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Ritual economy and craft production in small-scale societies: Evidence from microwear analysis of Hopewell bladelets

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A B S T R A C T

Ritual economy provides a powerful framework for examining aspects of the organization of craft production, especially in the absence of a strong, centralized political economy. This paper outlines the basic tenants of ritual economy and describes how this framework can expand the understanding of the organization of production in small scale societies. I apply these concepts in a case study based largely on microwear analysis of Hopewell bladelets from the Fort Ancient earthworks in southwest Ohio. Microwear analysis from many different localities excavated within and near the earthworks demonstrates that craft production was an important activity conducted using bladelets. Each of the localities in which crafts were produced concentrated on media distinct from the others. These findings have important implications for our understanding of Hopewell economy and social structure as well as craft production in general.

1. Introduction

This paper uses a ritual economy framework to study the organization of production in small-scale societies. Specifically I examine the structure of craft production at Fort Ancient, a Hopewellian earthwork, by studying the function of stone bladelets. Ritual economy is the analysis of the economic aspects of ritual and the ritual aspects of economic transactions as they relate to the materialization of ideology (Wells, 2006:284). Here materialization refers to the open process of reproducing and transforming cultural symbols into material objects (Wells and Davis-Salazar, 2007:3). Many scholars view political and ritual economy as complimentary but in small-scale societies ritual institutions can function to direct economic practices in the absence of hierarchical social divisions. Ritual economy provides a means to study the intensification of production in the absence of a centralized political force (i.e. Spielmann, 2002).

Small scale societies are those that contain several hundred to several thousand people united by diffuse political structures organized around kin groups (Spielmann, 2002:195). Recently, Spielmann (1998, 2008; see also Wright and Loveland, 2015) has highlighted the role of ritual contexts as important factors in the organization of craft production in many small-scale societies. Importantly, it is the ritual settings, rather than markets or highly ranked individuals, which attract many craft producers.

The Fort Ancient Earthworks were built and utilized during the Middle Woodland period (100 BC–AD 400) by a small-scale society associated with the Hopewell horizon (Fig. 1). The term Hopewell describes horticultural populations in what is now the eastern United States who lived 100 BC–AD 400, built earthworks, and participated in long-distance exchange networks. Hopewell populations lived in small, dispersed settlements, periodically traveling to earthworks for social/ceremonial gatherings (Dancey and Pacheco, 1997; Pacheco and Dancey, 2006; Ruby et al., 2005). Through their extensive trade networks, Hopewell people in Ohio were able to obtain copper from the Lake Superior region, marine shells from the gulf coast, and mica from the Appalachian Mountains among other things. These raw materials were then crafted into ritual or ceremonial artifacts.

The seminal study of Ohio Hopewell craft production was conducted by Baby and Langlois (1979) at the Seip earthworks. Excavations inside the earthworks in the 1970s revealed the outlines of seven complete and three partial rectangular structures that were associated with something other than mortuary activity (Baby and Langlois, 1979:16). The presence of exotic materials such as mica and sea shells, specialized lithic assemblages, and lack of habitation debris led Baby and Langlois (1979:18) to characterize the structures as specialized craft workshops. Several decades later, N'omi Greber (2009a, 2009b) led a team of investigators bent on thoroughly examining the stratigraphy and finding correlations between artifacts from the supposed Seip craft workshops. The complex stratigraphy described by Baby and Langlois (1979:17)

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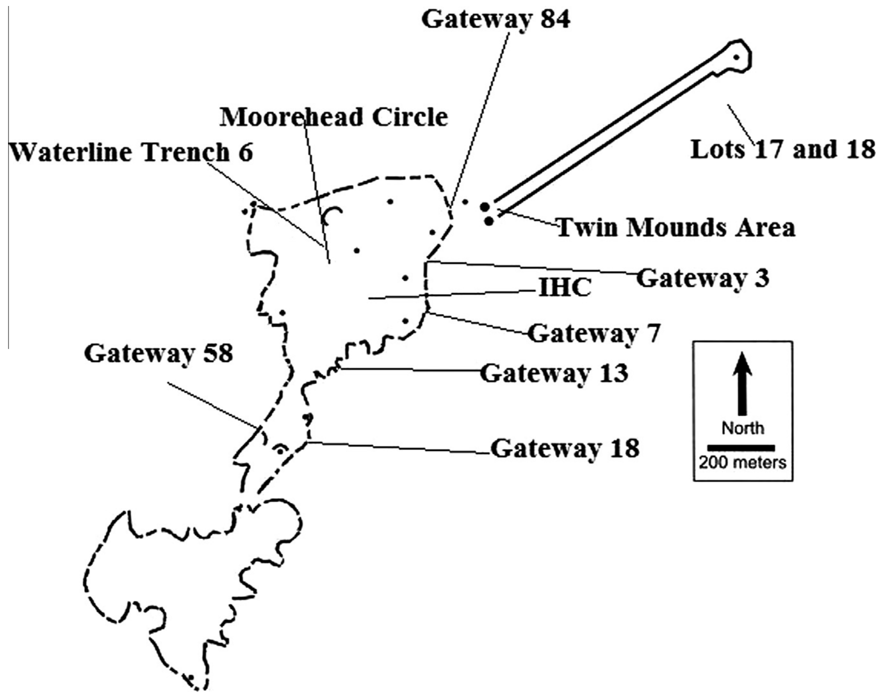

Fig. 1. Fort Ancient (33WA2).

is a result of the decommissioning of several of the structures. This involved capping dismantled structures with, sometimes several layers of, mound fill that was subsequently disturbed by historic plowing (Greber, 2009a). The fill materials used in the mounds were borrowed from unknown areas of the site and were largely responsible for introducing many of the craft materials and specialized tools to each structure. Additionally Baby and Langlois' (1979:18) assertion that different crafts were produced in each structure cannot be upheld due to lack of evidence from primary context, nor do all structures appear to be contemporaneous as originally argued (Greber, 2009b). Greber (2009b) concludes that while the Seip structures were special places and that craft production activities probably occurred somewhere in their general vicinity, they were clearly not specialized workshops. Similarly, Yerles's (2009) microwear analysis failed to identify substantial evidence of craft production within the chipped stone artifact assemblage. While Spielmann (2008:66) argues that craft production largely took place at earthworks she admits that little archaeological evidence exists as to how production was organized in these contexts.

In order to further characterize Hopewell craft production, this study examines the organization of production at Fort Ancient by studying the function of a particular class of chipped stone artifact, bladelets (Fig. 2). Hopewell bladelets are defined as the product of a prepared core technique with a length to width ratio of at least two to one, roughly parallel margins, and a triangular, trapezoidal, or prismoidal cross section (Greber et al., 1981; Nolan et al., 2007; Pi-Sunyer, 1965:61). Bladelets are often invoked as important components of Hopewell ritual production (e.g. Byers, 2006; Odell, 1994; Spielmann, 2009) but relatively few large-scale, systematic studies have been conducted to study this role (but see Kay and Mainfort, 2014; Odell, 1994).

The examination of bladelets is ultimately aimed at gaining insight into the organization of production at Fort Ancient. Bladelets offer unique insight into Hopewell craft production because (1) they are a diagnostic marker of the Hopewell horizon (Greber et al., 1981); (2) they were multipurpose tools serving as a proxy measure of all stone tool use (Yerkes, 1990, 1994); (3) bladelets regularly comprise over 75% of the formal tool assemblage at most Hopewell sites (Genheimer, 1996); (4) they were relatively expedient tools thus largely eliminating the interpretive problems caused by artifact curation.

2. Ritual economy

Economy and ritual are often falsely dichotomized with the former viewed as rational and the latter non-rational (McAnany and Wells, 2008:1; Wells and Davis-Salazar, 2007:2). However, the work of Mauss (1990[1925]) in *The Gift* was an early and highly influential examination of the rationality of ritual behavior in reciprocal exchange. Similarly, Malinowski (1961[1922]) recognized the inherent cultural rationality of ritual behavior. Ritual economy builds on this scholarship by recognizing the interconnected nature of economics and ritual. Watanabe (2007:313) argues for the importance of a ritual economy framework in studying relatively egalitarian societies where kinship largely defines social roles and obligations. Similarly, Spielmann (2002:203) argues that, in small-scale societies, "ritual and belief define the rules, practices, and rationale for much of the production, allocation, and consumption". Thus, any discussion of the economics of a small-scale society must include a consideration of ritual economy.

Most discussions of ritual economy analyze what Watanabe (2007:301, see also Wells and Davis-Salazar, 2007) describes as the *economics of ritual*, or the economic acts necessary to properly participate in or host ritual events. Ritual production is often surplus production with raw materials composed of exotic items (Wells and Davis-Salazar, 2007:1). These items are often used in communal ritual events such as festivals, feasts, and fairs which provide opportunities to reinforce and/or renegotiate social relationships. In this way ritual may be a major factor in regulating the production, distribution, and consumption of craft goods.

For example, Swenson and Warner (2012) argue that diverse groups of commoners were included in the production of copper objects at the Moche site of Huaca Colorada. Copper processing and production took place at this important ceremonial center in conjunction with other social/ceremonial gatherings (Swenson

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Fig. 2. Examples of Hopewell bladelets including complete specimens (top row); proximal (2nd row), medial (3rd row), and distal (4th row) fragments; rejuvenation and trimming flakes (bottom row). Artifacts on loan from the Ohio History Connection courtesy of the Collections Management Team.

and Warner, 201:314). The copper objects were important elements of the ritual process as well, serving as "rituals of embodied transformation" as their creators became part of the community's symbolic structures (Swenson and Warner, 2012:331). In this way, elites gave up some of their control of ritually significant symbols in order to negotiate social relations. Thus production *for* ritual performance became embedded *within* ritual performance through the careful structuring of ritual production.

As Watanabe (2007:301, see also Wells and Davis-Salazar, 2007) argues, ritual economy is also about ritualized economic interactions between individuals, or the *ritual of economy*. In order to maintain itself, each household must reproduce itself but in order to reproduce itself a household must enter into social relationships with other households which threaten its independence. Watanabe (2007:304) refers to this as the conflict between "autarkic production and necessary interdependence". According to Watanabe (2007:305), by standardizing the interactions between households the ritual of economy provides a means to structure production, exchange, and consumption in the absence of a centralized political authority.

For example, Watanabe (2007:306) cites Rappaport's work on ritual and feasting in New Guinea as ethnographic evidence for the nature of the ritual of economy. Among the Maring, the ritual cycle structures production and consumption—among other things—in a manner outside of the political control of any one group or individual. In this case economic interactions became embedded in the ritual cycle as a means to ensure peace and reciprocity while uniting groups outside of the bonds of kinship.

3. Fort Ancient Earthworks

The Fort Ancient Earthworks (33WA2) are located on a high terrace above the Little Miami River in Warren County, Ohio (Fig. 1). Fort Ancient is composed of 5.7 km of earthen walls divided into sections by 67 openings or gateways. Fort Ancient contains four basic architectural units; the North, Middle, and South forts, and the Parallel Walls which extended 0.85 km to the northeast of the earthwork before their destruction by plowing (Connolly, 2004; Essenpreis and Moseley, 1984; Moorehead, 1890). The following sections describe excavations at Fort Ancient from which bladelets were recovered and included in this analysis. Space limitations prevent in-depth discussion of all aspects of each excavation. For further information on the excavations see the cited references as well as Miller (2014b).

3.1. North Fort gateways

Excavations in and around gateways 3, 7, 8, 13, and 84 in the North Fort identified extensive evidence for earthwork construction as well as other activities associated with gatherings at the earthworks. While variation certainly existed across space and through time, gateways tend to contain evidence for short-term use in a restricted range of activities (Connolly, 1996a, 1996b, 2004; Morgan and Ellis, 1939).

3.2. Lots 17 and 18

Opportunistic salvage excavations by the Cincinnati Museum Center in conjunction with house construction in the mid-1990s exposed subsurface features in the Eastern Plateau south of the termination of the Parallel Walls (Cowan et al., 2004). An area of about 900 m^2 in house lots 17 and 18 was mechanically stripped, exposing the remains of at least three structures along with a number of additional postmolds and pit features (Cowan et al., 2004:119). A number of these posts and 20 pit features were excavated (Cowan et al., 2004:119). Pit features contained large numbers of bladelets, blade cores, and debitage (including obsidian and quartz crystal) while pottery, fire-cracked rock, bone, and botanical remains were present but relatively scarce (Cowan et al., 2004:120).

3.3. Twin Mounds area

East of Gateway 84 are two relatively large earthen mounds known as the Twin Mounds. Excavations in the late 1980s revealed hundreds of postmolds as well as pit features and the remains of several overlapping limestone pavements in the Twin Mounds area. Numerous structures must have been built and rebuilt in the area as evidenced by "overlapping walls, erratic patterns, and varying depths" of posts (Connolly, 1997:255). Lazazzera (2009:265) identified the partial outlines of eight separate structures, each about 10 m square, by identifying patterns of strait lines of recorded post holes. The eastern portion of the excavated area contains three overlapping limestone pavements. The earliest pavement (Connolly's Pavement 3) is "composed of a mixture of gravel, sand, small pieces of limestone, and clay" and is superimposed upon a layer containing the numerous posts and pits (Connolly, 1997:257). The middle pavement (Connolly's Pavement 2) is composed of a layer of gravel over small limestone slabs. The uppermost pavement (Connolly's Pavement 1) consists of a layer of gravel over larger limestone slabs (Connolly, 1997:256).

3.4. Interior household cluster (IHC)

In the mid-1990s the rebuilding of the Fort Ancient museum and related updates to the infrastructure necessitated large scale excavations within the North Fort (Lazazzera, 2004). Excavations exposed the remains of 11 separate structures, seven in the mechanically stripped area and four south of the tree line (Lazazzera, 2004:Figure 7.2). The only completely excavated structure outlines were in the mechanically stripped area of the new museum. Structures 1 and 2 were paired post structures and were about seven meters square (Lazazzera, 2004:90). Extrapolation from the sampled sections of the remaining structures indicates that 7×7 m is an accurate estimate for their sizes as well.

Four structures were located directly south of structures 1 and 2 in an area not subjected to historic plowing (Lazazzera, 2004:Figure 7.2). In addition to the structures a 25–40 cm thick midden extended over the area (Lazazzera, 2004:88). Structures 5 and 8 were associated with large refuse pits while features in structure 8 contained scraps of copper, galena, mica, and obsidian (Lazazzera, 2004:92–93). Lazazzera (2004:Table 7.1) notes that structure 5 was rebuilt once based on postmold patterns. This interpretation is bolstered by the fact that the refuse pit associated with structure 5 appears to have been used for an extended period of time (Lazazzera, 2004:94). Whether all structures were occupied simultaneously or structures were added through time remains to be demonstrated. Lazazzera (2004:105) notes that both scenarios are possible in that the relative paucity of overlapping features indicates the planned use of space, but this planning could have occurred over a long period of repeated habitation in which new structures were positioned away from the still visible remains of previous structures. To the west of these structures, in an area mechanically stripped for a water treatment facility and access road, two similar structures were discovered.

Most of the structures show no evidence of rebuilding. In addition to structure 5 noted above, an exception occurs at the extreme eastern end of the access road area where an array of overlapping features was uncovered (Lazazzera, 2004:Figure 7.2). The area contained the remains of two types of structures each rebuilt once, for a total of at least four different structure outlines (Lazazzera, 2004:Figure 7.10). The earlier structures were heavily built with large posts set in basins with limestone chinking stone for support. Later structures resembled the others found in the area (Lazazzera, 2004:95).

3.5. Moorehead Circle

The Moorehead Circle consisted of an outer ring of as many as 200 post holes, which, before their removal, contained wooden posts two to four meters tall (Burks, 2014; Miller, 2014a; Riordan, 2009:88). Excavations also revealed as many as two additional smaller rings of posts within the larger circle (Riordan, 2009). At the center of the Moorehead Circle is a mound of bright red soil surrounded by an apron of ash and burned timbers all covered by unburned soil and located within a larger pit (Riordan, 2009:23–28). An unroofed structure with overlapping clay floors was associated with the central feature (Riordan, 2011:76).

Alternating bands of meter-wide clay floors and sand and gravel filled trenches that follow the arc of the outer circle are located inside the outer ring of posts and they terminate just before the central feature (Burks, 2014:10). Artifacts recovered from the Moorehead Circle include stone tools and lithic debitage, ceramics, mica, shell, floral and faunal remains, and a small piece of textile (Riordan, 2007, 2009). Large quantities of refitted ceramic sherds recovered from around the central feature indicate that pots were smashed in place, either after depositing some since decomposed offering or as a ceremonial offering themselves (Riordan, 2009:40).

3.6. Waterline Trench 6

Installation of a waterline necessitated the excavation of a trench through a portion of a Civilian Conservation Corps enhanced drainage feature in a small ravine in the North Fort. The midden was used for the disposal of refuse including FCR, faunal remains, lithics, charcoal, ceramics, and a platform pipe (Lazazzera, 2009:196).

3.7. Middle Fort

Excavations in 1988 reopened and expanded an earlier excavation trench near Gateway 58 (Connolly, 2004:39). In addition to documenting a three stage construction sequence for the embankment wall, the excavations revealed two linear arrangements of postmolds at the base of the earthwork.

In 1982, a portion of the terrace to the east of Gateway 18 in the Middle Fort was excavated (Connolly, 1991:83). No features were identified but substantial amounts of lithics, FCR, and charcoal were recovered. Connolly returned to the area in 1991 and excavated a limestone pavement extending out of the gateway area and onto the terrace. A single postmold was discovered associated with the pavement (Connolly, 1996b:209). The upper levels of the excavation unit were composed of eroded embankment wall soils but Connolly (1996b:206) reports excavating an intact "living floor" associated with the pavement and postmold. Further east of Gateway 18, Connolly (1996b:212) placed an excavation unit near the remnants of a stone mound excavated by Moorehead (1890). Moorehead discovered two human burials in the mound and Connolly excavated the remains of an undisturbed pit feature.

4. Microwear analysis

Lithic microwear analysis is based upon the observation that use of stone tools on various materials will produce wear patterns that are distinct from those caused by non-use related processes as well as those of other materials. Microwear analysis as pioneered by Semenov (1964), and modified and expanded by Keeley (1980), uses both high and low power incident light magnification to identify polishes, striations, and edge damage caused by utilization. Comparisons of these markings with experimental tools of known use are used to identify tool function in specific motions on specific materials. Published experimental programs have recognized the distinct features of microwear associated with motions such as cutting, scraping, whittling, sawing, engraving, and projectile use on materials such as meat, wet, dry, and greased hide, bone, antler, wood, plant, soil, stone, shell, and even pottery (Gijn, 1990; Keeley, 1980; Vaughan, 1985). Recently, features associated with hafting and prehension have been thoroughly documented and discussed (Rots, 2010). The method has been validated by several independent blind tests which have led its adoption in countless studies worldwide (Bamforth, 1988; Juel Jensen, 1988; Yerkes and Kardulias, 1993).

This study presents the results of microwear analysis of 762 bladelets and bladelet fragments from Fort Ancient. Most bladelets are unmodified but fifteen were unifacially retouched. All retouch was marginal and did not form recognizable tools types (i.e. Fortier, 2000) except for two bladelets from a pit feature in the Interior Household Cluster that were formed into drills.

Prior to microscopic analysis, artifacts were photographed so that locations of use-wear could be noted. Each artifact was then washed in an ultrasonic cleanser first in a bath of liquid soap then in water. The artifacts were then examined with an Olympus model BHM incident light microscope at magnifications of 50–500× with photomicrographs taken of significant features. In order to interpret material worked and motion employed, microwear traces on the artifacts were compared to wear traces from a reference collection of over 200 tools composed of over a dozen Midwestern flint and chert types from experiments conducted by Miller (2010) and Yerkes (1983:504, 1990:171). Several of these experiments are presented below but see Miller (2014a, 2014b:Appendix B) for additional examples.

5. Producing Hopewell crafts

Interpretation of the use of a particular bladelet in craft production involves comparing the material worked and/or the motion employed with experimental and ethnoarchaeological data on the production of Hopewell craft products (Miller, 2014b). Certain materials such as stone and shell can definitively be linked to Hopewell craft production regardless of the motion employed. In cases where the material worked may be used for craft or non-craft products (e.g., dry hide, wood, and bone/antler) fine motions such as engraving, perforating, and drilling indicate craft production whereas scraping and sawing provide ambiguous results. While not meant to be an exhaustive list or definitive reconstructions of prehistoric productions techniques, the following section provides a brief summary of how bladelets may have been used in the production of some of the artifacts recovered at Fort Ancient.

Due to its ubiquity within Middle Woodland contexts, mica working is often cited as a major task for which bladelets were used (Wright and Loveland, 2015; Yerkes, 1990, 1994). Snyder et al. (2008) experimented with several different methods of working mica using replicated bladelets. Snyder et al. (2008:54) found that while cutting and sawing motions produced rough edges, engraving (i.e., using a sharp point to systematically perforate) produced clean edges like those found in archaeological specimens.

Minich (2004:46–49) has identified a basic production sequence for Hopewell platform pipes that involves pecking, grinding, drilling, polishing, and sculpting. Based on her analysis of unfinished specimens, Minich argues that tabular pieces of pipestone were pecked into a rough shape with a hammerstone before being ground smooth with a sandstone abrader. After forming the basic shape of the pipe, holes were drilled using one of several methods. Wand and cane drilling is one method that uses drills made of sticks or reeds to work sand against the stone. Flint or chert drills could also have been used to make smaller holes or drill harder material. Minich (2004:48) also argues that copper drills could have occasionally been used. Polishing was carried out by rubbing animal fats or plant materials mixed with abrasive agents over the pipe with a strip of leather. Finally, incised details such as animal features and abstract symbols would have been etched with a sharp flint tool, something like a bladelet. Similar techniques were probably used to produce slate or shale gorgets.

Shell beads could have been drilled by methods similar to those described by Minich (2004) for pipestone (see also Yerkes, 1983). On the other hand, Kozuch (1998:85) describes an ethnographically documented method of producing holes in shell by using focused flames to weaken the area and then punching it out with a hammer.

Crafts made from perishable materials, such as plant fibers and wood, may not be present in the archaeological record due to differential preservation but nonetheless could also have involved bladelets at certain manufacturing stages. Hurcombe (2014) argues that a wide variety of siliceous and non-siliceous plants were worked in a number of different ways to produce fiber crafts. For example, reeds, grasses, sedges, or weeds many be cut, scraped, split, pounded or shredded in fresh, dry, or rehydrated states using a variety of lithic and non-lithic tools. The most relevant of these motions to Hopewell bladelets are scraping and shredding. Scraping plant material may be done at several stages in the processing of materials for fiber objects. Hurcombe (1998:206–208) argues that a stone tool may be used in a scraping motion to flatten stems, separate fibers, and remove pith.

Bone presents similar problems to plant material in terms of both preservation and its occurrence in both craft and subsistence contexts. Microwear evidence for bone craft production is less ambiguous because bone engraving and drilling would have been limited to craft activities. For example, Seeman (2007:173) notes the common occurrence of flutes, rattles, and gorgets made of human bone in Hopewell contexts. Motions such as engraving and drilling would not have any place in subsistence practices or the production of bone tools as these motions have not been employed in any replicative experiments (Keeley, 1980; Gijn, 1990; Vaughan, 1985; Yerkes, 1987).

The production of leather crafts, like those discovered at the Mount Vernon site/GE Mound (12PO885) (Seeman, 1995; Tomak and Burkett, 1996), would have required cutting and scraping of Q6 both fresh and dry hide as part of the preparation process. These same cutting and scraping motions would also be sued to process hides for non-craft uses as well. Finishing of the "decorated leather objects" (Tomak and Burkett, 1996:359), however, would have involved engraving and perforating in order to make the final intricate designs. Thus, these finer, finishing motions probably reflect craft production.

6. Microwear results

The results of the microwear analysis are displayed graphically in Figs. 3 and 4. For individual artifact functional interpretations see Supplementary Material online. Additionally, a more detailed analysis of each locality is presented below.

6.1. North Fort gateways

Overall, 45 of 138 bladelets from four different North Fort Gateways were utilized. Meat/fresh hide butchering was the most common tasks performed with bladelets. Relatively large proportions of bladelets were also used to cut soft plant as well as work dry hide, stone, and bone/antler.

In Gateway 3, five of the 18 bladelets examined from a pit feature were utilized. Bladelets from the feature were used to butcher meat, cut dry hide, scrape bone/antler, and engrave stone. In the Gateway 13 area, 20 of 48 bladelets were utilized. The most common task was meat/fresh hide butchering followed in descending order by plant cutting, dry hide working, bone/antler working, and engraving stone. In the Gateway 7 area, 7 of 15 bladelets were utilized. Microwear evidence indicates that bladelets were used for butchering meat, cutting soft plant, working bone/antler, and engraving stone. Overall, 13 of 57 bladelets from Gateway 84 were utilized. Engraving stone and butchering meat/fresh hide were the most common tasks followed by working dry hide and bone/antler.

The majority of bladelets from Gateway 84 were recovered from the artifact rich deposit associated the two limestone pavements on the outer face of the embankment wall [Connolly's (2004:41) form 3]. Within this deposit, most bladelets were used to engrave stone while meat/fresh hide butchering, hide and bone/antler working were also represented.

6.2. Lots 17 and 18

Overall, 38 of 105 bladelets examined from Lots 17 and 18 showed evidence of utilization. Butchering meat/fresh hide was by far the most common task while similar, lesser numbers of bladelets were used to work bone/antler, dry hide, and wood. Bladelets used on plant, shell, and stone were present in minimal numbers. One bladelet shows evidence of hafting.

Feature 144 is a large (6 m diameter) pit which contained thousands of chipped stone artifacts and two Hopewell series rim sherds (Cowan et al., 2004:120). A total of 26 of 71 bladelets from feature 144 showed evidence of utilization. Meat/fresh hide, dry hide, bone/antler, wood, and soft plant working are all present on at least two bladelets. Of the four bladelets examined from postmolds in this area only one was utilized—to scrape bone/antler. Eleven of 29 bladelets recovered from the backdirt of this stripped area were utilized. Only three tasks were represented with meat butchering being most common, bone scraping present on a couple of bladelets, and one bladelet used to cut meat and stone.

Cowan et al. (2004:120) suggest that the structures in Lots 17 and 18 were not typical habitation areas due to low amounts of fire-cracked rock, subsistence remains, pottery and storage facilities coupled with the abundance of bladelet production and late-

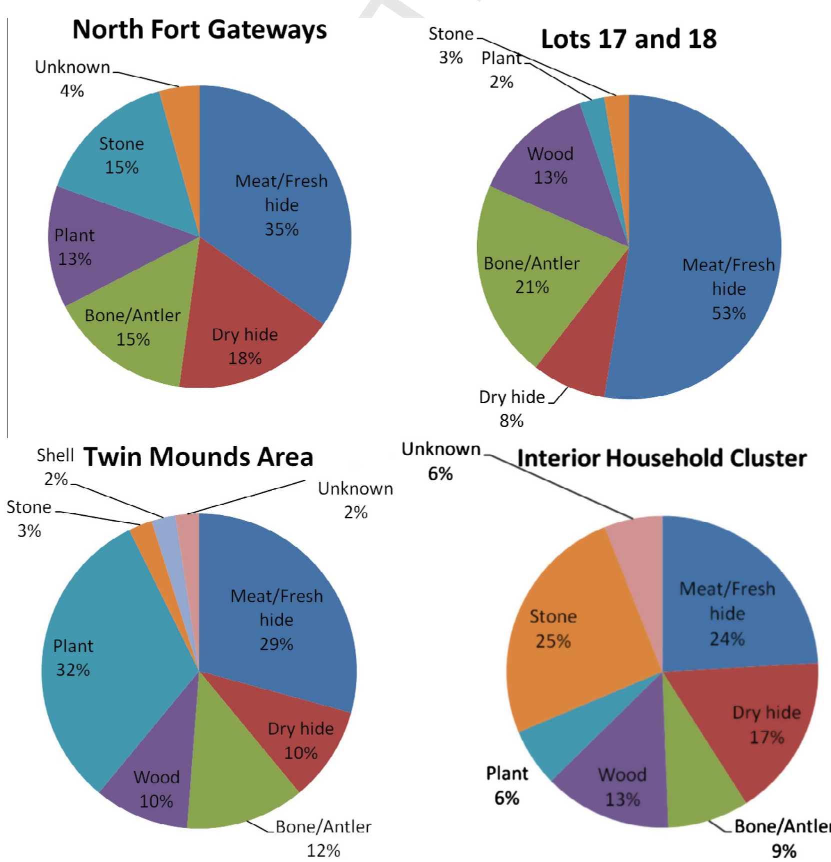

Fig. 3. Summary of the proportion of bladelets used to work different materials at Fort Ancient.

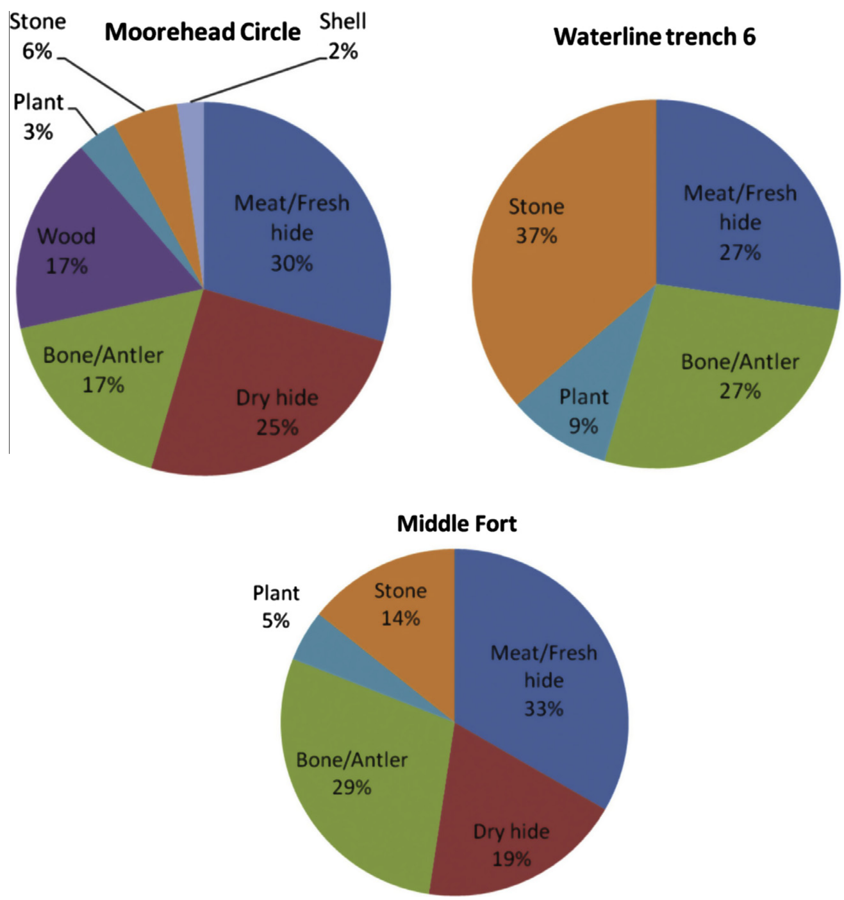

Fig. 4. Additional summary of the proportion of bladelets used to work different materials at Fort Ancient.

stage bifacial reduction debitage. The microwear data indicate that the preparation of meat was a common activity at the structures. However, a number of additional activities were conducted in this area as well pointing to a more generalized function, probably related to numerous relatively short term visits to the earthworks (Cowan et al., 2004:123).

6.3. Twin Mounds area

Overall, 42 of 98 bladelets from the Twin Mounds area were utilized. Soft plant was the most common material worked followed closely by meat/fresh hide and including bone/antler, wood, dry hide, shell, and stone in descending order. Cutting was the most common motion employed followed by scraping, engraving, and sawing. One bladelet from the Twin Mounds area was hafted.

Units within Twin Mounds area can be divided into three basic contexts; those with stone pavements, those without stone pavements, and plowzone. Connolly (1997) classifies those units without stone pavements, which contain numerous post molds and pit features, as habitation areas while describing the stone pavements as corporate activity areas. Comparison of utilized bladelets from the habitation units and the pavement units shows that those from the habitation context were used for a wider variety of tasks. In the habitation areas, 15 of 40 bladelets were utilized. Dry hide and wood working were the most common tasks in the habitation sample followed but plant cutting, bone/antler working, and butchering meat. Additionally, one bladelet was used to engrave stone. In the pavement areas, nine of 23 bladelets were utilized. Bladelets from the pavement contexts were used to work plant, meat, and bone/antler. The restriction of materials worked in the pavement sample to plant and animal products suggests possible feasting related activities. However the use of one bladelet to scrape soft plant material is more likely related to fiber artifact production and not food consumption.

In the plowzone, 18 of 35 bladelets were utilized. The plowzone contexts are more similar to the pavement than the habitation in that bladelets were used for a more restricted range of tasks, mostly related to meat and plant processing. However, there is a great deal of continuity in microwear patterns in units above habitation and pavement contexts. For example, of nine utilized bladelets that were recovered in the plowzone above limestone pavements, six were used to process soft plants and three were used to butcher meat. The plant processing activities included another example of a bladelet used to scrape plant for fiber processing. Conversely, the nine utilized bladelets recovered in the plowzone above habitation contexts were used to butcher meat, cut soft plant, saw bone/antler, scrape wood, and cut shell. Connolly (1997:256) suggests that the plowzone in this area is composed of soil from the Parallel Walls but this continuity in microwear patterns suggests that historic plowing truncated prehistoric deposits below the Parallel Walls as well.

6.4. Interior household cluster

Overall, 80 of 261 bladelets from the IHC were utilized. Most bladelets were used to engrave stone and butcher meat/fresh hide while more than 10% of the utilized bladelets were also used on dry hide and wood. Fewer numbers of bladelets were used for bone/antler and soft plant.

The majority of the bladelets from the IHC were associated with structures five and eight. This can be attributed to the complete excavation of large pit features associated with each of the structures. It is possible that similar features were associated with other structures in the cluster but went unexcavated. Thirteen of 49 bladelets recovered from units associated with structure five were utilized. Engraving stone, working dry hide, and cutting soft plant were the most common activities undertaken while one bladelet was used to butcher meat/fresh hide. In the excavation units within structure eight, 22 of 89 bladelets recovered were utilized. Engraving stone and butchering meat/fresh hide were the most common activities performed. Other bladelets were used to cut soft plant, work dry hide, work bone/antler, and scrape wood. To the northwest of structure five excavations uncovered a large (1.8 m diameter, .45 m depth) refuse pit (feature 316/95) with slumping walls, suggesting a long period of deposition (Lazazzera, 2004:94). Twelve of 24 bladelets recovered from this feature were utilized. Wood and stone working (including some of the only examples of drilling in the entire study assemblage) were the most common activities conducted by bladelets within the pit while dry hide working and meat butchering were also represented. Similarly, a large (2 m diameter, .2 m depth) refuse pit (feature 483/95) was excavated on "what may have been the [NE] exterior" of structure eight (Lazazzera, 2004:93). Seven of 36 bladelets examined from feature 483 were utilized. Butchering meat/fresh hide was the most common activity noted on bladelets from this feature while single bladelets were used for engraving stone and scraping wood and bone/antler. One bladelet was used on an unknown material.

Combining the structure and associated refuse pit feature microwear results indicates that the major difference between the two structures is the larger portion of bladelets in structure 8 used to butcher meat/fresh hide. Minor differences include more hide, wood, and plant working in structure five with bone/antler present in structure eight but absent in structure five.

Other structures in the IHC produced substantially fewer bladelets for study due to the lack of associated pit features as noted above. One of two bladelets from features in structure two was used to scrape bone/antler. Three of eight bladelets examined from structure four were utilized: two for butchering meat/fresh hide and one cutting soft wood. Neither of the two bladelets examined from structure six showed evidence of utilization. Minimal numbers of bladelets were examined from contexts outside of structures. For example, two of four bladelets from features associated with the northern mechanically stripped area were utilized. One was used to butcher meat/bone and the other was used to scrape bone/antler. Three of 13 bladelets recovered from the general sheet midden, but not associated with any particular structures, were utilized. Among this sample, two bladelets were used to saw wood and one was used to scrape dry hide. East of the IHC, in what

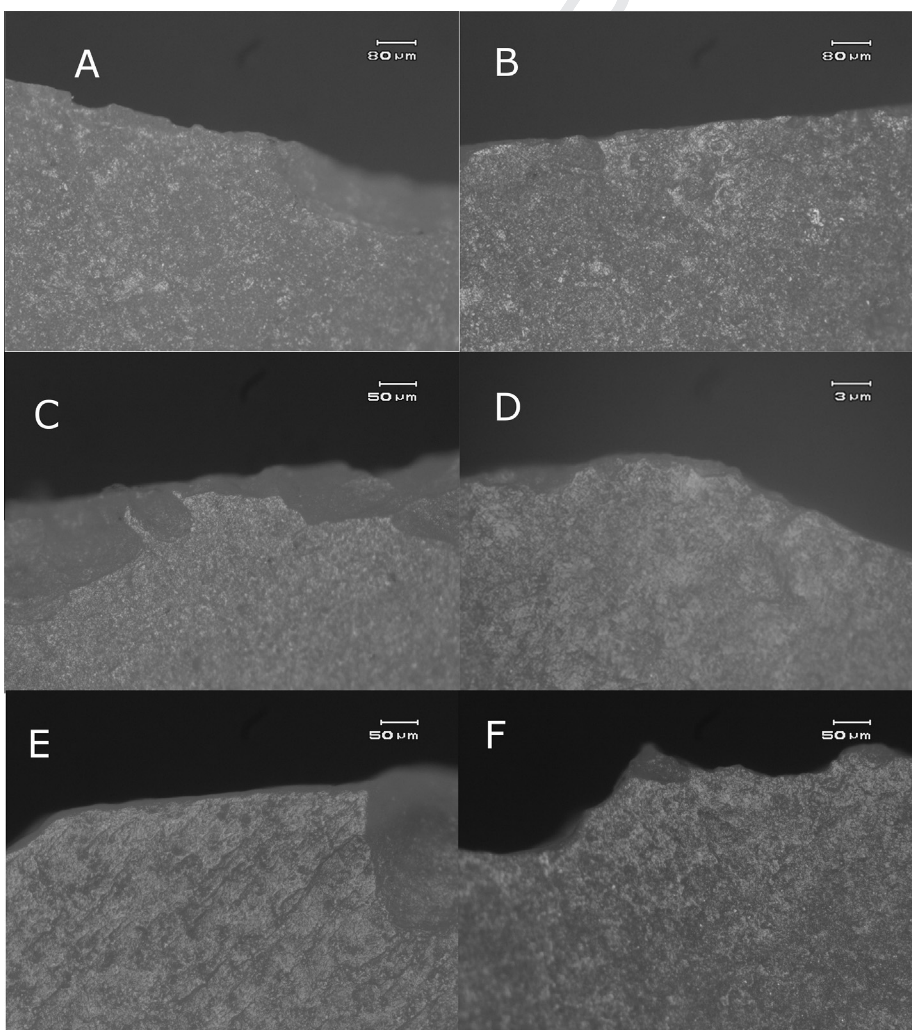

Fig. 5. (A) Edge of unutilized replica bladelet made from Wyandotte flint viewed at 125× magnification; (B) generic weak polish on lateral edge of replica bladelet used to engrave mica for 5 min (magnification 125×); (C) generic weak polish on distal bladelet segment (OHC cat. #2405.230) from Gateway 84 (magnification 187.5×); (D) meat polish from experimental flake used to butcher white tailed deer (magnification 187.5×); (E) meat/fresh hide polish on medial bladelet segment (OHC cat. #A1039 703.01) from the Twin Mounds Area (magnification 187.5×); (F) meat/fresh hide polish on proximal bladelet segment (OHC cat. #A1039 1102.40) from the Twin Mounds Area.

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Lazazzera (2004) refers to as the Water Treatment/Access Road area, bladelets were recovered from nine of eleven 2 × 2 m test units. Due to the small sample size and lack of definitive association with specific structures, the 26 bladelets from these units are treated as a single sample. Twelve of the bladelets were utilized, mostly for meat butchering but also for engraving stone, bone/antler working, and perforating dry hide.

6.5. Moorehead Circle

Overall, 77 of 89 of the bladelets from the Moorehead Circle showed evidence of utilization. Analysis of an initial sample of 66 bladelets has been presented elsewhere (Miller, 2014a). However, 23 additional bladelets were subsequently analyzed. An updated summary of the materials worked by bladelets from the Moorehead Circle is presented in Fig. 5.

The majority were used to butcher meat/fresh hide while substantial numbers were also used to process dry hide, bone/antler, and wood. Stone, plant, and shell microwear was identified on minimal numbers of bladelets.

6.6. Waterline Trench 6

Overall, 12 of the 34 bladelets examined from Waterline Trench 6 showed evidence of utilization. Sawing bone/antler and engraving stone were the most common tasks while butchering meat/fresh hide and soft plant cutting were also present.

The majority of the bladelets examined from this context came from feature 52/96 where 9 of 29 bladelets were utilized. Stone and meat/fresh hide wear was most common on bladelets from this feature with bone/antler, and plant wear present on one bladelet each. Three of four bladelets examined from nearby features were utilized (two on bone/antler and one on stone). One bladelet from backdirt was unutilized.

6.7. Middle Fort

Overall, 18 of 37 bladelets examined from Middle Fort localities were utilized. Meat/fresh hide and bone/antler were the most common materials worked while dry hide, stone, and plant wear was present on a few bladelets. Cutting was the most common motion employed while scraping, engraving, and sawing were also present on limited numbers of bladelets.

On the terrace east of gateway 18, 10 of 25 bladelets examined were utilized. Bone/antler, meat/fresh hide, stone, and dry hide were the materials worked in order of abundance. Cutting, sawing, engraving, scraping, and perforating were motions employed in descending order of abundance. Eight of 10 bladelets recovered from beneath the embankment wall on the south side of Gateway 58 were utilized. The bladelets were all recovered from levels in which postmolds were identified. Meat/fresh hide, dry hide, bone/antler, and stone were worked by bladelets from this context. Cutting was the most common motion employed while scraping, engraving, and perforating were also employed.

6.8. Microwear results by material worked

A focus on the materials worked with Hopewell bladelets in different localities gives insights into craft production at the earthworks. Meat/fresh hide was the most common material worked in most areas of Fort Ancient (Figs. 3–5). These results are not discussed further here—despite the importance for discussions of Hopewell feasting—as meat was not a craft material.

The amount of dry hide working was fairly consistent throughout all localities at Fort Ancient (Figs. 3, 4 and 6). In most localities, dry hide working hovered around 10–15% of the total materials worked. In the Moorehead Circle, 61% of the bladelets used to work dry hide were used to perforate the material. In all other localities, cutting and scraping dominated the dry hide working tasks.

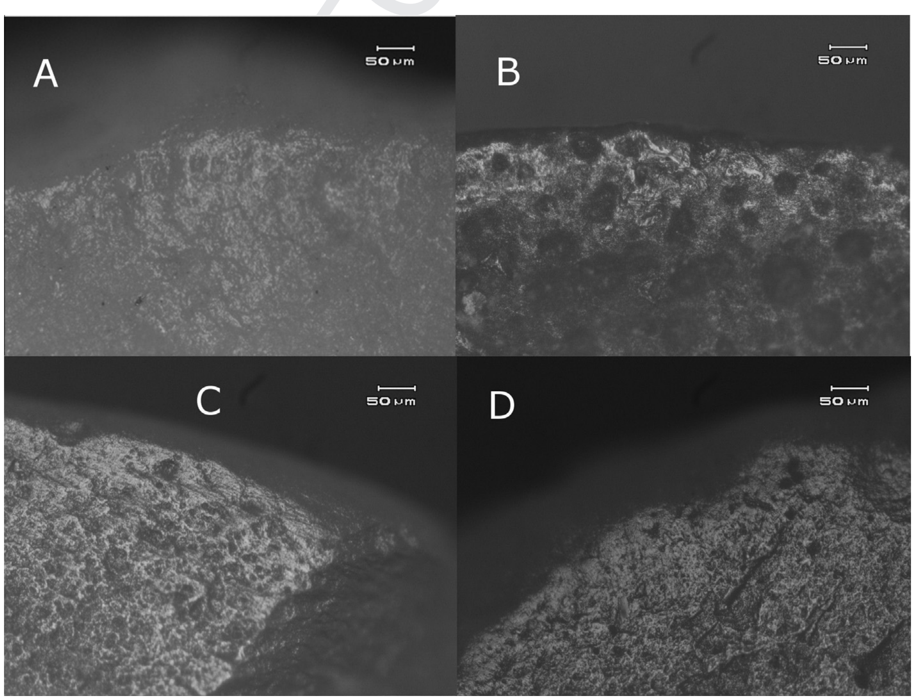

Fig. 6. (A) Experimental bladelet used to scrape dry hide for 30 min; (B) medial bladelet segment (OHC cat. #. A1039 703.04) recovered in the Twin Mounds Area displaying edge rounding and pitted polish characteristic of scraping dry hide; (C) medial bladelet segment (OHC cat. #A1039 2325.60) from Gateway 84 used to cut dry hide; (D) proximal bladelet fragment (OHC cat. #A1039 2325.115) recovered in Gateway 84 used to scrape dry hide.

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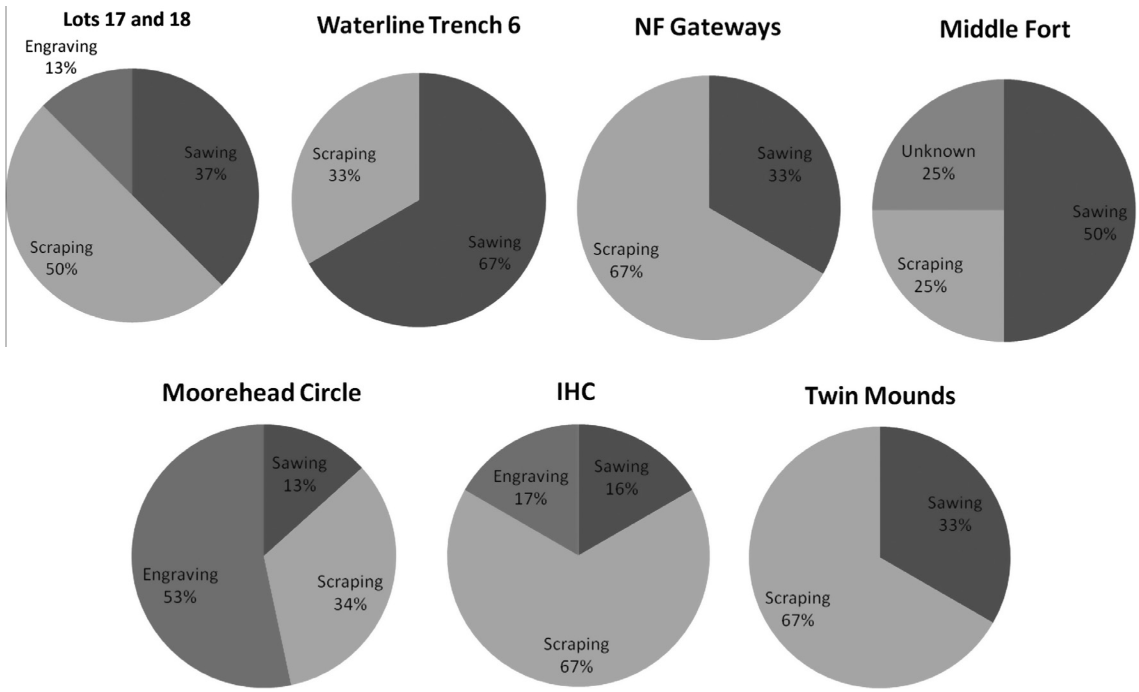

Fig. 7. Summary of the proportion of bladelet used to process bone/antler at Fort Ancient.

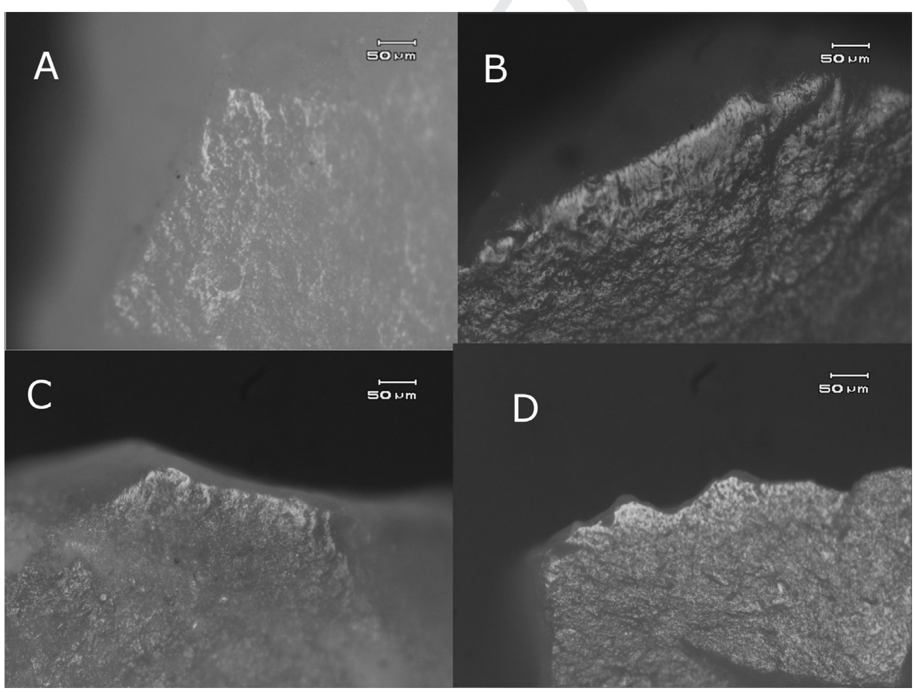

Fig. 8. (A) Experimental bladelet used to engrave wet bone for 15 min; (B) polish from scraping bone/antler on proximal bladelet segment (OHC cat. #A1039 703.05) from the Twin Mounds Area; (C) polish from scraping bone/antler on a complete bladelet (OHC cat. #A1039 2453.02) recovered from a post hole in the IHC; (D) microwear from engraving bone/antler on proximal bladelet segment (OHC cat. #A1039 2348.55) recovered in Gateway 84.

Perforating is identified as a craft production motion signifying that leather craft products were manufactured in the Moorehead Circle (Miller, 2014a).

The range for bone/antler working was larger than dry hide with most localities falling between 7% and 17% of the total materials worked (Figs. 3 and 4). Scraping was the most common motion employed in most localities (Figs. 7 and 8). The high proportion of bladelets used to engrave bone/antler at the Moorehead Circle suggests that these craft objects were produced there.

Wood working was highly variable with most localities having few to no bladelets used for the task (Figs. 3 and 4). When wood working was observed, sawing and scraping were the most common motions employed (Fig. 9). In the Moorehead Circle and the IHC about a quarter of the bladelets used for woodworking were

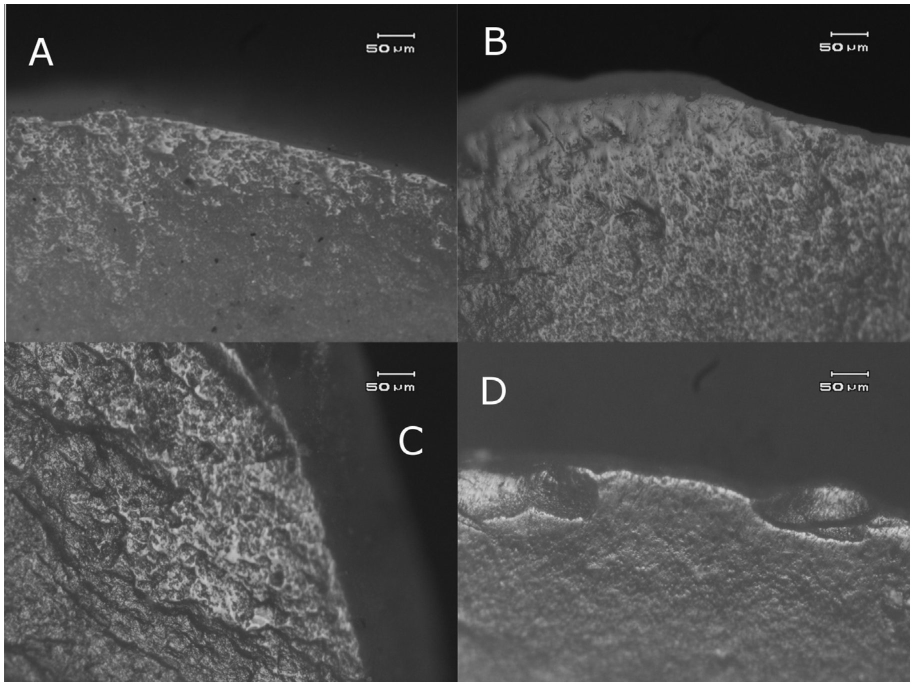

Fig. 9. (A) Experimental bladelet used to saw green Willow branch for 15 min; (B) polish from scraping wood on distal bladelet segment (OHC cat. #A1039 674.06) recovered in the Twin Mounds Area; (C) polish from cutting soft wood on medial bladelet segment (OHC cat. #A1039 2250.09) from a pit in the IHC; (D) microwear from scraping wood on distal bladelet segment (OHC cat. #A1039 2869.21) from the IHC.

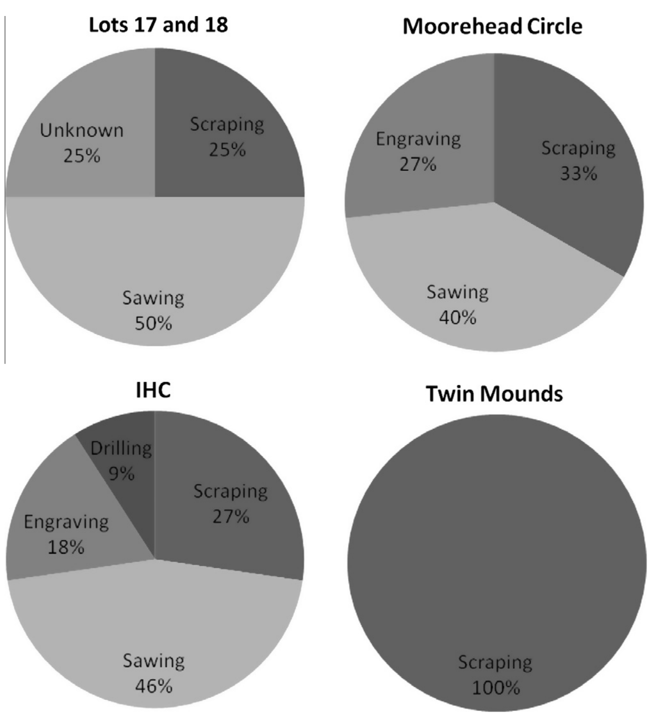

Fig. 10. Summary of the proportion of bladelet used to process wood at Fort Ancient.

used to engrave wood (Fig. 10). Drilling was only present in the IHC. This indicates that wood craft products were manufactured in the Moorehead Circle and the IHC.

While the number of bladelets employed in plant processing was highly variable as well, every locality, except for Gateway 84 and Lots 17 and 18, contained at least some bladelets used for this task (Figs. 3 and 4). Plant working was most common in the Twin Mounds area. The North Fort Gateways contained similarly high numbers of bladelets used for plant cutting.

Some of the bladelets from the Twin Mounds area can be attributed to use in craft activities. Specifically, two bladelets contain definitive evidence of use on plant material in a scraping motion (Fig. 11). The two bladelets used to scrape plant material were most likely used in fiber production. Scraping is well documented in fiber processing and scraping would not be an effective means of harvesting plant material (Hurcombe, 1998, 2014). The identification of two tools used in fiber production from the Twin Mounds Area indicates that other bladelets with evidence for plant processing were used for this purpose as well. These bladelets could have been used in other stages of fiber processing (Hurcombe, 2014).

All localities examined contained evidence of stone working (Fig. 12). Stone working was most intensive in the IHC (Figs. 3 and 4). Waterline Trench 6 and Gateway 84 each had stone working constitute relatively large proportions of the total materials worked with bladelets. Although Waterline Trench 6 and Gateway 84 have relatively high proportions of stone working, they also have the lowest sample size of any in the study area making their relative proportions easily skewed by small changes. Stone working was relatively low in Lots 17 and 18, the Moorehead Circle, the Twin Mounds area, and many of the North Fort Gateways.

Shell working was the least common wear pattern encountered at Fort Ancient (Figs. 3 and 4). Shell working was only identified on bladelets from Gregory's Field, the Moorehead Circle, and the Twin Mounds Area. There is no evidence for large scale shell artifact production at Fort Ancient, preventing any conclusive interpretation. Perhaps shell manufacturing did not occur at these sites or shell working was accomplished with tools other than bladelets.

7. Discussion

The variety of activities performed with bladelets both in and near Fort Ancient demonstrates that the recent debate on the generalized versus specialized nature of Hopewell bladelets

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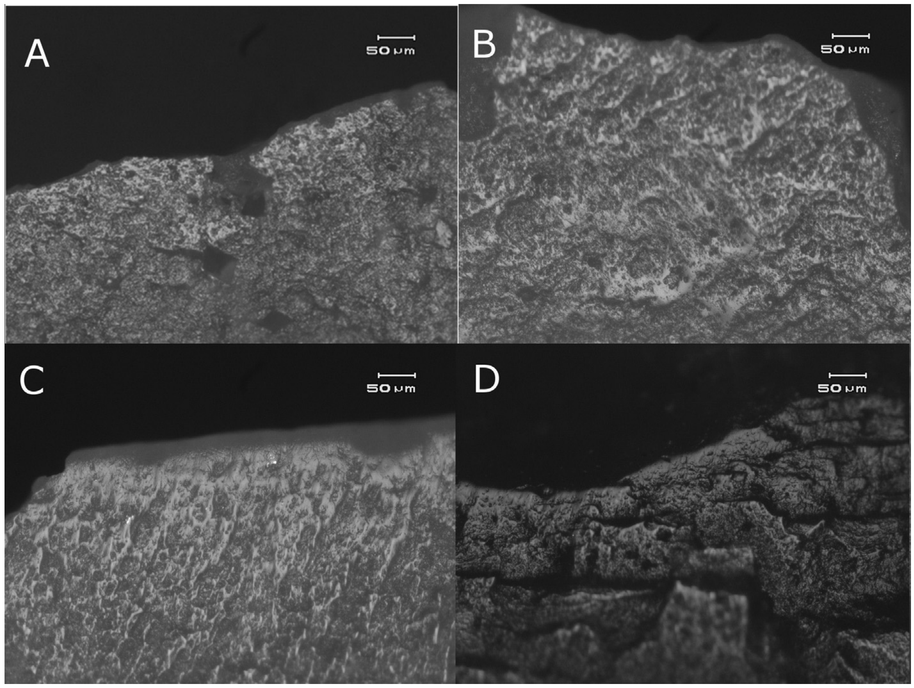

Fig. 11. (A) Experimental bladelet used to cut wild grass for 30 min; (B) plant cutting microwear on medial bladelet segment (OHC cat. #A1039 1102.03) from the Twin Mounds Area; (C) polish from scraping plant material on distal bladelet segment (OHC cat. #A1039 1134.14) from Twin Mounds; (D) polish from scraping soft plant on medial bladelet segment (OHC cat. #A1039 1102.103) recovered in the Twin Mounds Area.

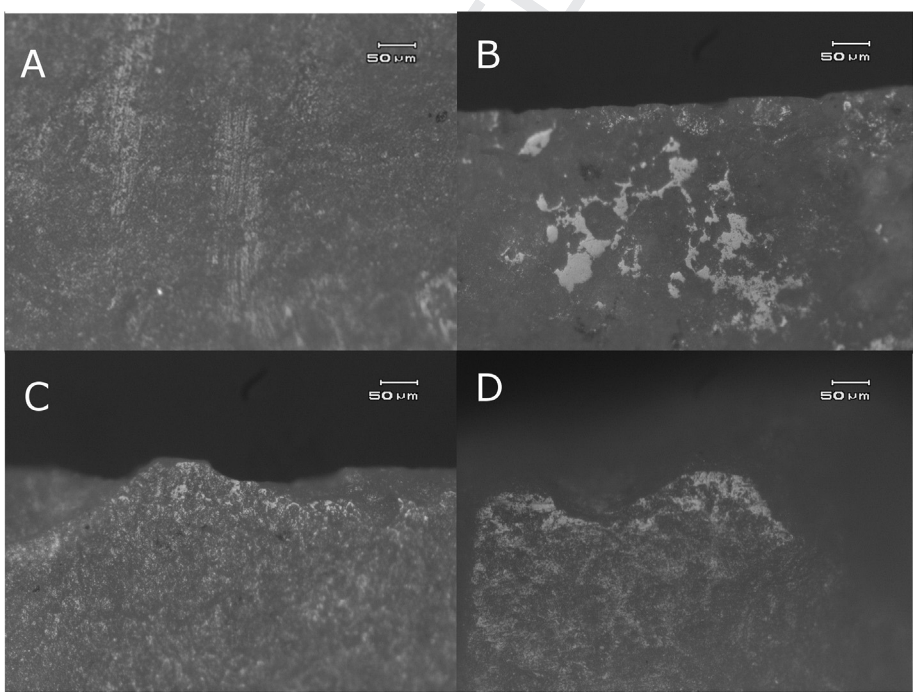

Fig. 12. (A) Experimental bladelet used to engrave mica for 15 min; (B) proximal bladelet fragment (OHC cat. #A1039 2198.16) from a posthole in the IHC used to engrave stone; (C) distal bladelet segment (OHC cat. #A1039 2882.03) from the IHC used to engrave stone; (D) distal bladelet segment (OHC cat. #A1039 2899.07) from feature 316 in the IHC used to engrave stone.

(Miller, 2014a; Odell, 1994; Yerkes, 1994) is an oversimplified view of this technology. It is also clear that a simple model of singular bladelet function cannot characterize the multitude of tasks conducted with bladelets at Hopewell earthworks. Bladelets were not used for one type of specialized activity at Fort Ancient. Additionally, the types of activities in which bladelets were employed varied within Fort Ancient. Hopewell bladelets were utilized in craft production but they much more than craft implements. Understanding Hopewell bladelet function must also take into account the unutilized specimens as well because the majority of bladelets were unutilized in most localities. This pattern mirrors the low proportion of utilized bladelets documented at numerous

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other Hopewell earthwork and non-earthwork sites (Yerkes, 1994, 2009). Several factors may be at work to account for this pattern. First, the vast majority of bladelets reported here are actually bladelet fragments. It is possible that the tools broke during use and the utilized portion remains undiscovered. Statistical analysis indicates that no significant difference exists between microwear on complete, proximal, medial, and distal bladelets indicating that breakage and recovery are random processes (Miller, 2014b:182). Second, once the core is prepared, blade reduction allows for the production of numerous tools in a relatively short period of time. Perhaps unused bladelets were being saved for later use, or only those bladelets possessing certain attributes were used as tools. Third, bladelets served more roles than just tools for processing raw materials. Bladelets were important elements in symbolic communication, meaning they have been produced for exchange or display in addition to use (see also Hofman, 1987; Kay and Mainfort, 2014; Morrow, 1987; Yerkes, 2002). Finally, while polishes, striations, and edge damage form within a few minutes of stone tool use they do not form instantaneously with use. In other words, tools used very briefly may not contain evidence of use (see Gijn, 1990; Keeley, 1980; Vaughan, 1985 for additional discussion of microwear formation).

The lone exception this pattern of low overall rates of bladelet utilization is the Moorehead Circle. Nearly 90% of the bladelets recovered from this ritual feature were utilized. This pattern reflects the ritual function of the area (Miller, 2014a). Feature data indicate that construction and destruction occurred with careful intentionality. For example, massive posts were set and then removed, a mound of culturally sterile red soil was created, and the floor of the roofed structure within the Moorehead Circle was renewed with successive layers of charcoal and clay (Miller, 2014a:87). The pottery placed around the central mound of red soil indicates that careful planning went into bringing artifacts to the feature for specific purposes. Similarly, those visiting the Moorehead Circle would have brought only the number of bladelets necessary to perform the tasks at hand. Bladelets would not have been produced nor would extra bladelets have been stored in the Moorehead Circle as in other localities at Fort Ancient. This process would serve to inflate the proportion of utilized bladelets as unutilized debitage and surplus bladelets are largely absent.

The microwear results demonstrate that craft production was relatively high in three areas at Fort Ancient. Stone working is relatively high in the Interior Household Cluster, dry hide perforating and engraving is high in the Moorehead Circle, and plant fiber processing is high in the Twin Mounds area. Possible ritual craft correlates include mica and slate objects at the IHC, leather craft products in the Moorehead Circle, and textiles or basketry at the Twin Mounds area.

Based on the microwear data, there is not much evidence for craft production activities in Lots 17 and 18. Several other lines of evidence suggest that the inhabitants of the structures were involved in craft production involving obsidian and crystal quartz. For example, a cache of several dozen stone tools made of obsidian, crystal quartz, and Wyandotte flint was discovered by the landowner about 20 m west of the structures (Connolly, 1997:267; Essenpreis and Moseley, 1984:26). At present it is impossible to definitively link the cache tools with Lots 17 and 18, within the mechanically stripped area of Lots 17 and 18 "[a] few small flakes of obsidian and crystal quartz were recovered" in addition to obsidian bladelets (Cowan et al., 2004:119). Similarly, Connolly's (Connolly and Sullivan, 1998:70) surface survey recovered "several obsidian and quartz flakes that indicate reworking or final reduction of these materials in the vicinity" of Lots 17 and 18. Therefore the artifact assemblage in Lots 17 and 18 suggests that the inhabitants were producing crafts from exotic chipped stone materials, most notably obsidian and crystal quartz.

Thus, microwear and other contextual evidence indicate that craft production was relatively intensive at four locations within and near Fort Ancient. The craft products produced included stone objects in the IHC, fiber products in the Twin Mounds area, and exotic chipped stone tools in Lots 17 and 18. Additionally, the Moorehead Circle was also a center of craft production as numerous bladelets were used to perforate dry hide.

8. Conclusion

In the following section, insights from this study as well as previous analysis of Hopewell society are examined through the lens of ritual economy to understand the connection between subsistence, settlement, ceremonialism, and craft production. Recall that the *economics of ritual* refers to the economic acts necessary to properly participate in or host ritual events whereas the *ritual of economy* represents ritualized economic interactions between individuals, or the *ritual of economy*. Both of these processes are important for understanding craft production at Hopewell earthworks.

Microwear analysis on hundreds of Hopewell bladelets demonstrates that raw materials from far distant, and not so distant, places were imported into Fort Ancient and subsequently made into finished craft objects. Numerous craft objects have been recovered from the earthwork suggesting that at least some of these objects were exchanged and discarded locally. Similarly, Braun (1986:121) argues that while raw materials were obtained across long distances, the movement of finished objects was restricted to reciprocal exchange at Hopewell earthwork centers. In fact, numerous scholars characterize Hopewell exchange, both of craft objects as well as more mundane materials, as reciprocal. Hall (1980) argues that ethnographically known dispersed groups exchanged goods reciprocally as a means to create social ties. Both Braun (1986) and Hall (1980)—to varying extents—attribute the upswing in reciprocal exchange during the Middle Woodland period to reliance on horticulture, decreased mobility, and population pressure. Later, Hall (1997:156) noted that the Hopewell Interaction Sphere was part of an organizational solution to problems of life in populations subsisting on wild foods with limited gardening. In other words, exchanges at earthworks were necessary to integrate the dispersed members of Hopewell tribes (Yerkes, 2002). At least partial reliance on cultivated plants coupled with a dispersed settlement contributed to a conflict between the desire of dispersed households to remain independent and the need to maintain social buffers in times of scarcity. However this interdependence extended beyond subsistence to other aspects of household reproduction such as the need to attract mates (Hall, 1997; Yerkes, 2002). Therefore important Hopewell social ties created through reciprocal exchange were maintained not just for subsistence but also for other social needs. Hall's and Yerkes's arguments, based on ethnographic and ethnohistoric data, receive additional support from biodistance, isotopic, and genetic studies that demonstrate a great deal of biological interaction across large geographic areas during the Middle Woodland (Beehr, 2011; Bolnick and Smith, 2007; Pennefather-O'Brien, 2006). Thus the *ritual of economy* periodically brought normally dispersed Hopewell groups to earthwork centers to engage in reciprocal exchange for the creation and maintenance of the social ties necessary for household reproduction. These social ties were based on both biological and fictive kinship as created and reinforced through the ceremonial events (Hall, 1997). The exchanges were mediated by participation in ritual to ensure fairness and reciprocation of gifts in a manner directly predicted by the processes outlined in the *ritual of economy* (Watanabe, 2007). Individuals and groups were, therefore, not just interacting but integrating into meaningful tribal social units (Parkinson, 2002).

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The Hopewell *ritual of economy* was a long term process played out at earthworks involving the exchange and display of craft goods—among other items—between interconnected groups. The materials, time, and labor necessary to participate in these ritualized exchanges illustrate the importance of the *economics of ritual* in Hopewell interactions. Microwear analysis demonstrated that the production of craft goods occurred in many different localities at Fort Ancient. Thus ceremonial centers were major hubs in the organization of production (i.e., Spielmann, 1998, 2002, 2008, 2009). This suggests that groups were tied up in the *ritual of economy* as evidenced by production for the *economics of ritual*.

The *economics of ritual* certainly included other productive activities not directly addressed here such as monumental construction, feasting, and mortuary activities (Hall, 1980, 1997; Smith, 1992; Spielmann, 2002). However, these topics, especially mound construction and mortuary rituals, have received considerably more research attention than the organization of craft production.

The numerous localities with extensive evidence for craft production at Fort Ancient suggests that lots of labor, consisting of many different skill sets, was necessary for the communal ceremonial gearing up that occurred at the earthworks (Spielmann, 2008:66, 2009). In a similar vein, Bernardini (2004) argues that the creation and materialization of meaning associated with Hopewell earthworks occurred through their communal construction—experiential meaning—rather than by reference to their completed, final form—referential meaning. Bernardini's argument for the importance of experiential meaning in Hopewell ceremonialism extends beyond earthwork construction to craft production as well. In other words, experiencing Hopewell ceremonialism involved building earthworks and making craft goods by most, if not all, of the individuals gathered at earthworks, not just ritual specialists or aspiring aggrandizers. These attendees would also have participated in mortuary behavior as well considering the large-scale, communal nature of most burials at Fort Ancient (Moorehead, 1890).

Therefore, the production of, or more accurately the experience of producing, craft products was more important for the *ritual of economy* than the finished goods themselves. In other words, because production occurred at the earthworks with, or at least within sight of, other members of tribal groups the process of production served to form social ties and integrate the members of these dispersed societies as much as the exchanges did.

The scenario outlined for Fort Ancient highlights the interconnection between the *ritual of economy* and *the economics of ritual*. Groups were drawn to the earthworks in order to create social ties through participation in communal ritual and reciprocal exchange. These exchanges were fueled by intensified craft production organized and orchestrated by ritual participation. Clear and unequivocal evidence for segregated crafting at an Ohio Hopewell earthwork context involving bladelets as the crafting tool has been identified here for the first time as an integral part of this process. Ultimately, the *economics of ritual* documented at Fort Ancient—and probably at work in numerous small scale societies throughout time—were probably more about the creation of relationships than the creation of objects.

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Appendix A. Supplementary material

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.jaa.2015.03.005.

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