Mississippian Celt Production and Resource Extraction in the Upper Big River Valley of St. Francois County, Missouri

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The Missouri Ozarks are known for their rich and varied mineral resources, such as chert, hematite, galena, flint clay, igneous rock, and salt. Over the past few decades researchers have come to realize the full importance of these resources to the inhabitants of the sprawling Mississippian center of Cahokia and surrounding American Bottom region (e.g., Emerson and Hughes 2000; Koldehoff 1987; Pauketat and Alt 2004; Walthall 1981). Igneous resources in particular have received little attention until recently, specifically the extraction of basalt and related materials for the manufacture of groundstone celts (ungrooved axe heads). The St. Francois Mountains, centered in St. Francois, Iron, Reynolds, and Madison counties, are the ancient volcanic core of the Ozarks. Unlike elsewhere in the Midwest, the St. Francois Mountains have vast exposures of igneous rock, including seams (sills and dikes) of basaltic materials (Tolman and Robertson 1969) well-suited for celt production.[1] While geologists have long studied the unique qualities and economic importance of the St. Francois Mountains, archaeologists have been slow to conduct similarly detailed studies. In fact, little is known about the locations and processes involved in igneous raw material selection, extraction, and reduction. With this article, we make an important step towards filling this information gap.

In terms of celt production, the greatest insights thus far have come from studies of celt caches and production debris discovered at the Cahokia site and neighboring floodplain and upland settlements (e.g., Esarey and Pauketat 1992; Kelly 2006; Pauketat 1994, 1997; Pauketat and Alt 2004). To better understand the political and economic forces that contributed to the rise and fall of Cahokia, better information is needed about the extraction and processing of lithic resources from the Ozarks. For example, large numbers of celts were needed to clear fields and to cut timber, as well as to fashion the timber into construction material for houses, temples, palisade walls, and dugout canoes. As the American Bottom landscape was transformed into fields, villages, and mound centers by cutting more and more timber, environmental impacts likely resulted (Lopinot and Woods 1993). These impacts reduced the quality of life and may have ultimately contributed to the decline of Cahokia. However, like the famous flint clay figurines, basalt celts and Burlington chert tools (from the

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Crescent Quarry area) may have been more than tools—they may have conveyed social and/or ritual information. These raw materials may have attained meaning and importance because of their association with the Ozarks and Cahokia (see Emerson and Hughes 2000; Pauketat 2004; Pauketat and Alt 2004; see also Koldehoff and Brennan, this volume).

In the following pages, we present new information about basalt extraction and celt production in the St. Francois Mountains by documenting the Foshee Collection. In particular, this collection includes 40 groundstone celts, the majority of which represent production failures and rejects. These and other artifacts in the collection were gathered by the Foshee family from cultivated fields along the upper reaches of the Big River between 1930 and 1990. Although precise site locations are not available and artifacts were not kept separate by site, we know that fields within a 10 km radius of the present-day community of Desloge were most frequently surface collected. We have designated this area the Desloge study area (Figure 1). The lithic resources available in and adjacent to the study area are summarized in the next section. In subsequent sections, we summarize the contents of the Foshee Collection, describe the celts, and review Mississippian settlement and lithic procurement in the Big River valley.

Lithic Resources

The Desloge study area is situated along the northeast margin of the St. Francois Mountains and is in the Southeast Missouri Lead District (Walthall 1981). For thousands of years, galena (lead ore) was extracted from the district. While historic documents provide a wealth of information about mining and manufacturing activities beginning with the French in the early 1700s, little is known about prehistoric mining. Employing trace-element analysis, Walthall (1981) documented the distribution of galena from this district across the Eastern Woodlands, starting in the Late Archaic and continuing through Mississippian times. Because Cahokia is located 70 km from the district and because galena is commonly recovered from domestic contexts in the Cahokia region, while galena is primarily recovered from ritual/mortuary contexts at distant sites like Moundville and Spiro, Walthall (1981:42) surmised that "Cahokia was a major Mississippian export center for galena."

Unfortunately, no extraction sites or related settlements have been definitively identified in the district. In the Desloge study area, salvage investigations at the Dorsey site (23SF127), an early Mississippian habitation area, yielded numerous pieces of galena, indicating that this settlement was likely associated with galena extraction (Fosterling 1993; Neal Lopinot, personal communication, 2010). Like much of the study area, the Dorsey site has been severely damaged by modern lead-mining activities.

Summarizing geological studies, Walthall (1981:29–30) reports that seams of galena up to 30 cm in thickness occur within the Potosi and Bonneterre for-

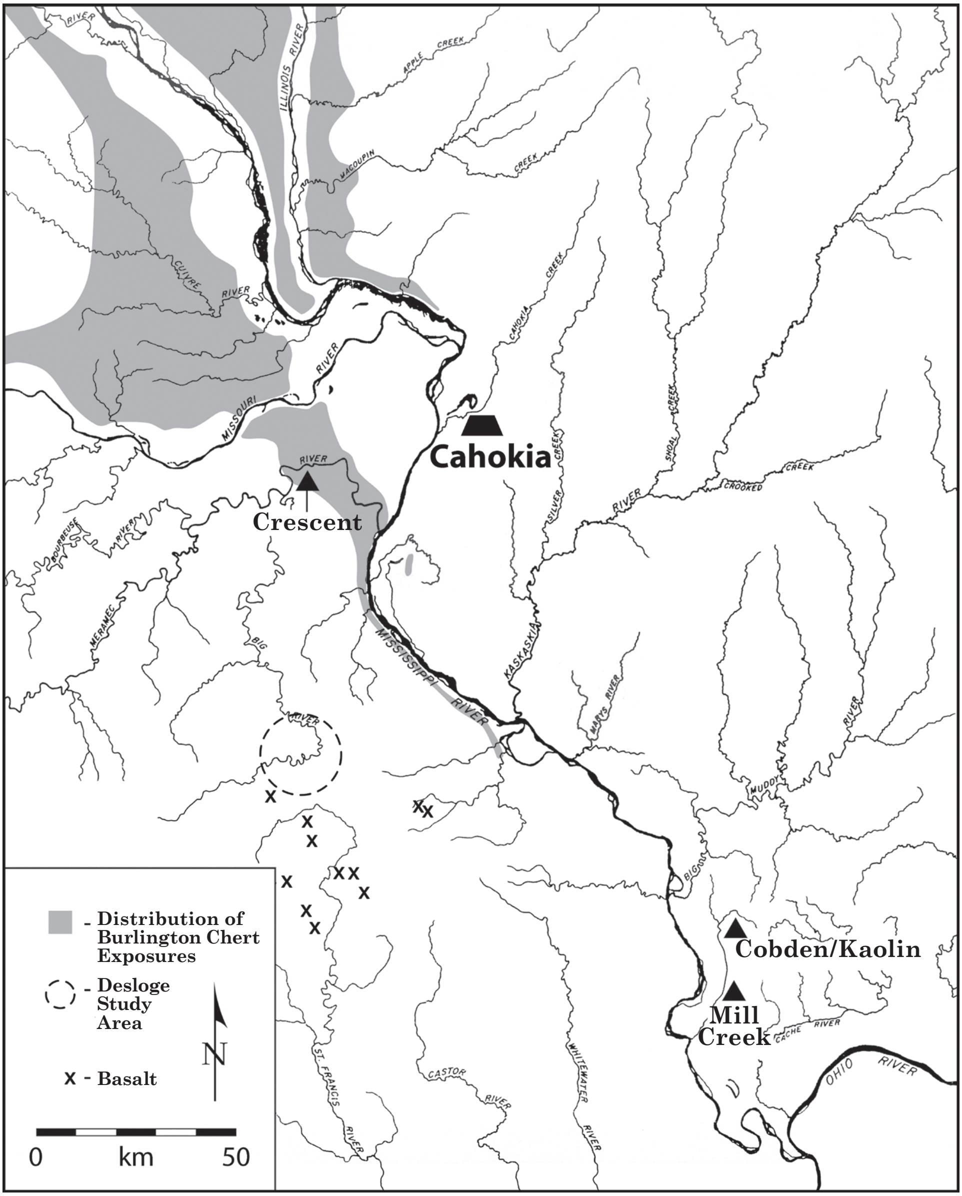

Figure 1. Location of the Desloge study area in relation to the Cahokia site and basalt and chert resources.

mations. Both formations have exposures in the study area (Anderson 1979). Walthall further reports that chunks of galena occur naturally in clay residuum along outcrop zones. Therefore, aboriginal mining techniques were probably simple. Exposed chunks of galena were collected and excavations were sunk into the galena-rich clay residuum. Such techniques were used in the Upper Mississippi Valley (UMV) lead district. For example, citing a report by Schockel (1916), Walthall (1981:30) mentions that “the first Euro-Americans in the UMV district found antler picks in abandoned drifts where aboriginal miners had dug galena from shallow surface deposits.” Holmes (1919) likewise documents aboriginal hematite mining operations that were exposed during early twentieth-century mining in nearby Franklin County, Missouri.

The northernmost exposures of basaltic dikes and sills are shown in Figure 1 and are taken from map locations presented by Tolman and Robertson (1969). They note that “Basalt dikes are probably much more common than the mapping indicates. This is because basalt is less resistant to weathering than felsite [rhyolite] or granite in which it occurs” (Tolman and Robertson 1969:59). The St. Francois Mountains are composed of igneous rock from three main episodes of volcanic activity: pre-batholithic rhyolites and felsites, followed by batholith granites, both of which are cut by intrusive dikes and sills of basalt and related materials, all of which weather more rapidly than their host materials (Tolman and Robertson 1969).

Fine-grained diabase is a common type of basaltic material found in the St. Francois Mountains and most of the groundstone tools in the Foshee Collection, including the celts, are made from this material. Tolman and Robertson (1969:56) provide the following insights:

> Fine-grained diabase dikes are rather common in the eastern part of the igneous region, but actual exposures are rare. Usually they are indicated by a concentration of dense, spheroidally weathered, olive brown cobbles. The boulders weather to a much lighter color than the dark gray fresh rock. A thin oxidized shell from about 3 to more than 7 mm usually surrounds the cobble. These boulders, when struck with a hammer, are very dense and have a metallic ring. They are very tough and samples are sometimes obtained with considerable difficulty.

More than half of the celts in the Foshee Collection have unworked patches of a similar oxidized rind or cortex, which ranges in color from reddish yellow to brown (7.5YR 7/8 to 5/8). Modified surfaces (flaked and pecked) range in color from yellowish green to light gray (5GY 5/2 to 5Y 7/1) and display tiny white phenocrysts. Freshly broken surfaces are darker. Tolman and Robertson’s comment about the difficulty they had breaking open and sampling weathered boulders suggests to us that prehistoric stoneworkers would have had similar problems. This notion is supported by Larry Kinsella and his efforts to extract celt blanks from weathered exposures at Mudlick Mountain in northern Wayne County, Missouri, where frost fractures provided the easiest means of acquiring slabs of raw material (personal communication 2008). A common strategy to avoid such difficulty is to gather appropriately sized cobbles from nearby streams (Callahan 1993; Hampton 1999; Toth et al. 1992). However, we know that such a strategy was not followed by the ancient stoneworkers who made the Foshee Collection celts because waterworn cobbles typically develop a hard, polished cortex, not a soft, weathered cortex like that on the Foshee celts.

Moreover, in the spring of 2009, we examined gravel bars along the Big River within the study area and not a single basaltic cobble was discovered. At the Leadwood public boat ramp, we collected a sample of cobbles that includes the following raw materials listed in their approximate order of abundance on the gravel bar: rhyolite, chert, quartz, and quartzite. The absence of basaltic cobbles in the bedload of the Big River is understandable because the nearest known exposures are along the headwaters of the St. Francis River, which flows to the south, whereas the Big River flows to the north (Figure 1). We suspect that one or more of the exposures along the St. Francis headwaters were the scene of prehistoric extractive activities and the source of the fine-grained diabase used to make the celts in the Foshee Collection. We have not had the opportunity to locate and sample these exposures, but they could have been accessed in aboriginal times by simply walking upslope from the study area to the divide between the Big River and the St. Francis River.

We did locate basaltic boulders in Ste. Genevieve County in the headwaters of River Aux Vases in Hawn State Park along Pickle Creek, located about 30 km southeast of the study area. However, the hard, polished cortex and fresh interior of these boulders are not at all comparable to the fine-grained diabase artifacts in the Foshee Collection. Furthermore, the sills or dikes from which the boulders were long-ago eroded could not be located. Lowell (1976:146) notes a similar difficulty in locating basaltic rock exposures in the Pickle Creek area. These observations reinforce Tolman and Robertson's (1969) comments about basaltic rock exposures being discrete, hard to locate, and having unique mineral and chemical characteristics.

These observations are significant in light of Pauketat and Alt's (2004:783) comment that "there are at least 12 recognizable varieties of St. Francois Mountain intrusive rocks represented in the Grossmann cache." They also note that specific varieties could represent "a single axe-head maker or a small, localized community of axe-head makers closely tied to the centralized production-and-distribution economy associated with Cahokia" (Pauketat and Alt 2004:792). Detailed mineralogical analyses may be able to link these varieties to specific exposures in the St. Francois Mountains.

Ethnographic studies among stone-age groups have documented vocabularies for identifying raw lithic materials (e.g., Best 1912; Hampton 1999). Among the Maori of New Zealand, Best (1912:30–42) reports 20 different terms used for different kinds of stone used to make groundstone woodworking tools. For nephrite, their most favored raw material for such tools, the Maori recognize 29 different varieties based on color patterns, inclusions, and source locations.

Chipped-stone resources are poorly represented in and around the study area. The chert and quartzite cobbles in the Leadwood boat ramp sample are likely derived from upstream exposures of the Gasconade and Roubidoux Formations. These cobbles are difficult to knap because of their grainy texture and internal fracture planes (Ray 2007). The rhyolite cobbles are similarly difficult to work, but outcrops of rhyolite are located nearby (Anderson 1979; Tolman and Robertson 1969). Better quality cherts derived from the Jefferson City and Burlington Formations are available 20–30 km to the north and east. The Crescent Quarry is located along the Burlington Escarpment near the confluence of the Big River and the Meramec River, whereas the renowned Cobden, Kaolin, and Mill Creek quarries are located in southern Illinois (Figure 1).

The Foshee Collection

The Foshee Collection contains approximately 600 prehistoric artifacts. In total, 500 items were inventoried and documented to varying degrees: 362 projectile points, 40 celts, 24 grooved axes, 20 hammering/pecking stones, 17 bifaces, 15 pottery sherds, 14 cobble tools, 2 adzes, 2 bannerstones, 2 abraders, and 2 discoidals. Items not inventoried included numerous untyped point and biface fragments, several chunks of worked and unworked hematite and galena, and five display frames containing intact points and bifaces not available for examination. While formal tools, both whole and broken, appear to have been routinely collected, informal tools (flake tools) and debitage were not.

The 15 sherds are diagnostic of two cultural periods: 3 are Mississippian shell-tempered body sherds—2 have plain surfaces and 1 has traces of exterior black slipping; and 12 are Late Woodland grog-tempered sherds with cordmarked exteriors. One of the Late Woodland sherds is a jar rim. In terms of the American Bottom cultural sequence, all of the Late Woodland sherds are consistent with the Patrick phase, but the Mississippian sherds are too fragmentary for phase assignment.[2]

Based on morphology and technology, the 362 intact and fragmentary (haft elements) points were sorted into 27 types (Table 1). The points were also tallied by raw material type (see Koldehoff 2002, 2006; Ray 2007). The point types are well represented in the cultural sequences of southern Missouri and southern Illinois (Ahler et al. 2010; Ahler and Koldehoff 2009; Fortier et al. 2006; McElrath et al. 2009; Ray et al. 2009). Several of the point types should be considered type clusters in that two or more types with temporal and morphological similarities were grouped together.

While it is beyond the scope of this article to further discuss point typology, we do find interesting the array of different point types in the Foshee Collection. We recognized a mix of the related types that we infrequently see together in Illinois collections. Late Woodland dart points in the Foshee Collection, for instance, include examples of American Bottom Lowe and Mund points, as well as Ozarks Rice Side Notched points. This observation likely reflects the importance of the Big River valley as a cultural shatter zone between late prehistoric groups (Ahler et al. 2010; Wettstaed 2000). The Big River, as discussed later, likely functioned as a major artery linking populations in the American Bottom region with lithic resources of the St. Francois Mountains. Overland trails

Table 1. Foshee Collection Point Types by Raw Material Types.

Period/Type	Burlington	Fern Glen	Salem	Bailey	Cobden	Kaolin	Jefferson City[a]	Quartzite[b]	Rhyolite	Total
Early Archaic										
Dalton	4	-	-	1	-	-	1	-	-	6
St. Charles	1	-	-	-	-	-	-	-	-	1
Hardin	1	-	-	-	-	-	1	-	-	2
Kirk/Rice Lobed	3	1	-	-	-	-	3	-	-	7
Graham Cave	1	-	-	-	-	-	1	-	-	2
Searcy	2	-	-	-	-	-	-	-	-	2
Hidden Valley	1	-	-	-	-	-	-	-	-	1
Middle Archaic										
Jakie	7	-	-	-	-	-	4	-	-	11
Cypress Creek/ Valmeyer	7	1	-	-	-	-	5	-	-	13
Brannon	7	-	-	-	-	-	1	-	-	8
Godar	16	1	-	1	-	-	6	-	1	25
Matanzas	1	-	-	-	-	-	1	-	-	2
Karnak	2	-	-	1	-	-	-	-	1	4
Late Archaic										
McLean/ Williams	28	1	-	-	-	-	13	4	15	61
Etley/Smith	31	1	2	1	3	-	8	4	37	87
Wadlow	2	-	-	-	-	-	-	-	8	10
Mule Road/ Ledbetter	3	-	-	-	-	-	-	1	2	6
Table Rock	3	-	-	-	-	-	-	-	-	3
Riverton/ Prairie Lake	26	-	-	1	-	-	6	-	-	33
Early Woodland										
Waubesa	6	1	-	1	-	-	2	-	1	11
Kramer	2	-	-	-	-	-	-	-	-	2
Middle Woodland										
Snyders	1	-	-	-	-	-	-	-	-	1
Manker	11	-	-	-	1	1	-	-	-	13
Gibson	1	-	-	-	-	-	-	-	-	1
Late Woodland										
Mund/Rice Side Notched	15	-	-	-	-	-	10	6	13	44
Scallorn	5	-	-	-	-	-	-	-	-	5
Mississippian										
Madison	1	-	-	-	-	-	-	-	-	1
Total	188	6	2	6	4	1	62	15	78	362

[a]Jefferson City chert, but may include items made from Gasconade and Roubidoux chert.
[b]Roubidoux quartzite, but may include some items made from McNairy quarzite.

should not be overlooked, since the Big River-St. Francis River divide forms a natural east-west trending 'highway' to the Mississippi Valley. Likewise, the headwaters of the River Aux Vases drain part of this divide and provide another link to the Mississippi Valley (Figure 1).

If we assume the frequency of different point types in the Foshee Collection approximates the intensity of different occupations, we can infer that the study area was most intensively occupied during the Late Archaic period. Late Archaic points account for more than half the collection (55%). The next most intensive periods of occupation are the Middle Archaic (17%) and Late Woodland (14%). Combined, Middle and Late Archaic points represent 72% of the total. Tools likely associated with the Middle and Late Archaic occupations include the 24 grooved axes, 17 bifaces, 2 bannerstones, and probably most of the 14 cobble tools. The cobble tools are hand-sized quartzite stream cobbles that functioned as manos, hammers, anvils, and pitted nutting stones or cupstones in various combinations. The two bannerstones are fragments of the crescent-shaped variety. The 17 early- and middle-stage bifaces are all made from rhyolite and are considered Late Archaic since 80% of all rhyolite points in the collection are Late Archaic, with Etley/Smith points accounting for 47% (Table 1). Twenty of the 24 axes are intact and fragmentary examples of finished/functioning axes: 18 are full grooved and 2 are ¾-grooved. Four are unfinished production rejects. Most of the axes appear to be made from the same fine-grained diabase used to manufacture the celts. The same is true for the two adzes, which are probably Archaic artifacts.

The celts are the primary focus of this article. They are examined in detail in the next section. In the American Bottom region, small groundstone celts appeared during the Late Archaic; celts were the principal heavy-duty woodworking tool by the Early Woodland period (McElrath et al. 2009). Based on size and shape, we believe the majority of the 40 celts are Mississippian. For example, Mississippian celts tend to be much larger then Late Woodland celts in the American Bottom region (Koldehoff et al. 2006:362). It is interesting, however, that the collection contains so few Mississippian artifacts—a single Madison point and three pottery sherds. It is possible that some of the 40 celts are Late Woodland, but the paucity of Mississippian habitation tools and debris does not necessarily mean that the majority of the celts are Late Woodland or earlier.

Since we do not have good provenience information for the celts, we cannot be certain of their cultural affiliation. Yet, the celts strongly resemble Mississippian celts in both size and shape (see below). The celts are singularly important for the insights they provide about the process of celt production: 73% of the celts were broken or discarded during manufacture. This fact, coupled with the scarcity of Mississippian habitation debris, may indicate that most of the celts were recovered from one or more specialized celt-production sites. This notion is supported by the close proximity of the study area to the northernmost basaltic deposits in the St. Francois Mountains. If celts were being made more for nonlocal use (export) than for local use, like hoe blades were made at the Mill Creek Quarry (Cobb 2000), we would expect to see more unfinished celts than finished celts. This, in fact, is the case—for every finished celt there are 2.6 unfinished celts. In contrast, only 4 of the 24 Archaic axes are unfinished; thus, there are .2 unfinished axes for every finished axe. Based on size and shape, it is unlikely that we have mistaken unfinished Archaic axes for unfinished late prehistoric celts.

The collection contains 20 spherical hammering/pecking stones. Four examples are shown in Figure 2 and eight are documented in Table 2. Based on experimental studies, particularly by Larry Kinsella, we know that these simple tools were well-suited for shaping groundstone tools by pecking, especially when they are made from brittle materials like chert and rhyolite.[3] Pecking is typically the most time-consuming (labor-intensive) aspect of celt production. The 20 hammers are made of the following materials: 8 diabase, 6 chert (Ordovician), 4 rhyolite, and 2 quartz. The diabase hammers are less brittle than the other hammers. They were likely used for initial shaping of celt blanks by fracturing and flaking, while the more brittle hammers were used for pecking the celt blanks into final shape before grinding and polishing. Initial grinding may have been completed with the brittle pecking stones because about half of them have one or more ground facets. Final grinding and polishing was likely completed with sandstone slabs and hand-sized flat abraders. Of the two sandstone abraders in the collection, one is slotted and the other is flat to slightly concave. The latter would have worked nicely as a tool for shaping and sharpening celt bits. No other sandstone grinding tools occur in the collection, although such artifacts are probably much underrepresented, particularly if worn out or broken. Final grinding and polishing also may have occurred at other locations, perhaps outside of the Big River valley.

Celt Production and Consumption

The 40 celts in the collection were analyzed to yield insight into the processes of their production and consumption (use, maintenance, and recycling). Our analysis was informed by previous studies of groundstone tools (e.g., Wilson 2001; Wilson and Koldehoff 2009), ethnographic studies (Best 1912; Hampton 1999; Toth et al. 1992), and experimentation in groundstone tool manufacture and use (e.g., Kinsella 1993).

The celts were sorted into two groups based on shape: 35 are broad and rectangular in outline and 5 are much narrower. The former are utilitarian celts that functioned as heavy-duty woodworking tools (ungrooved axe heads) and the latter are examples of so-called spuds or ceremonial celts (Figure 3). Spud is an unfortunate term that both Moorehead (1917:140) and Brown (1996:478) find objectionable and recommend instead the term "spatulate form." These items have narrow stems and broad flaring bits. They are probably not ordinary tools,

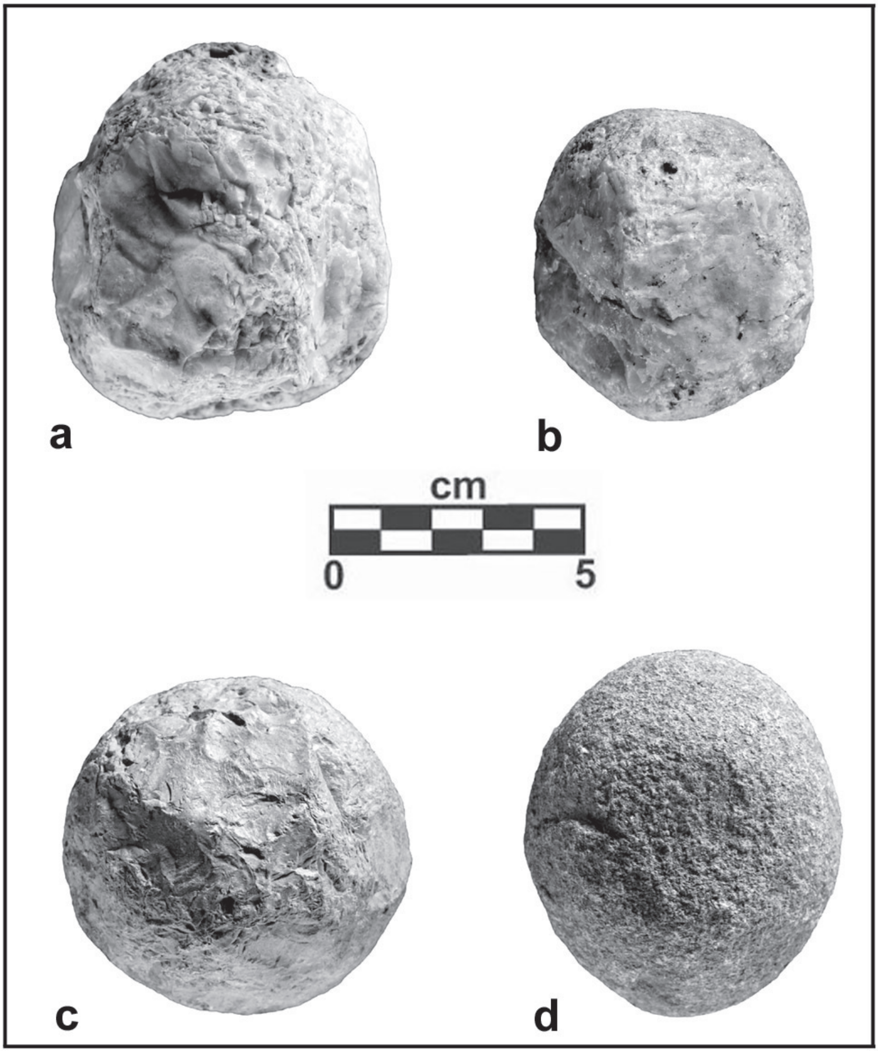

Figure 2. Foshee Collection hammering/pecking stone: (a) chert, (b) quartz, (c) rhyolite, and (b) diabase.

but rather ceremonial or sociotechnic objects—that is, they were ritual and/or status items that conveyed social information. However, like all celts, they were probably hafted and could have been used as weapons.

Each celt was assigned a specimen number and 10 observations were recorded: condition, stage of reduction, preform type, presence of cortex, presence of plow scars, weight, length, width, thickness, and notes about production and consumption (Table 3). Weight was recorded in grams, and length, width, and thickness were measured in centimeters (Figure 3). The celts were sorted into

Table 2. Foshee Collection Sample Hammering/Pecking Stones.

Raw Material	Wt (g)	Max./Min. (cm)	Cortex	Flake Scars	Crushing	Grinding	Notes
Ordovician chert	368	7.1/6	Y	Y	Y	Y	Figure 2a
Ordovician chert	201	6.1/3.4	Y	Y	Y	Y	broken, split during use
Ordovician chert	199	6.1/4.7	Y	N	Y	Y	small nodule with minor use
Diabase	292	6.8/4.2	Y	N	Y	N	broken, split during use, Figure 2d
Diabase	224	6.7/3.7	Y	N	Y	N	heat spalling, plow scars
Rhyolite	235	6.4/3.3	N	Y	Y	Y	broken, split during use, Figure 2c
Rhyolite	332	6.8/5.3	Y	N	Y	N	trace of burning
Quartz	184	5.8/4.5	Y	Y	Y	Y	Figure 2b

five stages of reduction based on manufacturing techniques, uniformity of shape, and evidence of use and recycling (Figures 4–6). The manufacturing process began with raw-material selection (locating a suitable exposure) and celt-blank acquisition. Specimens assigned to each reduction stage are discussed below.

Stage I: Flaked Celt Blanks (N=11)

Nine utilitarian and two ceremonial celts were broken or rejected during Stage I reduction, which entailed the initial shaping of blanks via direct percussion. Two types of preforms are evident—blocks and spalls. Spalls are large flakes that were detached from boulders or bedrock. Considerable force applied with a heavy hard hammer would have been needed to produce the spalls. Celt blanks of this type are relatively thin and have remnant flake attributes. Block preforms are chunky tabular pieces that lack flake attributes and were likely extracted from weathered, jointed bedrock and/or boulders. The largest intact preform in the entire collection is a Stage I spall that was initially shaped by percussion, but it was apparently rejected because it was too thin and narrow (Figure 4a). The heaviest preform in the entire collection is a Stage I block that was broken by a misplaced blow during initial shaping and thinning that truncated the butt end (Figure 4b). Even at this early stage of reduction, it is obvious that these two specimens and many others in this and the next stage represent broken and rejected preforms of large, rectangular celts, many with flared bits (a common Mississippian trait). Two Stage I preforms are classified as ceremonial celts because they are much narrower than the other preforms (e.g., Figure 6a). Of the 11 Stage I preforms, 3 are intact, 5 are bit fragments, and 3 are butt fragments. As for preform types, six are spalls, four are blocks, and one is indeterminate. Except for one, they all retain at least one patch of cortex.

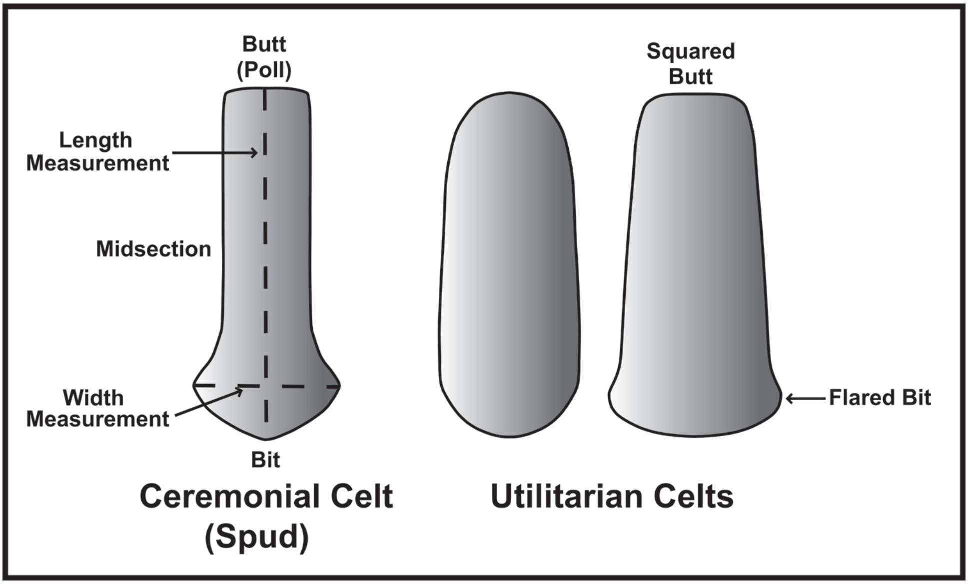

Figure 3. Celt types, attributes, and measurements.

Stage II: Pecked Celt Blanks (N=16)

The 16 Stage II preforms include 1 ceremonial and 15 utilitarian celt blanks that were shaped by pecking after having been initially shaped by Stage I percussion. Because their surfaces are more heavily modified, it is more difficult to ascertain preform type: 3 are spalls, 3 are blocks, and 10 are indeterminate. Cortex is less common on Stage II blanks (50%) than it is on Stage I blanks (90%). Only one of the Stage II blanks is a production reject (intact). The rest appear to be production failures (broken during manufacture)—eight bits, one midsection, and six butts. The higher number of Stage II failures (94%) compared to the lower rate of Stage I failures (73%) is intriguing because pecking typically does not involve the same application of force as percussion flaking. Hence, there should be fewer production failures in Stage II than in Stage I. While the plow may have broken a few specimens and while several others may have broken along internal fracture planes (Figures 5d), most were apparently broken by heavy blows that truncated bit or butt ends (e.g., Figure 5a–b). Such heavy blows may have been made during pecking to remove resistant high spots or because of inexperience. The true rate of failure in this stage, as well as in the other stages, cannot be determined because we do not know how many celts successfully moved through the reduction process. The degree of pecking exhibited by Stage II preforms ranges from rudimentary, with flake scars and cortex patches still visible (Figure 5a–c), to refined, with no visible flake scars or cortex (Figure 5d). In the latter case, such specimens appear ready for grinding and polishing.

Table 3. Foshee Collection Celts.

Type/ Condition	Stage	Preform	Cortex	Plow Scar	Weight (g)	Length (cm)	Width (cm)	Thickness (cm)	Item No.[a]	Notes
Utilitarian (N=35)										
intact	one	spall	Y[b]	Y	700	21	8.8	3	1	production reject, too thin and narrow, Figure 4a
intact	four	spall	Y	Y	356	14.1	6.3	3.7	20	crude/expedient, use wear
intact	one	spall	Y	N[c]	405	15.3	8.5	2	23	production reject, too thin
intact	five	indet.[d]	N	N	438	12.3	7.4	4	30	hammer use, reworking into discoidal, Figure 7
intact	two	block	Y	N	849	14.9	8.8	5.2	31	production reject, too thick and short
intact	four	spall	N	N	NR[e]	12	5	NR	42	crude/expedient, use wear
intact	one	spall	Y	Y	331	14.2	7.9	2.6	19	production reject, too thin
bit	one	block	Y	N	1595	14.2	11.3	5.9	2	production failure, Figure 4b
bit	two	indet.	N	Y	596	10.5	9.2	3.4	3	production failure, Figure 5c
bit	two	indet.	N	Y	629	11	8.9	4.7	4	production failure, Figure 5d
bit	two	indet.	Y	N	331	9.2	8.2	3.7	5	production failure, Figure 5a
bit	two	block	N	Y	370	7.8	7.7	3.7	12	production failure
bit	two	indet.	N	N	242	6.8	9.1	3.8	14	production failure
bit	two	indet.	Y	Y	471	11.1	9.7	3.3	15	production failure
bit	one	block	Y	Y	846	14.8	9.2	5.7	16	production failure
bit	five	indet.	N	N	200	6	8.7	4.1	27	broken in use
bit	three	indet.	N	N	214	5.1	8.6	3.4	29	production failure
bit	two	indet.	Y	N	198	8.4	6.2	3.2	34	production failure
bit	one	spall	N	N	NR	6.9	5.7	3	36	production failure
bit	five	indet.	N	N	NR	5	5.2	NR	37	broken in use
bit	one	block	Y	Y	NR	14.3	9.6	5.1	41	production failure
midsection	two	indet.	N	N	355	7	7.2	4.4	18	production failure
midsection	five	indet.	N	Y	NR	8.9	7.5	4.4	35	broken in use, hammer/anvil use

Table 3 (continued).

Type/ Condition	Stage	Preform	Cortex	Plow Scar	Weight (g)	Length (cm)	Width (cm)	Thickness (cm)	Item No.[a]	Notes
Utilitarian (N=35)										
midsection	five	indet.	N	N	NR	4.8	5.8	NR	38	broken in use
butt	two	indet.	Y	N	299	8.1	8.7	3.7	6	production failure, Figure 5b
butt	five	indet.	N	N	348	10	7	3.4	7	broken in use, hammer use, Figure 6c
butt	one	spall	Y	Y	562	13.4	8.9	3.4	11	production failure, heat spalling
butt	two	indet.	N	N	200	7	7.2	2.8	13	production failure
butt	two	block	N	Y	605	10.5	8.6	3.9	17	production failure
butt	two	spall	Y	N	209	9.1	6.4	3	22	production failure
butt	five	indet.	N	N	388	11.1	6.7	3.8	26	broken in use, heavy hammer/anvil use
butt	five	indet.	N	N	434	9.5	7.4	4.1	28	broken in use, hammer use
butt	two	spall	Y	N	373	9.6	7.1	4.3	32	production failure
butt	two	spall	Y	N	218	7.4	6.4	3.8	33	production failure
butt	one	block	Y	Y	NR	10.3	8.7	7.1	39	production failure
Ceremonial (Spud) (N=5)										
bit	one	indet.	Y	N	347	8.1	7.8	5.1	24	production failure
bit	two	inDET.	N	N	NR	8.5	7.5	6	40	production failure
midsection	five	indet.	N	N	123	7.2	4.9	2.5	8	bit reworked by flaking, Figure 6d
butt	three	indet.	N	Y	111	6	4.9	2.7	9	hammer use, Figure 6b
butt	one	spall	Y	Y	145	8.3	4.8	2.7	10	production failure, Figure 6a

[a]Item no. 21 and 25 are adzes and are not listed here.
[b]Y=Yes.
[c]N=No.
[d]indet.=indeterminate.
[e]NR=Not Recorded.

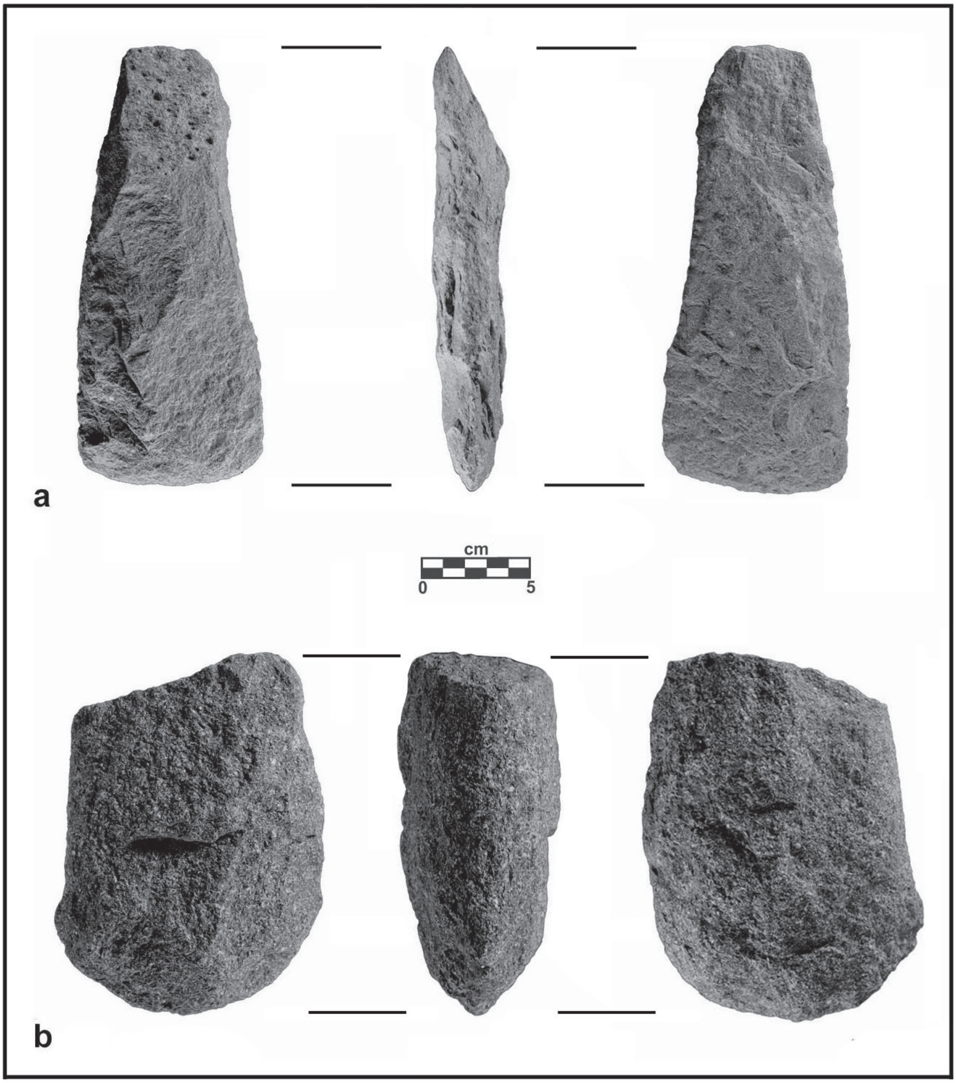

Figure 4. Foshee Collection Stage I utilitarian celt blanks: (a) production reject, spall-type preform (Item No. 1); (b) production failure, block-type preform (Item No. 2).

Stage III: Ground and Polished Celt Blanks (N=2)

Only two Stage III celt blanks were identified: one is the bit of a utilitarian celt and the other is the butt of a ceremonial celt (Figure 5b). Both are well shaped, smooth, and exhibit a developing polish. The utilitarian celt may have been broken prehistorically, but the ceremonial celt was broken by the plow. There should be few, if any, production failures and rejects at this stage in the reduction process. Celts at this stage were probably exported out of the study area, with some being finished and used locally.

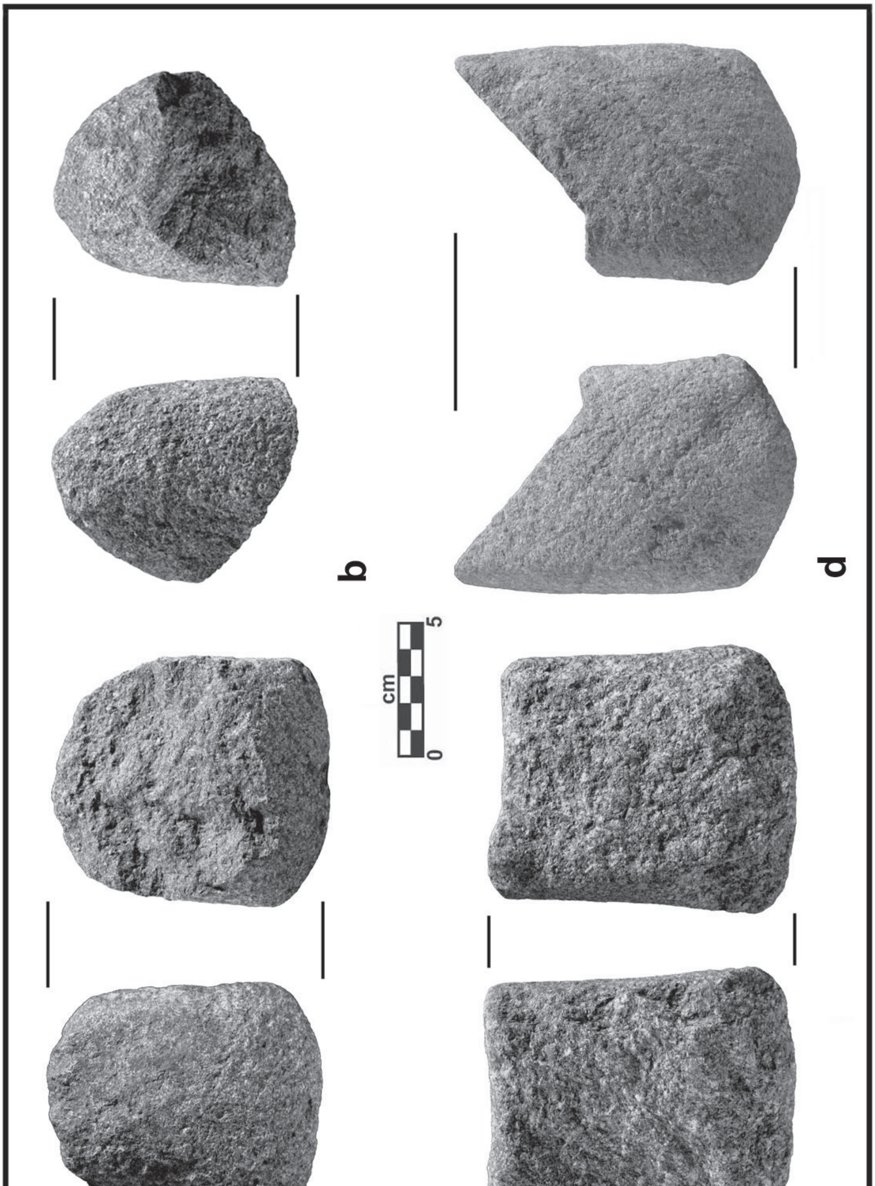

Figure 5. Foshee Collection Stage II utilitarian celt blanks, production failures: (a) bit fragment (Item No. 5); (b) butt fragment (Item No. 6); (c) bit fragment (Item No. 3); and (d) bit fragment (Item No. 4).

Stage IV: Finished/Functional Celts (N=2)

Stage IV celts are intact and fully functional. There are only two such celts in the collection and both are atypical in that they are made from thin spalls that were expediently shaped, briefly utilized, and then discarded. Complete examples of standard functional celts should be rare in most collections, unless found in a cache, because they would have been continuously used and maintained until broken and/or recycled.

Stage V: Finished Broken and Recycled Celts (N=9)

Stage V celts include one ceremonial and eight utilitarian celts. The former is the bit of a finished spud intentionally reworked by the removal of several flakes (Figure 6d). The utilitarian celts include one intact specimen and two bits, two midsections, and three butts (e.g., Figure 6c), all of which were apparently broken during use. One midsection and two butts exhibit traces of hammer and anvil use, with the bulk of the hammer use occurring after they were broken. The intact celt first functioned as an axe head, then as a hammer (with use damage along its bit and butt), and finally a circular depression 4–5 mm deep was picked into each face (Figure 7). The latter indicates the celt was perhaps being reworked into a discoidal. While celts, both whole and broken, were often recycled into hammerstones, to our knowledge they were rarely, if ever, reworked into discoidals. A similar, but smaller specimen was recovered from a Mississippian site in the northern American Bottom (Millhouse 2003:Figure 15.8d). This specimen was recently examined by the primary author; it appears to be a celt fragment that was reused as a hammer and then had a depression pecked into each face. We have not seen Late Woodland celts reworked in this manner, which lends support to our position that this celt, as well as all or most of the other celts in the collection are Mississippian.

Discussion

Because the majority of the celts in the Foshee Collection were broken or rejected during the manufacturing process, particularly during the earliest stages, they document heretofore poorly understood aspects of celt production in the Central Mississippi Valley. For instance, celt blanks were obtained by either prying or breaking blocky tabular pieces from boulders/bedrock or by detaching large spalls from boulders/bedrock. Significant force applied with a large hammerstone would have been required to detach large spalls (12–24 cm long). These spalls were occasionally rejected from further reduction because they were too thin. Of the six intact celt blanks, five were rejected because they were too thin (2–4 cm) and only one was rejected because it was too thick (Table 3). All five that were too thin are spalls.

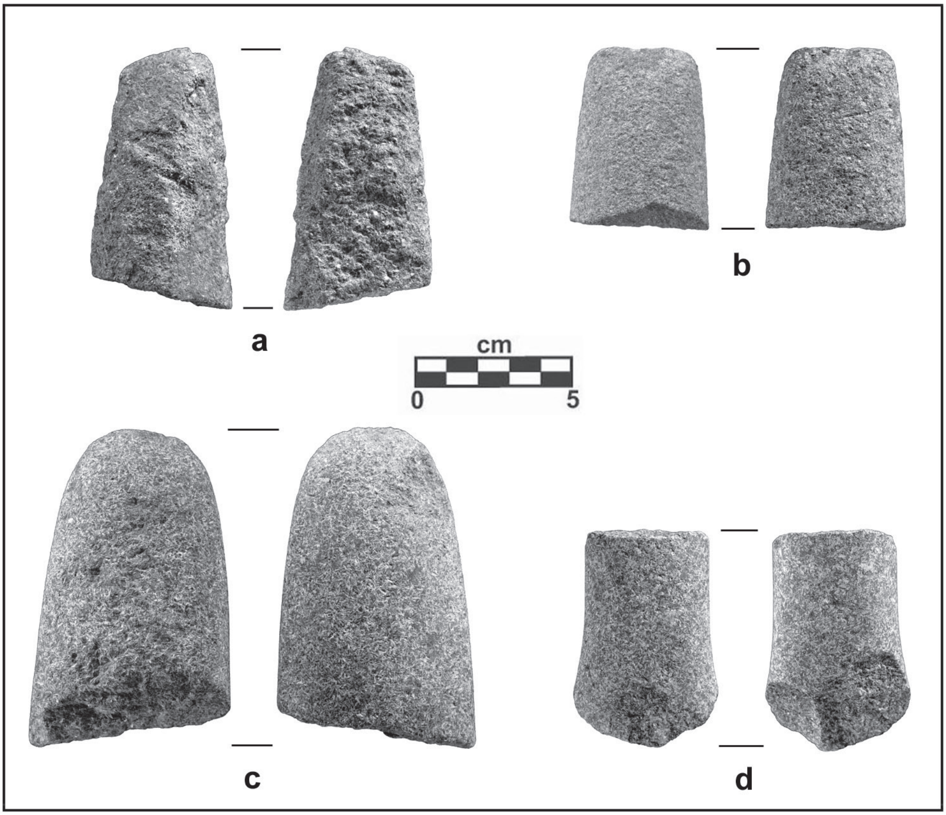

Figure 6. Foshee Collection celts: (a) Stage I ceremonial celt butt fragment (Item No. 10); (b) Stage III ceremonial celt butt fragment (Item No. 9); (c) Stage V utilitarian celt butt fragment (Item No. 7); and (d) Stage V ceremonial celt bit fragment (Item No. 8).

Ethnographic studies have documented the use of fire to generate thermal spalls for tool blanks (Hampton 1999). This method was not used by the stoneworkers who made the celt blanks in the Foshee Collection. The Foshee spall blanks display remnant platforms and/or percussion rings. Only one blank exhibits traces of burning. The advantage of using a spall rather than a block to make a celt is that less flaking, pecking, and grinding is required. If an extra-large celt (measuring 25 cm or greater in length) was desired, however, it would have been difficult to detach an appropriately sized spall.

We suspect that diabase exposures in the uplands south of the study area will eventually provide evidence of prehistoric quarrying activities. The most obvious traces should be exposed bedrock or boulders with flake scars, scattered debitage, and broken or discarded hammerstones. Such traces should likely be present at other utilized rock exposures. However, the technique of detaching spalls from rock exposures was probably not used when generating blanks for extra-large Mississippian celts. Instead, large block preforms were used. This

Figure 7. Foshee Collection utilitarian celt (Stage V) perhaps being reworked into a discoidal (Item No. 30).

strategy makes sense because huge flakes (25–50 cm long) would be difficult and dangerous to detach. Thus, the strategy of producing spalls for celt blanks was likely geared towards smaller Mississippian celts, whereas extra-large celts were made from blocks extracted from jointed and/or frost-fractured bedrock outcrops or boulders. The extraction of these blocks may have left few marks on the exposures, but debitage and hammerstones should have been discarded nearby. Some degree of excavation may have been required to further uncover suitable boulders or bedrock seams.

Given the chunky nature of block preforms, substantial flaking and especially pecking and grinding would have been needed to convert most of them into finished celts. This labor investment may, in part, explain why large unfinished celts are most often found in caches at Cahokia and related sites. Their acquisition and distribution was likely controlled by elites, who may have also controlled the labor necessary to peck and grind them into finished celts (Pauketat 1997; Pauketat and Alt 2004). Pecking and grinding did not have to be completed at or near the igneous rock quarries. It could have occurred anywhere, given the proper tools and enough time. Pecking, grinding, and polishing are time-consuming tasks that are less technically demanding than are the tasks of celt-blank acquisition and initial shaping because these latter tasks require expertise in fracture mechanics and involve greater risk of failure. A misplaced blow or a hidden fracture plane can result in failure. Thus, unlike chipped-stone hoe-blade manufacturing, which requires expertise in fracture mechanics throughout the production process, a similar expertise was only required during the early stages of celt production (see Koldehoff 1990; Koldehoff and Brennan, this volume; Koldehoff and Carr 2001). Such skills are not needed to peck, grind, and polish celts. Consequently, the celt-production process could have been segmented into two general stages completed by different individuals or groups at different locations: 1) celt-blank acquisition and initial shaping; and 2) celt-blank final shaping and polishing.

The insights gleaned from the Foshee Collection about Mississippian celt production must be tempered with the fact that we cannot be confident that all of the celts in the collection are Mississippian. Yet, based on overall size and shape, the celts are fully consistent with typical Mississippian celts recovered from domestic contexts in the American Bottom region. Drawing upon data and insights gathered from ongoing research into late prehistoric patterns of celt production and use (e.g., Koldehoff et al. 2006:362; Wilson and Koldehoff 2009), we can demonstrate that the Foshee Collection celts, based on size (length and width), are more similar to Mississippian celts from domestic contexts than they are to Late Woodland (Patrick and Sponemann phase) and Terminal Late Woodland celts from domestic contexts.

Not considering large caches and extra-large Mississippian celts (greater than 25 cm) we have gathered length and width measurements from 75 intact functional celts and compared these data to the 7 intact Foshee Collection celts (Table 4). The Foshee celts, on average, are larger than Late Woodland and Terminal Late Woodland celts, but they are the same basic size as Mississippian celts. These differences and similarities are observable when length and width measurements for the 82 celts in our sample are plotted: 7 Foshee, 27 Mississippian, and 48 Late Woodland and Terminal Late Woodland (LW/TLW combined). Indeed, Figure 8 shows two basic clusters: larger celts cluster in the upper right-hand corner of the graph, whereas smaller celts cluster towards the center of the graph. The cluster of larger celts is primarily composed of Mississippian and Foshee celts, whereas the cluster of smaller celts is primarily composed of LW/TLW celts.

We evaluated this observation by using the numerical method K-means cluster analysis (Kintigh 1990; Kintigh and Ammerman 1982). K-means is a nonhierarchical, iterative clustering method commonly used to identify patterning in archaeological data. The results of this statistical procedure are summarized in

Table 4. Summary Metric Data for Celt Size Comparison.

	Length (cm)		Width (cm)	
	Mean	Range	Mean	Range
Foshee Collection (N=7)	14.8	12–21	7.5	5–8.8
Mississippian (N=27)	15.1	8.7–20.2	6.9	4.6–9.4
Terminal Late Woodland (N=36)	8.9	5–12.9	5.8	4.4–8.3
Late Woodland (N=12)	10.4	4.2–18.1	5.2	4.1–8.3
	[a](9.7)	(4.2–12.5)	(4.5)	(4.1–6.1)

[a] Late Woodland data minus limestone celt/hoe outlier.

Table 5 and presented graphically in Figure 8 by two ellipses, which represent 95% confidence intervals around cluster means. Hierarchical agglomeration confirmed the statistical validity of the two-cluster solution for our sample of 82 celts. Cluster 1 encompasses the largest celts, which are primarily of Mississippian (N=20) and Foshee (N=6) celts, with just three LW/TLW celts. Cluster 2 encompasses most of the smaller celts, which are primarily LW/TLW (N=45), but includes seven Mississippian celts and one Foshee celt.

The three smallest Foshee celts are finished/functional celts, although the widest of these was perhaps being worked into a discoidal (Figure 7). The four other Foshee celts are production rejects, which means they would have been somewhat shorter and narrower when finished, but this slight reduction would not have moved them into the cluster dominated by LW/TLW celts. As seen in Figure 8, a length measurement of 13 cm is the dividing line between LW/TLW celts and Mississippian celts. Although the measurements for two Foshee and six Mississippian celts are below this line, only one LW/TLW celt is above this line. This LW/TLW outlier is also anomalous in that it is made from limestone, unlike most LW/TLW celts which are made of igneous and metamorphic materials. This celt was recovered from a Late Woodland Patrick-phase feature at the Range site (Williams 1987), and it may have been a hoe blade (or hoe blade fragment) that was reworked into a celt. Limestone hoe blades were recovered from other Patrick-phase features at the Range site, but no other limestone celts were identified.

In addition to being smaller than Mississippian celts, LW/TLW celts are made from an assortment of both igneous and metamorphic materials. Mississippian celts were routinely made from igneous (basaltic) materials that appear to have been derived solely or primarily from the St. Francois Mountains (Pauketat and Alt 2004). Further research is needed to confirm this pattern, but it is supported by the likelihood that LW/TLW groups collected appropriately sized cobbles from glacial till deposits exposed in the Illinois uplands. These deposits have an array of igneous and metamorphic cobbles and boulders. The simple strategy of collecting locally available cobbles is consistent with the overall expedient and homespun character of Late Woodland technological patterns and procurement practices, compared to Mississippian patterns and practices (see Koldehoff and

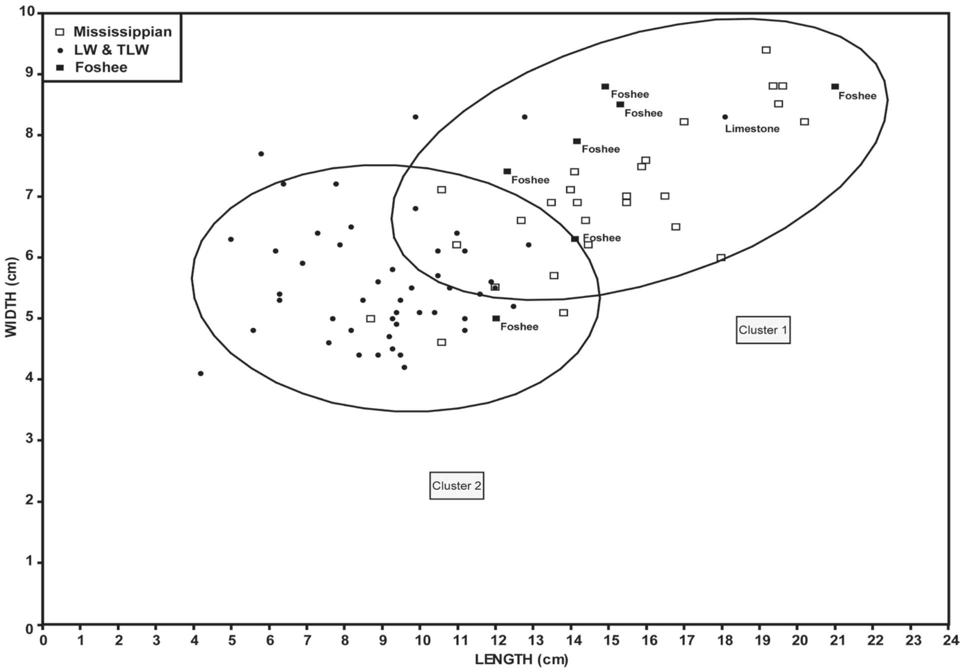

Figure 8. Plot of 7 intact Foshee Collection celts against 27 Mississippian and 48 Late Woodland and Terminal Late Woodland intact celts from the American Bottom.

Galloy 2006; Koldehoff et al. 2006; Pauketat 1994, 2004). Thus, Late Woodland groups in the American Bottom region likely had no need to import igneous celts from the St. Francois Mountains. In contrast, Mississippian populations, which had increased in size and density, did have the need because they were actively creating and expanding fields, villages, and mound centers, and such activities required more and bigger celts (axe heads).

As argued by Pauketat and Alt (2004:792), igneous celts from the St. Francois Mountains likely moved through a centralized economy managed by elites as indicated in part by the large caches of extra-large celts found at Cahokia, Grossmann, and other sites in the region. No caches of Late Woodland celts have been reported from the region. Moreover, Late Woodland groups infrequently used galena, compared to Mississippian groups (Walthall 1981).

The extraction of igneous celt blanks and galena coincides with the early Mississippian "Big Bang" at Cahokia (Pauketat 1994, 2004). Before the Big Bang, there was no need to extract celt blanks from the St. Francois Mountains because smaller celts could be fashioned from glacial cobbles. However, if the Cahokian economy required a steady supply of large celts, it is unlikely that glacial deposits could have furnished a steady supply of suitable cobble preforms, whereas igneous exposures in the St. Francois Mountains could have.

Table 5. K-Means Cluster Analysis of Celt Metric Data.

Cluster	No.	Miss.	LW & TLW	Foshee	Maximum Distance	Mean Length (cm)	Mean Width (cm)
1	29	20	3	6	1.602	15.83	7.61
2	53	7	45	1	1.887	9.36	5.50

Big River Mississippian

Researchers have long recognized that the Big River valley in late prehistoric times was not like the rest of the river valleys in the Ozarks. The Big River valley, unlike other river valleys, is dotted with Mississippian sites. More important, these Big River Mississippian sites yield ceramics akin to those found at Cahokia and other sites in the American Bottom (e.g., Adams 1949; Ahler et al. 2010; Chapman 1980; Milner 1990, 1998; Pauketat 1994; Wettstaed 2000).

James Wettstaed (2000) finds this pattern puzzling because he equates the Mississippian occupation of the Big River valley with agricultural pursuits. He notes that the Big River valley has far less prime farmland than do other Ozarks valleys (Wettstaed 2000:87):

> Big River is a tributary of the Meramec River, and the latter would be much more appealing to farming peoples than the Big River. It seems strange that Mississippian farmsteads would be found throughout the length of the Big River but nowhere along most of the length of the Meramec. This also is the case with the Gasconade River, which is lined with large terraces that would be excellent for farming.

To us, this pattern is not at all strange because Cahokia Mississippians were living in the Big River valley not just to grow crops, but to extract lithic resources and conduct other activities, some of which were ritual in nature, leaving behind cemeteries and rock art sites.

We have already discussed the galena and igneous resources available in the upper reaches of the Big River. Further downstream, particularly near the confluence of the Big River and the Meramec, there were abundant salt and chert resources (Mills 1949; Titterington 1937). Burlington chert from the famed Crescent Quarry area was intensively extracted and commonly utilized by Mississippians, especially in the American Bottom region (e.g., Koldehoff 1987; Pauketat 1994; Ray 2007).

The Big River was almost certainly a major artery linking the lithic resources of the Ozarks with the large Mississippian population centers in the American Bottom via the Meramec and Mississippi rivers. Galena and igneous celt blanks were probably floated down the Big River. There are archaeological discoveries that support this notion. Edwin Mills (1949:4) mentioned the discovery of an igneous boulder and an unfinished celt from two sites near the town of Fenton on the Meramec River:

> Another resident of Fenton, after giving me a stone mortar, showed me a large boulder of light green granite or porphyry near the river. It must have weighed at least five hundred pounds. Large spawls [spalls] had been knocked from it. As there is no similar material in the vicinity it is probable that the boulder was carried to the spot by glacial ice.
>
> On the crest of a hill north of the Gravois Road and a mile east of Fenton were the remains of a small burial mound… . Among the limestone slabs displaced by the plow were found teeth, bones, potsherds, flint artifacts and a large celt which was pecked into shape but unpolished. The material of the celt is similar to that of the boulder across the River.

The "light green granite or porphyry" boulder is likely diabase, but it is unlikely a glacial erratic because the Missouri River 15 km to the north was the southern limit of glacial advances in the St. Louis area (Anderson 1979). Consequently, it is possible that this boulder was transported by human agency down the Big River. At the East St. Louis mound center along the east bank of the Mississippi River, Rau (1869:402–403) reported the discovery of "several boulders of flint and greenstone, weighing 15 to 30 pounds each." It is difficult to be certain of the raw material without examining these boulders, but we suspect that they are composed of Burlington chert from the Crescent Quarry area and igneous rock from the St. Francois Mountains, respectively.

In Washington County, Missouri, about 30 km downstream from the Desloge study area, there is a sizable settlement known as the Boatyard site (23WA31). Wyatt (1960) reported two plowed-down mounds and acres of farmland covered with Late Woodland and Mississippian village debris, including Ramey Incised ceramics. Decades earlier, Thomas (1907:174) reported the following details, "The 'boat yard' is filled with pieces of pottery, mussel shells and burnt corn cobs… . Chunks of lead ore, round as croquet balls and from three to six inches in diameter, were also found but they were subsequently smelted into lead." These galena balls may have been on their way down the Big River to Cahokia.

The Boatyard site is located next to Washington State Park, which has numerous Mississippian petroglyphs (Diaz-Granados and Duncan 2000). The Three Hills Creek site, located near the Desloge study area, is another large rock art site with abundant Mississippian motifs. Such motifs occur at smaller rock art sites along the Big River and its tributaries (Diaz-Granados and Duncan 2000). In addition to rock art sites, the Big River valley is home to many stone-box cemeteries (e.g., Chapman 1980; Cooley et al. 1979; Diesing 1955; Zimmerman 1949).

Perhaps the best documented Mississippian site in the valley is the Long site (23JE15). Located several kilometers downstream from the Boatyard site, the Long site is a mound-and-village complex that has produced a large assemblage of Mississippian ceramics including Ramey Incised vessels (Adams 1949). Excavations sponsored by the WPA uncovered wall-trench structures, three mounds (one of which was a platform mound), and large amounts of habitation debris, including fragments of galena. Because of the Long site's close proximity to the Southeast Missouri Lead District and because galena is common in collections from the site, Milner (1990:22) believes that the Long site played a key role in the distribution of galena. Investigations conducted by the Missouri Department of Transportation archaeologists in the Big River floodplain near the Long site resulted in the discovery of the Pine Ford site (23FE764). This buried, stratified site has Mississippian and Late Woodland occupation levels (Schumann 1999).

Two Mississippian sites in the Desloge study area have been investigated. Salvage excavations undertaken at the Dorsey site (23SF127) recovered early Mississippian habitation debris and numerous fragments of galena (Fosterling 1993; Neal Lopinot, personal communication, 2010). The ceramics include several examples of Lohmann and/or early Stirling-phase jar rims. Salvage excavations at the Saunchegraw site (23SF40) documented a cluster of about 12 stone-box graves (Cooley et al. 1979:48–70). Five largely intact vessels were recovered that compare favorably with Moorehead-phase vessels from the American Bottom (Figure 9a–e). Also recovered were two chert woodworking tools (Figure 9f–g). Decades earlier, stone-box cemeteries along the Big River and its tributary Terre Bleu Creek were examined by Zimmerman (1949). Numerous Moorehead-phase and probably Sand Prairie-phase vessels were recovered along with lithic items. Noteworthy is Zimmerman's (1949:13) comment about the abundance of galena in graves and on village sites: "Galena was often found in the graves. One grave contained seven pieces an inch square or larger. Galena also was very common on the village sites in this [St. Francois] county."

That igneous celt blanks and galena also moved east directly into the Mississippi Valley is indicated by the recovery of these materials from two sites near the town of Ste. Genevieve. The sites are located just north of where the River Aux Vases enters the Mississippi Valley, and across from the mouth of the Kaskaskia River. Investigations at the Bauman site (23STG158), a large Mississippian village, resulted in the recovery of finished and unfinished basalt celts and other woodworking tools, in addition to a large cache of galena (Voigt 1985). Finished and unfinished basalt celts were also recovered from the Common Field site (23STG100), a Mississippian mound-and-town complex. Also recovered were fragments of basalt debitage (Trader 1992).

Summary and Conclusions

Numerous Mississippian sites have been recorded in and along the Big River valley. However, few attempts have been made to place these sites into a regional framework by highlighting the valley's rich and varied lithic resources, such as galena, chert, and igneous rock. These resources were widely utilized by

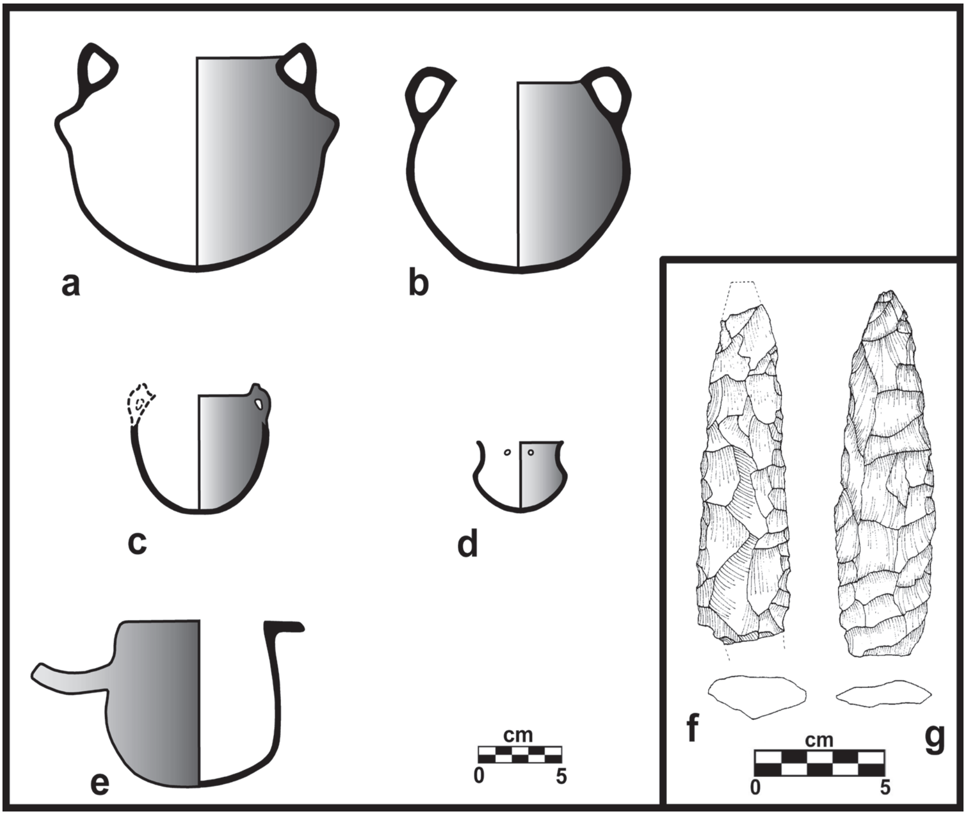

Figure 9. Mississippian artifacts recovered from stone-box graves at the Saunchegraw site (23SF40): (a–d) jars; (e) beaker; and (f–g) chert woodworking tools (redrawn from figures in Cooley et al. 1979).

Mississippian populations in the American Bottom region. Given the similarity of Mississippian ceramics in the Big River valley to those in the American Bottom, the Big River valley may have been part of the Cahokia polity. Control over or unfettered access to these resources must have been critical to the Cahokian economy. Most households used these raw materials or tools fashioned from these raw materials on a daily basis, especially chert and basalt.

Our analysis of 40 celts collected decades ago from fields along the Big River has resulted in new insights into the locations and processes involved in Mississippian celt production. Largely production failures and rejects, the celts were divided into five stages of reduction, with the majority of the celts classifiable into the first two stages: the acquisition and initial shaping of celt blanks. Two types of blanks were identified (spalls and blocks). Extra-large Mississippian celts, like those commonly found in caches, were likely made solely from large blocks rather than from large spalls. The manufacture of these large celts, as well as smaller celts, required considerable time and effort in the form of pecking, grinding, and polishing. These tasks did not have to be performed at or near igneous source exposures. In comparison to chipped-stone hoe-blade production, groundstone celt production was more labor-intensive (time-consuming) work, while hoe-blade production was more technically demanding work—that is, requiring more training and practice because of greater chances of failure throughout the manufacturing process. Further research into the organizational implications of these different technologies may shed new light on the topics of craft production and trade networks.

We hope our efforts here will spur additional research focused on the Big River valley, its mineral resources, and its place within the Cahokian polity. The Big River valley and the adjacent St. Francois Mountains are important puzzle pieces in attempts to better understand not only Cahokia, but also the entire prehistory of the Central Mississippi Valley. Geologist John Nelson (1995:2) notes that modern political boundaries create "state-line faults" that complicate research efforts aimed at regional synthesis. This article helps to bridge a state-line fault that has too often separated the American Bottom from the Big River valley and the St. Francois Mountains.

Acknowledgments

This study is possible because the Foshee family collected broken and unfinished artifacts decades ago and because they were willing to share this information with us. Jerry Wilson played a key role in documenting the Foshee Collection, which was largely a volunteer project with some logistical and photographic support provided by the Illinois State Archaeological Survey (ISAS). Information about igneous resources in the St. Francois Mountains and archaeological sites in the Big River valley was provided by Neal Lopinot, Rusty Weisman, Kerry Nichols, Mike Meinkoth, and Larry Kinsella. Larry also provided invaluable insights into various aspects of celt production and use. The figures were prepared by Greg Wilson, except for Figure 1, which was prepared by Mera Hertel. The photographic images used in Figures 2 and 4–7 were taken by Mera Hertel and Brad Koldehoff and are used here courtesy of the ISAS. John Walthall and Tim Pauketat provided comments on an earlier version of this article.

Notes

1. In this article we use the terms 'basalt' and 'basaltic rocks' interchangeably in a generic sense to denote various intrusive igneous rock types available in the St. Francois Mountains, such as basalt, diabase, diorite, and gabbro.

2. We examined artifacts in the Foshee Collection from an American Bottom perspective, but we tempered our observations and interpretations with information from the Ozarks.

3. The chert hammer in Figure 2 is nearly identical to one used by Larry Kinsella in his replication work focused on the largest celt in the Grossmann cache. Larry also examined a sample of the Foshee Collection celts and hammers, providing important insights.

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