In the Black Warrior valley, the Mississippian standard jar is a common vessel form found within Mississippian assemblages, including the Moundville ceramic assemblage (Steponaitis 1983; Taft 1996). Phillips (1939:38) was the first to recognize the widespread occurrence of the Mississippian jar form, though Steponaitis (1983) was the first to produce a formal characterization for Mississippian standard jars found at Moundville (Figure 2). Moundville standard jars are "vessels that have a more or less globular body, and a wide neck that is constricted in profile. The neck is typically less than one third of the height of the body, and the minimum diameter of the neck is no less than three fourths of the maximum diameter of the body" (1983:69). Moundville standard jars are overwhelmingly un-

burnished with outward slanting necks (Steponaitis 1983:69–70). They are coarse shell-tempered and may have anywhere from two to more handles. Additionally, Steponaitis (1983:36–45) demonstrated that coarse shell-tempering, another characteristic of unburnished standard jars at Moundville, has certain benefits over fine shell-tempering: vessels that are tempered with coarse shell have greater resistance to thermal shock, meaning that they are better equipped to withstand prolonged periods of heat exposure, as well as rapid heating and cooling.

In the Moundville ceramic assemblage, Moundville standard jars fall within four size classes based on orifice diameter: small (6–10 cm with a volume range of ca. .2–.9 liters), medium (14–26 cm, volume range ca. 2.5–6 liters), large (34–44 cm, volume range ca. 9–28 liters), and oversized (50 cm or more, with an unknown volume range because the body shape for these vessels is still unknown) (Barrier 2011; Knight 2010; Taft 1996). Medium jars are the most abundant size class recovered within residential contexts, while small jars are the most abundant size recovered from burial contexts. Likely, both small and medium unburnished standard jars were primarily cooking pots that were suspended over a heat source. Large jars, when filled approximately half to two-thirds full, would have likely been too heavy for suspension. It is possible that large jars were used for storing both water and dry goods (Hally 1986:287). Oversized jars do not have handles and were almost certainly dedicated dry goods storage jars (Barrier 2011).

The Woodland Stage Nut Foodway

Among local populations during the Late Woodland stage in west-central Alabama, nuts were the dietary carbohydrate base (Scarry 1986, 2003). Within the region, there are three families of woody plants with edible nuts: *Juglandaceae* (which includes hickory, pecans, black walnuts, and butternuts), *Fagaceae* (which includes acorns, chestnuts, chinquapins, and beechnuts), and *Betulaceae* (which includes hazelnuts) (Scarry 2003:57). Of these, the most heavily utilized were acorns, hickory nuts, and chestnuts.

Oak (*Quercus* sp.) is the most abundant family of hardwoods in the Eastern Woodlands, both historically and prehistorically (Messner 2011:16), and acorns were a staple food in many parts of the region both before and after the introduction of maize. Generally, *Quercus* sp. can be divided into two categories: white oaks and red oaks. From a dietary standpoint, the important difference between white and red oaks is that white oaks produce less bitter nuts that are low in tannic acid while red oaks produce more bitter nuts with higher concentrations of tannic acid. Before eating red oak acorns, their tannic acid has to be reduced or neutralized.

Based on ethnographic, ethnohistoric, and experimental studies, there are three general ways to leach tannic acid from red oak acorns. In all cases, red oak acorn shells were lightly cracked. In the first method, hot or even boiling water was poured over the nuts. Leaching in this manner was a lengthy process, lasting almost half a day (six hours), and it required changing the water several times (Kupperman 1988). Alternatively, cold processing involved submerging the nuts in cold water, either in still water, such as an artificially dug sand pit or bog, or flowing, such as in a stream (Anderson 2005). Cold processing had the advantage of removing only the tannic acid; boiling water removed tannic acids but risked removing some of the oil as well. A third method drawn from ethnographic observations of native Californian groups again involved boiling water, but, in this method, the acids were not removed; instead, they were neutralized by adding an alkaline substrate such as wood ash or lye during cooking or while being rendered for oil (Anderson 2005; Messner 2011:78). Though it is unclear which method was preferred among prehistoric groups living in the Black Warrior valley, Swanton noted that the historic Choctaws used cold running streams to remove tannic acids (1918:58).

Both white oak acorns and chestnuts required far less processing than red oak acorns, and were likely processed in similar manners—they were first dried and then, depending on the desired final product, were ground to varying degrees and either added to soups or stews, or made into meal that could be used to make bread. As with red oak acorns, all could be rendered for oil, but because of their low fat content, this was neither a high-yield nor an expedient process.

Alternatively, hickory (*Carya* sp.) nutmeat is high in both fat and protein (Messner 2011:14)

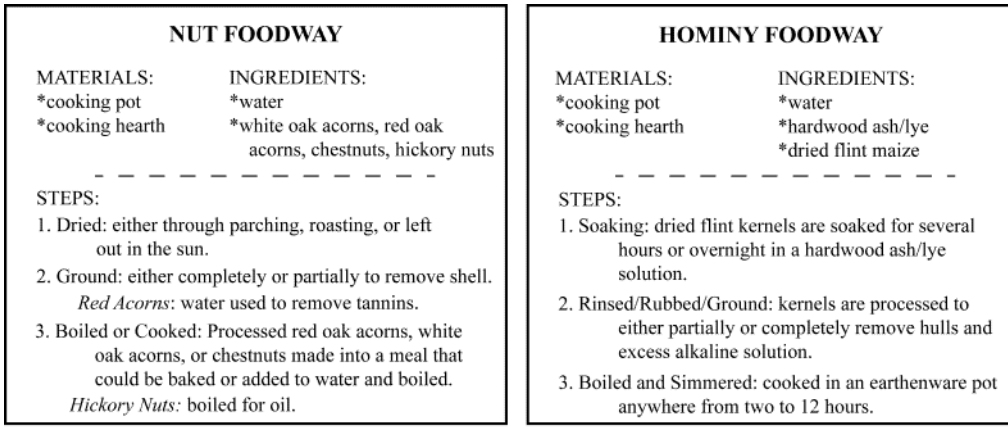

Figure 3. The nut and hominy foodways of the Black Warrior River valley, Alabama.

and was generally rendered into oil or made into a kind of nutmeat ball that could be used to make stock for stews and soups (Fritz et al. 2001). Either cold or boiling water could be used to render hickory nut oil. Boiling hickory nutmeat, however, was not only more effective than cold processing, rendering more oil, but also more expedient—hickory nut oil could be rendered with only 10 to 20 minutes of heat exposure (Talalay et al. 1984:352).

Acorns and chestnuts, like other starchy carbohydrates, undergo considerable changes in texture and nutritional quality when cooked. When plant starches are heated to their gelation range, or a temperature range that usually starts well below boiling at around 50–60ºC, they begin to absorb large quantities of water, and their granules begin to break down (McGee 2004:611–613), resulting in a food product with a soft texture that is much easier to digest than when raw. Importantly, not all starches require the same amount of heat exposure in order to begin or fully achieve gelatinization. The range is variable and best thought of as a continuum dependent on a number of characteristics of the food being prepared. Generally, acorn, hickory nut, and chestnut meats, which are already soft, require less heat exposure to begin gelatinizing than other plant starches.

Although there are several differences in how each kind of nut needs to be processed, it is possible to articulate a general nut foodway. First, those nuts not immediately consumed were dried either through parching, roasting, or possibly sun-drying. In addition to increasing the storage life of nuts and neutralizing insect larvae, drying also made them easier to shell (Messner 2011:70). Next, nuts were ground to completely or partially remove their shell, a distinction based on the intended final product. Boiling was primarily used to make soups and stews, which needed only a minimal cook time of anywhere from 30 minutes to an hour (Figure 3). Thus, heat exposure was modest—each might be boiled to render oil, or in the case of red oak acorns, water was perhaps boiled in the process of removing tannic acids, but, overall, only a minimally sustained boil was needed to cook nuts.

The Mississippian Stage Hominy Foodway

The first traces of maize in the Eastern Woodlands are found during the Middle Woodland stage (100 B.C.–A.D. 500) (Chapman and Crites 1987), although the earliest evidence for extensive cultivation of the plant does not occur until the Late Woodland stage (A.D. 500–1000) (Fritz 1993). At this time, in areas like the American Bottom, maize was incorporated into diets that already utilized native starchy seeds and grasses as primary carbohydrates (Fritz 1993; Johannessen 1993), whereas in areas such as the Tennessee valley and west-central Alabama, maize supplemented diets principally centered on nuts (Scarry 1993a). Though maize may have initially supplemented these foods, in many areas it eventually eclipsed other carbohydrates and reached the status of a true dietary staple (Schoeninger and Schurr 2007).

Based on both ethnohistoric and ethnographic accounts, the most widely practiced maize foodway throughout the historic Eastern Woodlands

was the hominy foodway (Briggs 2015). Hominy is a dish of boiled maize kernels, either ground or whole, that have been soaked in an alkaline solution and then boiled, a preparation technique known as nixtamalization. Nixtamalizing maize serves two purposes: first, it makes maize kernels easier to grind, and, second, it makes maize kernels easier to digest, the latter resulting in the nutritional enhancement of the product. Whereas all variants of maize have kernels high in several essential amino acids and B vitamins, including tryptophan and lysine (the former a niacin precursor), these compounds are stored within the kernel's endosperm and germ, both largely indigestible for humans (Katz et al. 1974:765). Alkaline and heat treatment loosen the outer seed coat, making it easier to remove, while also increasing the digestibility of the essential amino acids stored within (Bressani and Scrimshaw 1958:777; Bressani et al. 1958).

Studies show that unless properly prepared or supplemented, a population subsisting primarily on untreated maize will experience high levels of malnutrition manifesting as pellagra. *Pellagra* is a chronic wasting disorder brought on by severe niacin deficiency and includes such symptoms as roughened skin (for which the disease is named), chronic diarrhea, and dementia; if left untreated, the disease is fatal. Unfortunately, maize and nixtamalization were not always disseminated together, resulting in several devastating historical examples of widespread "corn sickness" (Chacko 2005; Katz et al. 1974).

An alternative to nixtamalization is to complement a primarily maize-based diet with other foods such as the common bean (*Phaseolus vulgaris*). However, the common bean was not introduced into most parts of the Eastern Woodlands until sometime around A.D. 1300 (Hart and Scarry 1999; Yarnell 1993), nearly two centuries after maize was elevated to a dietary staple in many Mississippian communities (Scarry 2007) and a full millennium after its initial introduction to the region (Riley et al. 1994).

Powell's (2007) study of Moundville burials indicates that all chronological segments of the population were generally healthy, including the Moundville I phase population (A.D. 1020–1260), at which time maize was a true dietary staple, accounting for over 40 percent of their diet (Schoeniger and Schurr 2007). This healthy status is critical because it strongly suggests that this early population subsisted on a nutritionally complete maize-based diet, and, without the common bean, a nixtamalizing foodway is the most parsimonious explanation.

Like the nut foodway, the historic native Eastern Woodland hominy foodway follows several general steps and also incorporates certain material classes (Briggs 2015) (Figure 3). First, dried flint maize kernels are soaked, usually overnight but for at least several hours, in a solution made with hardwood ashes or lye extracted from such ashes. The kernels are then processed through any combination of rinsing, rubbing, or grinding to either completely remove or to begin removing the hulls as well as any excess alkaline solution. Later, the kernels are boiled and simmered in an earthenware pot anywhere from 2 to 12 hours, with longer cooking times favored (Briggs 2015:120–121; Wright 1958). Therefore, the historic hominy foodway involves flint maize kernels, hardwood ash, and an extensive cooking period. Owing to the prolificacy and conservancy of this foodway throughout the historic Eastern Woodlands, I suggest that an ancestral hominy foodway including nixtamalizing practices emerged and was disseminated during the Late Woodland and Early Mississippian periods, roughly A.D. 1000–1200, in tandem with a flinty maize variant (Briggs 2015:127).

Although alkaline treatment is key for enhancing the nutritional quality of maize, for my purposes here, the important point is that maize needs to be boiled for an extended period. At different times, the nut and hominy foodways served as dietary carbohydrate bases, and, although there are similarities between the two foodways, the cooking time required by each was substantially different. Hominy, without question, required longer heat treatment.

Cooking Heat: Fire and Hot Coals

Cooking vessels are adapted not only to the foods they are mainly used to prepare, but also to the type of cooking heat and cooking technique they are most frequently used with. As noted, both the nut and the hominy foodways involved boiling, although the time used for each differed. Likely, the cooking technique primarily used with each

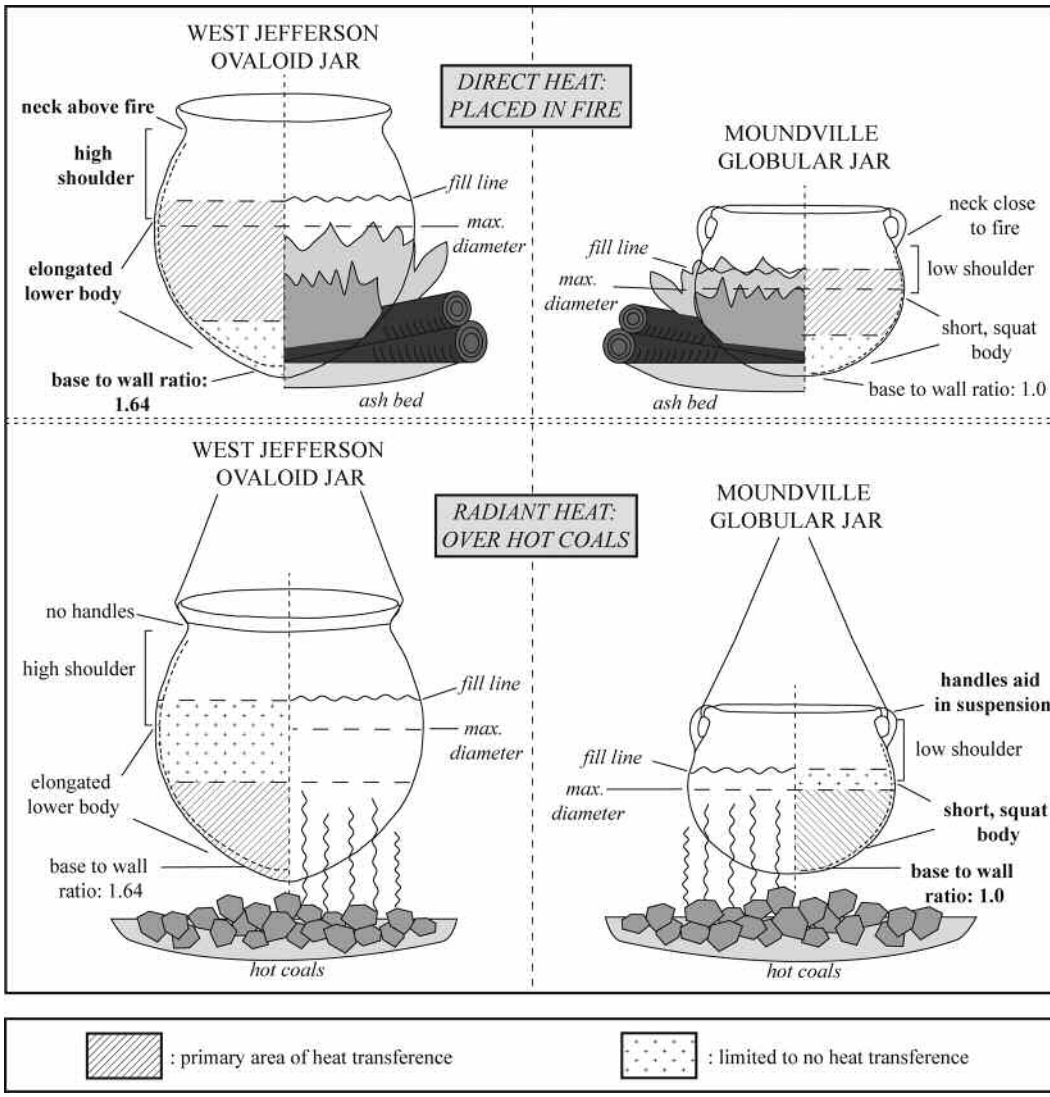

Figure 4. West Jefferson ovaloid jar and Moundville globular jar in direct fire and indirect cooking conditions. Bolded attributes are those that have a clear advantage in that particular cooking mode.

also differed. Historically, in the prehistoric southeastern United States, there were three types of cooking techniques used to reach a boil in ceramic vessels: hot rock cooking, direct fire cooking, and radiant heat cooking over hot coals.

Conical vessels, like the ovaloid West Jefferson cooking vessels, are best adapted to those preparation techniques that involve direct fire cooking (Figure 4). When conical vessels are placed directly in a fire, heat is transferred primarily through the walls, not the base. This is because the base is seated within the ash bed, which is shielded from airflow. Further, conical-shaped vessels are morphologically adapted for primary heat transference through their walls—the relatively steep angle, flat sides coupled with a high shoulder maximizes the surface area exposed to the flames. That West Jefferson ovaloid vessels have thicker bases compared to their walls may be a measure to help reinforce the base. Regardless, a thicker base means that even less heat is transferred through the base than the walls, stressing the primary importance of the latter for heat transference.

Use alteration analyses conducted on West Jefferson phase sherds from large and medium sized ovaloid vessels indicate exterior sooting only on

lower body sherds, just below the maximum diameter of the vessel and absent from the base (Hawsey 2015:52–54). This pattern suggests that West Jefferson cooking vessels were in fact propped with the base resting directly in the hearth, and that cooking fires were built around them (Figure 4). While this configuration would maximize the vessel walls for heat transference, placing a pot directly in a fire is not an efficient long-term cooking strategy—not only does ash accumulate around the base affecting the airflow, but the fire must be continually stoked with fuel to maintain a boil. The walls of the vessel that work so well to maximize heat transference conversely work equally well to maximize cooling. As such, these features fit well with the assertion that West Jefferson ovaloid jars were best suited for cooking nuts and other foods that required a relatively short period of boiling.

Globular pots, alternatively, are not well equipped for being placed directly in a fire. Globular pots have broader bases than conical vessels; assuming these vessels were filled to at least two-thirds (Skibo 1992:151) would leave almost one-quarter to one-third of the surface area between a globular pot and its contents in the base of the vessel. If placed in the ash bed of a fire where the airflow is restricted, the lower contents of the vessel will receive only a marginal amount of heat, leaving only a narrow area from the lower portion of the jar to the shoulder for heat transference (Figure 4). Additionally, the squat curved walls and low shoulder of the vessel position the opening precariously close to an open fire.

Globular cooking pots, like the Mississippian standard jar, are best suited for being positioned above a fire or a hot bed of coals. When the pot is elevated, the relatively wide, broad base of the jar is the area closest to the cooking heat, making it the primary location for heat transference (García Arévalo 1978:265). Among Mississippian standard jars, heat transference through the lower portion of the vessel is also enhanced by the relative thinness of the walls and base.

We are uncertain how Mississippian peoples used standard jars in the Black Warrior valley. Hally found exterior soot deposits on the body and base sherds of small and medium sized Mississippian standard jars dating to the Mississippian Barnett and Beaverdam phases of Northwest Georgia, suggesting that they were regularly used over an open flame (1984:62; 1986:281). However, radiant heat cooking can be a more labor-efficient and a more easily controlled cooking technique than direct fire cooking. Coals made from hardwoods remain hot for quite some time and need to be replenished only every 45 minutes to an hour, unlike direct fire cooking, which requires more frequent stoking. When making hominy, for which cooking time lasted several hours, these may have been important considerations.

Not only is hot coal cooking well adapted for long-term heat exposure, but so too is coarse-shell tempering. Greater thermal shock resistance increases a vessel's ability to withstand prolonged heat exposure, a quality that directly translates into a longer use life for any regularly used cooking pot (Steponaitis 1983:45).

Analysis of Mississippian Standard Jars at Moundville

By describing the shape, qualities, and technical features of the Mississippian standard jar, previous researchers demonstrated its effectiveness as a cooking pot, one particularly suited for boiling (Hally 1986; Steponaitis 1983). However, I want to take this conclusion a step further and propose that the jar was a specific nixtamalizing tool, adapted for long-term boiling. Absorbed residue analysis has been successfully used to help determine the kinds of foods and other materials to which unglazed ceramics were exposed throughout their use life (Heron and Evershed 1993), including ceramics recovered at Moundville (Reber et al. 2010). Despite this, absorbed residue analysis is not yet at a stage where it can unequivocally address questions about the presence or absence of maize (Reber et al. 2015; Reber and Evershed 2004). Even stable isotope analysis is limited, and researchers caution that it should be used only as a presence/absence test for maize, and not as a test for quantity (Hart et al. 2007).

Instead, I approach this problem from a morphological standpoint. Following both Linton's (1944) and Braun's (1983) suggestions that cooking pots are first and foremost tools adapted for specific tasks, I propose that, if the Moundville Mississippian standard jar was a tool essential to the hominy foodway, and if that foodway was

practiced roughly unchanged throughout Moundville's history, then the qualities of the vessel that made it a tool would be more resistant to change than other, stylistic qualities. This proposal is founded on a "communities of practice" model, which holds that the process of pottery making took place within a series of culturally embedded practices and processes rooted within the physical steps of ceramic production (Stark 1998). Stylistic choices, while subject to structural conditioning, are also based on individual taste and experience, and thus are subject to variation and change over time (Dietler and Herbich 1998). Technological choices, on the other hand, are subject to a different set of structural conditions based on practice and performance and, as such, are less likely to vary over time, provided that the tasks for which these choices are adapted also remain relatively constant (Schiffer et al. 1994).

While there are very few either whole or partially reconstructed Late Woodland cooking vessels from the subject area, a sizeable number of whole Mississippian standard jars have been recovered from Moundville, primarily from burial contexts excavated during the early part of the twentieth century (Steponaitis 1983:9). Although these vessels may have ended as mortuary items, there are no recorded instances of dedicated mortuary vessels from Moundville, including Mississippian standard jars (McKenzie 1965:51–53; Phillips 2012; Steponaitis 1983:33–34; 69). Thus, vessels recovered from burials routinely show evidence of prior use. Drawing on the whole jar assemblage from Moundville, I examined two samples: whole, unburnished jars from burial contexts dating to the Moundville I phase (ca. A.D. 1120–1260); and the same from Moundville II/III phase (ca. A.D. 1260–1520) burial contexts. Of the 1,121 whole vessels recovered from mortuary contexts at Moundville, 254 are unburnished, shell-tempered globular jars (Steponaitis 1983:304–334). Of these, only 39 are from Moundville I phase burials, of which 22 are currently available for analysis. Eighteen Moundville II/III phase jars were randomly selected and included as well, bringing the initial total sample to 40 jars. However, two jars were judged to be extreme size outliers, leaving the final sample size at 38.

Moundville jars from burials overwhelmingly fall into the small size class defined by Taft (1996:26–28), with orifice diameters ranging between 6–10 cm. Thus, where the sample is biased, it is toward smaller sizes, lacking those large jars with orifices in the range of 33–45 cm that are common in sherd samples from Moundville middens (Taft 1996:26–28). There is little that can be done about this bias, as whole large jars or fragments large enough to use in this analysis do not exist in any collection.

For each jar, I took 11 vessel body measurements: five evenly spaced body width measurements beginning at the point of vertical tangency on the neck to within 1 cm of the base, two height measurements from the rim and from the throat to the base, handle height, handle thickness, and both rim and base thickness (Figure 5). Because of their size, five body measurements were sufficient (Shennan 1997). Although most morphological measurements were taken on the vessels themselves, the five body width measurements were taken from photographs. I photographed each vessel while maintaining a constant distance between the camera and the vessel being photographed and using a sensitive photographic scale consistently positioned parallel to the central plane of the vessel. I then used Adobe Photoshop and Illustrator to measure the bodies of the jars (Figure 6). A drawback to this method is that the measurements acquired are indirect. Thus, these values cannot be compared to measurements from other assemblages. However, because they are proportionate, they are comparable to one another.

The stylistic variables used in this analysis were the number of handles, handle decoration, rim decoration, and surface treatment. While handles are a clear technological feature of Mississippian standard jars, the number of handles on an unburnished jar from Moundville can range from two to over 16 (Steponaitis 1983:70). Arguably, rim thickness could also be included as a stylistic variable. Early in the Moundville ceramic sequence, folded and folded-flattened rims were common on unburnished jars, although this trait is missing by the beginning of the Moundville II phase (ca. A.D. 1260), making it an excellent chronological marker (Knight 2010:16). In this analysis, though, they were included as a technological trait because rim thickness has the potential to be a functional feature as well.

Figure 5. Morphological measurements taken on Mississippian standard jars.

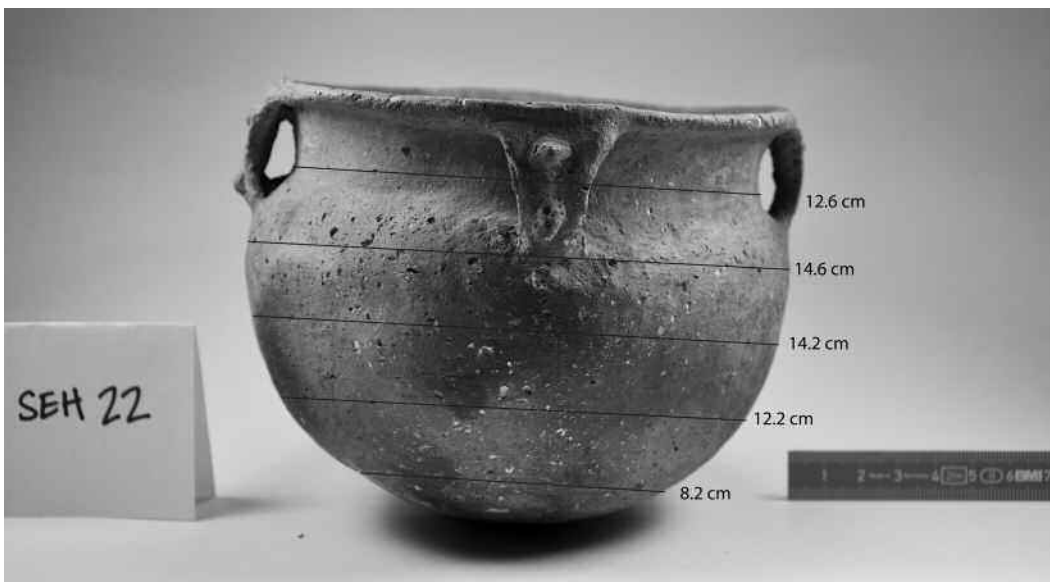

Figure 6. Example of measurements taken from photographs for this analysis.

Following Skibo's (1992, 2013) recommendations, information on use alteration was also collected. During cooking, there are three different classes of sooting that can occur on the exterior surface of a vessel, but the one most informative for archaeologists interested in cooking position and heat source is that which occurs when airborne resins adhere to the comparably cooler vessel surface (Skibo 2013:90–91). Visible to the naked eye, this sooting on the vessel exterior is a direct indication of cooking in or over a fire, while the location of this sooting pattern is an indication of the vessel's position in relation to the fire (Skibo 1992:157–161). Exterior sooting does not occur when vessels are suspended over hot coals because hot coal cooking is flameless and smokeless (García Arévalo 1978:265). A second form of use alteration, interior carbonization, helps determine

Table 1. Pearson Correlation Values.

Variable	Measure 1	Measure 2	Measure 3	Measure 4	Measure 5	Height 1	Height 2
Measurement 1	–	–	–	–	–	–	–
Measurement 2	.931	–	–	–	–	–	–
Measurement 3	.878	.986	–	–	–	–	–
Measurement 4	.834	.956	.987	–	–	–	–
Measurement 5	.700	.804	.839	.878	–	–	–
Height 1	.657	.791	.818	.796	.535	–	–
Height 2	.799	.838	.800	.762	.498	.836	–

what mode of cooking was predominately employed. In wet-mode cooking, including "wet" culinary techniques such as boiling, an interior carbonized ring can occur above the waterline, whereas in dry-mode, including "dry" culinary techniques such as parching, carbonization is found throughout the interior (Skibo 2013:97). For this analysis, I examined each vessel for both exterior and interior sooting, as well as interior pitting and abrasions.

Using SPSS, a pairwise Pearson correlation indicated that the vessel body data demonstrate a strong positive correlation ($p < .001$) (Table 1). Conversely, a pairwise correlation indicated no statistically significant relationship for any of the stylistic variables, either in the early or late sample. Interestingly, two morphological features that were not correlated with the rest of the vessel body measurements were rim thickness and base thickness. However, the importance of base thickness in the Mississippian standard jar is probably best understood in relation not to the vessel width or height, but to wall thickness. Along this line, Hawsey demonstrated that the ratio of base to wall thickness in Black Warrior valley early Mississippian standard jars is 1.0 (Hawsey 2015:58).

The vessel body width and height data were then used in a principal components analysis (PCA) with individual vessels serving as the unit of analysis. PCA is used to assess underlying patterns or structures within a dataset (Shennan 1997:288) and, along with factor analysis, has been successfully used to describe vessel shapes and to assess differences in vessel forms within and between assemblages (Shennan and Wilcock 1975). PCAs work particularly well with smaller datasets. The PCA for this research extracted a single, unrotated solution underlying the seven correlated body measures (Eigenvalue = 5.865), accounting for 83.78 percent of the variance exhibited in these data (Table 2). This single solution again suggests that the globularity is highly consistent among small, unburnished Moundville jars and, consequently, that the jar body is the important element of this tool.

To assess whether there are significant differences between the early and later unburnished cooking jars, I used an ANOVA to compare the morphological measurement means between the early and late jar samples. Importantly, these data indicate that there is no statistically significant difference found between the general contours of early and late jars from Moundville ($F = .100$; $p > .05$). Thus, stylistic variation aside, the bodies of early and late unburnished jars are virtually indistinguishable.

Finally, there were almost no indications of visible use alteration related to cooking activities on either the interior or exterior of any vessel analyzed. While exterior sooting was common, this was clearly a by-product of the ceramic firing process and not related to culinary activities. Additionally, there were no indications of interior pitting or use alteration detected on any other portion of these jars. While this differs from Hally's observations of Barnett and Beaverdam phase Mississippian standard jars in northern Georgia, it does conform to expectations for hot coal cooking.

Table 2. Results of Principal Components Analysis.

Variable	Component 1
Measurement 1	.909
Measurement 2	.988
Measurement 3	.988
Measurement 4	.973
Measurement 5	.822
Height 1	.848
Height 2	.864

Moundville and the Hominy Foodway

Beginning around A.D. 1120 in the Black Warrior valley, the Mississippian standard jar was not only the preferred cooking pot among Mississippian populations, but also the ideal pot for making hominy. That shell-tempered jars and maize are two of the earliest traces of Mississippian culture in the subject area suggests that these two items were disseminated together into the region. In the classic model for the emergence of the Moundville chiefdom, maize agriculture is the crux of early political formation in the Black Warrior valley. Maize was an important resource, intensified and used to produce a surplus, which was then employed by emergent elites to sponsor feasts and other social events (Fritz 1993, 1998:178; Scarry 1993b; Welch and Scarry 1995). During the Early Mississippian period, sponsoring public feasts would have been one tactic available to elites used to attract and maintain followers, drawing the group as a whole into a new political and social identity (Pauketat et al. 2002; Scarry 1993b).

Surprisingly, though, archaeologists have found no evidence of public, communal feasting activities, either on or off mound, at Moundville (Knight 2010:302, 341, 346), and none within the valley save a single context (Maxham 2000). What if the genesis of a Moundville social identity was rooted not in elite sponsorship of public feasting events, but instead in the more mundane? While the research presented here is not sufficient to discard the traditional model, it is enough to offer an alternative, one in which the primary importance of maize in Moundville's emergence may not have been as an elite resource, but instead as a foodway that structured quotidian activities.

Clearly, the shift to a maize-based lifeway was no small concern. However, before maize could be intensified, both the plant and hominy had to be deemed good to eat. While some researchers have proposed that maize's sweet taste is universally appealing (Smith and Cowan 2003), cultural perceptions of food and what is considered edible are deeply entrenched. Ethnohistoric and ethnographic research indicates that many historic native groups prized hominy for its bitterness, a taste specifically derived from the wood ash lye used during its preparation (Briggs 2015:129–132). While maize was made bitter through alkaline cooking, a number of heavily exploited plant resources, including red oak acorns, leafy greens, and roots endemic to the subject area, are also naturally bitter (Messner 2011; Scarry 1993a). During the terminal Late Woodland, hominy, involving both maize and the Mississippian standard jar, may have initially been adopted not for risk management or for surplus production, but because hominy was a boiled, slightly bitter food, one that fit well within the Late Woodland culinary tradition of the Black Warrior valley.

Once deemed good to eat and subsequently adopted, the hominy foodway would have restructured the daily lives of those who practiced it. As noted earlier, food and food preparation techniques not only are conservative aspects of cultural systems, but also are intimately tied to identity (Atalay and Hastorf 2006; Twiss 2007). A change not only in what people eat, but how they prepare it—extending to how they prepare the tools they use to make it—represents a substantial shift that reverberates from the everyday into conceptions of how people see themselves, especially when compared to others. The shift to a hominy-based diet would have resulted in a number of everyday changes. In addition to those shifts in ceramic technology and subsistence practices, cooking hominy involved soaking maize overnight in an alkaline solution, cooking over hot coals, and substantially longer periods spent maintaining the hearth and cooking pot. A change in what was eaten and what was grown, a change in ceramic technology, a change in domestic cooking arrangements—each of these small changes would have restructured the daily lives of those who practiced them. Thus, feasting may not have been necessary to foster a social genesis. Long before Mississippian residents of the valley came to identify themselves as Moundvillians, they may have first identified themselves as hominy eaters.

What the data presented here suggest is that throughout Moundville's occupation (A.D. 1120–1520), the Mississippian standard jar was a tool that morphologically changed very little. Based on these results, we may propose the following addition to characterizing the Mississippian standard jar: while stylistic attributes such as rim decoration, handle design, and surface treatment may vary, its globular contours and uniform wall and base thickness are compatible with specific re-

quirements of the hominy foodway, the first foodway in many parts of the Eastern Woodlands that required long-term boiling. I propose that the jar was thus an essential material component of this foodway and was likely disseminated in tandem with maize during the Late Woodland and Early Mississippian periods, as a tool specially designed for long-term heat exposure in a cooking mode suspended or propped above hot coals.

Acknowledgments. First, thank you to Jim Knight for his invaluable help. This manuscript benefitted greatly from conversations with Ian Brown, John Blitz, Bill Dressler, and Margaret Scarry, as well as from comments from Kandace Hollenbach, Robert Kelly, and two anonymous reviewers. Ashley Peles and Margaret Scarry were kind enough to share an early draft of some of their work, which greatly informed the nut foodway presented here. The composite West Jefferson ovaloid cooking vessel used was produced by Kareen Hawsey. Thank you to Bill Allen for help locating the jars used in this analysis. Danny Covarrubias translated the abstract, and Maria Fernanda Boza C. checked it. Finally, thank you to Andrew Draughon for his characteristic diligence.

Data Availability Statement. All ceramics used in this research are currently housed in the Erskine Ramsay Repository at the University of Alabama, Moundville. All digital data, including the photographs and measurements recorded for this research, are available by contacting the author.

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Submitted September 6, 2015; Revised November 29, 2015; Revised January 4, 2016; Accepted January 4, 2016.