PERISHABLE MATERIAL CULTURE IN THE NORTHEAST

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Edited by
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CHAPTER 1

INTRODUCTION: PERISHABLE EVIDENCE IN THE NORTHEAST

Penelope B. Drooker

ABSTRACT

As an introduction to perishable material culture in northeastern North America, this chapter reviews some of the means by which evidence for objects made from organic materials is preserved in the archaeological record. Although rare in the Northeast, actual preservation of organic remains does occur through a variety of methods, including favorable environmental conditions, carbonization, association with metals, and very short-term burial. Most evidence, however, is indirect. Secondary evidence for now-vanished objects includes mineralization, impressions on pottery and other materials, stains on non-organic artifacts or in the soil, characteristics and patterns of disposition of non-perishable objects associated with organic artifacts that have disappeared, inferences from tools used to fashion organic materials, patterns of decoration or design in "hard" media such as pottery that echo forms made of perishable materials, and images of objects made from perishable materials. Examples of these methods of preservation are drawn primarily from in and around New York, plus some recent or less-well-known cases from other areas of the Northeast.

INTRODUCTION

As we all know, organic materials do not preserve well under typical archaeological conditions in the Northeast.[1] In other parts of the continent where more-complete assemblages of material culture have survived, an overwhelming proportion of remains — as much as 95 percent — consists of objects constructed from wood, bark, plant fiber, leather, fur, and feathers (Coles 1988:7-8; Croes 2001:358; Purdy 2001:xvii). Northeastern archaeologists know intellectually that this is so — for instance, from historical descriptions of Iroquois longhouses — but have become accustomed to relying extensively on artifacts of stone, pottery, and sometimes bone for their analyses of early lifeways.

In an effort to counteract that tendency, this book, like the Northeast Natural History Conference symposium from which it grew, brings together recent archaeological scholarship that makes extensive use of perishable material culture. The most recent in a series of similarly conceived volumes developed over the past two decades (e.g., Drooker 2001b; Drooker and Webster 2000; Petersen 1996a), it is the first one to focus solely on the Northeast. I have been very pleased at the range of geographical locations, time periods, materials, analytical methods, and research problems currently being addressed.

At the New York State Museum, we know in very practical terms how difficult it is to reconstruct prehistoric lifeways on the basis of extant archaeological artifacts alone. George Hamell, who researched and helped design the "Native Peoples of New York" permanent exhibits for the

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Figure 1.1. New York State Museum diorama depicting a Paleoindian quarry and campsite at the West Athens Hill archaeological site, Greene County.

Museum, scoured the entire archaeological collection, searching for exhibit-quality artifacts and good models for objects to be replicated for a series of life-sized dioramas. In his large notebook inventorying and describing likely examples, fewer than four pages out of 200 contain entries for likely specimens fashioned from perishable materials.

In the Museum's Paleoindian[2] life group (Figure 1.1), set at the West Athens Hill quarry site in Greene County, New York, ethnographic analogy was utilized extensively in depicting the non-lithic material culture. Skin clothing, for example, is modelled upon historical examples from the Arctic.

The Late Archaic life group (Figure 1.2a,b) is set at the Lamoka Lake site in Schuyler County. Here, a conscious effort was expended to show perishable material culture. Reproductions and depictions of bags, mats, wooden utensils, clothing, harpoons, fishing nets and lines, a weir, dugout canoes, fish-drying racks, and of course the dwelling, highlight the importance of organic materials in everyday life. For this exhibit, much data came from secondary evidence such as woodworking tools and thousands of netsinkers found at the site.

Between these two dioramas in the Museum is a purely archaeological exhibit (not illustrated), representing Early to Middle Archaic lifeways at the upper Susquehanna Valley Russ site. On display are actual artifacts. All are of stone. Although a variety of tools and weapons are represented, including spear points, knives, drills, scrapers, hammerstones, netsinkers, and pestles, this is surely a skewed portrayal of the realities of life in eastern New York 8,000 years ago.

The point, of course, is that it takes a conscious effort to reconstruct the richness of traditional material culture in the Northeast, and, inevitably, much will be missed due to lack of historical analogy or easily decipherable archaeological evidence. Therefore, it is very important for archaeologists to pay attention to the fragments of perishable material culture that do happen to survive.

In this broad-brush introduction to the chapters that follow, I review some of the important means by which evidence for perishable material culture is preserved, using examples mainly from in and around New York State plus some recently published or not widely known cases from other areas of the Northeast (Figure 1.3). Although rare in the Northeast, actual preservation of organic remains does occur through a variety of methods, providing some primary evidence for the utilization of perishable materials. Most evidence, however, is secondary, deduced from clues such as impressions of cordage on pottery, or tools such as stone gouges and bone

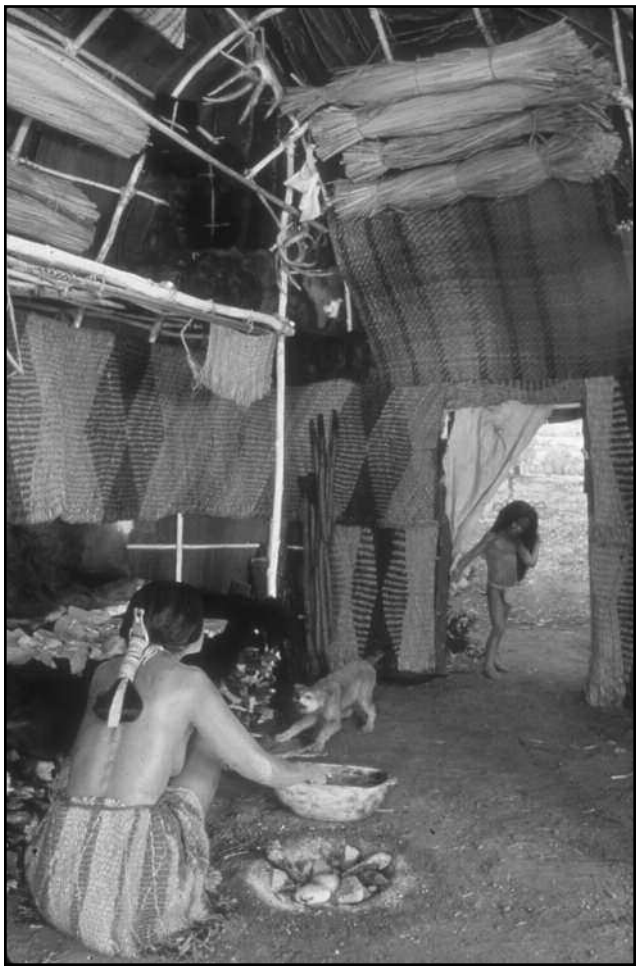

Figure 1.2. Details of New York State Museum diorama depicting a Late Archaic village at the Lamoka Lake archaeological site, Schuyler County. Top: Exterior scene. Bottom: Interior scene.

awls that were used to fashion objects from wood, leather, and other organic materials.

PRESERVATION OF PRIMARY EVIDENCE

In the Northeast, primary evidence of objects made from organic materials almost always is in fragmentary form. Fragments of such objects may be preserved through favorable environmental conditions, carbonization, association with metals, or very short-term burial.

ENVIRONMENTAL CONDITIONS DETERRING DETERIORATION

Good environmental conditions for preservation may be found at anaerobic wet sites, extremely dry sites, or continuously frozen sites. Although they are rare, both wet and dry sites have been excavated in the Northeast, providing

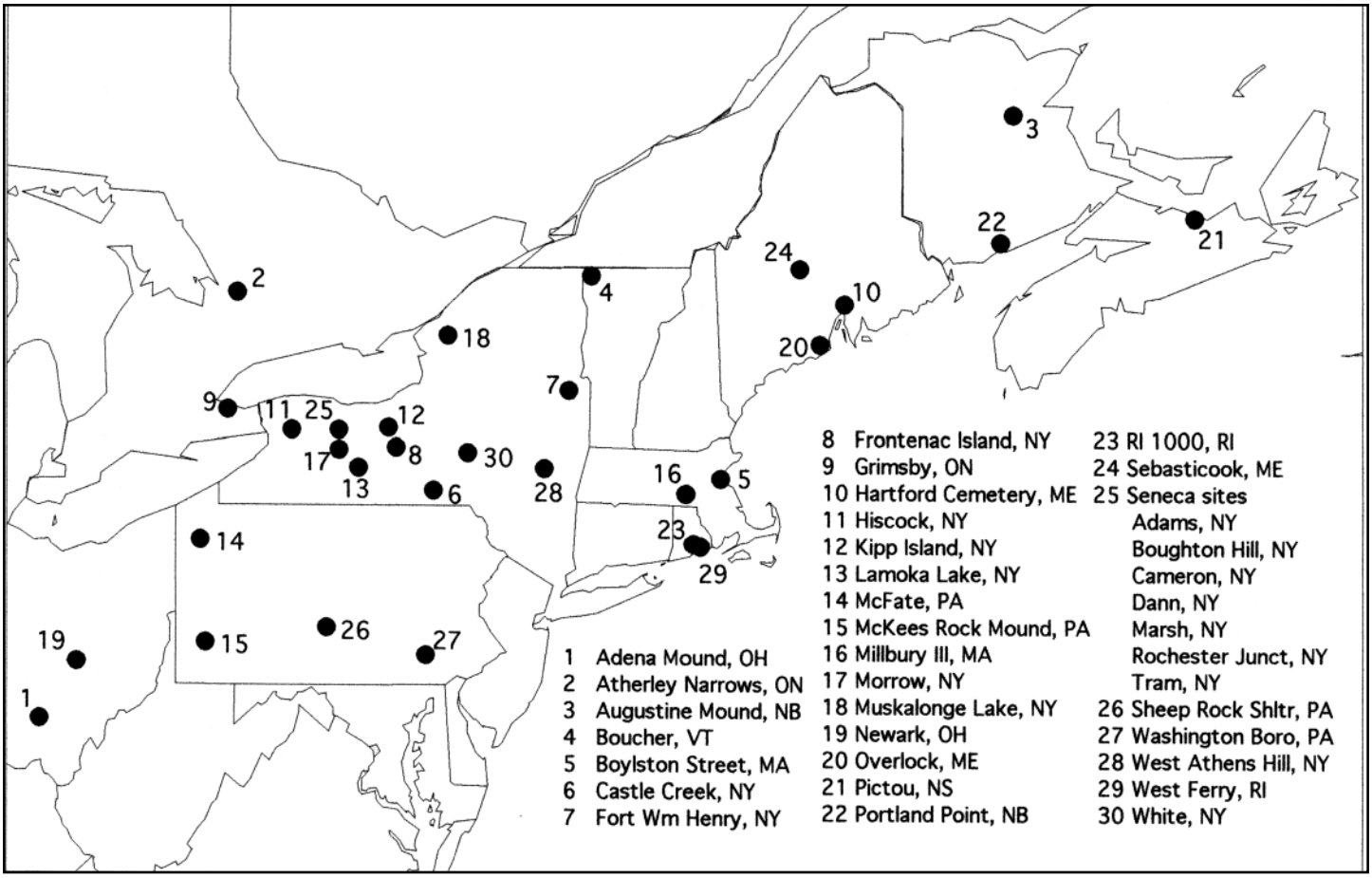

Figure 1.3. Map showing locations of sites mentioned in this chapter.

very important windows on the past.

Probably the best-known wet sites in the Northeast are previous locations of fish weirs. Just a decade ago, James Petersen and colleagues mapped and analyzed a wooden fish weir complex at Sebasticook Lake in central Maine that was utilized during the Late Archaic and Woodland periods (Petersen et al. 1994). With components dating as early as 5080 ± 90 B.P. (uncalibrated), it is possibly the earliest radiocarbon-dated fish weir in North America. Only two other well-mapped and directly dated wooden fish weirs are known from the Northeast, the Boylston Street weir in Massachusetts and the Atherley Narrows weir in Ontario (Décima and Dincauze 1998; Dincauze and Décima 2002; Johnson 1942, 1949; Johnston and Cassavoy 1978). Based in part on ethnographic analogies, Petersen and colleagues hypothesize that the construction, maintenance, and utilization of weirs at the Sebasticook facility might have required substantial effort and significant group cooperation (Petersen et al. 1994:216-217). In contrast, Elena Décima and Dena Dincauze conclude that the weirs constructed and utilized in Boston's Back Bay over a period of approximately 1,000 years during the Late Archaic were "small, short-lived, uncomplicated tidal operations" (Décima and Dincauze 1998:159).

Dryness figured importantly in the preservation of an extremely varied hunting and domestic assemblage at Sheep Rock Shelter in central Pennsylvania (Conway and Moser 1967; Hardenbergh 1967; Kent 1984:Figs. 43, 44, 46; Michels 1994; Michels and Dutt 1968; Michels and Smith 1967; Willey 1968, 1974). From one dry section of the shelter were recovered numerous pieces of fire drills, self-tipped arrow fragments, a fletched portion of an arrow, a wooden awl, leather thongs, pieces of perforated and

fringed leather, moccasin fragments, a leather bag, fur fragments, feathers, a great variety of plied and braided cordage, wider plaited strips interpreted as possible pack straps, fragments of knotted netting, three snares, two types of twined pliable fabrics, a woven sandal fragment, bark-strip matting or basket fragments, and a bark container mended with cordage. The midden from which they came was not only protected by the rock overhang but sealed with a thick layer of sheep dung — an unusual and fortuitous circumstance. Grass-filled depressions, identified as beds, also were preserved. Although materials from the shelter date as far back as Early Archaic, it is believed that the perishables are mainly Late Woodland to Protohistoric.

CARBONIZATION

Charring, or carbonization, which inhibits organic breakdown, is an important method of preservation for wood and fiber artifacts, just as it is for foodstuffs such as corn kernels. Charred specimens typically are brittle and extremely fragile, and must be handled with great care.

One very early example is a piece of plied cordage from the Transitional Archaic Millbury III site in Worcester County, Massachusetts (Largy and Leveillee 1995; Leveillee 2002:72). It came from a feature dated to 3410 $\pm$ 100 B.P. (B-56226), making it the earliest extant Archaic fiber artifact from New England.

William Ritchie illustrated several carbonized specimens in *The Archaeology of New York State* (1980). Plate 67 in that book is a photograph of a fragment of knotted netting taken from a large but fragile carbonized fish net with attached stone netsinkers that came from the Early Woodland Morrow site in Ontario County. From the same site came carbonized fragments of basketry (Ritchie 1980:Pl. 70). An *in situ* cremation at the White site, Chenago County, left a charred fragment of twined fabric, perhaps from a shroud (Ritchie 1980:259, Pl. 89). Plate 93 (Ritchie 1980) provides drawings of carbonized artifacts from the Late Woodland Owasco Castle Creek site near Binghamton, including two fragments of twined fabrics, a trot line for fishing, and compound fishhooks made from hawthorne spines attached together with cordage (see also 278-279, 290).

Examples of carbonized specimens curated at the New York State Museum include fragments of cordage from Middle Woodland and Late Woodland sites (e.g., Drooker 1996b; Funk and Kuhn 2001), twined fabrics, bark basketry and matting (e.g., Funk and Kuhn 2001), and wooden spoons and bowls. Effigy faces from late prehistoric-protohistoric wooden vessels (e.g., NYSM Cat. No. 35102, from the 17th-century Marsh site)[3] echo the much better known examples from contemporaneous pottery vessels (e.g., Wray et al. 1987:Fig. 3-35).

Barry Kent notes a number of important carbonized artifacts from Pennsylvania sites, including a "charred cord-wrapped potter's paddle" from the McFate site in the southwestern part of the state (Kent 1984:184, Fig. 47). Many artifacts preserved in this way are mundane, workaday tools and objects that are less likely to be deposited as grave goods and thus preserved by contact with metal (see below).

ASSOCIATION WITH METAL

Association with metal is extremely important in preserving or fossilizing organic materials in archaeological contexts. Most typically these are found with burials, where metal tools, ornaments, or ceremonial objects were deposited in contact with leather or fiber bags, clothing, or shrouds.[4] Metal beads and ornaments frequently preserve the cords or thongs on which they were strung or the fabric or leather to which they were attached.

Perhaps the oldest Northeastern examples are fossilized fragments of two Late Archaic twined fabrics from the Hartford Cemetery site in Maine, preserved as pyrite pseudomorphs; that is, metal corrosion products that replicate the shape of an object (see Definitions). Malinda Blustain and colleagues interpreted the fabrics as fragments of bags containing fire-starting kits (Blustain et al. 1999). Preserved layers of grass and hide also were found with one of the pyrites. One layer of skin, with fur on one side that allowed it to be identified as from a small mam-

mal, may have been painted with red ocher on its outer surface.

A hafted copper flaking tool was deposited with a burial at the Early Woodland Muskalonge Lake site in Jefferson County, New York (Ritchie 1980:183, Pls. 62, 63). The decoratively incised wooden handle and bark(?) fiber wrapping elements were preserved through proximity to the metal blade.

The Early Woodland Boucher site in northwestern Vermont produced a remarkable assemblage of cordage and complex fabrics from burial contexts, analyzed by Michael Heckenberger and colleagues (Heckenberger et al. 1990a, 1990b, 1996). Most of the 56 cordage fragments and 99 twined or braided fabric fragments were from garments, shrouds, or bags preserved by association with copper beads and ornaments (e.g., Petersen 1996b:Fig. 6.5). Yarns were fashioned from both plant fibers and animal hair. One leather-lined twined bag contained copper nuggets (Heckenberger et al. 1996:Fig. 3.9). Footwear and lower portions of garments not in contact with metal did not survive (Heckenberger et al. 1996:64).

Another Early Woodland site, Augustine Mound in New Brunswick, produced fabrics preserved by contact with hundreds of copper beads. For example, a fragment of a twined bag survived due to the fact that it contained "copper beads crimped over leather thongs" (Gordon 1997:59, Fig. 31). Comparable to the complex Boucher fabrics was a fabric that alternated spaced rows of plain twining with areas containing warps wrapped with bundles of moose hairs in a checkerboard pattern (Gordon 1997:59, Fig. 32).

Extant fabrics and other perishable artifacts from Early Woodland Adena and Middle Woodland Hopewell contexts often were preserved by contact with copper ceremonial objects, one example being the fragments of cloth preserved by contact with an imitation copper bear claw at the McKees Rocks Mound in southwestern Pennsylvania (Dragoo 1963:Pl. 49). In a different vein, Ellanor White examined the interior surfaces of Hopewell artifacts like copper earspools and determined that the very fine, gauze-like interlaced fabrics preserved on them were not present accidentally, but had been an integral part of the manufacturing process (White 1987:61-62, 88-89). Numerous other examples are illustrated in Chapters 4 and 5 of this volume, by Dee Ann Wymer and Virginia Wimberly, which focus on Hopewell fabrics and other perishables.

The Contact period[5] saw an abrupt rise in the presence of metal, and thus of the preservation of organic materials of all sorts: leather, fur, traditional twined fabrics (Figure 1.4; Drooker 1996e, 1996g), and European textiles, from utilitarian blankets and mantles (e.g., Drooker 1996e, 1996f, 1996g, 1996j; Whitehead 1993:Fig. 73; Willoughby 1935:247) to luxury textiles and decorations, such as a complex silk fabric from the 18th century Munsee Van Etten site in the lower Hudson Valley (Drooker 1996j) and a metallic bobbin lace from Geneva, Ontario County (Drooker 1996b). Hafted brass knives are known from a number of New York and New England sites. A fine example has been published from the late 16th century Seneca Adams site (Wray et al. 1987:55-56, Figs. 3-25, 3-82), from which also came a hafted oval chert biface, preserved by proximity to a large metal gorget (Wray et al. 1987:98, Figs. 3-23, 3-47). Another came from a burial in Winthrop, Massachusetts (Brasser 1978a:Fig. 2; Willoughby 1935:239-240). Bindings and foreshafts are preserved with brass arrowheads from 17th century Susquehannock sites in southeastern Pennsylvania (Kent 1984:Fig. 50).

Some of the earliest examples of Contact period perishables preserved by contact with metal come from 16th- and early-17th-century New Brunswick and Nova Scotia sites whose residents obtained copper kettles and other metal items from Basque fishermen (Gordon 1993, 1995, 1997; Harper 1956:28-34, 40-51; Whitehead 1987, 1993). A burial at Portland Point, New Brunswick, contained garment fragments including European woolen cloth and metallic "braid" trimming (Harper 1956:34). Preserved perishables at the Pictou site in Nova Scotia included a wooden bow, wooden knife hafts, swords with wooden handles and traces of leather scabbards, pieces of moccasins, a leather and birch-bark arm band, European cloth, and indigenous twined, interlaced, and sewn fabrics, bags, and matting (Gordon 1993, 1995, 1997;

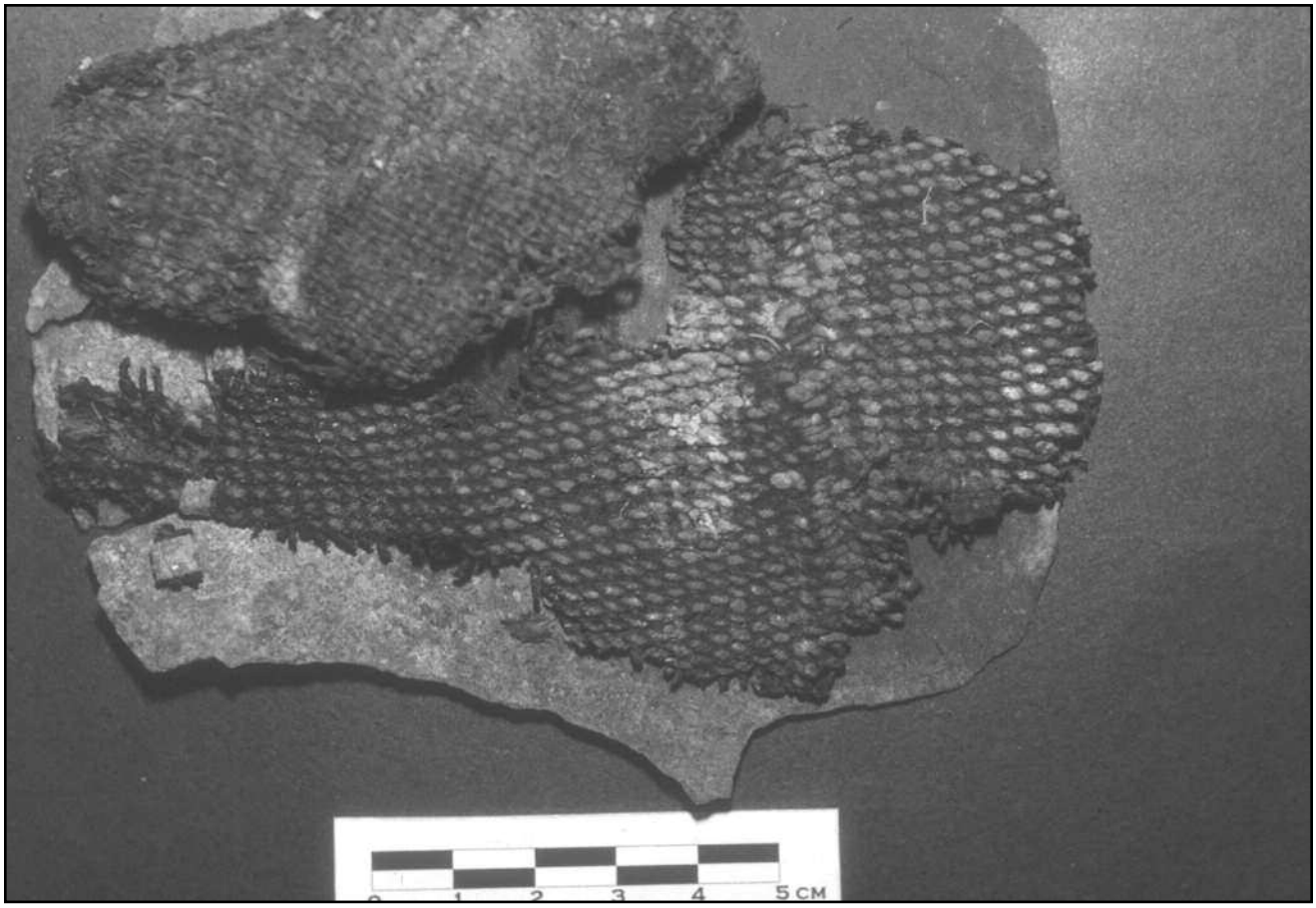

Figure 1.4. Two fragments of close-twined fabrics preserved by proximity to metal, provenience unknown (NYSM Cat. No. 74475). Note two selvages sewn together in coarser piece.

Harper 1956:40-51; Whitehead 1993). Two metal daggers carried the remains of twined sheaths (Whitehead 1993:69, 115, Fig. 37). Later burial sites with even higher concentrations of metal objects, such as the well-known Neutral Grimsby cemetery site in Ontario and 17th-century Susquehannock sites in Pennsylvania, also preserved a remarkable range of fiber, bark, and wood artifacts (Kent 1984:179-193; Kenyon 1982).

Quite a few leather pouches and twined bags have survived from this period because they contained metal objects, such as published examples from the late-16th – early 17th-century Seneca Tram and Cameron sites (Wray et al. 1991:130, 135-140, 332-334). The Rochester Museum and Science Center also curates examples from later Seneca settlements, such as the mid-17th-century Dann site (Cat. No. 665/28), and the New York State Museum collections include a twined bag from the late-17th-century Seneca Boughton Hill site and another from an early-17th-century site in the Seneca sequence, Tram (Drooker 1996d, 1996g). A number of published examples from Seneca and Erie sites in western New York have been interpreted as medicine bags or dream bundles (e.g., Tooker and White 1964; White 1967:15-16; Wray et al. 1987:129; Wray et al. 1991:135-140). Such interpretations are strengthened by the presence of items such as worked fruit stones interpreted as dice (Tooker and White 1964:1-2) that probably would not have survived if metal had not been present.

Some remarkable leather objects decorated with brass "clips" have come from the late 17th-century Seneca Dann, Rochester Junction, and Boughton Hill sites, which overlap in time. The

small brass pieces are bent into cylinders through slits cut into the leather, forming designs that look much like sewn or woven beadwork. The Susquehannock Washington Boro site produced a "belt or girdle made of rolled strips of buckskin held together with brass strips" (Cadzow 1936:125-126), which would have produced the same effect through a slightly different technique. Most Seneca examples are in the collections of the Rochester Museum and Science Center, but some fragments are at the New York State Museum (e.g., Beauchamp 1903:Pl. 25). The two largest are a magnificent belt from Dann (RMSC Cat. No. 13143/28), which is reminiscent of wampum belts, and a large item from Boughton Hill consisting of decorated leather strips, which seems designed to be worn over the shoulders (RMSC Cat. No. AR43734). The only analogous objects from Iroquois contexts that I have found so far are so-called "harnesses" decorated with beads and buttons that were worn by some 19th century Six Nations entertainers (Gabor 1980:37-38). The lack of historical written descriptions or depictions of similar objects means that their existence would have been unknown if they had not been preserved by their metal decorative elements.

Euro-american perishables also, of course, are preserved by contact with metal. For example, I analyzed fragments of military clothing from French and Indian War burials at Fort William Henry that were preserved together with metal buttons (Baker et al. 1997; Baker and Rieth 2000:57; Drooker 1996h). Small as they were, two groups of layered fragments showed the construction of a typical military coat or waistcoat — warm felted wool outer fabrics backed by stiffer plant-fiber fabrics — while other "sandwiched" fabrics with buttons probably came from shirts or pants.

In Chapter 8, James Petersen and Malinda Blustain describe Contact period fabrics and other perishables preserved by contact with copper at 16th- and early-17th-century sites in Maine. In the following chapter, Margaret Ordoñez and Linda Welters discuss fiber and leather objects preserved or fossilized through proximity to metal from two 17th-century Native American sites and an 18th-century Boston privy. A number of fabrics were preserved as metal pseudomorphs, but others, including a wampum headband that incorporated both shell beads and copper beads, maintained their organic nature.

SHORT-TERM BURIAL

Perishable artifacts excavated from more recent contexts in the Northeast simply may not yet have deteriorated significantly. For instance, a small wooden figurine has survived from the late-17th-century Seneca Marsh site (NYSM Cat. No. 35102).[6] It is of a form, the "September Morn" or "baby" figure, that is known primarily from examples of antler (e.g., Wray et al. 1991:218-223), which typically survive longer under archaeological conditions. Similarly, a rare oblique-interlaced band, probably made of plant-fiber cordage, fortuitously survived from the late 17th-century Seneca Boughton Hill site (Drooker 1996d). It has structural analogues in historically collected plant-fiber burden straps and elaborate beaded woolen sashes made and used by 17th–19th-century Senecas.

Likewise, many of the fabrics and leather from 17th- through 19th-century contexts in Rhode Island and Massachusetts that are discussed by Margaret Ordoñez and Linda Welters in Chapters 9 and 10 — particularly the more recent ones — simply had not yet deteriorated beyond recognition. The same is true of fragments of Native American mats, baskets, bags, and fabrics from the 17th-century RI 1000 site in Rhode Island, although proximity to metal also was a significant factor in their survial (McNeil 2003:75-79).

Even a "mere" century underground can result in loss of a large proportion of organic artifacts. The extensive late-19th–early-20th-century Albany Almshouse cemetery excavated in 2002 by members of the New York State Museum's Cultural Resource Survey Program yielded many clothing fragments, but only a small number of garments well preserved enough to determine their original size and form; among those were felt hats, woolen jackets and pants, silk ties, a silk shirtwaist, and some belts, suspenders, and shoes. By far the majority of surviving frag-

ments were of animal fibers (wool and silk) or leather. The few whole garments that survived tended to be worn in layers, or folded or bunched up in the coffin rather than worn; the interior of such a bundle would be protected from immediate direct exposure to soil conditions promoting deterioration.

The rare historical example of a late-17th-century twined bag from New England discussed in Chapter 11 should bring home the contrast between archaeological fragments and above-ground curation of perishable objects in the Northeast.

SECONDARY EVIDENCE

Almost all the artifacts discussed above were actual organic objects, providing primary evidence of the many ways in which perishable materials were utilized in the Northeast over the centuries. In addition, secondary evidence for the previous existence of perishable material culture sometimes is available (if you know where to look for it), and can be used to reconstruct or deduce the presence of vanished objects.

Secondary evidence for artifacts of organic materials includes, among other things, mineralization and pseudomorphs, which provide fossilized replications of the original; impressions on pottery and other materials; stains on non-organic artifacts or in the soil; characteristics and patterns of disposition of non-perishable objects associated with organic artifacts that have disappeared; inferences from tools used to fashion organic materials; patterns of decoration or design in "hard" media such as pottery that echo forms made of perishable materials; and images of objects made from perishable materials (see discussions and examples in Drooker 2001a, 2001c; Hastorf 2001).

MINERALIZATION AND PSEUDOMORPHS

Replication of an organic object though the gradual replacement of its material by a mineral substance or through covering it with a thin layer of a metallic corrosion product can produce extremely accurate secondary evidence of the original. These processes have been mentioned above with respect to fossilized Late Archaic fabrics from the Hartford Cemetery site in Maine (Blustain et al. 1999). Many of the Hopewell fabrics discussed by Virginia Wimberly in Chapter 5 are in the form of pseudomorphs, as are a number of the textiles from three 17th-18th century New England sites described in Chapter 9 by Margaret Ordoñez and Linda Welters.

IMPRESSIONS, MOLDS, AND CASTS OF OBJECTS

Impressions of basketry, fabric, and cordage pressed into pottery or unfired clay can be used as molds to produce three-dimensional casts of one surface of the original organic object (Figure 1.5) from clay, rubber, or other materials (Drooker 1992, 2001a; Rachlin 1955). Occasionally, casts of fabrics and basketry are produced naturally, although such products are much better known from paleontological specimens.

I have already mentioned the complex fabrics preserved by contact with copper at the Early Woodland Boucher site in northwestern Vermont. That site also produced fabric impressions on pottery, including some of the same cloth structures used to make the burial fabrics (Heckenberger et al. 1996:69). Kathryn Browning has reconstructed twined fabric types from impressions on pottery from Long Island (Browning 1974). At the Pictou site in Nova Scotia, impressions from twined fabrics were "preserved in mud on leather, sewn to a birch-bark armband"; these are too fragile to use as molds for casts of the original objects, but the pattern of twining is clear (Gordon 1997:Fig. 9).

E. Leonard Kroon has made a case that some Black Duck pottery from Ontario was formed within a mold made around a basketry form (1982). On one rim sherd, both the interior and exterior surfaces of his examples show convex designs with the appearance of coiled basketry (not the concave "reverse images" typical of impressions). Of course, coiling was not a basketry technique known in this region during historic times, but that does not negate the possibility that it could have existed earlier.

At least three chapters in this volume draw

Figure 1.5. Fabric-impressed pottery sherd (right) and the cast made from it (left) showing an open plain twined fabric, from the Slack Farm site, northern Kentucky near the Indiana-Illinois line (Drooker 1992:184-185; Pollack et al. 1996). Although this is not an example from the Northeast, it illustrates the excellent resource that impressions of now-vanished organic objects can provide.

upon evidence from impressions on pottery and other materials. J. M. Adovasio and colleagues report on a fabric from the Early Holocene Hiscock site in western New York (Chapter 3). This rare ancient specimen is a naturally formed cast of a fine-scale twined fabric. Both William Johnson and Andrew Myers (Chapter 6) and Christina Rieth (Chapter 7) utilized cordage and fabric impressions on pottery in their analyses. Both projects employed data from large numbers of impressed sherds, utilizing cordage attributes in combination with pottery attributes to study group affiliations of their makers. Johnson and Myers studied materials from Late Prehistoric and Protohistoric sites in northwestern Pennsylvania, analyzing cordage twist together with pottery temper and decoration to trace group movements over time. Rieth utilized cordage and fabric data together with trace element analysis of the sherds on which they were impressed to effectively demonstrate continuity between Owasco and earlier archaeological traditions in the Susquehanna Valley of New York.

STAINS

Virtually all archaeologists have excavated soil stains indicating the former position of now-disappeared organic objects. Stains on non-perishable artifacts can preserve images of perishables, although occurrences are rare. For example, negative images of open-twined fab-

rics (or a single fabric) were stained onto groundstone bayonets at the Late Archaic Overlock site in Maine (Blustain et al. 1999:192; Gordon 1997:20, 22, 23; Petersen et al. 1984; Robinson 1996:Fig. 18; Whitehead 1987; see also Chapter 8 of this volume).

MISSING PORTIONS OF COMPOSITE ARTIFACTS

Simple logic often dictates the nature of missing portions of tools, weapons, or ornaments. Stone netsinkers and bone fishhooks, such as from the Late Archaic Lamoka Lake site in central New York (Ritchie 1980:46-50), imply the necessary presence of strong, well-crafted cordage for fish nets and lines. Stone projectile points and bone harpoon heads would have required wooden shafts, and so on. Ornaments with suspension holes needed leather thongs or fiber thread to attach them to garments or headdresses, or to fashion them into necklaces, bracelets, and other such articles.

DISPOSITION PATTERNS OF NON-PERISHABLE OBJECTS

Disposition patterns of less-perishable objects formerly affixed to or associated with perishable items can be used to help reconstruct the vanished artifacts. For example, in conjunction with an analysis of Monongahela social organization through mortuary patterns, Christine Davis (1984) described 15 burials that had large numbers of bone beads in geometric patterns in the abdominal area, as if they had been affixed to skirts or other garments. William Ritchie reported a pattern of perforated bear claws around the upper body of an adult male burial at the Middle Archaic Frontenac Island site in Cayuga Lake, such that the claws appeared to have been sewn to a shirt or jacket (1980:117, 121).

TOOLS FOR WORKING ORGANIC MATERIALS

Tools used to fashion items made from organic materials frequently are analyzed by archaeologists to deduce the nature of perishable material culture for a particular site, region, or time period. For instance, stone-cutting and woodworking tools, including adzes, gouges, and celts, at Late Archaic River phase sites in the Hudson-Mohawk Valley, together with the absence of evidence for substantial wooden houses or palisades, led Ritchie to hypothesize the production of dugout canoes (1980:131). He also hypothesized that a barbed bone artifact found at Lamoka Lake was a net-making tool (1980:48). Stone or bone hide scrapers and bone awls and needles often are taken to indicate processing of hides and production of sewn animal-skin bags or clothing.

SKEUOMORPHS

Objects with decorative elements that copy functional designs typical of other media are called skeuomorphs. When the copied items are of perishable materials, their replication may preserve an excellent record of a no-longer-existing type of object. Christine Hastorf gives the example of a cordage net used to hold a ceramic pot later being replicated in metal as a decoration on a Chinese bronze vessel, and also cites Frank Cushing's discussion of Iroquois castellated pots as deriving from bark vessels having rounded bottoms and square tops, with the pots' incised linear decoration evolved from porcupine quill designs on birchbark (Cushing 1886:519-520; Hastorf 2001:34-35).

Kathryn Browning Hoffman (1979) has described a number of examples of design elements on prehistoric New York pottery that she interprets as replicating patterns typical of interlaced basketry weaves and of quillwork. Incised designs such as herringbone patterns and the filled triangle motif could well derive from interlaced basketry (although the presence of interlaced wood splint basketry in the Northeast prior to the advent of European examples has been debated [Bardwell 1986]). Hoffman also notes the similarity between projecting spiky nodes on a Late Woodland pottery vessel and decorative "porcupine twist" work (see Definitions) on some 19th-century Iroquoian wood splint basketry.

IMAGES OF PERISHABLE OBJECTS

In other regions of the continent, painted, engraved, or sculpted images of people often provide clues to the nature of their clothing and other perishable objects that they made and used. Unfortunately, these are rare in the pre-Contact Northeast. However, two famous carved stone human effigy pipes from Ohio do depict clothed people. One from the Adena Mound in Ross County shows a man wearing a decorated loincloth, and the other, a Hopewell pipe from Newark in Licking County, shows a person in a bearskin (Brose et al. 1985:Figs. 15, 29).

Drawings and paintings made by early European visitors, and especially engravings realized by artisans who never had visited the New World, must be analyzed carefully, since the artists often worked from secondhand description rather than firsthand observation, as with portrayals of people and villages on a 1612 map of Champlain's explorations and a 1635 map of New England (Brasser 1978a:Fig. 1, 1978b:Fig. 2), or they only poorly depicted unfamiliar objects such as shell ornaments, as in the well-known 17th-century portrait by an unknown artist of the Eastern Niantic sachem Ninigret (Simmons 1978:Fig. 4).

ETHNOHISTORICAL ANALOGY AND EXPERIMENTAL ARCHAEOLOGY

Ethnohistorical analogy and experimental replication are two other types of secondary evidence often used by archaeologists to help reconstruct now-vanished objects made from organic and other fragile materials. For instance, Lorraine Willey replicated many of the fabrics from the Sheep Rock Shelter site in Pennsylvania, and learned much about their construction in the process (Michels 1994:39; Willey 1968:249, 1974). Joleen Gordon utilized both replication and 19th–early-20th-century ethnographic research in her studies of matting and basketry excavated at the 16th century Pictou site in Nova Scotia (Gordon 1995, 1997).

As mentioned at the beginning of this chapter, museum displays of long-ago lifeways, like the Paleoindian group depicted at the New York State Museum, often require the use of ethnohistorical analogy to "flesh out" information obtained directly from artifacts of stone and other non-organic materials. This must be done cautiously, of course, with reference to any extant archaeological specimens. For example, the woven sandal recovered from Sheep Rock Shelter (Michels 1994:Fig. 11) has no exact historically known counterpart, to my knowledge; 18th- and 19th-century natives of Pennsylvania and New York are typically depicted wearing leather moccasins.

CONCLUSION

The chapters that follow make use of all these types of evidence, and more, in overviews and case studies that clearly illustrate both the significance of perishable material culture in the lives of Northeastern people over many centuries, and the importance of their extant remains to archaeologists attempting to reconstruct and interpret these lifeways. By carefully preserving and analyzing what are often small fragments of undistinguished-looking organic materials, we can greatly expand our understanding of long-past subsistence strategies, technologies, and social, economic, and ritual relations.

NOTES

1. For the Northeast Natural History Conference, at which most of the chapters in this publication were first presented, Northeast was defined as including eastern Ontario, Quebec, the Maritime Provinces, Labrador, New England, New York, New Jersey, Pennsylvania, and Ohio.
2. The time periods mentioned in this chapter can be very broadly defined as follows: Paleoindian, ca. 9500–8000 B.C.; Early Archaic, ca. 8000–6000 B.C.; Middle Archaic, ca. 6000–4000 B.C.; Late Archaic, ca. 4000–1000 B.C.; Early Woodland, ca. 1000-0 B.C, Middle Woodland, ca. 0 B.C.–A.D. 1000; Late Woodland, ca. A.D. 1000–1700. All of these periods are defined somewhat differently within particular regional cultural traditions, depending on local timing of changes in subsistence and material culture.

The Late Woodland overlaps with the Protohistoric, a period after 1492 when Native groups began to acquire European goods, but intensive interaction (and written accounts of that experience) had not yet begun. As might be expected, the Protohistoric period began and ended later in the interior than along the eastern seaboard. The Contact period, a term that implies face-to-face, extended contact between Native Americans and Europeans, likewise began at different times in different places, although it sometimes is applied across-the-board to the post-1492 period.

3. Many of the artifacts described in this chapter, most notably (but by no means exclusively) those preserved by contact with metal, were grave goods potentially subject to the Native American Grave Protection and Repatriation Act. Thus, no photographs of them are included.
4. See note 3.
5. See note 2.
6. See note 3.

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CHAPTER 2

PREHISTORIC PERISHABLE FIBER TECHNOLOGY IN THE UPPER OHIO VALLEY

J. M. Adovasio and J. S. Illingworth

ABSTRACT

Located on the extreme western margin of the Northeast and the northern periphery of the Mid-South, the Upper Ohio Valley affords a strategic, if highly episodic, view of prehistoric non-durable technology that extends back more than 12 millennia. The oldest perishables from the Northeast derive from this area and are directly dated to pre-Clovis contexts at Meadowcroft Rockshelter in Pennsylvania. Thereafter, basketry, cordage, and related industries are sporadically represented by actual specimens or impressions up to and beyond European contact. The salient characteristics of this long trajectory of perishable fiber technology are summarized and compared to developmental trajectories elsewhere in eastern North America.

INTRODUCTION

For the purposes of this chapter, the Upper Ohio Valley is not a precise or tightly circumscribed geographic area. Rather, as defined here, the Upper Ohio Valley encompasses the drainage of the Ohio River above the Falls of the Ohio at Louisville, Kentucky, and includes the drainages of its major feeders and tributaries as well as immediately contiguous areas. Thus loosely defined, this region encompasses portions of the states of Pennsylvania, Ohio, West Virginia, Maryland, and Kentucky, and extends into southern Indiana, eastern Missouri, and southwestern New York (Figure 2.1). As noted by many scholars, the Ohio Valley, generally, and the Upper Ohio Valley, specifically, form a boundary or border area between the archaeological Northeast, the Midwest, and the Southeast (cf. Dragoo 1959; Muller 1986). Consequently, the material culture and lifeways of its prehistoric and post-European contact inhabitants frequently reflect multiple directional relationships and affinities.

Although human occupation of this relatively large area extends well back into the late Pleistocene, the Upper Ohio Valley is, with a few notable exceptions, relatively devoid of deeply stratified rockshelter, cave, or open sites. The principal consequence of this situation is that the long sequence of human visitation/utilization of this region is, for the most part, pieced together from discontinuous episodes of occupation at literally hundreds of separate localities. Particularly germane to this chapter is the additional fact that, unlike the arid stretches of the Great Basin, the American Southwest, Lower and Trans-Pecos Texas or, closer to "home," the Ozark Bluffs of Arkansas and the limestone caves of Kentucky, organic preservation in the Upper Ohio Valley is usually poor, with limited recovery of so-called perishable artifacts like cordage, netting, basketry, textiles, snares, and other plant-based or, for that matter, wood-based tech-

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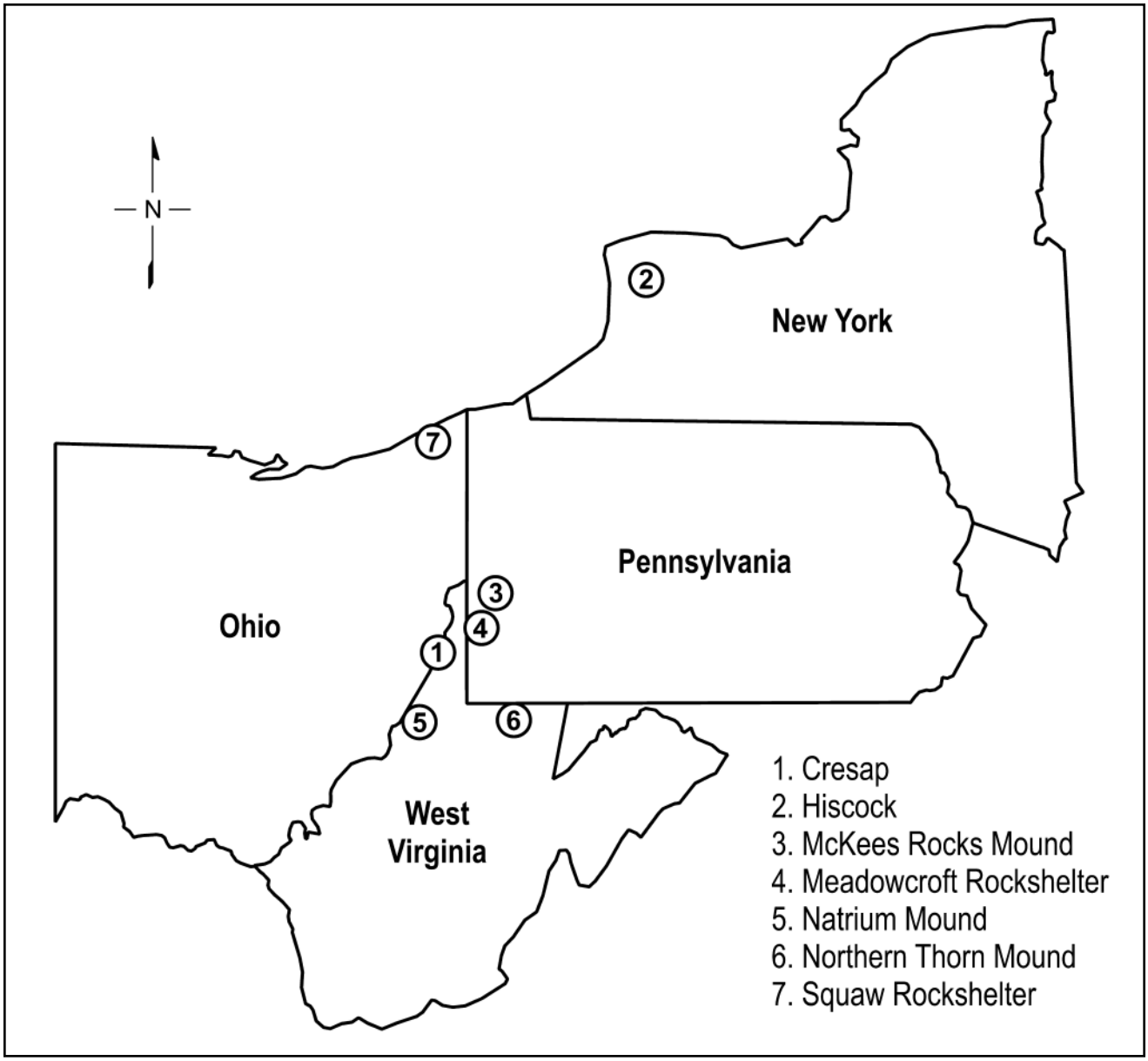

Figure 2.1. Locations of the Upper Ohio Valley sites discussed in this chapter.

nology. The combination of poor preservation with an absence of long occupational sequences renders the discernment of specific developmental sequences or even chronological trends in perishable technology much more difficult in the Upper Ohio Valley than it is in Texas, Arizona, New Mexico, Utah, Nevada, Oregon, or other points west of the "Cactus Curtain."

Despite these limitations, however, it is possible to broadly outline some of the temporal and regional trends in non-durable plant-based technology by using data from admittedly widely separated localities with generally temporally circumscribed occupations both within and near the Upper Ohio Valley. In what follows, the perishable assemblages from a series of sites are briefly described and summarized in terms of the "windows" they individually and collectively afford into the plant-based technology of the commonly recognized temporal segments of Upper Ohio Valley prehistory. By design, this summary includes only sites and assemblages

from Paleoindian through Early Woodland times, since perishable developments in later time periods are treated by other contributors to this volume.

PERISHABLE TECHNOLOGY

In the context of this chapter, the definition of perishable technology follows Andrews and Adovasio (1996:30-31). Perishable technology and its products, fiber perishables, subsume a minimum of six basic compositional classes of vegetal artifacts — basketry, cordage, netting, knotted fibers, sandals, and miscellaneous fiber constructions. The constituents of these classes are treated here as the products of closely interrelated but technologically distinct prehistoric industries, the output of which are normally subject to rapid decomposition in unprotected depositional settings — hence, they are truly perishable.

Basketry herein encompasses several distinct kinds of items, including rigid and semi-rigid containers or baskets proper, matting, and bags. Matting includes items that are essentially two-dimensional or flat, while baskets are three-dimensional. Bags can be viewed as intermediate forms because they are two-dimensional when empty but three-dimensional when filled. As Driver (1961:159) notes, these artifacts can be treated as a group because the overall technique of manufacture is the same in all instances. Specifically, all forms of basketry are manually produced without any frame or loom.

There are three major kinds or subclasses of basketry that are generally mutually exclusive: twining, coiling, and plaiting. The term "twining" denotes a subclass of basket structures manufactured by the passing of two or more moving (or "active") horizontal elements called wefts around stationary (or "passive") vertical elements called warps (see Definitions). Twining techniques can be employed to produce containers, mats, and bags, as well as fish traps, cradles, hats, clothing, and other "atypical" basketry forms.

The term "coiling" denotes a subclass of basket structures manufactured by sewing stationary, horizontal elements (the foundation) with moving vertical elements (stitches). Coiling techniques are used almost exclusively in the production of containers and hats, but rarely for bags. Mats and other flat forms are seldom, if ever, produced by coiling.

The term "plaiting" denotes a subclass of basket structures in which all elements pass over and under each other without any engagement. For this reason, plaited basketry is technically described as unsewn. Plaiting can be used to make containers, bags, mats, and a wide range of other, less-standardized forms.

The term "cordage" denotes a class of elongate fiber constructions the components of which are generally subsumed under the English terms "string" and "rope." "Netting," in this context, subsumes a class of openwork fabrics built up by the repeated interworking of a single continuous element with itself (see Emery 1966:30, and Definitions).

Two remaining classes, knotted fibers and miscellaneous fiber constructions, represent respectively the "end" products of a spectrum of functionally specific activities and a residual "catchall" category. Knotted fibers probably served a multiplicity of functions and are precisely what the term implies — single, paired, or bunched fibers with one or more knots. Miscellaneous fiber constructions are perishables that cannot be accommodated within any of the other five compositional classes. This class contains such diverse artifacts as braids, latticework constructions, fiber rings, "fish sandwiches" (edible plant-based "constructions" like split *Opuntia* sp. pads that contain fish remains [Andrews and Adovasio 1980:261-262]), etc.

Sandals are herein synonymous with open or closed vegetal-fiber footwear normally referred to in English as shoes or slippers. Despite the exclusion of sandals and the various remaining classes of fiber perishables from additional discussion here, we nonetheless stress that all such constructions are properly characterized as fiber constructions. Although the present discussion focuses on basketry, cordage, and (to a lesser extent) netting, we wish to emphasize that the remaining classes of fiber constructions certainly were as ancient and important — if not occasionally more important — than those discussed below by cultural period.

Although none of these six compositional

Table 2.1. Presence of Perishable Construction Techniques and Chronology for Materials Discussed in this Chapter, by Perishable Class and Site.

Site	Construction Technique[a]	Cultural Period				
		Paleo-indian	Early Archaic	Middle Archaic	Late Archaic	Early Woodland
	Plaiting (interlacing)					
Meadowcroft Rockshelter	Simple, 1/1 interval	X	—	X	X	—
Salts Cave	Simple, 1/1 interval	—	—	—	X	—
	Twill	—	—	—	X	—
	Twining					
Arnold Research Cave	Miscellaneous	—	X	—	—	—
Graham Cave	Miscellaneous	—	X	—	—	—
Hiscock	Close diagonal, Z-twist weft slant	?	?	—	—	—
Icehouse Bottom	Miscellaneous	—	X	—	—	—
Modoc Rockshelter	Miscellaneous	—	X	—	—	—
North Thorn Mound	Close simple, S-twist weft slant	—	—	—	—	X
	Close simple, S- and Z-twist wefts	—	—	—	—	X
Russell Cave	Miscellaneous	—	X	—	—	—
Salts Cave	Close simple, S-twist weft slant	—	—	—	X	—
	Close simple, S- and Z-twist wefts	—	—	—	X	—
	Open, unknown weft slant	—	—	—	X	—
	Cordage					
North Thorn Mound	Two-ply, Z-spun, S-twist	—	—	—	—	X
Salts Cave	Three-strand braid	—	—	—	X	—
	Two-ply, Z-spun, S-twist	—	—	—	X	—
	Netting					
Ice House Bottom	—	—	X	—	—	—
	Miscellaneous					
Cresap Mound	Unidentified	—	—	—	—	X
McKees Rocks Mound	Unidentified	—	—	—	—	X
Natrium Mound	Unidentified	—	—	—	—	X
Squaw Rockshelter	Spun and knotted	—	—	X	—	—

[a]See Definitions

classes of vegetal artifacts is represented continuously throughout the occupational history of the Upper Ohio Valley, one or another class is evidenced, however briefly, in each of the major time segments (see Table 2.1 and below).

PERISHABLE TECHNOLOGY BY CULTURAL PERIOD

PALEOINDIAN (?–8000 B.C. [9950 B.P.])

Perishable remains of any kind are extremely rare in Paleoindian contexts east of the Rocky Mountains, including the Upper Ohio Valley. However, the oldest reliably dated unequivocal specimen of basketry from anywhere in North America nonetheless derives from this area in one of the very few deeply stratified and long-occupied sites presently known. The item is a wall fragment of 1/1 interval simple plaiting with single elements from Middle Stratum IIa at Meadowcroft Rockshelter, Washington County, Pennsylvania (Stile 1982:133). The specimen lacks selvages, shifts, splices, and decoration. While the "finished" form of the plaiting fragment cannot be ascertained, it was manufactured (as with all of the Meadowcroft basketry) of a cut, birch-like (*Betula* sp.) bark (Stile 1982:133) (Figure 2.2).

A far older but more tentatively classified perishable from Meadowcroft Rockshelter is of Lowest Stratum IIa provenience and is directly dated to 19,600 ± 2400 B.P. The specimen consists of a single element of bilaterally cut, birch-like (*Betula* sp.) bark that is not dissimilar in overall configuration to the strips employed in all of the later Meadowcroft simple plaiting. If the specimen is a portion of a plaited construction and even if at the *youngest* end of the date range (i.e., 17,200 B.P.), it is at once the oldest actual basket fragment (as opposed to impression) in eastern North America, the rest of the continent, and the world.

The only other basketry or textile specimen of possible Paleoindian ascription from anywhere near the Upper Ohio Valley derives from the Hiscock site in Genessee County, New York, and is the subject of a separate contribution to this volume (Chapter 3). The Hiscock specimen is a remarkable positive cast of close diagonal twining with Z-twist wefts. Both the warps and wefts of the Hiscock specimen are composed of two-ply S-spun, Z-twist cordage produced from retted plant stems or bast fibers of an as yet

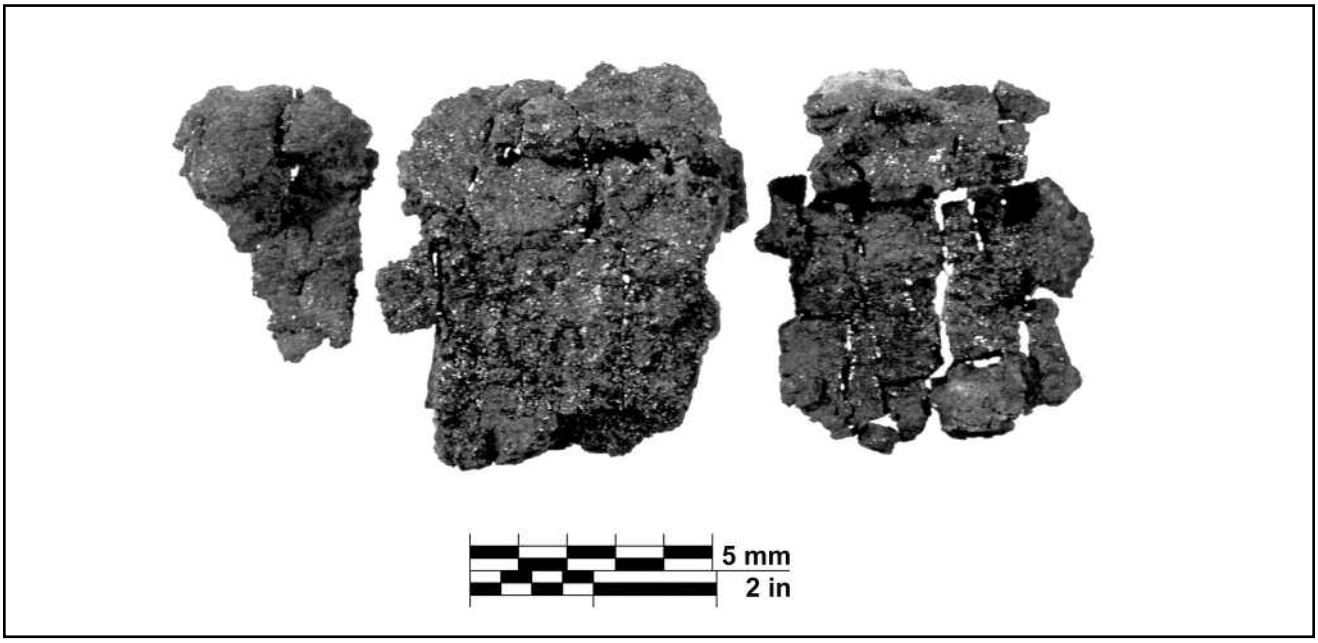

Figure 2.2. Late Archaic 1/1 interval plaited basket from Meadowcroft Rockshelter. This specimen exhibits a reinforced and sewn 180° rim.

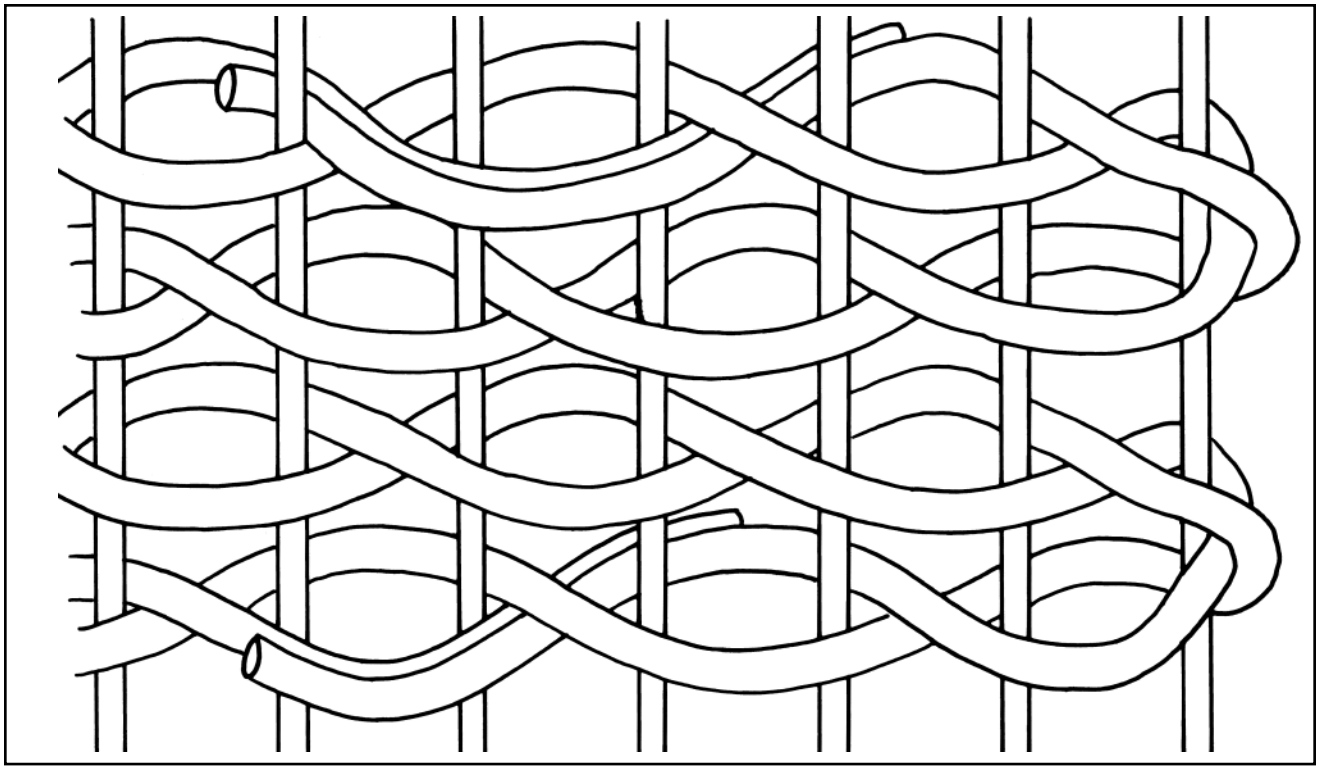

Figure 2.3. Schematic of the Hiscock, New York, twined specimen exhibiting continuous weft side selvage and laid-in weft splices.

unidentified plant and the item may be a portion of a fragment of cloth or a bag (Figure 2.3).

Regrettably, the exact context of the Hiscock diagonal twining is somewhat ambiguous and its age cannot be presently fixed with certitude. If it derives from the Fibrous Gravelly Clay layer at Hiscock, it is of Eastern Clovis "vintage" or Paleoindian ascription and if it derives from the overlying Woody Layer, it is Early Archaic in age. In either case, it is the oldest example of twining in the Northeast.

EARLY ARCHAIC (8000 B.C.–6000 B.C. [9950 B.P.–7950 B.P.])

With the singular exception of the Hiscock specimen which, as noted previously, may be of Early Archaic ascription, no other perishable plant fiber artifacts or impressions of this age are known from the Upper Ohio Valley. However, the widespread manufacture of twined basketry in Early Archaic contexts is firmly documented at Graham Cave, Missouri (Andrews and Adovasio 1996; Klippel 1971; Logan 1952); Ice House Bottom, Tennessee (Chapman and Adovasio 1977); Modoc Rockshelter, Illinois (Fowler 1959; Styles et al. 1983); and probably Layer G at Russell Cave, Alabama (Griffin 1978). Early Archaic twining in the form of sandals is also evidenced at Arnold Research Cave, Missouri (Kuttruf et al. 1998), and Ice House Bottom produced knotted netting in addition to twining. (Chapter 3 provides a more detailed discussion of twined perishables from eastern North America.)

MIDDLE ARCHAIC (6000–4000 B.C. [7950–5950 B.P.])

Middle Archaic fiber perishables are somewhat more common in and near the Upper Ohio Valley than those of earlier time horizons. Perhaps most informative of the complexity of developments during this period is an enigmatic fiber construction from Test Unit II at Squaw Rockshelter located in Cuyahoga County, Ohio (Andrews and Adovasio 1989). This item, which is ascribable to a level radiocarbon dated at ca. 3500 B.C. (5450 B.P.), represents a rather intri-

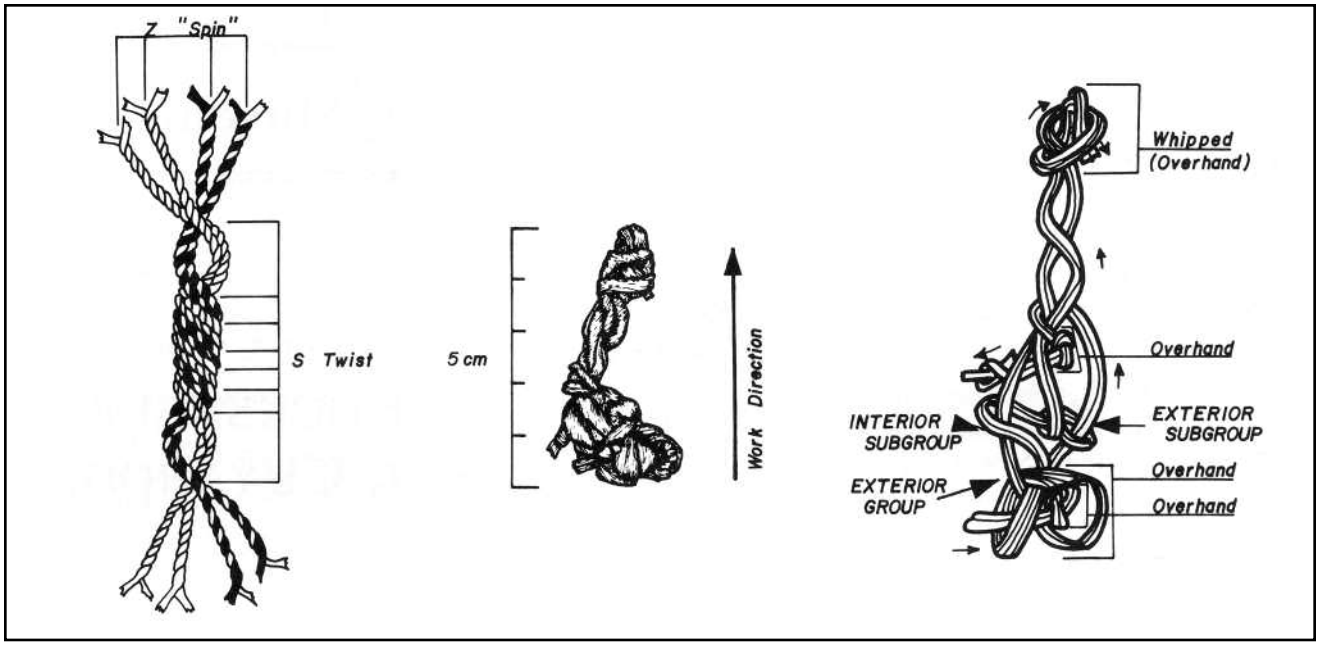

Figure 2.4. Reconstruction of the Squaw Rockshelter cordage. Left to right: twisted yarns and plies, the knotted element, and the knotting groups (adapted from Andrews and Adovasio 1989:Fig. 1).

cately interwoven, elaborately knotted complex of four Z-spun single elements to which a final S twist is imparted; it is attributed to the late Middle Archaic period by its excavator (Brose 1989). While the details of manipulation are too lengthy and complex to present here, a simple description follows. Initially, two unspun single-ply elements were secured in and subsequently affixed to another pair of unspun elements with two overhand knots. Six of the eight emergent ends were imparted a slight Z spin, intricately interlooped and overhand knotted with four of the plies, finally S-twisted together, and terminated with a final whipping knot (Figure 2.4). While the function of this complex construction is unknown, it is thoroughly charred and undecorated. It is possible that this specimen represents a mend or splice of a larger and quite elaborate cordage construction, or it may simply constitute a "doodle."

A directly dated simple plaited fragment from lower Stratum IIb at Meadowcroft Rockshelter is the only known radiocarbon-assayed perishable fiber artifact represented east of the Rockies. The Meadowcroft specimen, which differs in no way from its Paleoindian predecessors or its Late Archaic/Woodland period successors at the site (see below), exhibits a 1/1 plaiting interval without shifts. It is made of a birch-like (*Betula* sp.) bark and lacks selvages. This specimen, which dates from ca. 4720 ± 140 B.C. (6670 ± 140 B.P.) to 3350 ± 130 B.C. (5300 ± 130 B.P.), was directly associated with hackberry (*Celtis* sp.) seeds and may represent a portion of a circular or rectangular container.

Although it is safe to assume that twining continued to be produced across the entire breadth of eastern North America, no Middle Archaic examples are presently available from the Upper Ohio Valley or immediately adjacent areas.

LATE ARCHAIC (4000–1000 B.C. [5950–2950 B.P.])

While perishable-bearing sites of Late Archaic ascription are relatively common in some portions of eastern North America, at least as compared to earlier periods, plant fiber artifacts of this time period continue to be rare in and near the Upper Ohio Valley.

Two of the simple plaited Meadowcroft Rockshelter basketry fragments from upper Stratum IIb and one specimen from Stratum III are ascrib-

able to the Late Archaic period. Collectively, these specimens date to ca. 2000–900 B.C. (3950–2850 B.P.). One of them is directly dated at 1820 ± 90 B.C. (3770 ± 90 B.P.). All three specimens are composed of simple plaiting (1/1 interval) without apparent shifts. All three fragments are unmended and undecorated. The single and, rarely, doubled strips of birch-like (*Betula* sp.) bark are of apparently equal width (Stile 1982:133). The plaiting element size, combined with the large size of a few specimens and their direct association with hackberry (*Celtis* sp.) seeds, raspberry (*Rubis* sp.) seeds, and nuts, suggest that these specimens may represent fragments of large circular or rectangular containers (Stile 1982:133, 134). Stile also reports that the largest specimen is collapsed onto itself. Further, one of the specimens contains a selvage described by Stile (p.133) as follows: "In this example, which may be the edge of a circular container of unknown size, the end or rim selvage is of the 180° self type folded over a rod which circumscribes the exterior of the rim [see Figure 2.2]. The elements have been folded over the rod (which is a whole, undecorated twig of presently unknown species), and then sewed to the body of the basket with cordage of an unknown number of plies, initial spin or final twist."

More numerous but of less-precise chronological placement are the perishable remains from Salts Cave, Kentucky, to the immediate southwest of the study area. As detailed by King (1974:31-40), the Salts Cave collection includes both twined and plaited objects, as well as spun, twisted, and braided cordage. Although space precludes an extensive discussion of this remarkable collection, it minimally includes close-twined sandals (called slippers) with S twist only or both S-twist and Z-twist two-ply wefts; open-twined sandals with an unknown weft slant (see Definitions); and simple- and twill-plaited basketry and/or sandal fragments. Cordage in this assemblage includes two-ply Z-spun, S-twist cordage, three-strand braid, and perhaps other varieties. At least some of these artifacts are probably terminal Late Archaic in age, though available dates range from 1190 ± 150 B.C. (3140 ± 150 B.P.) to A.D. 30 ± 160 (1920 ± 160 B.P.), with the majority ascribable to the Early Woodland period.

EARLY WOODLAND (1000 B.C.–A.D. 1 [2950–1949 B.P.])

By the dawn of the Early Woodland in the Upper Ohio Valley, which is essentially synonymous with the Adena phenomenon or florescence, there is widespread evidence for perishable fiber technology from many localities. Indeed, the ubiquity and diversity of Adena textile and basketry technology is, in itself, eloquent testimony to the great time depth that these and related plant-based industries exhibit in the study area. Although, admittedly, it would be useful to summarize all of the perishable data available from Early Woodland contexts in the Upper Ohio Valley and contiguous areas, due to obvious space constraints we prefer to concentrate on a suite of sites where perishable remains typify or exemplify developments during this time span.

Excavation in Burial 2 at the Northern Thorn Mound (46MG78) in Monongalia County, West Virginia, yielded some 70 "clods" or chunks of unfired and/or partially fired puddled clay having either negative impressions or actual decomposed perishables (Adovasio and Andrews 1980:33-72). At a minimum, this assemblage contained eight pieces of cordage and 19 specimens of twined "basketry." The cordage assemblage was dominated by two-ply Z-spun, S-twist string and rope-sized products while the basketry included two types of simple twining (close simple twining, S-twist; close simple twining, S- and Z-twist) and two types of diagonal twining (open diagonal twining, S-twist; open and close diagonal twining, S- and Z-twist wefts). All of the basketry was made with two-ply Z-spun, S-twist cordage warps and wefts (Figure 2.5).

Although the term "basketry" was employed in the original Thorn Mound perishable artifact study, these items also could be labeled accurately as twined fabrics if one follows the usage of Emery (1966). If that convention is followed, the close simple twining, S-twist weft specimens are analogous to Emery's "Compact 2-strand S-twist weft-twining" (Emery 1966:Fig. 305). Similarly, the open diagonal twining, S-twist weft specimens are analogous to Emery's "Spaced 2-strand S-twist alternate-pair weft-twining" (Emery

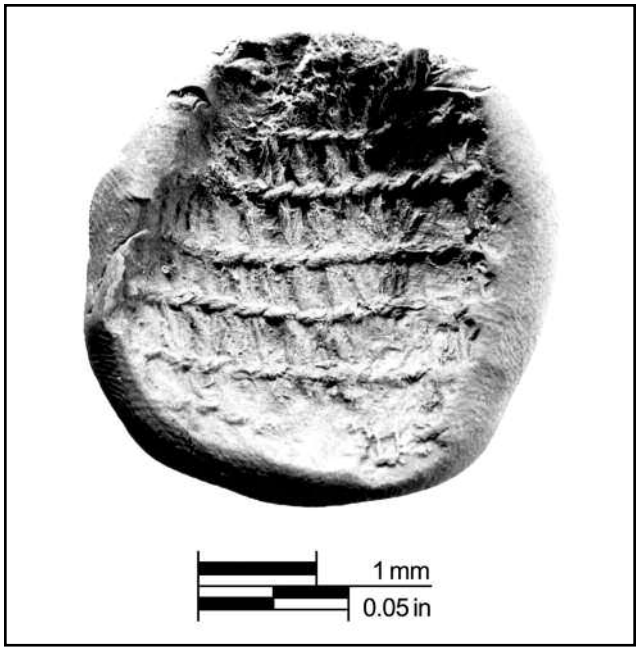

Figure 2.5. Positive cast of open simple S-twist weft twining from Northern Thorn Mound, West Virginia.

1966:Fig. 310) while the open diagonal twining, S- and Z-twist weft specimens represent the open or "spaced" counterpart of Emery's "countered compact 2-strand alternate-pair weft-twining" (Emery 1966:Fig. 311).

The foregoing information is particularly germane when the form or forms of the Northern Thorn Mound twining are considered. Although all of the impressions from the site represent incomplete segments of basketry (or fabrics), their probable forms are difficult to ascertain with precision. To be specific, all four twining types as reflected in the extant sample could represent flexible bags or articles of clothing. While the bag "option" is certainly not impossible, we consider it more likely that all of the twining represents portions of some sort of apparel. The close simple twining, S-twist weft and close simple twining, S- and Z-twist weft specimens from the vicinity of the skull of Burial 2 may represent either hoods, cowls, skull caps (or aboriginal "beanies"), or perhaps a kerchief/scarf that may have been draped and/or tied over the face and head. The other two twining types with their open work mesh could likewise represent bags, although it is equally if not more likely that they are segments of robes, cloaks, blankets, or some such similar item of apparel.

As previously summarized by Adovasio and Andrews (1980:65-67), and earlier by Webb and Snow (1945) and Dragoo (1963), many other sites in and near the Upper Ohio Valley have yielded perishables of Early Woodland (and later) ascription. Indeed, as early as 1945, a sufficient number of sites had produced basketry, textiles, and cordage remains to permit Webb and Snow (1945:27) to generate a "list" of 10 traits that purportedly characterized Adena textiles and basketry. This list included the presence of plain (i.e., simple) and twill plaiting, plain (i.e., simple) and diagonal twining, "chevron twining" (i.e., simple twining with alternate S- and Z-twist weft courses), "lattice or bird cage" [*sic*] twining (i.e., wrapped twining), and the use of three-ply cordage. The illustrations of these techniques clearly indicate that open and close, simple and diagonal twining were indeed standard elements in the Adena basketry and textile repertoire, as were "clockwise" or S-twist warps and wefts. Also known are three-ply Z-twist warps in which three specimens of two-ply Z-spun, S-twist cords are combined with a final Z twist. Three examples of two-ply Z-spun, S-twist cords were braided together and are employed as warps.

Not only are the Northern Thorn Mound perishable remains generally consistent with the "preferred" attributes enumerated by Webb and Snow, but so also are the bulk of the materials reported from the Natrium Mound in West Virginia (Solecki 1953:374-375), the McKees Rocks Mound in southwestern Pennsylvania (Mayer-Oakes 1955:149), and the Cresap Mound in West Virginia (Dragoo 1963). The Cresap perishable assemblage is one of the largest in the Upper Ohio Valley. Feature 12 at Cresap (Dragoo 1963:32-33), a basin-shaped layer of burned clay, yielded a small piece of cloth preserved by copper salts in association with a circular string of 22 rolled copper beads. Feature 15 (Dragoo 1963:35, 129) produced the highly friable remains of what are variously described as a basket or a plaited shallow bowl (Dragoo 1963:35,129). Although the description is attenuated, the specimen is alleged to be "tightly woven" (Dragoo 1963:35).

Other features at the site may have contained highly fragmentary and amorphous textile, basketry, cordage, or netting remains (Dragoo 1963:41, 49-50). Indeed, Dragoo (1963:69) notes that 11 of the 20 elliptical to oval, flat to basin-shaped features at Cresap contained disintegrated bark and/or other organics. Two small pieces of what Dragoo calls cloth associated with Burials 8 and 9, respectively, are also recorded (Dragoo p.122, 128). The Burial 8 specimen measures 1.1 cm x 2.8 cm while the other is approximately 1.4 x 3.9 cm. Unfortunately, the Burial 8 specimen is described simply as tightly woven, while the Burial 9 specimen is listed as plain twining with warps and wefts of approximately equal size. From what little can be extracted from the Cresap perishable descriptions, it appears that the basic assemblage includes types not unlike those reported from the Northern Thorn Mound.

Indeed, no matter how many Upper Ohio Valley sites are added to this comparison, it is clear that the perishable materials from any and all of them fit comfortably and conformably into a regionally distinctive Early Woodland (or Adena) industry whose immediate roots lie in the preceding Late Archaic and whose genesis is in much more remote time periods. This trajectory does not, of course, cease in the Early Woodland, but instead continues, as other chapters in this volume document, up to and even beyond European contact.

OVERVIEW

In retrospect, the material reviewed here confirms in the microcosm of the Upper Ohio Valley a series of developmental trajectories for perishables technology previously established for eastern North America and, for that matter, North America at large.

1. From the initiation of human occupation of the Upper Ohio Valley or, indeed, any part of North America where preservation permits, the production of basketry, textiles, cordage, netting, and related materials is part and parcel of the armamentarium of the first colonists (Adovasio et al. 2001).
2. Within and near the Upper Ohio Valley, and by extension other parts of eastern North America, the production of plaited and twined baskets or fabrics is firmly documented by the beginning of the eighth millennium B.C. at the very latest, as is the manufacture of cordage and, presumably, cordage by-products (cf. Andrews and Adovasio 1996:45).
3. The persistence of plaiting and twining in one form or another can be documented, at least episodically, from Early Archaic through Early Woodland times (and beyond), and the continued manufacture of cordage and cordage by-products may be confidently inferred by extrapolation from neighboring areas.
4. By Early Woodland times, Upper Ohio Valley twining and cordage production was highly elaborated within a regionally distinctive tradition, the "living" functions of which were doubtless myriad, but whose principal recovered manifestations are in mortuary contexts.
5. As in all of the rest of eastern North America where organic preservation is good, the perishable remains from the Upper Ohio Valley document a typologically diverse and technologically sophisticated series of industries equal in every way to — and which in some ways actually surpass — their much better-preserved and more common counterparts and contemporaries in western North America. This in turn leads to the inescapable conclusion that the manufacture of plant-fiber-based perishables is a nearly universal feature of the prehistoric North American landscape. Moreover, by its very nature and ubiquity, this technology is a critical, if still radically underappreciated, component in the adaptive success of virtually all Native Americans throughout all time periods.

ACKNOWLEDGMENTS

Figure 2.1 was drafted by J. S. Illingworth. Figures 2 and 5 were taken by J. M. Adovasio and digitally processed by D. R. Pedler. Figure 2.3 was drafted by K. K. Manske. Figure 2.4 was drafted by R. L. Andrews. This chapter was edited by D. R. Pedler.

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CHAPTER 3

PERISHABLE TECHNOLOGY FROM THE HISCOCK SITE

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ABSTRACT

The 1996 excavations at the Hiscock site in New York yielded an impression of a close diagonal twined, Z-twist weft textile with a continuous weft side selvage and, possibly, actual minute pieces of that textile. The specimen is generally associated with a concentration of white-tailed deer (Odocoileus virginianus) *bones and originates in deposits of possible late Pleistocene/early Holocene age. The technology, context, associations, and possible age of the specimen are discussed, and this unique item is placed in the larger framework of perishable developments in the New World.*

INTRODUCTION

A single positive impression (cast) of a basketry or textile fragment and possible minute fragments of this construction were recovered during the 1996 excavations at the Hiscock site in Genesee County, New York (Figure 3.1). The Hiscock site is an approximately 0.8 ha spring-fed basin that is situated within an area of ground moraine about 1.5 km west-northwest of Byron, New York, and about 37 km west-southwest of Rochester. The site is flanked on the north by the Niagara Escarpment and on the south by the Onondaga Escarpment, both of which contain abundant outcrops of high-grade lithic resources. Between these escarpments lie the remnants of two postglacial lakes, Towanda/Wainfleet and Tcakowageh (Muller and Calkin 1985; Tinkler et al. 1992), which during the late Pleistocene through early Holocene collectively formed a formidable east–west barrier to both human and animal movement (Laub 2002:105). The Hiscock site's location within a gap in this barrier, along with its active springs, may have made it an attractive locus for migratory animal or human populations (Laub 2002:105).

The Hiscock site was discovered and initially tested in 1959, with additional testing taking place in 1982. Major excavations began in 1983 and have continued with attendant analyses to the present. These excavations have revealed a series of five layers, the deepest of which is a cobble till that is culturally sterile (Laub 2002; Laub et al. 1988). Superimposed upon this so-called Cobble Layer is a complex unit of sediments called the Fibrous Gravelly Clay Layer, which has yielded pollen, plant macrofossils (especially jack pine [*Pinus banksiana*] cones), abundant remains of mastodon (*Mammut americanum*), and remains of other species including caribou (*Rangifer tarandus*), stag-moose (*Cervalces scotti*), California condor (*Gymnogyps californianus*), and giant beaver (*Castoroides ohioensis*). Thirteen radiocarbon assays indicate that this layer dates to ca. 11,400–9500/9200 uncalibrated

Perishable Material Culture in the Northeast, edited by Penelope Ballard Drooker. New York State Museum Bulletin 500.

Figure 3.1. Approximate locations of perishable-bearing sites discussed in this chapter: 1=Hiscock, New York; 2=Meadowcroft Rockshelter, Pennsylvania; 3=Graham Cave, Missouri; 4=Icehouse Bottom, Tennessee; 5 =Modoc Rockshelter, Illinois; 6=Russell Cave, Alabama.

radiocarbon years B.P. The textile impression discussed in this chapter was recovered from the upper reaches of the Fibrous Gravelly Clay Layer.

The Fibrous Gravelly Clay Layer is unconformably overlain by a Holocene peat liberally interspersed with numerous fragments of wood. Called the Woody Layer, this unit has also yielded pollen, plant macrofossils, and remains of modern fauna, notably white-tailed deer (*Odocoileus virginianus*). The base of the older and deeper part of the Woody Layer is dated to ca. 9300/9200 uncalibrated radiocarbon years B.P., while the upper part of the unit is ca. 6200 uncalibrated radiocarbon years B.P. in age (Laub 2002:107). The remaining stratigraphic units are much younger and beyond the scope of this chapter.

In addition to ecofactual remains, the Fibrous Gravelly Clay has also produced five fluted bifaces, an untyped projectile point fragment, and a triangular end uniface, all of Onondaga chert (Laub 2002:110-111). Overlying layers yielded a small suite of Archaic materials. Preliminary assessments of the Hiscock site are available in Laub et al. (1988) and Laub (2002). A major monograph detailing the archaeological investigation of the Hiscock site is in press (Laub 2003).

METHODS

BASKETRY DEFINED

Technically, basketry is usually treated as a subclass or variety of textile, which, in turn, may be defined as a larger, all-encompassing class of woven materials (see "Textile" in Definitions). In terms of process and product, however, both textiles and basketry can be regarded as belonging to or representing two distinct, albeit closely interrelated, perishable industries and, thus, these two categories can be defined at an equivalent classificatory level.

Specifically, basketry consists of those items including containers, bags, and matting which, as recognized by many researchers (e.g., Adovasio 1977; Balfet 1952; Drooker 1992; Mason 1904), are usually not fully pliable, and, as Driver (1961:159) points out, are manually woven without the support of any frame or loom. Textiles generally represent infinitely flexible materials, produced with the aid of a frame or loom. The difference between basketry and textiles then is customarily determined by the degree of flexibility of the specimen, the form of the item, and whether the item was made with some variety of hanging or horizontal heddle or non-heddle frame. Since these three features — and thus the distinction between basketry and textiles — can usually be determined only by examination of actual specimens, as is discussed further below (see Discussion, Internal Correlations), no final determination can be definitively made as to whether the Hiscock site impression and possible related fragments represent loom-woven or non-loom-woven materials. As is also detailed below, however, regardless of whether a supportive frame was used, the manufacturing process can usually be distinguished from an impression. Of the three major and generally mutually exclusive manufacturing processes (Adovasio 1977) — twining, coiling, and plaiting — only twining is represented at the Hiscock site.

CONSERVATION PROCEDURES

Upon its discovery on 28 July 1996, the specimen and its adhering matrix were treated with glycerin procured from a local drugstore, wrapped in plastic, stored on an aluminum foil "boat," and then kept refrigerated. The specimen was then transferred to Mercyhurst Archaeological Institute (MAI) by R. Laub on 27 August 1996, and initially examined by J. M. Adovasio and R. B. Davis. A small amount (approximately 1 cm^2) of what appeared to be mold was observed on the opposite side of the specimen from the textile/basketry impression. Samples of the mold were taken for analysis by L. Gauriloff, Department of Biology, Mercyhurst College, and the specimen was placed in a translucent Tupperware container and stored in an environmentally controlled chamber where, as of this writing, it still resides. Temperature in the chamber is maintained at 34–36°F (1–2°C) and humidity is maintained at 54–56 percent.

The mold was identified as penicillin (*Penicillium* sp.). Gauriloff recommended treatment of the affected areas with a mixture of isopropyl alcohol and deionized water (DI H_2O). Treatment was delayed until 21 October 1996, while researchers at MAI contacted I. Taylor at the Radiocarbon Laboratory, University of California, Riverside, to determine the potential effects of isopropyl alcohol on radiometric dating. Taylor concluded that there would be no detrimental effects and the penicillin was subsequently excised. The affected area was then spot-treated with reagent-grade isopropyl alcohol. There is no longer any detectable microbial activity on the specimen.

Since its initial treatment, the specimen has remained stable, receiving only periodic misting with DI H_2O. Currently, the specimen shows no signs of degradation and all indications are that it will remain stable for an indefinite period of time. Plans for final stabilization are being prepared by the Canadian Conservation Institute (CCI), Ottawa, Ontario (Logan et al. 2001).

ANALYTICAL METHODS

The specimen was analyzed in its wet state with the aid of a Leica Wild — 10 stereoscopic microscope. Data were recorded on standardized analysis forms. The specimen's degree of flexibility, the degree of attrition wear, possible form and function, as well as raw material and method of preparation were noted. Measurements were recorded in the metric system with a Helios needle-nosed dial caliper. The specimen was photographed before, during, and after analysis using both black-and-white and color 35 mm film. Digital photographs were also taken using a Panasonic WV-CP410 digital camera and the Snappy Video Snapshot computer program. Additionally, prior to analysis, the specimen was submitted by R. S. Laub to the Canadian Conservation Institute (CCI), Ottawa, Ontario, for documentation via three-dimensional laser scanning.

The twined impression from the Hiscock site was assigned to a single structural type based on the number and sequence of warps engaged at each weft crossing and the spacing of the weft rows. Twining denotes a subclass of basketry/textile structures manufactured by passing two or more moving (active) horizontal elements, called wefts, around stationary (passive) vertical elements, called warps (see Definitions). Twining techniques may be used to produce containers, mats, and bags, as well as fish traps, cradles, hats, or fabrics of a wide variety of configurations. The specimen was also examined for selvage, method of starting, work direction, and type(s) of decorative mechanics and mending. Classificatory protocols and descriptive terminology follow Adovasio (1977), Emery (1966), and Hurley (1979).

RESULTS

Description of the specimen (Figure 3.2) is as follows, in standard Mercyhurst Archaeological Institute format.

Close Diagonal Twining, Z-Twist Weft

Number of Specimens: 1 (Specimen E9SW-215).

Type of Specimen: Fragment with selvage, 1.

Number of Individual Forms Represented: 1.

Type of Form Represented: Bag or cloth, exact configuration unknown.

Technique and Comments: This specimen employs diagonal twined weaving over paired warp elements. Wefts are paired and closely spaced to partially conceal the warps. Both warps and wefts are composed of two-ply S-spun, Z-twist cordage produced from retted plant stems or bast fibers from an as-yet-unidentified plant (Figures 3.3 and 3.4).

There are no apparent warp splices, although the specimen does exhibit laid-in weft splices. The specimen exhibits a simple, continuous weft side selvage (Figure 3.5) on one margin. The specimen is undecorated, unmended, and exhibits no diagnostic attrition wear. The specimen is not covered with pitch, nor does it show pre-depositional residues. It probably represents a fragment of cloth or, somewhat less likely, a fragment of a bag.

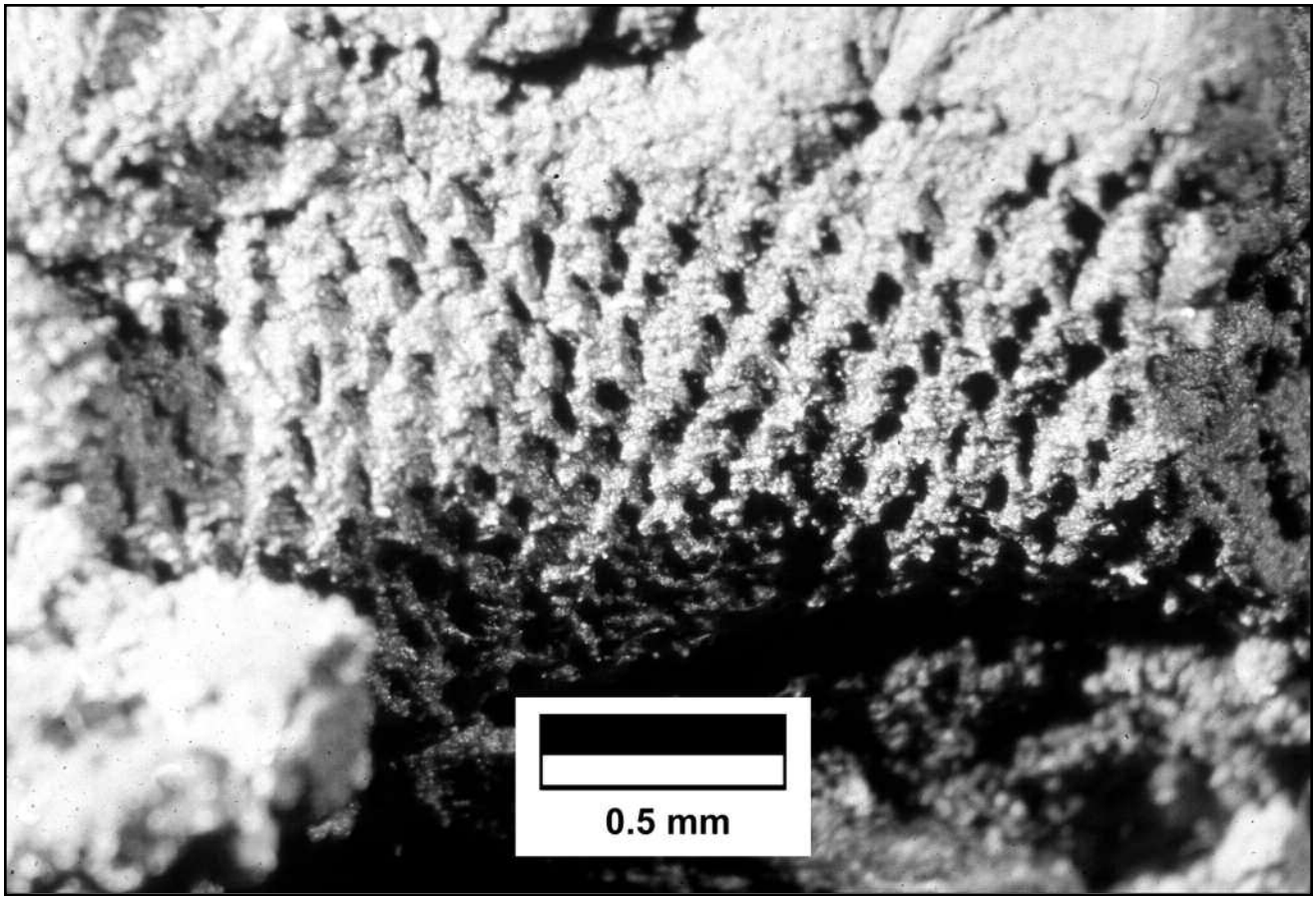

Figure 3.2. The Hiscock twining specimen.

Measurements:

Specimen Dimensions:	20 x 12 mm
Range in Warp Element Diameter:	0.12–0.19 mm
Mean Warp Element Diameter:	0.17 mm
Warp Unit Diameter:	0.32 mm
Warp Units per cm:	16 (extrapolated from measurable area of 0.5 mm)
Weft Element Diameter:	0.10 mm
Range in Weft Unit Diameter:	0.16–0.28 mm
Mean Weft Unit Diameter:	0.20 mm
Weft Units per cm:	14 (extrapolated from measurable area of 0.5 mm)
Weft Gap:	0 mm

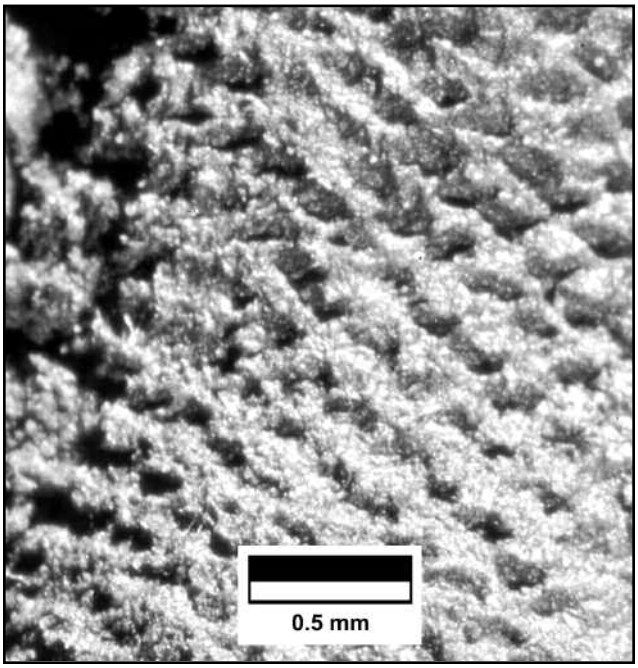

Figure 3.3. Close-up of the structure of the Hiscock twining specimen.

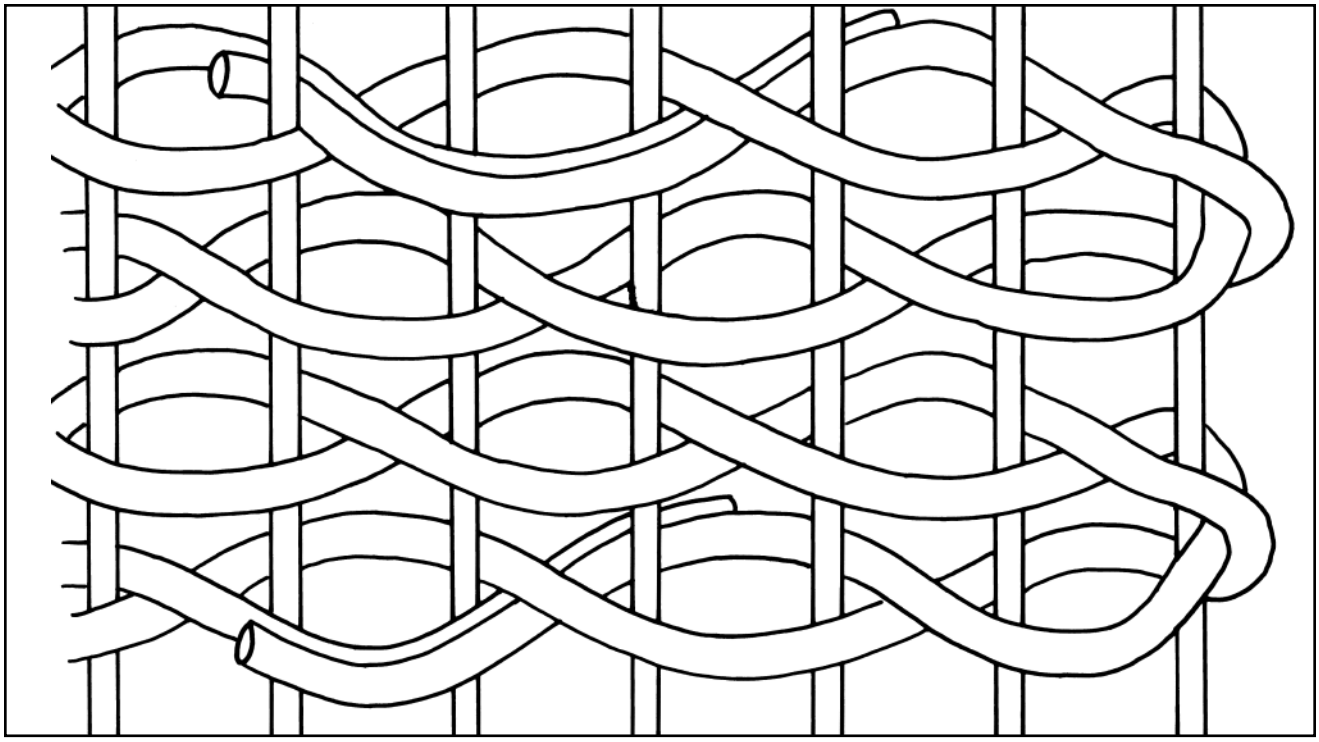

Figure 3.4. Structural schematic of the Hiscock twining specimen. Note the presence of laid-in weft splices and a continuous weft side-selvage.

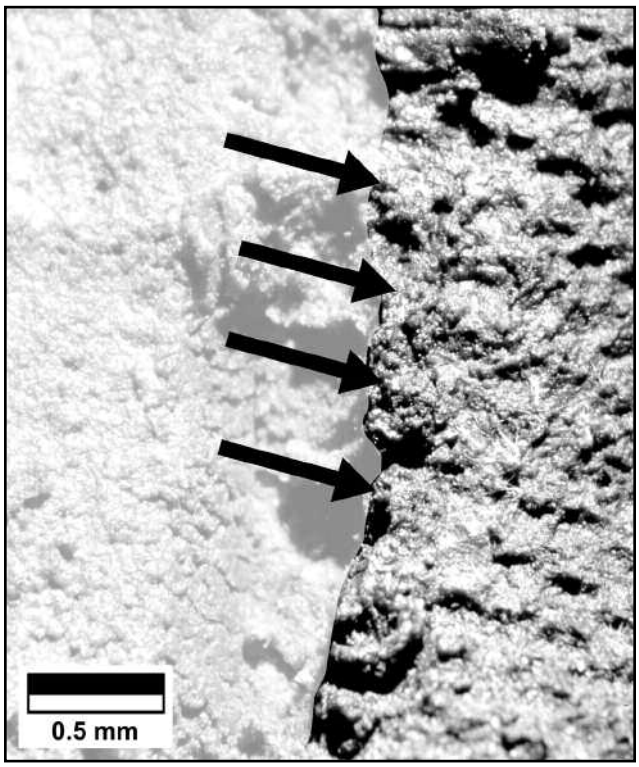

Figure 3.5. Close-up of the selvage of the Hiscock twining specimen, indicated by arrows.

DISCUSSION

INTERNAL CORRELATIONS

Genesis of the Specimen. The Hiscock site twining specimen represents one of the rarest types of basketry or textile fossil replication encountered in the archaeological record. Specifically, it is a natural positive cast of a portion of a larger item as opposed to a negative impression of an item produced by impressing the original into a compliant medium or matrix.

To our knowledge, the only way that a natural cast like the Hiscock site example can be formed is via the complete encasement and subsequent disintegration of the original within an essentially undeformed matrix. Once all or most of the original is gone, the "mold" or negative space is infilled with fine silt or clay-sized sediment, thus producing the natural equivalent of a ciré perdue or lost wax cast. This interpretation is strongly supported by the fine-grained composition of the body of the Hiscock site specimen as well as its remarkable integrity. Interestingly,

the decomposition of the original may not have been complete, as some microscopic strands of plant material within the impression may represent minute fragments of the original construction. It should be noted that there is no way such a positive cast could have been created by any of the excavators or other contemporary users of the site.

Provenience, Context, and Association. The Hiscock site twining specimen was not recovered or documented *in situ*. Rather — and remarkably, considering its fragility — it was retrieved from the screens. The matrix containing the specimen was hand-excavated from grid square E9SW, the southern half of which (E9SW[S1/2]) was excavated in 1996. This matrix was recovered 77–82 cm (30.3–32.3 in) below modern ground surface within the upper portion of the Fibrous Gravelly Clay Layer near the upper interface of that unit with the overlying Woody Layer (Figure 3.6).

The specimen is considered by the excavators to be "loosely" associated with faunal elements mostly assignable to a single white-tailed deer (*Odocoileus virginianus*), the majority of which clustered in the lower part of the overlying Woody Layer and intruded down into the Fibrous Gravelly Layer (Laub, personal commu-

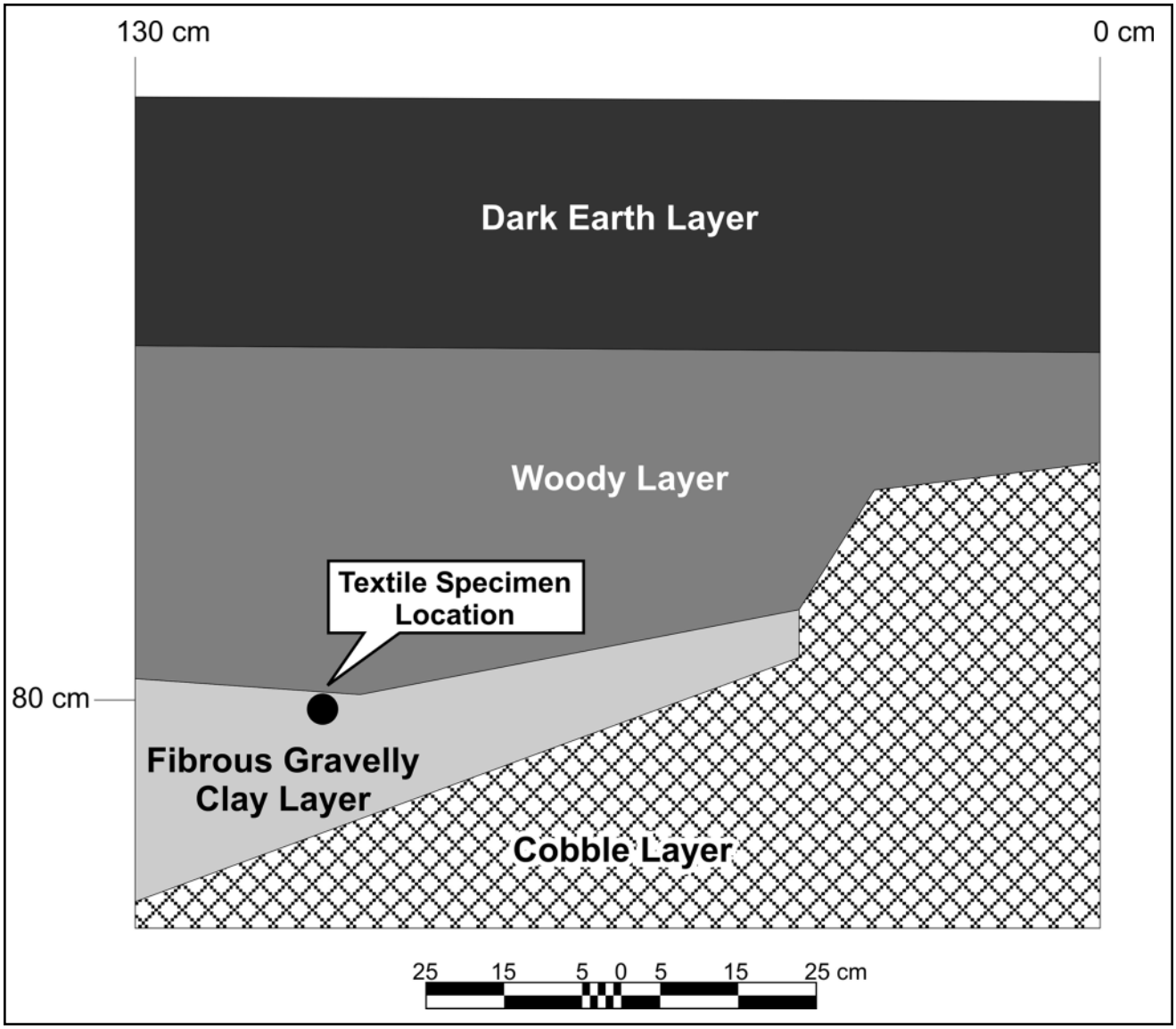

Figure 3.6. Stratigraphic profile of the east face of Unit E9SW[S1/2].

nication 2001). Put most simply, the exact provenience of the impression is somewhat ambiguous. It may have originated within the Fibrous Gravelly Clay, or it may have intruded into it from the base of the overlying Woody Layer. Interestingly, and perhaps tellingly, pollen analysis of sediment from the matrix directly around the impression is consistent with an origin within the Fibrous Gravelly Clay rather than the overlying Woody Layer (Laub, personal communication 2001).

Chronology. Given the uncertainties of the exact provenience of the Hiscock site twining specimen, a precise age for this item cannot be established on purely stratigraphic or contextual grounds. Unfortunately, neither can radiometric determinations resolve the matter. Accelerator mass spectrometry (AMS) assays run on a twig fragment of unidentifiable wood from the matrix of the specimen produced an uncorrected date of 10,180 ± 50 B.P. (CAMS-75232), while a piece of unidentifiable plant tissue from the matrix yielded an uncorrected date of 7950 ± 50 B.P. (CAMS-75233). Obviously, the earlier assay is consistent with an origin in the Fibrous Gravelly Clay, which is of demonstrated late Pleistocene age, while the later date is consistent with an origin in the older Woody Layer, which is of early Holocene ascription (Laub 2001; Laub et al. 1988).

It should be noted that neither assay was run on fibers thought to be part of the original specimen. The few surviving crumbs of the original provided an insufficient volume for dating by currently available means, and have been archived to await the development of adequate technology. At that time, the age of the twining specimen may be established with greater certitude.

Technology, Form, and Function. Whatever its precise age, the Hiscock site twining specimen represents a technically sophisticated and well-executed example of close diagonal twining. The standardization (i.e., consistent gauge and diameter) of the warp and weft elements, the regularity and even spacing of weft row engagement, and the consistency of the side selvage treatment collectively mark or signal a mature perishable technology rather than any sort of initial essay in the craft.

Unfortunately, despite these insights, the relatively small size of the specimen precludes specification of finished form or presumed function(s). While it is virtually certain that the original construction was fully flexible, it is not possible to determine whether the fragment is an item of clothing or a bag fragment. The presence of a side selvage suggests that the specimen is most likely a segment of a twined cloth or fabric of indeterminate shape. However, it is possible that this specimen is a fragment of an envelope-like bag, made by folding and then sewing rectanguloid lengths of twined textiles. As such, the bag may exhibit side selvages unlike the far more common radially twined form.

Regardless of the specific form represented by the specimen, it is noteworthy that Logan (personal communication 2001) suggests the item may have been used to transport raw clay which, in turn, could have been used in wattle-and-daub construction. Interestingly, such a function has also been suggested for some of the much earlier textile fragments recovered from Gravettian contexts in central Moravia (Adovasio et al. 1997; Adovasio, Hyland, Soffer, and Klíma 2001; Soffer et al. 2000).

EXTERNAL CORRELATIONS

Despite the ambiguities of its age, as well as the uncertainties surrounding its exact form or function, the Hiscock site specimen is nonetheless one of the oldest evidences of perishable fiber technology in eastern North America. Indeed, if the earlier AMS date is correct, the Hiscock site specimen is the oldest example of twining from anywhere east of the Mississippi River. Even if the younger AMS date is accepted as a minimum age, the Hiscock site specimen is the oldest example of twining within the Northeast and one of only a handful of early Holocene examples of this technology in eastern North America.

As discussed by Adovasio and Illingworth in Chapter 2 of this volume, perishable remains of any kind are extremely uncommon in Paleoindian sites east of the Cordilleran Front and its outliers. Indeed, with the singular exception of the simple plaited basketry from Meadowcroft

Rockshelter (Stile 1982; Chapter 2, this volume) none of the extant remains are indisputably of late Pleistocene age.

By the onset of essentially modern climatic conditions, which is concomitant with the initiation of the Early Archaic period (ca. 8000 B.C. [10,000 B.P.]), perishables are somewhat better represented in widely separated portions of eastern North America. A single specimen from Level 6 (Zone IV) at Graham Cave in Montgomery County, Missouri (see Figure 3.1), ranges from 9700 ± 500 B.P. to 9290 ± 300 B.P. in age and may be assigned to the very beginning of this period (Klippel 1971:22; Logan 1952:74). This fired clay impression, erroneously identified as "coiled" (Logan 1952:58), is — with the possible exception of the Hiscock site impression — the oldest evidence of twining in eastern North America. Examination of a clay "positive" made directly from the impression indicates that the specimen was composed of close simple S-twist twining. The paired twining wefts appear to have been single elements of loosely Z-"spun" fibers[1], while the structure of the warps is not discernible. If the warps were rigid, the specimen probably represents a container of some sort, and if they were flexible, it may be a bag fragment. The condition of the impression precludes the determination of splicing techniques or any other detail of construction, save to note that the object was not structurally decorated. Similarly, the raw material employed in construction cannot be ascertained.

Later levels (zones) at Graham Cave produced additional basketry impressions, again on fired clay (Logan 1952:58). Specimens representing a minimum of two types of twining were recovered (Logan 1952:Pl. XXI) from Level 5 (Zone IV/III), Level 4 (Zone III), and Level 2 (Zone II). Collectively, these specimens date between 8830 ± 500 B.P. and 7630 ± 120 B.P. One of these types (Logan 1952:Pl. XXIc) is an impression of open simple S-twist twining over what appears to be two-ply Z-spun S-twist cordage warps, while the other (Logan 1952:Pl. XXIb) is either a representative of the same type (except with Z-twist warps) or it is open diagonal twining, again with Z-twist warps. As the "fibrous nature" of the warps and wefts seems to indicate, these two fragments probably represent portions of flexible containers such as bags. The specimens lack selvages, splices, or decoration, and were composed of indeterminate raw materials.

Southeast of Graham Cave, Icehouse Bottom in Monroe County, Tennessee (see Figure 3.1), also yielded an assemblage of impressions of Early Archaic vintage (Chapman and Adovasio 1977:620). Twenty-seven of the site's thirty specimens originate from Strata M-O, the Lower Kirk horizon, and span a period of 9450–9250 B.P. (Chapman and Adovasio 1977:623). The remaining three fragments derive from Strata L and J, the Upper Kirk horizon, and may be ascribed to a 9250–8850 B.P. time interval.

Twenty-nine specimens from the site represent impressions of open simple twining with Z-twist wefts. Warps and wefts consisted of two-ply, S-spun, Z-twist cordage. These specimens lack selvages and were probably originally flexible; thus, they probably represent impressions of the undecorated "walls" of matting or bags. Further, some of these items appear to have been radially twined, although splice type and raw material cannot be determined.

From the same general area (see Figure 3.1), two twined basketry impressions were documented within the early deposits at Modoc Rockshelter, Illinois (Fowler 1959; Styles et al. 1983). The oldest specimen, which derives from the Stratum 20–23 interface, was open simple twining, with Z-twist wefts. Both warps and wefts apparently were two-ply, S-twist fiber. There was an approximately 8.5 mm gap between weft rows. The texture appears flexible and the specimen — or more accurately, the surface from which it derives — is not directly dated but it underlay the second Modoc specimen, which is dated to ca. 8350 ± 100 B.P. The younger impression from Modoc Rockshelter was recovered from Feature 252 in Stratum 26 and appears to be an open simple twined fragment of indeterminate weft slant. Unfortunately, the impression is not well delineated and the composition and flexibility of the warps and wefts cannot be determined with certainty. It may be another mat fragment.

While the Graham Cave, Icehouse Bottom, and Modoc Rockshelter perishables are clearly of

Early Archaic ascription, somewhat less certain is the temporal placement of perishable specimens from Layer G at Russell Cave, located in northeastern Alabama (see Figure 3.1). This "unit" is dated between 8950 B.P. and 6950 B.P., and has yielded four examples of what is alleged to be over-and-under interlacing — that is, simple plaiting (Griffin 1978:62). While the single published photograph does not allow exact determination of actual construction techniques or any other details of manufacture, the specimen appears to be twined. Specifically, the illustrated item clearly seems to be wrapped twining with one semi-rigid fixed weft and one flexible "running weft." Although rare in the extreme, this type of twining (see Figure 11.12d) is represented in the archaeological records of the Pacific Northwest and the Lower Pecos in Texas. The illustrated Russell Cave specimen apparently represents a (flexible?) wall fragment (without selvage) of a container of unspecified configuration and is unspliced, unmended, and undecorated. Lamentably, the problematic identification and interpretation of the Layer G artifacts is compounded by the fact that these materials may be intrusive from later levels.

Whatever the type(s) or exact age(s) of the Russell Cave assemblage, the data from Icehouse Bottom, Modoc Rockshelter, and the Hiscock site indicate that, regardless of their precise forms, the twining of plant-fiber-derived products was well established in the east by the early Holocene at least. It is also quite clear that — despite the fact that other plant-derived products, like plaited basketry and knotted netting (Andrews and Adovasio 1996), also exhibit a venerable antiquity — the technology of twining plant fibers lies at or near the base of basketry/textile developments in eastern North America, just as it does in western North America (Adovasio 1974; Andrews et al. 1986) or, for that matter, Mesoamerica (Adovasio 1980) or South America (Adovasio and Maslowski 1980). If the Hiscock twined impression is indeed of terminal Pleistocene age, it only reinforces the great antiquity of this seminal technology.

It should be stressed in this regard that the earlier AMS assay for the Hiscock site specimen is not inconsistent with either the known age of twining in western North America (cf. Adovasio 1974; Andrews and Adovasio 1980; Andrews et al. 1986) nor the demonstrated antiquity of this technology in the Old World (cf. Adovasio, Hyland, Soffer, and Klíma 2001; Adovasio, Soffer, Hyland, Illingworth, Klíma, and Svoboda 2001). Indeed, given the documented occurrence of twining in 29th millennium B.P. Gravettian contexts in Central Europe and slightly later elsewhere in the Old World, it is virtually certain that this basketry subclass, specifically, and related perishable fiber technology, generally, were part and parcel of the material culture suite brought to the New World by its first colonists (Adovasio, Hyland, Soffer, and Illingworth 2001).

What is unique about the Hiscock site specimen is that if it is indeed of late Pleistocene age, it represents the first time this technology has ever been recorded from an open, fluted point locality in the entire New World. As such, it conclusively demonstrates that perishable plant fiber-based textile or basketry technology was an integral part of the lifeway of groups hitherto defined, described, and putatively explained almost entirely on the basis of their durable tool kits. In fact, if the recovery of twining from Old World Gravettian contexts may serve as an analogue, it may well prove that perishable fiber-based technology in the form of baskets, nets, and textiles was far more important to the ultimate success of Clovis and related populations than any fluted point ever could be.

CONCLUSIONS

The following salient points can be made about perishable fiber technology at the Hiscock site:

1. A positive cast of a close diagonal twined basket/textile with Z-twist wefts was recovered from the Hiscock site.
2. Although the form and function(s) of the specimen are unknown, the cast reflects a mature and technically sophisticated textile/basketry technology, not an initial essay in these crafts.
3. The age of the specimen is ambiguous, with a possible range from late Pleistocene to

early Holocene based on two uncalibrated AMS determinations.

4. If the specimen is late Pleistocene in age, which is supported by pollen spectrum data, then it represents the first documented occurrence of twined textiles or basketry in an open Clovis-era site in all of the Americas.
5. Whatever the age, the Hiscock site specimen is consistent with previous reconstructions of textile/basketry developments in eastern North America, specifically, and North America, generally.

ACKNOWLEDGMENTS

The authors wish to thank Judith A. Logan (Canadian Conservation Institute, Ottawa) for sharing ideas about the function and significance of the Hiscock fabric. Figure 3.4 was drafted by K. K. Manske. Figure 3.6 was drafted by J. S. Illingworth. Figures 3.2, 3.3, and 3.5 were taken by D. C. Hyland and digitally processed by D. R. Pedler. This chapter was edited by D. R. Pedler.

NOTE

1. It should be noted that, in this context, the use of the term "spun" does not necessarily indicate the use of a spindle whorl (see Definitions, "Spun yarn"). The term as used here allows for that possiblity, or for simple twisting.

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CHAPTER 4

ORGANIC PRESERVATION ON PREHISTORIC COPPER ARTIFACTS OF THE OHIO HOPEWELL

DeeAnne Wymer

ABSTRACT

This chapter reviews the categories and nature of organic materials that have been identified for the Ohio Hopewell Moundbuilder culture. Special emphasis is given to recent research that has identified new classes of materials under unusual preservation conditions with copper ceremonial artifacts. In addition, the author focuses on the role that the identified organic materials may have played in Hopewell rituals centered on the dead and the larger ceremonial sphere embedded within earthwork and mound construction.

INTRODUCTION

The prehistoric culture known today as "Hopewell" has fascinated both archaeologists and the public for centuries. The Hopewell populations, centered in the rich river systems of the Ohio Valley, built burial mounds and associated ceremonial earthworks from approximately 100 B.C. to A.D. 400. Hopewell archaeology is famous for the elaborate nature of the burials recovered from the mounds, which included an apparently complicated sequence of ritual events before and during the interment of the dead. Most of the largest and most impressive of these mounds were excavated during the late 1800s and early 1900s. The excavations were conducted to procure the artifacts and ritual paraphernalia that had been placed with the burials, which included raw materials spanning nearly the entire North American continent. Obsidian and grizzly bear canines from the American West, copper from southern Canada, shells and shark teeth from the Florida coast, pearls, and mica from the Carolinas are some of the most prominent materials turned into beautiful and elaborate ritual artifacts associated with the Hopewell culture. (See Brose and Greber 1979; Dancey and Pacheco 1997; Fagan 2000; Greber 1983; Greber and Ruhl 2000; Mainfort and Sullivan 1998; Pacheco 1996; and Seeman 1979 for a general discussion of Hopewell archaeology.) These items were carefully placed with cremation burials or extended burials, or as ritual caches inside the Great Houses, which held the dead on clay-lined platforms. The final ritual act seems to have been the burning of the ceremonial building followed by the creation of the earthen mound.

The most noteworthy excavations of the largest and most complicated of the Hopewell mounds were conducted by such prominent archaeologists as Frederic W. Putnam, Warren K. Moorehead, and William C. Mills. Mills wrote detailed and careful descriptions of his work in a number of seminal articles in the *Ohio Archaeological and Historical Quarterly* during the early 1900s. What is intriguing when reviewing these early documents, as well as those of Moorehead

Perishable Material Culture in the Northeast, edited by Penelope Ballard Drooker. New York State Museum Bulletin 500.

and Putnam, is the rather frequent reference to perishable fibers in the burial contexts. Mills, for example, incorporated separate sections in his publications describing the fabrics (including leather) and even had a fabric sample identified for the raw material (bast fibers) by a botanist.

> In a number of graves [at the Seip Mound] . . . the final ceremony consisted of setting fire to the covering of straw, twigs and cloth, and here the charred remnants of cloth and matting were preserved. In the first section [of the charnel house] the charred cloth, showing the simplest to the highest art in primitive weaving, was found at the burial shrines outside the graves . . . the cloth was made from bast fiber secured from many of the trees and plants known to exist in prehistoric times. (Mills 1909:316)

Mills notes that copper objects and the cremations appeared to have been laid upon leather (on top of puddled clay platforms) and then were covered by matting or "fine textiles" which were set on fire in some cases and then apparently quickly covered with dirt before the fire had totally destroyed the organic material. Other excavators noted the same pattern as well:

> These chambers [at the Edwin Harness Mound] were made by placing logs, from 5 to 6 inches in diameter, on the clay which forms the lowest layer of the mound, in such a way as to make enclosures six to seven feet in length and from 2 to 3 feet in width and about a foot in height. In these the bodies were placed, evidently wrapped in garments, as indicated by the charred cloth and mats found in several of the chambers . . . On the breast of one of the skeletons was a thin copper plate . . . The chemical action of the copper had preserved the texture of a piece of finely woven cloth lying between the plate and the bones of the chest. (Putnam 1887:405-406)

Apparently, the perishable fibers were preserved under two primary conditions. Some of the material, especially what appears to have been plant-based matting (principally cane), bark layers or worked bark mats, and fabrics made of various organic substances, were preserved when they became carbonized during ritual burning. The second situation included organic materials that had come into contact with metal artifacts, especially the rather significant quantities of copper, that had been placed with the dead or in ritual caches. Several of the early archaeologists, especially Putnam and Mills, collected samples of charred perishable materials from burial contexts, as well as the more intact organics associated with the copper artifacts, for the collections of their various museums.

Ironically, and sadly, little attention was paid to the perishable fibers recovered during these early excavations. In fact, it seems apparent that much of the material carefully collected by Putnam, Mills, and other researchers, especially the large quantities of burned organic layers and fabrics, were lost during the curation histories of the collections from these prominent mounds. More-recent researchers have examined the fine fabrics present on the copper breastplates, for example, but these studies emphasized the analysis of weave patterns or preliminary social information (see Church 1984, for example). In some cases organic material was noted when samples were evaluated or removed for radiocarbon dating (for example, I have identified materials over the past several years for N'omi Greber). However, no systematic assessment or study of the range of organic materials that may still be preserved in archived collections has been undertaken. This chapter thus outlines a recent project that has been initiated to expand upon the earlier research conducted with Hopewell perishable materials.

THE PROJECT

This chapter describes the procedures and results of the analysis of 77 copper objects from the collections curated at the Ohio Historical Society, Columbus, Ohio, conducted in the summer of 2000 (summarized by site in Table 4.1). The main thrust of the analysis was to identify and evaluate organic materials and residue preserved on the surface of Hopewellian copper artifacts. The artifacts selected were dictated by the parameters of a larger project conducted by

Table 4.1. Number of Artifacts Examined for Preserved Materials.

Sites	Breastplates	Celts	Headplates
Seip	31	5	0
Hopewell	17	8	3
Liberty/Harness	5	0	1
Ater	3	0	0
Fortney	1	1	0
Fort Ancient	1	0	0
Rockhold	1	0	0
Total	59	14	4

Dr. Christopher Carr and consequently included "breastplates" (59 in number), "celts" (14), and "headdresses" (4) [the original project term "headdress" has been replaced by the more appropriate term "headplate" for this chapter and Chapter 5, this volume]. The larger number of breastplates reflects both the greater quantity of these artifacts in the curated collections and their tendency to have retained organic materials in a fairly good state of preservation. Seven sites are represented in the analysis, including examples of prominent Hopewell sites with large collections (Seip, Hopewell, and Liberty/Harness), plus sites with either smaller numbers of curated artifacts or less-well-known localities (Ater, Fortney, Fort Ancient, and Rockhold) (Figure 4.1). In fact, both Seip and Hopewell are fairly well represented with examples of breastplates and celts; the Hopewell site includes three headdresses as well. The other sites' analyses tended to be based upon the examination of breastplates; Fortney did produce one celt specimen (see Table 4.1).

ANALYTICAL TECHNIQUES

The detailed examination of the copper artifacts followed a specific format that I created for this project. The analysis consisted of carefully scanning the surface of each artifact side with the aid of a stereobinocular microscope (with magnifications ranging from 7x to 30x), the standard "tool" of paleoethnobotanical research. The scan followed a set pattern, typically beginning at the upper right edge/corner of the artifact, with the artifact being slowly moved to the right until the entire upper edge had been examined; the next pass, moving from left to right, included an overlap of the field of vision of the first transect to ensure that nothing was missed. The pattern of overlapping transects was continued until the entire side had been completed. Once the entire side had been inspected and notations made (see below), selected areas that revealed complicated layers of materials, unusual substances, or particularly well-preserved fragments were reexamined in detail. Once the first side was completed, the object was turned over and a scan completed for the opposite surface. Each side was treated independently and forms and notes were made for each object side.

The location and identification of organic materials on the artifacts was facilitated by the use of transparencies marked in a grid layout that were placed on top of digital color photographs (not to scale) of each side of each object (see Figure 4.2). The outline of the object, such as the edges of a breastplate, was marked on the transparency with black permanent marker pen and the object catalog number and side number were also identified on the transparency. Consequently, materials identified on the object with the microscope could be directly outlined and drawn on the transparency along with written comments. An assortment of different colored marker pens was utilized with commonly encountered materials represented by selected colors (e.g., the outline of hide marked in orange ink, plant fabrics in purple, and wood charcoal and other macrobotanical specimens in red). Thus, the use of this method created an immedi-

Figure 4.1. Map showing site locations.

ate visual impact of the type, location, and nature of the preserved organic materials still extant on the surface of the copper. In addition, the use of a grid system on the transparency allowed for precise locations of materials or items (or edges/boundaries of substances) in the handwritten or typed notes.

In addition, an extensive five-page form was utilized to ensure that uniform and accurate notes were kept for each object side. The forms included objective data, such as a series of checklists recording the presence of specific organic categories (e.g., the presence of hide/leather, plant fabrics, feathers, fur, and others). Subjective data, which may be some of the more important descriptions of the material, included extensive and detailed notes and impressions indicated on the last page of the form that were subsequently typed into a laptop computer at the museum.

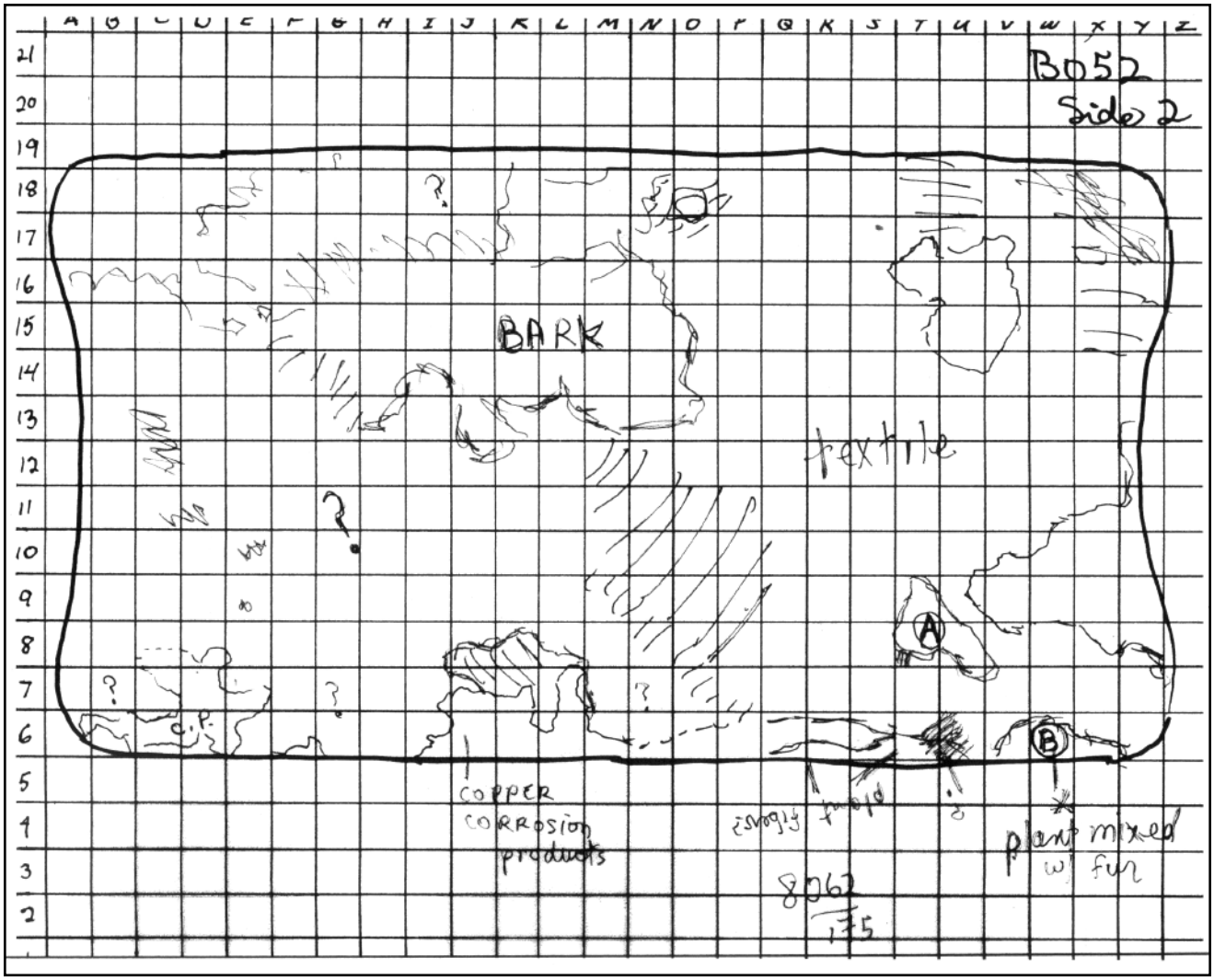

Figure 4.2. Example of analysis transparency and grid system.

Due to time constraints a few objects (11 in number) were simply "scanned"; this enabled the individual sides of the objects to be more rapidly assessed. This was often done with objects that a preliminary visual examination suggested might not have much organic material remaining. Also, several specimens could only be assessed for a single side (one breastplate, for example, had been glued to a wooden back after excavation, and thus only the visible side could be analyzed).

Typically, I first assessed and described the organic materials on each artifact and then passed the object on to the project textile expert, Dr. Virginia Wimberley, if traces of fabrics were present (see Chapter 5, this volume, for Wimberley's assessment of the fabrics). The partnership of a paleoethnobotanist and textile analyst proved to be extremely advantageous. I believe that our assessments of the objects were strengthened by the interaction and discussion while reviewing the same set of artifacts at the same time.

Surprisingly, a wide variety of organic materials were still present on the copper artifacts. The first phase of the research consisted of developing macro- and micro-level characteristics useful for materials identification. Some materials, such as hide and bark, revealed remarkably similar attributes at first glance; however, closer micro-level examination, along with an increasing familiarity with the materials as the project

progressed, produced consistent and distinctive criteria that could be used to identify and differentiate among the materials. Identification was especially hindered in some cases by the degree of copper corrosion replacement of organic materials. Some substances, such as feathers and hide, seem to more readily uptake and absorb corrosion products, thus obscuring macro and cell structure. Other substances, such as wood charcoal, seemed to be little affected by corrosion by-products. However, increasing experience and the development of a comparative collection geared specifically toward the project greatly facilitated the identification of materials on the copper surfaces.

IDENTIFIED MATERIALS

MATERIALS ON BREASTPLATES

All copper artifact classes exhibited traces of preserved organic substances. In fact, virtually every object analyzed in this project produced at least some residue of organic material. Breastplates, however, revealed the greatest quantity and diversity of identifiable materials. The substances on celts and headdresses seemed to reflect what had been identified on the breastplates; the only item not observed on the breastplates that was unique to the celt artifact class included a single specimen of a small copper bead adhering to a celt from the Hopewell site (Tables 4.2, 4.3, and 4.4).

A review of the organic materials associated with the various breastplates is a good way to initiate a discussion of the materials identified during the project analyses. One difficulty in this discussion is the sheer diversity of the materials involved. I have grouped the substances into twelve basic categories: (1) textiles, (2) feathers, (3) leather/hide, (4) hair/fur, (5) hide/bark?, (6) macrobotanical, (7) bone, (8) pearls, (9) beads - other, (10) prehistoric pigments, (11) historic repair, and (12) unidentified organic (Table 4.2 and Figures 4.3-4.14). I first discuss the nature of the materials in these categories, emphasizing the perishable fibers identified on the objects, and then follow with a review of the pattern of their occurrence by artifact type and site locality.

Table 4.2. Materials Identified on Breastplates.[a]

Materials	Identifications (number of sides)	
	Confirmed	Possible
Textiles		
— plant - Group 1	40	4
— plant - matting	2	1
— plant - yarns	14	1
— plant - unidentified	3	—
— hair - interlaced	14	1
— hair - unidentified	1	—
— bark cloth	2	1
Feathers	15	2
Leather		
— suede	20	—
— outer hide	1	1
— unidentified	15	12
Hair/fur		
— red	4	—
— undifferentiated	9	3
Hide?/bark?	1	1
Macrobotanical		
— bark	19	4
— wood charcoal	40	—
— seeds	12	—
— flower masses	1	—
— unidentified plant masses	12	1
— monocot stem/leaves	6	2
— leaf fragments	2	1
— possible unidentified botanical	1	—
— nutshell?	1	—
Bone		
— calcined (burned)	20	—
Pearls		
— whole, drilled	5	—
— fragments	11	—
Beads - other		
— shell	2	—
Prehistoric pigment		
— red	2	1
— yellow	1	—
— green	1	—
— cream	1	—
Historic repair		
— wax	7	—
— glues	11	3
— plant mass fill	1	—
— new copper	2	—
— seed/plant mass	3	—
— other	1	—
Unidentified organic	22	1

[a]N = 59 objects (116 sides)

Table 4.3. Materials Identified on Celts.[a]

Materials	Identifications (number of sides) Confirmed	Possible
Textiles		
— plant - Group 1	5	—
— plant - matting	1	1
— plant - yarns	2	—
— hair - interlaced	2	—
Feathers	3	—
Leather		
— suede	2	—
— outer hide	2	—
— unidentified	3	6
Macrobotanical		
— bark	3	1
— wood charcoal	5	—
— seeds	7	—
— flower masses	—	—
— unidentified plant masses	3	—
— monocot stem/leaves	4	—
Bone		
— calcined (burned)	—	2
Pearls		
— whole, drilled	—	—
— fragments	1	—
Beads - other		
— shell	2	—
— copper	1	—
Historic repair		
— wax	—	—
— glues	1	—
— plant mass fill	—	—
Unidentified organic	13	—

[a]N = 14 objects (28 sides)

Table 4.4. Materials Identified on Headplates.[a]

Materials	Identifications (number of sides) Confirmed	Possible
Leather		
— suede	2	—
— outer hide	1	—
— unidentified	1	1
Hair/fur		
— undifferentiated	3	—
Historic repair		
— tape	1	—
— solder	2	—
— applied pigment	2	—
Unidentified organic	4	—

[a]N = 4 objects (8 sides); 3 from Hopewell, 1 from Harness

Textiles. "Textiles" (as used in this chapter) include materials that exhibited traces of an intact strand or yarn pattern, such as the presence of interlocking strands, often with active and passive components. The materials examined included frequent examples of a beautiful, finely made fabric composed of yarns made from Group 1 plant fibers (the bast fibers from select herbaceous plants such as Indian hemp or milkweed, for example [see Jakes et al. 1993]). These specimens are often well preserved, retaining a golden hue, and exhibit a closely spaced, well-constructed twined pattern (see Chapter 5 for further description). This class of organics was the most common material identified during the analysis and a significant number of breastplate specimens incorporate large, well-preserved fragments on their surfaces (Figures 4.3 and 4.6). It became apparent during the scan and analysis that some of the breastplates had been entirely covered (sometimes on both sides) with this material. As noted below, the Group 1 fabrics are often found in association with other materials and, in fact, may have functioned in some cases as the backing for the attachment of other items.

Fragments of fabrics created from interlaced animal hair elements (yarns made from animal hair that had been worked together in a simple braiding or interlacing pattern) are another common item on the copper artifacts. In a number of cases, the residue of eroded hide is associated with the hair/fur. My impression is that at least some of the interlaced animal hair fabrics may have been sewn onto various backings, including hide, plant fabric, and bark cloth (see Definitions, and below). I did observe that on one breastplate from Seip (Specimen B036), which is covered in well-preserved interlaced animal hair elements, yarns of Group 1 plant fibers looped over and around individual animal hair yarns. These plant-fiber yarns appear to attach the animal hair fabric to hide that can be seen lying underneath the interlaced animal hair elements.

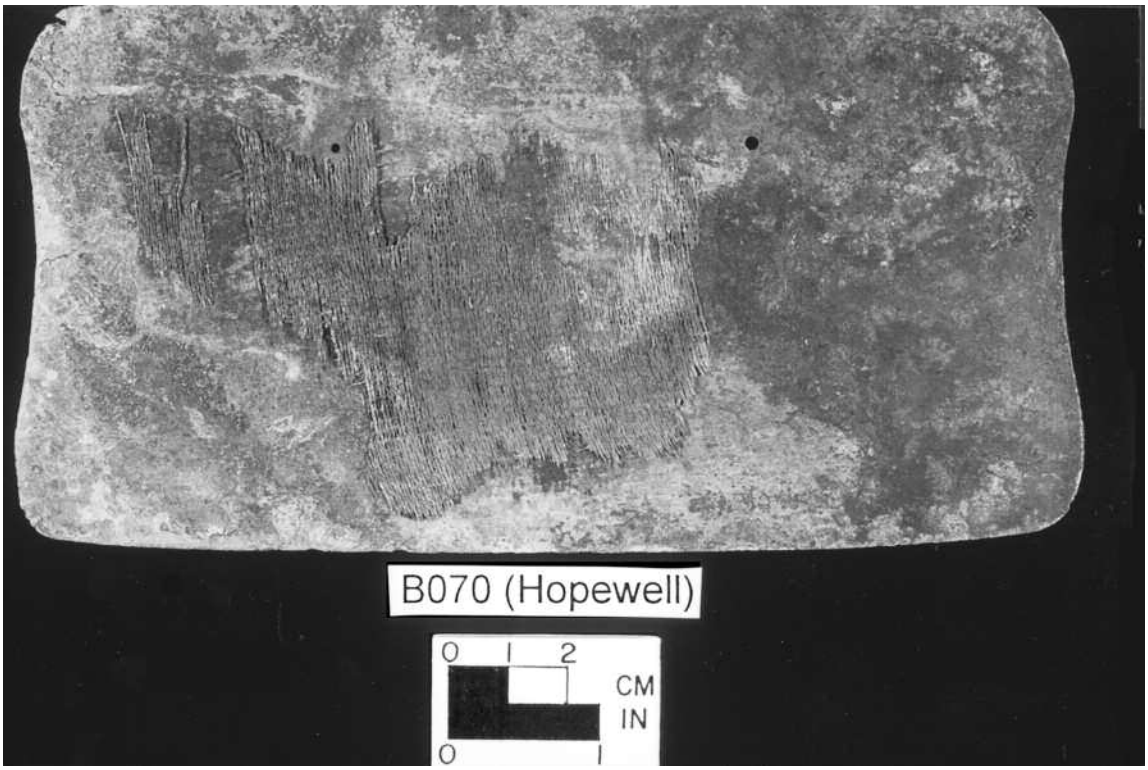

Figure 4.3. Breastplate B070 from the Hopewell site, with a finely made Group 1 plant fabric on its surface.

Also, I examined at least one breastplate on which interlaced animal hair yarns lay on top of a bark-cloth fabric (see Figure 4.7). The majority of the interlaced animal hair specimens (of those segments that had not severely absorbed copper corrosion by-products) are made of a fine light-colored hair, which may be rabbit; some specimens exhibit longer, coarser, more golden-colored/reddish strands, which may be fox, and others a dark-colored hair/fur that could very well represent bear (Figure 4.10). It will take an analysis by a specialist in animal hair identification to verify the taxa represented by the various hair/fur specimens. I do believe that at least three different types (and probably more) of fur/hair are extant on the copper objects.

The other examples placed in this textile category only loosely match the traditional use of the term "textile" (see Definitions). For example, two different types of bark fabrics were noted on the breastplates. First, several examples of what appeared to be thin strips of a pliable bark that had been interlaced were noted during the analysis. Second, some specimens revealed examples of bark cloth — a soft, pliable bark that had been pounded into a substance analogous to felt.

Other examples not usually demarcated as textiles also were included in this broad category. These include examples of a nearly intact matting made out of a long, linear leaf interlaced in an over-under-over pattern. Some of these examples are verified as cane and some may represent cattail (*Typha*). I also observed isolated or non-patterned twisted plant yarns and unidentified processed plant strands.

Feathers. Another common material identified on the breastplate specimens includes bird feathers. At least 15 breastplate sides produced confirmed identifications of this material (Table 4.2 and Figures 4.4 and 4.8). Both long mature flight or body feathers and down feathers had been utilized. The longer intact feathers seem to be the most common, and include the shafts as well as the individual feather segments and possibly barbs. In most cases, it appears that entire

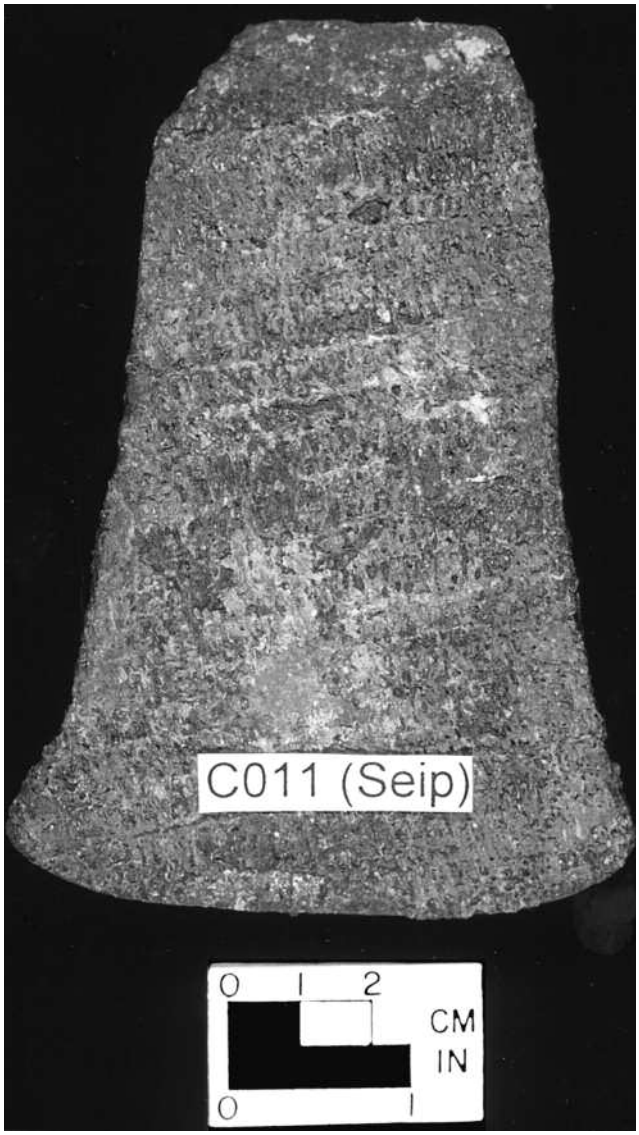

Figure 4.4. Celt C011 from the Seip site covered with a possible fabric created from colored feathers. Although remains of the material are eroded, the row pattern can still be discerned. (See also Figure 5.2).

surfaces (sides) of breastplates are covered with feathers with no obvious discernable pattern or traces of a formal backing. Several breastplates did exhibit a general orientation of the feathers; the shafts and feather segments, for example, were generally oriented in the same direction, often "starting" from one of the lengthwise edges of the plate and sweeping downward across the body of the plate. One celt is covered in what appears to be pigmented short feathers in alternate bands that may have been originally backed to some material (discussed below). On some breastplate specimens, it is apparent that the feathers had formed part of a larger, more complicated item made out of diverse materials that had adhered to the plates and had thus been preserved.

Leather/Hide. Specimens of napped and worked leather/hide were also frequently encountered during the project analysis (Figure 4.9). The hide specimens include two versions: (1) the outer or "skin" side of leather, and (2) the interior napped or "sueded" portion of hide. Both types produced distinctive characteristics and could thus be discerned during analysis. The sueded specimens, for example, revealed unique fiber characteristics, and were probably created from deer hide. Most of the extant examples appeared to be from the interior suede of hide rather than the outer worked skin area.

The leather/hide specimens, like the various "textile" category examples, seem to represent a number of different uses of this material. Several breastplates have one or both sides completely (or nearly completely) covered with hide. This may indicate that the copper artifact had been originally wrapped in the material or had lain adjacent to a hide or leather object. In some cases, portions of the hide or leather still had hair attached and may thus represent a fur item that had been in contact with the copper artifact (discussed below). Second, some examples may be the remnants of hide backing in which a plant or animal hair fabric, or other objects (e.g., pearls or bone beads), may have been originally attached or sewn to the leather. Finally, another common occurrence seems to be the utilization of leather or hide strips or segments that may have been a component of a more complicated piece or item that had been in contact with the copper.

Hair/Fur/Undifferentiated Fur. This category represents fur or hair (most likely animal hair) that is present but had not been worked into a fabric. Some of this material is associated with hide specimens and probably represents remnants of an animal-fur object; some of the breastplates that have such materials are entirely covered with fur on at least one side. Some breastplates have areas that seem to be simply a low-density scatter of

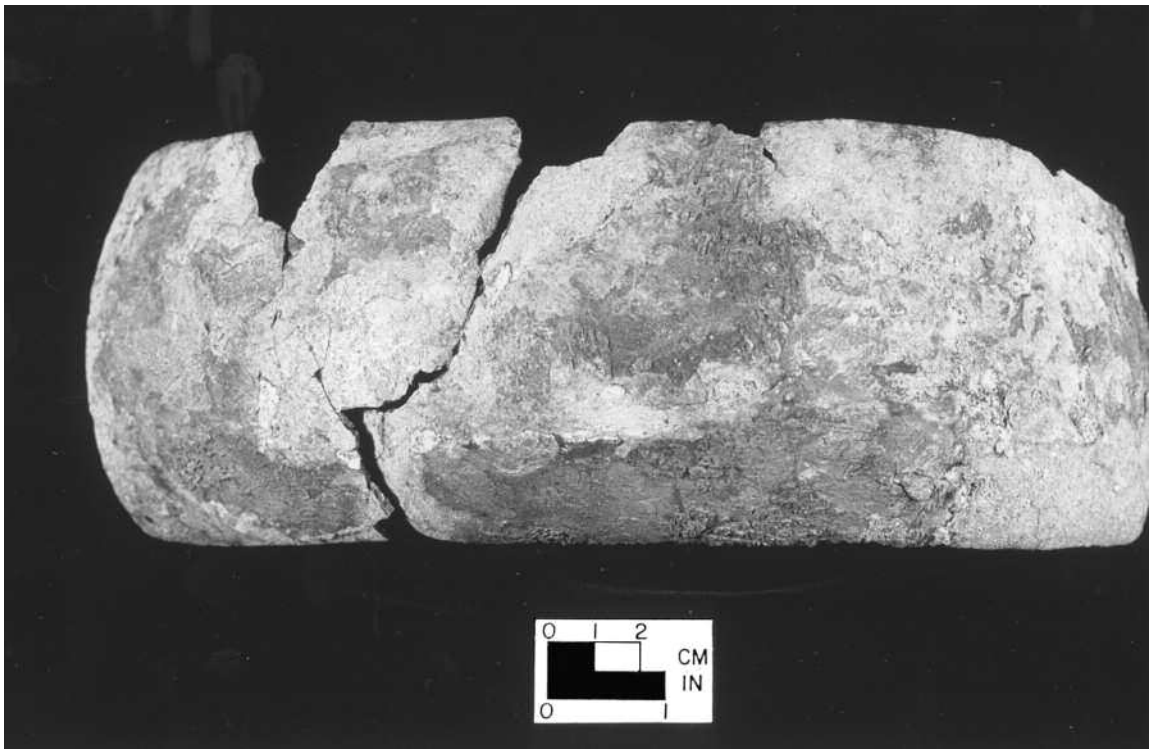

Figure 4.5. Headplate specimen H014 from the Hopewell site. The lighter material on the convex surface shown in the photograph is a mixture of dirt with traces of hide.

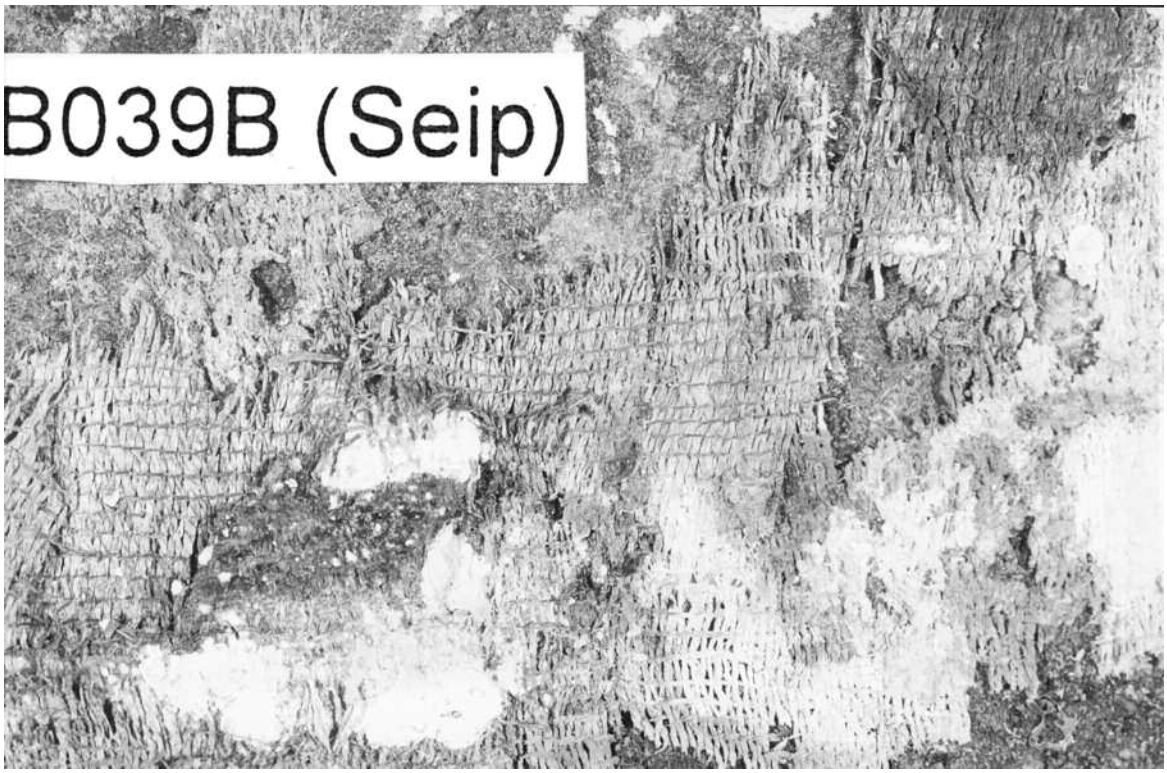

Figure 4.6. Close-up of Group 1 plant fabrics on the surface of breastplate specimen B039 from Seip. The material and structure are very similar to the example shown in Figure 4.3.

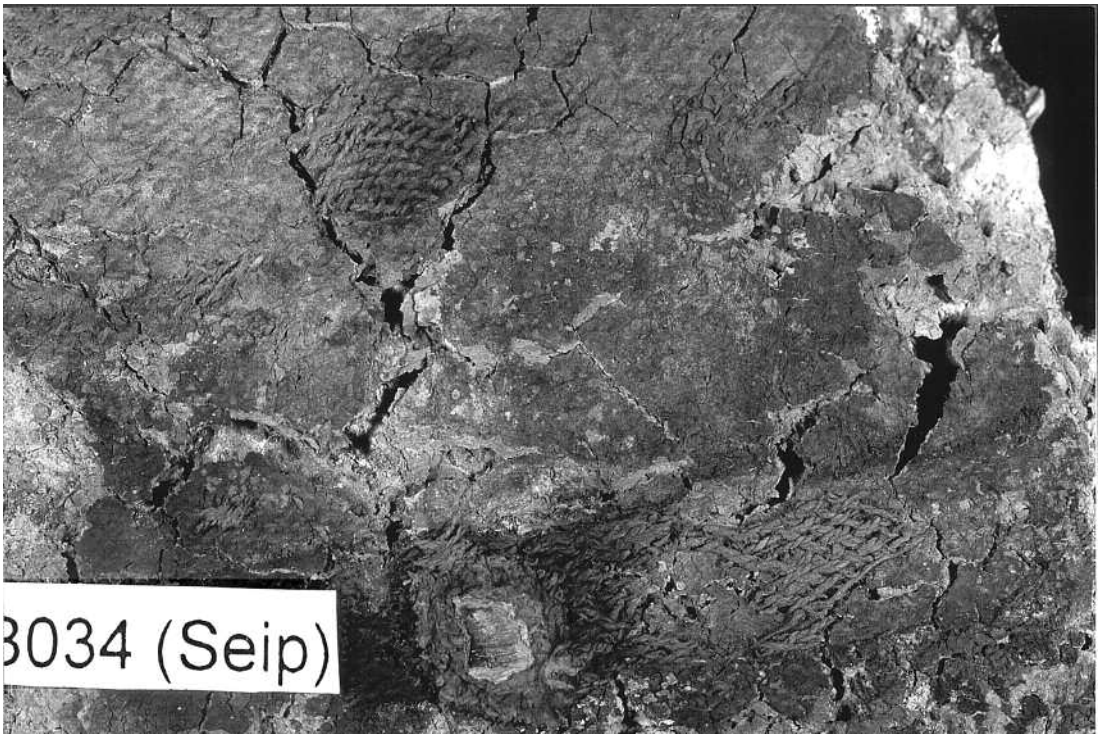

Figure 4.7. Close-up of breastplate specimen B034 from Seip. The photograph shows traces of interlaced animal hair yarns (upper left and lower right) lying on top of felted bark. Please note that the interlaced fabric exhibits green (lighter color in photograph) and red (darker color) pigments. The opposite side of this breastplate contains pearl beads mixed with calcined bone and wood charcoal.

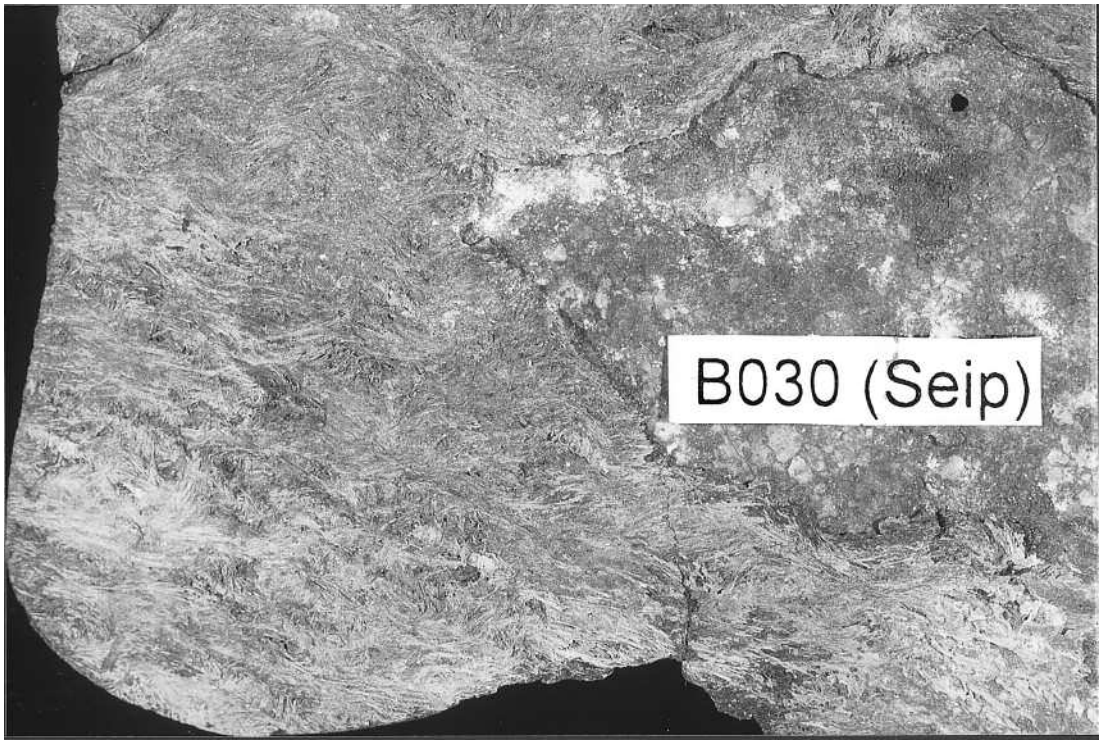

Figure 4.8. Close-up of patterned feathers that cover the entire side of breastplate B030 from Seip (the opposite side is covered with hide). Feathers are lying directly on the copper with traces of an eroded hide on top of the features. In the lower left corner is a well-preserved area in which plant yarns seem to have been associated with the quills of several feathers.

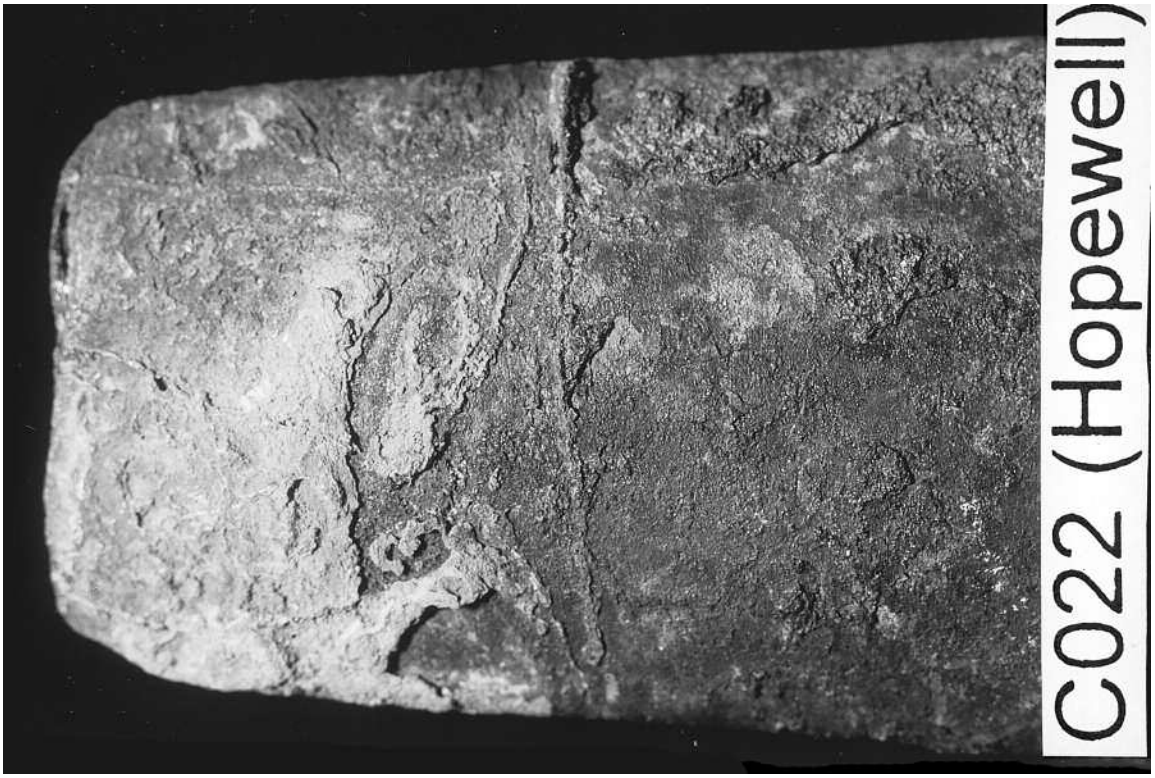

Figure 4.9. Celt C022 from the Hopewell site showing hide wrapped around the non-bit end of the artifact.

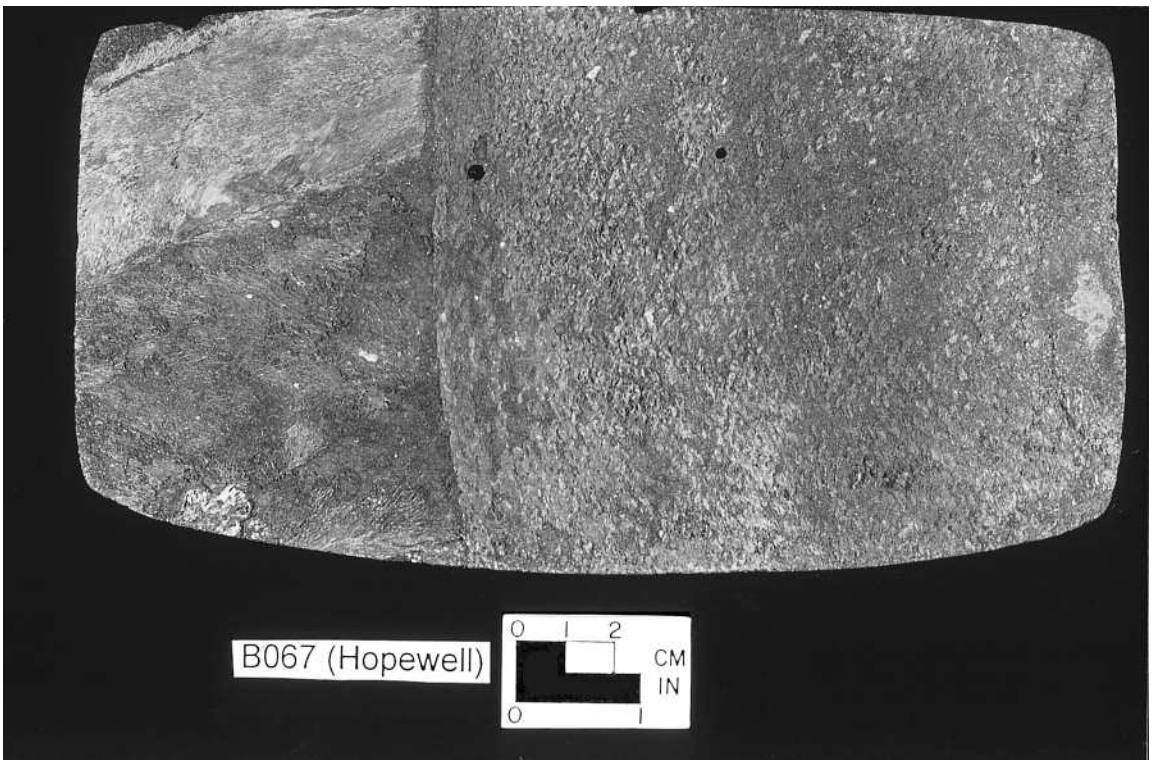

Figure 4.10. Breastplate B067 from the Hopewell site showing three different types of fur/hair material covering the surface. The central and right area of the plate is enfolded with an interlaced animal hair textile

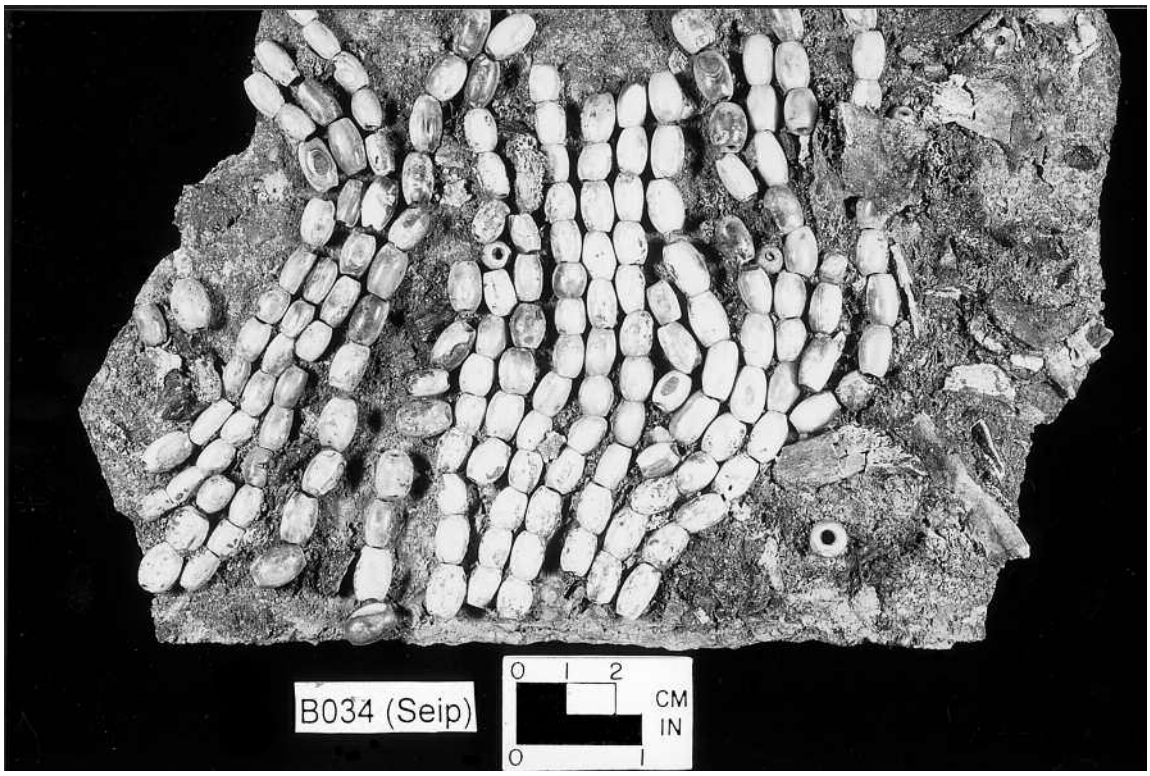

Figure 4.11. Breastplate B034 from Seip revealing strands of pearl beads with calcined bone and wood charcoal.

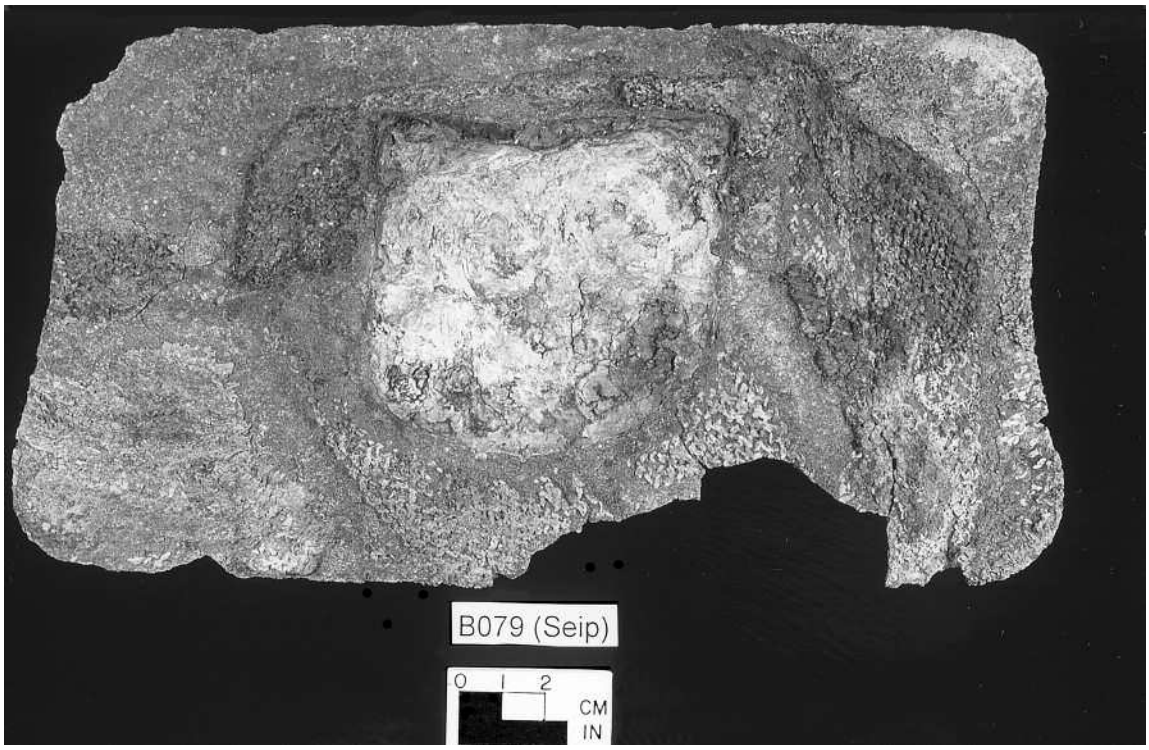

Figure 4.12. Breastplate from Seip (specimen B079) described in text. This photograph shows Side 1, which is covered with a complex mixture of a bark and Group 1 plant-fiber fabric with a central area of feathers and hides.

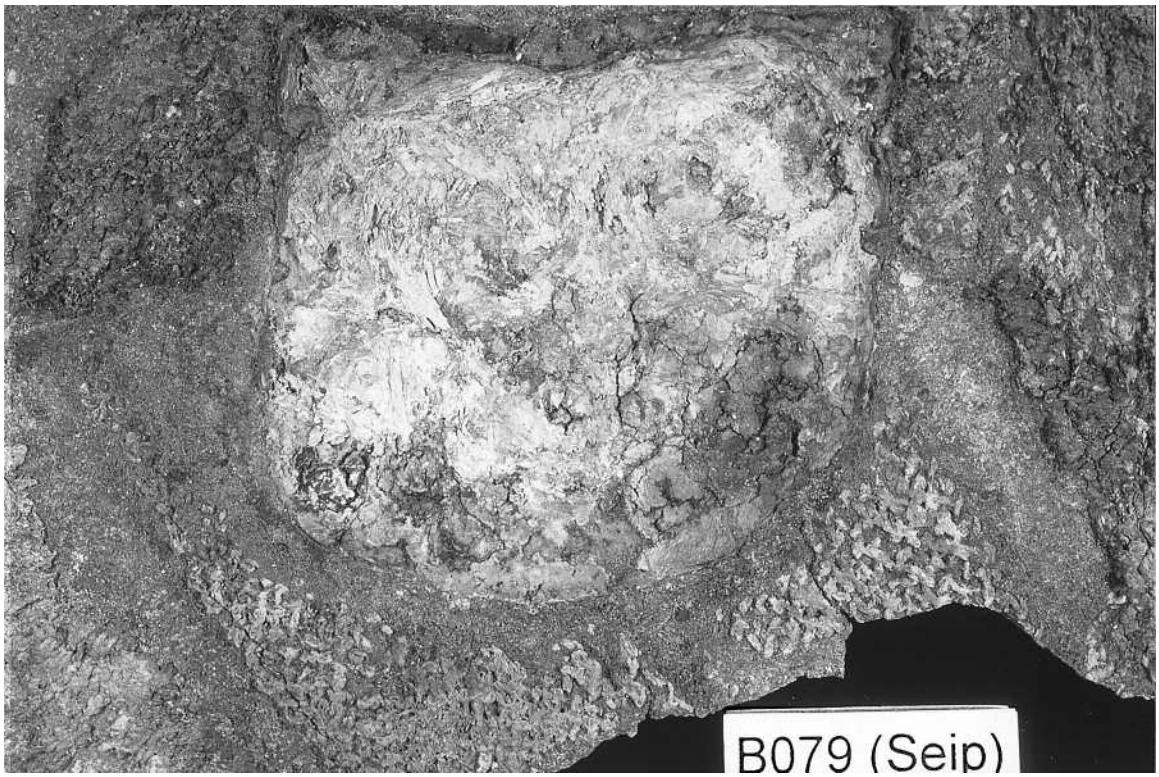

Figure 4.13. Close-up of specimen B079, side 1.

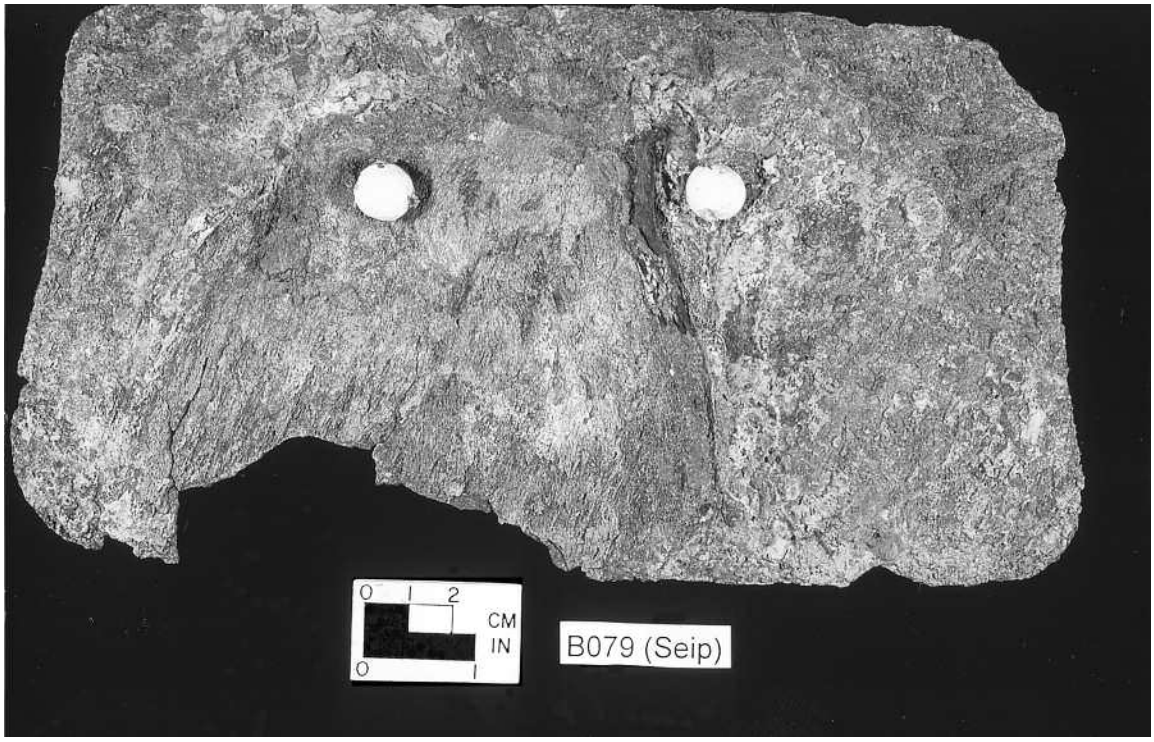

Figure 4.14. Side 2 of specimen B079 with hair/fur and traces of hide and bark.

single or grouped strands still preserved on a few random or isolated locations on the surface (the "undifferentiated" group). These might represent animal skin objects in which erosion and degradation had removed much of the original surface. Alternatively, the breastplate might have been in close proximity or contact with a hair/fur object at some time as it lay in a burial or ritual context. At least four of the hair/fur examples exhibit the same reddish-brown color and may represent the same animal taxon (fox?).

Macrobotanical Materials. Materials in the "Macrobotanical" category represent a wide variety of distinctive plant parts or masses. Perhaps the most common manifestation of this group includes wood charcoal adhering to the surfaces of many of the breastplates. A number of these occurrences include small, scattered flecks of wood charcoal, but a significant number of the breastplates exhibit masses of large (1–4 centimeters in size) fragments of wood charcoal. There is no obvious orientation to the wood charcoal fragments and they do not seem to be part of any larger wooden object that may have burned. These large masses of wood charcoal are often associated with the presence of calcined (burned) bone (see Figure 4.11), and undoubtedly represent the placement of copper breastplates within a burial cremation. At least one case — Specimen B007 — included human facial bones. I suspect that these copper artifacts had been placed in their final position after the initial crematory episode since the plates did not exhibit burning; in addition, with the exception of wood charcoal and calcined bone, the other organic materials typically did not reveal any evidence for burning (that is to say, the other groups in this category, such as plant masses, flower masses, seeds, and the others were not carbonized).

Unfortunately, it was extremely difficult to ascertain the wood taxa from the charcoal specimens associated with the copper artifacts. In order to confirm wood identifications, a fairly "clean" cross-section, revealing the vessel (cell) structure and arrangement unique to different taxa, must be viewed and assessed. I was able to determine from a few fragments that walnut (*Juglans* sp.), hickory (*Carya* sp.), ash (*Fraxinus* sp.), oak–white group (*Quercus* sp.), and possibly a conifer (pine?) had been utilized as a fuel source.

Uncarbonized bark also occurs fairly frequently on the breastplates. In these cases, the bark specimens typically appeared as random strips or fragments without any clear orientation or any evidence of purposeful modification.

Seed specimens were observed, usually as isolated examples in low density, on a number of breastplates. Most of the seeds, unfortunately, had been so readily absorbed into the copper that identification was difficult or impossible. Those that could be identified were typically "weedy" types that were probably incorporated onto the copper from the surrounding soil. Rush (*Juncus*), grass (Graminae — probably panic grass [*Panicum* sp.]), and possibly ragweed (*Ambrosia* sp.) are present. No specimens from the Eastern Agricultural Complex have yet been identified.

Rather unusual plant categories include examples where entire plate sides are covered with masses of stem and leaf fragments. Many of the stems look to be from medium-sized grasses, and several grass florets were in fact identified (see, for example, Specimen B043 from Seip). One unique case, a breastplate from Hopewell, Mound 25, Burial 6, has one entire side completely covered with the preserved remains of thousands of small flowers (approximately 3 mm in size). The small flowers are multipetaled and appear to be on top of hide that is lying directly upon the breastplate's surface. The inflorescences contain mature seeds still incorporated into the flower, revealing distinctive linear seeds, and many are still embedded in a honeycomb shape within their attachment site on the developing seed head (imagine a sunflower "disc" on an extremely small scale). I am still trying to verify the taxon of the plant, but given the seeds and flower structure, my preliminary assessment is that the flowers are from one of the Compositae (Aster family) species. Given the apparent fresh state of the flowers upon incorporation onto the breastplate and the maturation rate of the seeds, it seems evident that this particular ritual or burial episode occurred in late summer or early fall. Unlike the seeds noted above that most likely

represent accidental incorporation onto the breastplates, and certainly given the nature of this flower mass, it appears that this was a very deliberate and purposeful inclusion with the breastplate at its final burial.

Six breastplate sides from Seip and Hopewell yielded fragments of large monocotyledon leaf segments. The majority of the specimens seem to represent remnants of split cane matting or isolated cane (or cattail) leaf fragments. At least one example, an unusual breastplate with elaborately shaped corners in the "classic" stylized raptor bird claw shape (Specimen B048 from the Hopewell site), apparently had been covered with a series of long monocotyledon leaves.

Bone. As mentioned above, a commonly occurring element on the breastplates is calcined bone. The bone fragments tend to range in size from 2 mm to several centimeters; the larger size range is more typical (see Figure 4.11). The bone appears to be random scatters of material probably from cremation burial events; in fact, this seems particularly likely because during my examination, calcined bone was always found with accompanying specimens of wood charcoal. Intriguingly, several breastplates with calcined bone and wood charcoal on one side have Group 1 plant fabrics on the opposite side or fabrics mixed in with the bone and wood charcoal, yet the fabrics are nearly all entirely uncharred. This indicates, perhaps, that the breastplates had been introduced into the mound or burial feature during a second ritual involving the deceased, after the initial cremation burning episode.

Pearls and Shell Beads. A significant number of breastplates produced specimens of entire and fragmented freshwater pearls (some charred and some unburned) (Figure 4.11). In addition, a few specimens of cut, polished, and drilled shell beads were found on several breastplates from the Seip site. Well-preserved specimens of pearls always revealed carefully drilled holes through their centers and many are fairly large. Pearls seem to have unique associations, appearing on breastplates that often have a more diverse array of complicated materials. Four distinct patterns were noted during my examination: (1) pearls, sometimes surrounded by small circular fragments of hide, were placed over the holes drilled in the breastplates, (2) charred and uncharred pearls were often found randomly mixed with calcined bone and wood charcoal, (3) some breastplates revealed what had clearly been strings of pearls that had lain upon the breastplate, sometimes occurring with bone and wood charcoal (in some cases the string was still present inside some of the pearls); and (4) some pearls appeared to have been originally sewn onto "Group 1" fabrics or possibly hide.

Prehistoric Pigment. In this category, I only included examples of traces of clear and obvious artificial pigments that could be differentiated from copper corrosion by-products. Two of the interlaced animal hair fabric specimens exhibit traces of a definite pigment painted on the surface of the fabric. One includes a red and an olive green coloration, and a second specimen (and possibly a third) exhibits what appears to be the same red pigment. In these cases, both colors of pigment had been applied as a solution or "wash" on top of the hair, and the stratigraphy of a material substrate overlain by pigment was easily seen through the microscope (Figure 4.7). One breastplate specimen included an unusual substance, cream in color, which looked like an applied liquid pigment.

One breastplate from Seip is quite unusual. Apparently, when it was first excavated in the early 1900s it had a preserved portion of a painted, complicated fabric adhering to one side of the copper artifact. The original textile, a Group 1 plant fabric, is now missing, but traces of it are still extant on the copper surface together with the pigment. The painting included a complicated curvilinear design outlined in black pigment with the spaces painted with a bright yellow pigment. It was clear from the analysis, however, that some time during this specimen's curation someone had "enhanced" the image by painting on the copper surface; a historic replica of the original fragment is also included with the object. However, my analysis revealed that the recent replication of the original pattern probably is fairly accurate, judging from the fact that faint traces of the original fabric and pigment can still be discerned on the copper, which match the replicated version.

Recent Repair. Not surprisingly, a significant number of the breastplates exhibit traces of post-excavation repair. Many of these repairs are located at the more vulnerable, thinner edges or corners of the artifacts. A variety of repair techniques and materials had been utilized during the curation histories of the copper artifacts, including green-pigmented wax, glues, tape, and new (sometimes artificially patinated) copper replacement parts. Glues and wax seem to be the predominant repair techniques.

One interesting element of which future researchers need to be aware is that in several instances entire sides of particular breastplates (e.g., B059 from the Harness site) had apparently been covered with some form of modern cloth. This is a white material with the appearance of nylon or perhaps silk, which was then subsequently covered with plant and seed masses. In fact, at first glance I mistook the masses as originally prehistoric in origin, for they appeared to be virtually identical to the prehistoric plant and seed/flower masses noted on other breastplates. Their uniformity at first puzzled me and on closer examination I could see in eroded areas an underlying, obviously modern textile underneath the plant/seed masses. The attribution to postexcavation repair was confirmed when on one of the plates with this treatment I identified the presence of clover (*Trifolium repens*), a plant introduced from Europe.

Unidentified Organic. Finally, a "catch-all" category utilized in paleoethnobotanical analysis is that of "unidentified organic." This includes material that has been so eroded or corroded by copper salts that no cell structure or definable characteristics are still extant.

MATERIALS ON CELTS AND HEADPLATES

Overall, the same types of materials identified on the breastplates were also detected on the celts and headplates analyzed during this project, albeit with a lower diversity (Tables 4.3 and 4.4). A number of differences are apparent, however, and seem to reflect both the nature of the metal objects themselves and the excavation and/or curation histories of the artifacts. For example, it was readily apparent during the analysis that materials were less well preserved on the celts than the breastplates. There is a greater degree of copper corrosion on the celts, which often obscures identifying features of the organic materials. Perhaps the increased corrosion was either due to the greater thickness or mass of copper present in the celts compared to the breastplates, or related to the different manufacturing processes that created these two classes of artifacts.

Finally, a major difficulty with analyzing the headplate specimens is that after their removal from their original contexts they had been heavily repaired and cleaned. This was undoubtedly related to the crushing that had occurred to these complicated three-dimensional artifacts as well as the intrinsic interest that this particular artifact class held for earlier curators and researchers.

Celts. Celts were observed to have on their surfaces essentially the same types of fabrics noted on the breastplates. This includes both the relatively common Group 1 plant fabrics and the interlaced animal hair fabrics (Table 4.3). Feathers were also identified on three of the four sides of two of the celts, including the unusual celt specimen that has a remnant of colored (dyed? natural? painted?) possible feather fabric of some form (mentioned above). This celt has one side that appears to have on it eroded traces of a Group 1 plant fabric associated with alternating bands of orange and dark-colored small feathers (see Figure 4.4).

Some of the celts also yielded examples of preserved leather/hide fragments, including both interior sueded/napped and exterior outer skin (leather) remnants. Unfortunately, most of the hide readily absorbed corrosion by-products, so anything beyond a basic notation of the presence of hide was nearly impossible to evaluate. However, one celt did produce a distinctive pattern of the material (Specimen C022 from the Hopewell site) that suggested that the non-bit end had been wrapped in the substance with the bit end relatively devoid of organic material (Figure 4.9).

Fragments of carbonized wood, as well as uncharred bark segments, are also fairly ubiquitous on the celt specimens. Cross-sections with a

clear view of the vessel structure were not available for the wood charcoal so taxon identification was not feasible. A number of celts also have their surfaces covered with fragments of masses of leaf and stem portions from large and small grasses (including probably cane). Drilled shell beads and pearl fragments are also present.

Headplates. Only four objects that are interpreted as "headplates" or "headdresses" were analyzed for the project (Table 4.4; see also Figure 4.5). The assessment as headplates is probably accurate given their unusual shape (a distinctive subrectangular curved form) and the recovery of some of them from the skulls of extended burials. (Three of the artifacts are from the Hopewell site and may be from burials from Mound 25, while the fourth headplate is from the Liberty/Harness site.) The most intact and well preserved of the headplates revealed a similar form, a rectangular curved shape (curved lengthwise) with one or two holes drilled through the copper close to one of the long ends of the piece. It is most likely that the holes were utilized to attach the headpiece to a textile or other material (or to attach some other item to the copper).

Unfortunately, given the state of repair and cleaning of the pieces, most of the organic material has been removed. However, at least one of the headplates (H011 - Hopewell, Mound 25, Burial 24?) exhibits clear traces of the sueded portion of hide on the exterior (concave) part of the artifact. The best-preserved sections of this substance are on the topmost (most concave exterior) portion of the piece. The other headplate from Hopewell (H014) also yielded severely eroded hide in the same location ("exterior" or concave area) as H011, as did the artifact from Harness (H001) (minute traces of hide on both interior and exterior surfaces). Intriguingly, the H014 artifact produced a few strands of what appears to be long, dark hair near the larger central hole on the interior of the piece. The same phenomenon may exist on headpiece H003 (on this object, it is either fur or hair). Thus, it seems most likely that the copper headdplates were probably originally part of more complicated objects that included worked leather/hide attached directly to the copper in some manner.

COMPARISIONS

ARTIFACT CLASS COMPARISONS

One interesting assessment that can be conducted with the results of the analysis is a comparison of any similarities or distinctions that may occur in the simple presence or absence (ubiquity) of organic materials by artifact class. Given the small sample size for headplates (four), this evaluation must be limited to the breastplate and celt artifact categories. For purposes of comparison, I selected the most common items that were identified on the artifacts: Group 1 plant fabrics, interlaced animal hair fabrics, feathers, leather/hide, non-textile bark, wood charcoal, and calcined bone (Table 4.5 and Figure 4.15).

Not surprisingly, the breastplates exhibit the greatest diversity of materials compared to the celts. The greatest difference between celts and breastplates appears for the Group 1 plant fabrics, wood charcoal, and calcined bone, all of which were more prevalent on breastplates than on celts. The greater prevalence of wood charcoal and calcined bone on breastplates than celts may be due to a more frequent placement of breastplates with cremations, if this is indeed the context for the majority of the specimens of this artifact class. The higher prevalence of Group 1 fabrics could reflect a ritual distinction between the celts and breastplates in the use of this type of textile or may merely reflect differential preservation conditions (the flat, thinner form of the breastplates, for example, perhaps better pre-

Table 4.5. Comparison of Selected Materials by Artifact Type.

Material	Breastplates (% of total sides)	Celts (% of total sides)
Group 1 plants	35%	18%
Leather	24%	21%
Wood charcoal	35%	18%
Bark	16%	11%
Feathers	13%	11%
Hair/fur	12%	7%
Bone	17%	0%

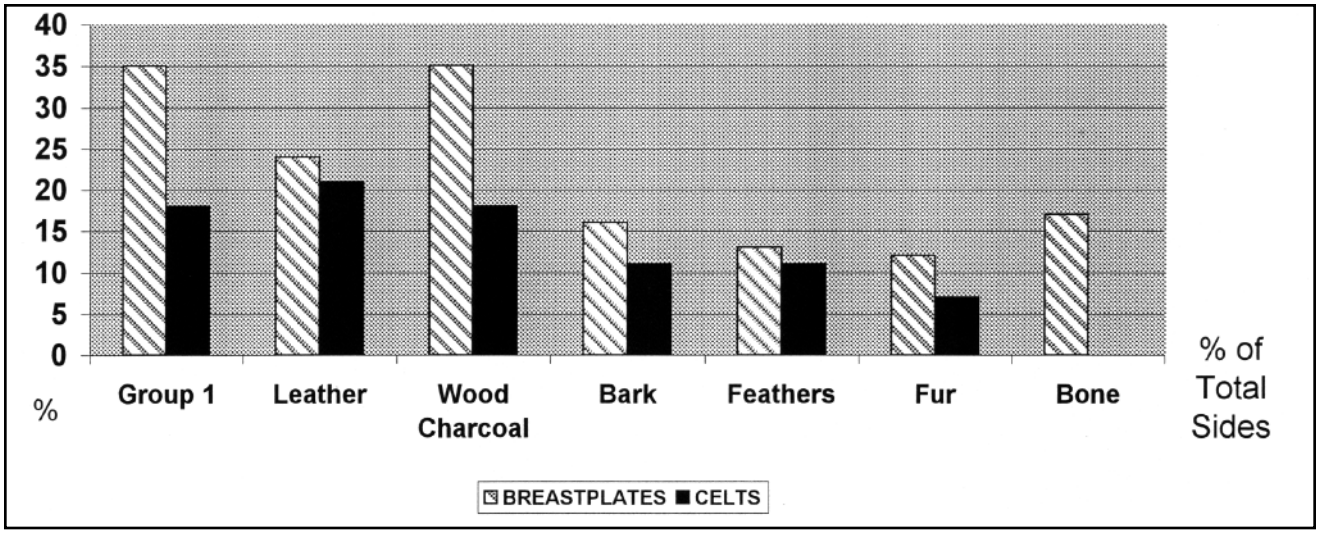

Figure 4.15. Graphical comparison of selected materials by artifact type. "Group 1" indicates fabrics made from Group 1 plant fibers. "Fur" includes both animal hair from fur pelts and interlaced fabrics made from animal hair yarns.

served this delicate fabric than did the celts). Leather/hide and feathers were identified nearly as frequently on the sides of the celts as they were on the breastplates. Whether these are significant patterns or merely fortuitous associations is impossible to assess at this time. Further research on a larger sample of celts (as well as breastplates and other copper objects) is necessary.

INTRASITE COMPARISONS

Due to sample size, the only artifact class that could be utilized to compare and contrast differences in the frequency of materials by site is the breastplates. The three major sites producing significant numbers of curated breastplates, Seip, Hopewell, and Liberty/Harness, were compared for the presence of ten different organic materials on breastplate sides. I analyzed the percentage of breastplate sides that yielded Group 1 plant fabrics, interlaced animal hair fabrics, feathers, leather/hide, bark, wood charcoal, plant masses, monocotyledon leaves, calcined bone, and pearls (Table 4.6 and Figure 4.16). Some intriguing differences did emerge among the sites.

Seip clearly produced the greatest occurrence of the Group 1 fabrics compared to either Hopewell or Harness, while interlaced animal hair fabrics are more predominant for the Hopewell site (and were not identified at all in the sample of breastplates from the Harness site analyzed for this project) (Table 4.6). My initial impression is that the Group 1 fabrics are extremely similar in plant/yarn processing and fabric structure among all three sites (see also Chapter 5, this volume). Feathers are fairly common on the breastplates from Harness, with nearly a third of the sides producing evidence for this organic material; feathers are much less common on the breastplates from the other two sites. Leather/hide fragments are fairly uniform in occurrence on the breastplates from all three sites, being identified on approximately 20 to 28 percent of the sides. Uncarbonized bark specimens are more common on the Seip breastplates, and wood charcoal is quite common on the Seip artifacts as well. (The Harness site also produced a significant percentage of wood charcoal by breastplate side.) Plant masses range around 10 to 12 percent of the breastplate sides for all three sites. Monocot leaf fragments only occur on breastplates from the Hopewell and Seip sites. Finally, bone and pearls are more common on the breastplates from the Seip site, and are either absent or present in lower percentages for the other two sites (Figure 4.16).

Thus, the Seip site is significantly distinctive in yielding a greater presence of Group 1 plant

Table 4.6. Materials Identified on Breastplates, by Site.

Materials	Number of Sides						
	Seip (N=31 objects)	Hopewell (N=17 objects)	Harness (N=5 objects)	Ater (N=3 objects)	Fortney (N=1 object)	Ft. Ancient (N=1 object)	Rockhold (N=1 object)
Textiles							
-- plant - Group 1	28	9	1	--	--	--	2
-- plant - matting	1	--	--	--	--	1	--
-- plant - yarns	9	2	--	1	--	1	1
-- plant - unidentified	2	--	1	--	--	--	--
-- hair - interlaced	6	6	--	1	1	--	--
-- hair - unidentified	1	--	--	--	--	--	--
-- bark cloth	1	--	1	--	--	--	--
Feathers	6	6	3	--	--	--	--
Leather							
-- suede	9	7	2	--	--	--	2
-- outer hide	1	--	--	--	--	--	--
-- unidentified	8	5	--	2	--	--	--
Hair/fur							
-- red	4	--	--	--	--	--	--
-- undifferentiated	3	2	--	2	2	--	--
Hide/bark?	--	1	--	--	--	--	--
Macrobotanical							
-- bark	14	3	1	1	--	--	--
-- wood charcoal	26	2	3	--	1	--	--
-- seeds	6	6	--	--	--	--	--
-- flower masses	--	1	--	--	--	--	--
-- unidentified plant masses	6	4	1	--	--	1	--
-- monocot stem/leaves	2	4	--	--	--	--	--
-- leaf fragments	2	--	--	--	--	--	--
-- possible unident. botanical	1	--	--	--	--	--	--
-- nutshell?	1	--	--	--	--	--	--
Bone							
-- calcined (burned)	18	1	1	--	--	--	--
Pearls							
-- whole, drilled	3	1	--	1	--	--	--
-- fragments	8	2	--	--	--	--	1
Beads - other							
-- shell	2	--	--	--	--	--	--
Prehistoric Pigment							
-- red	2	--	--	--	--	--	--
-- yellow	1	--	--	--	--	--	--
-- green	1	--	--	--	--	--	--
--cream	1	--	--	--	--	--	--
Historic repair							
-- wax	5	2	--	--	--	--	--
-- glues	6	3	1	--	1	--	--
-- plant mass fill	--	1	--	--	--	--	--
-- new copper	--	2	--	--	--	--	--
-- seed/plant mass	--	1	2	--	--	--	--
-- other	1	--	--	--	--	--	--
Unidentified organic	6	11	2	--	1	2	--

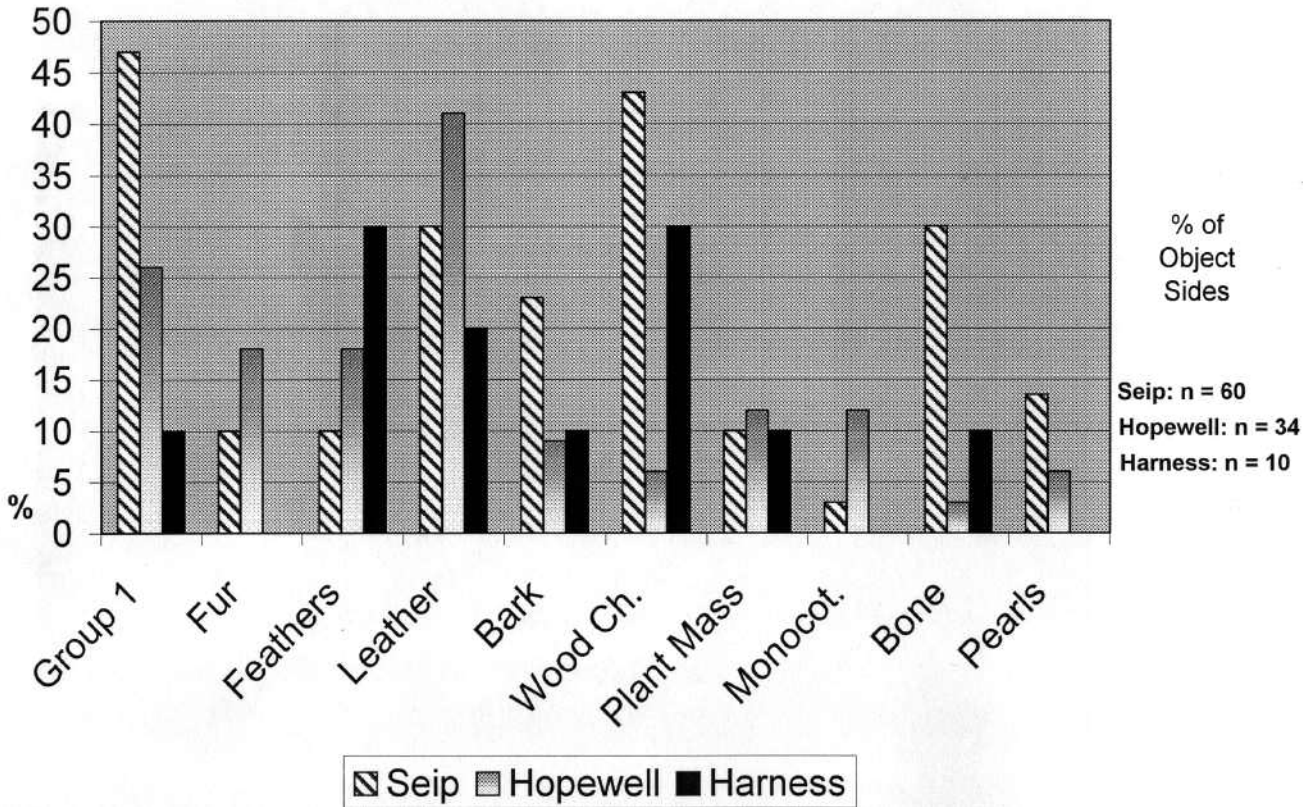

Figure 4.16. Graphical comparison of materials associated with breastplates. Percentages of object sides with selected materials, by site. "Group 1" indicates fabrics made from Group 1 plant fibers. "Fur" includes both animal hair from fur pelts and interlaced fabrics made from animal hair yarns.

fabrics, bark, wood charcoal, bone, and pearls. The Hopewell site produced the greatest frequency of leather/hide fragments and monocotyledon leaf fragments. The Harness site returned the highest percentage of feathers and a fairly good quantity of wood charcoal as well. Overall, the breastplates from Seip produced the greatest diversity and quantity, often with good preservation, of the organic material identified during the scope of this current project (see Table 4.6). I should note that the most common materials that appeared on the Seip and Hopewell breastplates — Group 1 plant-fiber fabrics, interlaced animal hair fabrics, and leather/hide fragments — also were identified on the breastplates from the other project sites of Ater, Fortney, Fort Ancient, and Rockhold; the fabrics and items made out of these materials (especially the Group 1 plant and interlaced animal hair fabrics) seem quite similar in manufacture and appearance among all of the project sites (Table 4.6).

MATERIAL ASSOCIATIONS AND OBJECT COMPLEXITY

During the examination of the copper artifacts, it was readily apparent that they incorporated a palimpsest of diverse substances and materials, often yielding a complex stratigraphy of different compounds layered upon each other. For example, reviewing the breastplates from Seip alone (which produced the greatest variety of organics among the artifact classes and the project sites), it is evident that nearly every side of each breastplate produced a diversity of materials (Table 4.6). Of the 60 breastplate sides examined for this site, 52 (86.70%) yielded two or more distinct organic materials.

The most common association of materials on the Seip breastplates, as well as on plates from the other sites, included Group 1 plant fabrics that were often found on the same side with traces of leather/hide. It was not unusual, for

example, to find plant-fiber fabrics identified with fragments of hide, interlaced animal hair fabrics, and plant yarns (for example, Specimens B034 and B044). Feathers were also typically found associated with faint traces of leather/hide (e.g., Specimen B079; see Figures 4.12 and 4.13). The same pattern occurs with celts: interlaced animal hair fabrics or feathers are often found with traces of hide, along with the presence of processed plant yarns (on Specimen C011, for example). These associations may indicate the faintly preserved fragments of a once more elaborate item (cloak? garment? bag??) of two different types: (1) a finely interlaced animal hair fabric (rabbit, bear, or possibly fox) that had been attached with plant yarns to a hide backing or to a Group 1 plant-fabric backing, or (2) feathers attached to hide or to Group 1 plant-fabric backings. In several cases, I could see processed plant yarns looped over and around individual animal hair yarn elements, apparently attaching the elements to either a hide or plant-fabric backing. Furthermore, on at least one artifact, I observed Group 1 plant yarns associated with the quills of feathers. My impression of this example, especially given the definite alignment of the feathers in symmetrically placed rows, is that this could represent feathers that once had been attached to a hide backing (Specimen B030 and possibly B035; see Figure 4.8). As noted above, two breastplates from Seip also exhibited at least two colors of pigment painted on top of preserved segments of an interlaced animal hair fabric, so these objects must have also been vividly colored during their use-life.

The stratigraphy of the materials on the copper indicated that for some of the artifacts the sequence may have been copper followed by feathers or interlaced animal hair fabric, followed by plant yarns followed by hide or Group 1 plant fabric. In some cases the sequence was virtually the reverse: copper overlain by plant fabric or hide followed by feathers or interlaced animal hair fabric. This pattern may indicate that in some cases, the copper artifact may have lain upon the outer surface of a once complicated hair/fur or feather fabric (thus the hair/fur or feathers were first embedded in the copper followed by the backing laying upon the hair/fur strands or feather quills), or that something had once wrapped the copper object (with the hide or plant backing against the copper surface). Further research will, of course, be necessary to verify these possibilities as well as alternative ideas. The nearly identical format of interlaced animal hair fabric perhaps attached with plant yarns to a hide backing (or a Group 1 fabric backing), which was found on artifacts from Seip, Hopewell, Harness, and Fortney, indicates some degree of similarity in the construction of ritual or ceremonial items among the different Middle Woodland contexts.

In fact, there may be some deliberate association between animal hair and bird feathers in the Hopewell ceremonial realm, reflected in the organic materials appearing on the copper artifacts examined for this project. Intriguingly, during the 2000 summer pilot project for this larger study I examined a well-made breastplate from the collection at Mound City (Hopewell Culture National Historical Park, Chillicothe, Ohio). One side was entirely covered with what looked almost like a carefully cut and/or applied section of dark fur (bear?) and the opposite side was covered with feathers; in fact, it appeared to be a nearly complete wing (skin and feathers) of a larger bird sweeping across the entire side. (I suspect, given the overall shape and topography of the breastplate, that the fur side may have been the "presentation" or "front" of the piece.)

The complexity of materials preserved on the surfaces of copper objects, especially the breastplates, was in some cases nearly overwhelming. One specimen from Seip (B079) is a good example of the diverse nature of these artifacts, and the frustration associated with viewing the eroded and faint traces of what must have been a complicated object at one point in time. Side 1 is covered with an oblique-interlaced fabric made from two-ply bark yarns (the inner bast fibers of a non-conifer bark), with possible traces of Group 1 plant-fabric yarns still extant in certain sections of the bark fabric (Figures 4.12 and 4.13). Feathers are then found on top of this material. In the center of this side, on top of the bark fabric, had been some object or addition to the plate made of hide (which was on top of the bark and general feather layer), with a thick mass of larger feathers and down feathers on top of the hide. The feathers are impressed with an irregular

shape that hints of a heavy, but no longer extant, object that had once been attached to or covering the feathers in the center.

Side 2 is equally perplexing. This side is covered with a short, dark fur (bear?) that is oriented in a linear fashion on the plate (Figure 4.15); this is not an interlaced animal hair fabric. Some areas of this side produced traces of an eroded sueded/napped hide that had been on top of the fur. The center of this side revealed a thicker area of fur with an impression of a more complicated sequence of materials. The "edges" of the central shape were bounded by thick, flexible segments of bark (not a textile), and hide was identified on top of the fur contained within the shape defined by the bark. Unidentified (and probably unidentifiable) organic materials are also associated with this central area, often adjacent to the bark "arc" shapes. Historic glue around the drilled holes, and the presence of large pearls in a plastic bag, suggest that possibly pearls may have covered the breastplate holes on this side (but this association is not clearly known at this time). And, just like the breastplate from Mound City, there seems to be a pattern of feathers on one side and fur on the other of the breastplate.

CONCLUSION

Overall, the analysis for organic components preserved on the copper artifact classes of breastplates, celts, and headplates reveals that nearly every item produced some residue. Typically, it was more common to find a mix of several different materials on a single side than just a solitary substance. The breastplates yielded the greatest diversity and best preservation of the artifacts examined. Some of the more prevalent organic materials included Group 1 plant fabrics (with a similar structure across all of the project sites; see, for instance, Figure 4.3), interlaced animal hair fabrics, hide, feathers, pearls, wood charcoal and bark, and calcined bone. More unusual categories included grass, flowers, and unidentifiable plant masses. The breastplates from Seip revealed some of the more complicated and best-preserved examples of organic items.

Celts tended to yield hide, feathers, and interlaced animal hair fabrics as well as the same Group 1 plant fabrics noted for the breastplates. Plant (grass) masses and large monocotyledon leaf segments were also identified. Headplates tended to be severely repaired and cleaned during curation, but all specimens did produce traces of the sueded portion of hide and at least one may have preserved a few strands of human hair.

Many of the artifacts, especially the breastplates, preserved traces of what originally must have been complicated textiles or items. The identified combinations and stratigraphy suggest that some of the items may have been interlaced animal hair fabric (some of it painted) attached with plant yarns to a hide or to a Group 1 plant-fabric backing, and to a lesser extent, bark; pearls and other objects also may have been attached to such fabrics. Feather fabrics also may have been utilized, and some evidence from specimens suggests that these, too, may have been attached to a hide or plant fabric.

I believe that perhaps one of the most important results of the examination of the copper artifacts under the parameters of this project is the clear evidence for the preservation of diverse and complicated organic materials still extant on these curated objects. It seems apparent that this little-investigated realm of Middle Woodland archaeology may offer remarkable insights into the ceremonial sphere of the Hopewell people. Perhaps, however, it is not surprising that this analysis reveals a microscopic world of artifacts that reflects the degree and depth of complexity that has made the Hopewell culture so fascinating to both professional archaeologists and the public.

NOTE

In addition to the results reported herein, a pilot study undertaken during the summer of 1999 in Chillicothe, Ohio, at the Ross County Historical Society and the Hopewell Culture National Historical Park also revealed organic residue still extant on the surface of several copper artifacts in the collections of those institutions. This research is continuing with the analysis of copper objects curated in the collections of a number of institutions.

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CHAPTER 5

PRESERVED TEXTILES ON HOPEWELL COPPER

Virginia S. Wimberley

ABSTRACT

This chapter presents the analysis of textile fragments adhering to particular types of copper artifacts from Ohio Hopewell burial mounds at the Hopewell, Seip, Mound City, Liberty/Harness, Ater, and Rockhold sites. Non-destructive analysis of the textile remains was used to gather data on fibers, yarn structures, and fabric structures, with the object of discovering possible relationships among artifacts related to variations in the fabric structural elements. Anomalous attributes often were found in yarns within twined structures adhering to copper artifacts from the same site. The mixture of yarn attributes within single fabrics may indicate multiple spinners supplying one textile creator with the necessary volume of yarns to create high-thread-count textiles more rapidly for ceremonial purposes.

INTRODUCTION

Textiles serve important functions in most societies. They may function as an economic commodity for local consumption or trade, as an aesthetic expression of individual or corporate artists, as decoration of the individual or of his/her surroundings, as protection from natural elements, and/or as semiotic messages for communication of information about the individual and the groups to which s/he belongs. Such information includes indications of age, gender, social status, and/or power within the society. Weiner and Schneider compiled research studies demonstrating the multifaceted functions of textiles within society in their volume, *Cloth and Human Experience* (1989). In choices of raw materials, yarn and textile construction, modes of decoration, and methods of finishing, fabrics can reveal clues to the technological level of the group or of individuals producing them, as well as to the constraints on materials and workmanship in the society (Carr and Maslowski 1995; Minar 2000; Petersen and Wolford 2000; Sibley and Jakes 1989). The purpose of this chapter is to continue the investigation of how textiles functioned within the Ohio Hopewell Middle Woodland period, from this semiotic and material culture perspective.

HOPEWELL CULTURE

From 100 B. C. to A.D. 400 the Hopewell culture flourished within the Middle Ohio Valley. Although Ohio Hopewell populations participated in a pan-eastern Hopewellian cosmology, evidence is that they were not "culturally homogeneous" (Pacheco 1996:18), and settlement systems varied in separate geographical areas of drainage basins. These areas were the Great Miami and Little Miami Valleys in southwestern Ohio, the Central Scioto Valley in south-central Ohio, and the central Muskingam-Licking Valley in east-central Ohio. These independent variants and their social interaction form the definition of Ohio Hopewell. This Ohio Hopewell culture is well known for gigantic geometric earthworks,

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burial mounds associated with earthworks, and exotic artifacts found in the mounds, such as zoomorphic platform pipes; mica and copper cutouts; and copper plates, headdresses, and ear spools. It has taken time for researchers to discover the more mundane aspects of the Hopewell culture, including habitation sites and day-to-day life events. The archaeological evidence for nucleated villages has not been convincing (Pacheco 1996). Rather, the preceding Adena settlement pattern prevailed: scattered household clusters of one to three houses, composed of families probably linked by some larger relationship such as clans or lineages (Brose and Greber 1979; Cowan 1996; Dancey and Pacheco 1997; Greber 1979; Pacheco 1996; Prufer 1965; Woodward and McDonald 1986). Cowan proposed a model for the use of the large-scale earthworks as places for "world renewal rituals" (Cowan 1996:131). Burial mounds were erected over the sites of former structures. While some of these mounds were constructed as a single event, Greber and others have shown that complex centers, such as the Seip mound group, were the result of long-term activities of a small number of cooperating households over a long period of time. Mounds of simple types (Mound City) or complex, multiroom structures (Seip, Liberty/Harness, and Mound 25 of the Hopewell mound group) served as "repositories of the bones and earthly possessions of the honored members of the lineages or clans" (Brown 1979; Cowan 1996:133). Three-fourths of Hopewell burials were cremations. Tomb burials in the flesh have been presumed to be reserved for the highest social class. Caches of artifacts in basins or sections within the mounds are definitely dedicatory in nature, with items possessing suprafamilial, semiotic properties (Cowan 1996).

The sites considered in this chapter were located in the Great Miami River and Scioto River valleys (Figure 5.1). Each had its own distinctive features. Hopewell contained 40 conical mounds enclosed by an extensive embankment

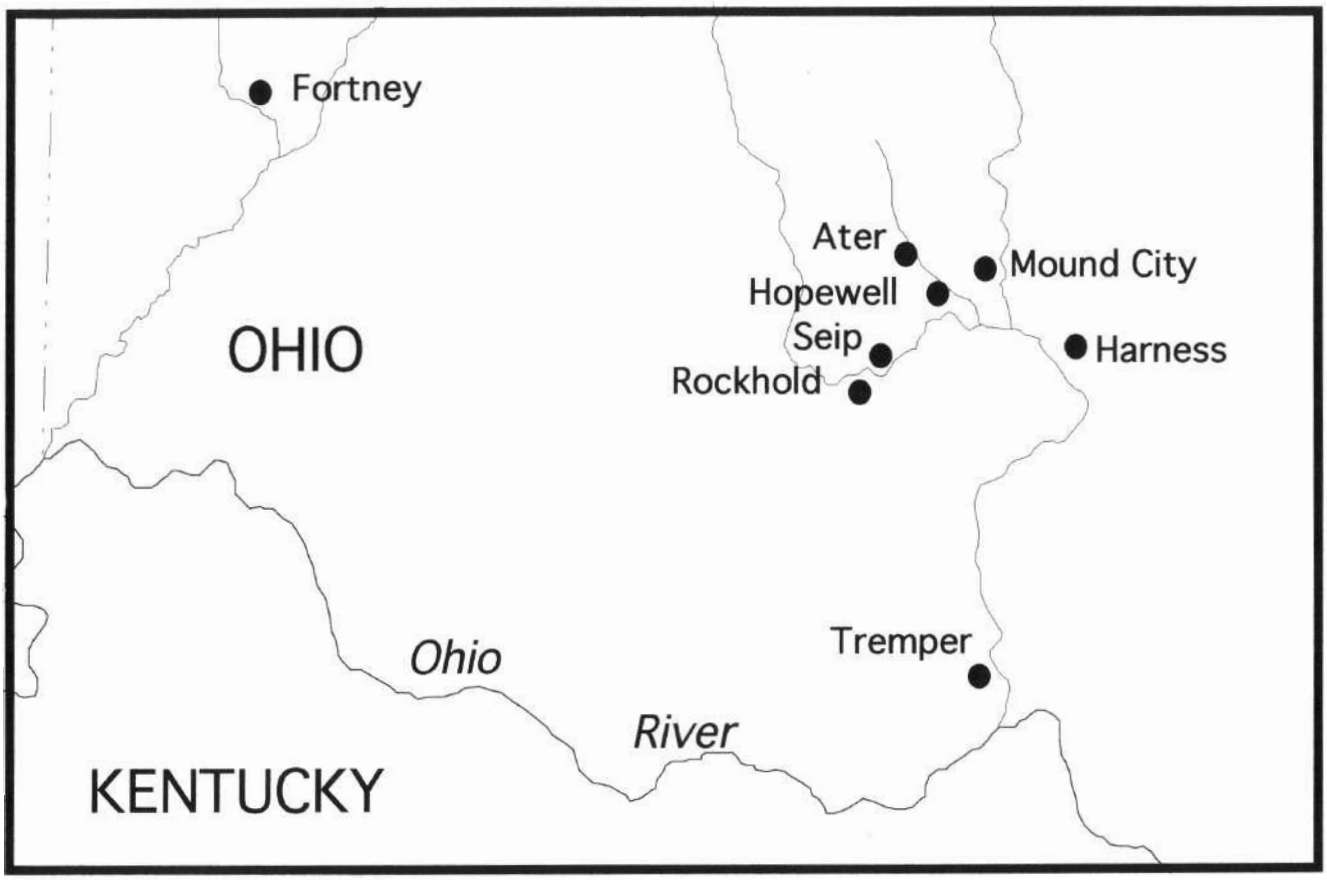


Figure 5.1. Map of Lower Ohio showing locations of Hopewell sites.

(Greber and Ruhl 1989). Another major concentration of burial mounds associated with an earthwork enclosure occurred at Mound City. Seip mound group, located on several terraces of South Paint Creek, a tributary of the Scioto, had two large mounds and five smaller civic and ceremonial structures. At the Liberty/Harness site, the remains of a "Great House" beneath Edwin Harness Mound incorporated complex symbols of special colors, trees, and directions that indicated usage beyond mortuary rituals (Greber 1983). Tremper Mound is located on a high terrace along the western edge of the Scioto Valley. An embankment originally enclosed the mound. Within the mound was a multichambered oval charnel house with added "wings." Rather than individual burials characteristic of other Hopewell sites, Tremper contained four communal depositories for the dead and their grave offerings (Woodward and McDonald 1986:110).

Opulent, non-utilitarian grave offerings and the fine craftsmanship and artistry of Hopewell art distinguish Hopewell burials from the preceding Adena period. The raw materials for these objects came from a far-reaching trade network. Copper from the Great Lakes was formed into breastplates and headdresses. Mica from the southern Appalachians was carved into effigy forms and sometimes used to cover burials like a blanket. Freshwater pearls were strung together and sewn onto clothing. These pearls represented great wealth in individual burials; 100,000 pearls were recovered from the Hopewell mound group and approximately 15,000 pearls covered a multiple burial in Seip Mound 1 (Moorehead 1922; Woodward and MacDonald 1986). Excavation of an Ater Mound burial of an adult male and infant revealed 1,350 pearl and shell beads on the chest of the adult and a decorated blanket covering the infant, with 1,500 conch shell beads forming a diamond pattern on a twined fabric substrate (Ohio Historical Society 1976:4).

PREVIOUS HOPEWELL TEXTILE STUDIES

Gifted as an artist, observer, and writer, Charles C. Willoughby wrote extensively about the artifacts of North American excavations, including studies of textile collections from a number of sites. His research involved replication studies as to how the fabrics could have been produced. His report on the excavations at the Hopewell site from 1891 to 1892 provides a view of the textiles in association with their accompanying remains. He documented the types of twined constructions commonly attributed to Hopewell sites (Willoughby 1938).

Flora Church (1984) studied the variation in textiles within and between sites for Ohio Hopewell. Within burial contexts, not every individual was associated with textiles. Some persons had more elaborate textiles, some had less elaborate ones, and some had no textiles at all. Textiles appeared to be part of some form of ranking. Church studied 120 fabric specimens from the Liberty/Harness, Hopewell, and Seip sites, housed at the Ohio Historical Center. The original group was narrowed to 62 specimens for more intensive analysis. The sample included textile fragments described as charred, fragments with evidence of metallic salts absorption, fragments *in situ* on copper, and impressions of textiles on copper. She noted thirteen types of fabric structures, including five types of weft twining, one type of weft wrapping, five types of interlacing (including both twill and plain weave), and two variations of beaten bark cloth (Church 1984: Fig. 4). Sixty-four per cent of the total samples were twined.

Seip fabric samples studied by Church evidenced finer yarn elements than fragments from Harness or Hopewell. Table 5.1 summarizes the results of Church's yarn analysis. Spaced alternate-pair twining (see "Twining" in Definitions) predominated at all sites over the other 12 structures. Compact alternate-pair twining and spaced plain twining occurred at Hopewell and Seip. All three sites had small numbers of fabrics in oblique interlacing. Church attributed the spaced alternate-pair twining and oblique interlacing to clothing uses for higher ranked individuals, based upon the fine yarn elements, high thread counts, and contact with copper artifacts. She predicted that the fine-scale spaced alternate-pair twining and oblique interlacing found in the burial contexts would not be found in habitation context textiles (1984:11).

Willoughby (1938) reported eight types of

Table 5.1. Yarn Diameter Comparisons Made by Church (1984).

Site	N	Spaced Alternate-Pair Weft Twining		N	Oblique Interlacing	
		Warp Mean (mm)	Weft Mean (mm)		Warp Mean (mm)	Weft Mean (mm)
Liberty/Harness	6	1.12	1.32	1	2.49	2.46
Hopewell	8	1.02	1.18	2	3.00/3.18	2.96/3.23
Seip Mound 1	9	0.48	0.55	1	1.24	1.32
Seip Mound 2	3	1.16	1.25	1	0.32	1.06
Seip No Mound	3	0.83	0.78	0	-	-

textile structures, including three types of interlacing, four types of twining, and one type of looped netting (Willoughby 1938:Fig. 1). While Church's sample did include most of Willoughby's fabric structure classes, there were no examples of "coiled" (looped) netting. Interestingly, she found several slits or openings, stained with copper salts, which she suggested were buttonholes for copper buttons (Church 1984:8). While Church refers to the work of Whitford (1941) on fiber analysis, she does not report fiber diameters from her analysis.

Song, Jakes, and Yerkes (1996) studied primarily textiles mounted between glass plates from the Seip mound group, curated at the Ohio Historical Center. They examined visual characteristics of fabric structures, coloration, and fiber types for the purpose of understanding Ohio Hopewell textile production and utilization behaviors. The analysis of this sample revealed the use of animal fibers, bast fibers, and a combination of the two. "Blackened" (carbonized) textile fragments were smaller in size than "unblackened." Of the unblackened fragments all but 15 showed copper staining and 27 showed evidence of other coloration, in agreement with Shetrone and Greenman's 1931 report of the excavation of textiles with painted designs typical of Hopewell patterns. Song was not able to distinguish patterns, due to the small size of the fragments and the amount of surface degradation. Willoughby (1938) had reported hair fibers in his samples, speculating that they might be buffalo, bear, and rabbit. Song et al. (1996) found that the animal fibers in their sample had pigmented internal structures or medullas. Seven samples (14%) had the fiber structures typical of rabbit or hare fibers. Forty-one samples (81%) of fibers occurred in bundles with nodal structures throughout the length, typical of bast fibers. Surface encrustation and degradation prevented a more specific identification. Four samples (5%) contained both bast and rabbit fibers. Fiber type was tied to textile construction, in that the combined-fiber yarns were from oblique interlacing fragments and bast-only yarns were from spaced alternate-pair twining fragments, with only two exceptions (one sample each of oblique interlacing and spaced twining).

The widest survey of Hopewell Middle Woodland textiles was reported by Kathleen Hinkle (1984), using the Hopewell collections of the Ohio Historical Society, Kent State University, the Cleveland Museum of Natural History, and the Field Museum of Natural History in Chicago. While her original sample was of 389 fabrics from nine Hopewell sites, a sample of 154 specimens was studied most intensely, noting fiber type, fabric structure, yarn size, and warp and weft yarn spin direction. The emphasis was to determine the textile attributes that would range from the most visible to the least visible for conveying social meaning in the development of a synthetic theory. This theory proposed that the attributes of an object that pertain to individual social and manufacturing processes are organized hierarchically in the manner of Wobst's (1977) information exchange model. Hinkle recorded 12 variations in textile structure, which included six variations of twining, five variations of interlacing and oblique interlacing, and spiral interlinking. Working with the problem of provenience for many Hopewell artifacts,

Hinkle encoded the fabrics with the most accurate locational data possible in order to compare intra-site attributes. Her data analysis compared the Scioto River Valley sites, since data were too limited for the Great Miami River Valley and Muskingum River Valley sites. Hinkle also tabulated context and end uses for the textiles. Her categories included fabric canopy, blanket, bag, burial shroud, carbonized on charnel house floor, carbonized on mound floor, preserved on copper bracelet, preserved on copper ear spool, and cane matting. The Hopewell site evidenced the largest number of variations, with 10 of the 12 fabric structures. Seip samples included five of the variations. Tremper had three, including the only example of countered compact twining. Liberty/Harness specimens included only two variations. Ater, Fortney, Mound City, and Rockhold each produced only one or two fabric samples of a single structural variation. Besides the countered compact twining, three other variations were found in single specimens: oblique interlacing, spiral interlinking, and weft-faced plain weave, all of them from Hopewell.

Ellanor P. White (1987) utilized a sample of Hopewell mound group fabrics curated at the Field Museum of Natural History in Chicago. Her sample included 1,101 pieces of fabric, 490 of which were fragments on metal celts and plates. The Field Museum collection includes primarily the artifacts found with skeletons 260 and 261, which had the largest collection of copper plates and celts of all the Ohio Hopewell sites. These two burials contained 90 copper plates and 66 celts, with the plates broken into shapes similar to the mica forms, and then laid on top of the skeletons with the edges touching (Christopher Carr, personal communication 2002). While some of White's findings are similar to those coming from studies of the Ohio Historical Center collections, her data show some unique occurrences in textile production. First, she reported fine, open fabrics of oblique interlacing over 95 percent of the copper artifacts in her sample (1987:60). She concluded that all pieces of copper were wrapped in this fine gauge oblique interlacing before being interred. The reported yarn element mean diameter was 1 mm. There were also examples of a coarser oblique interlacing with mean element diameters of 2 mm. Second, White (1987:70, 73-74) described five fragments of very fine twined tapestry and one fine, flat woven cloth with fringe. She also found that remnants of fur, feathers, and/or down were restricted to a few categories of copper artifacts (1987:79). Finally, she reported that oblique interlacing was the most common covering on celts (1987:83).

Comparison of data from these studies and the present one is difficult because of (1) sometimes idiosyncratic and poorly defined definitions of fabric structure types; (2) in the case of studies that utilized Ohio Historical Society collections (all but White), analysis of samples that overlapped to an unknown extent with the one reported herein; (3) the fact that most studies included but were not limited to fabrics adhering to copper artifacts, and data usually were not presented in such a way that fabrics associated with copper could be singled out; and (4) while the present study included only fabrics associated with copper celts, breastplates, and headplates, other studies included fabrics associated with other types of copper artifacts such as buttons and beads.

THE PRESENT STUDY

The research reported in this chapter was part of a larger project conceived by Christopher Carr to employ a multidisciplinary approach to the analysis of the full range of copper artifacts held by the Ohio Historical Society in Columbus, Ohio. The purpose of my study was to analyze fabrics adhering to a variety of copper artifacts from seven Hopewell sites (Figures 4.1 and 5.1), and to assess the possible function(s) of the fabrics; whether, for instance, the fabric remains were the result of bagging or wrapping before deposition or of clothing in contact with copper or some other purpose. Metallurgists, digital and infrared imagists, and a paleobotanist, DeeAnne Wymer, were also part of the team assembled by Carr. See Chapter 4, this volume, for Wymer's discussion of additional organic materials preserved on these artifacts. Since the Carr study employed only textiles currently attached to copper artifacts, the sample does not consider car-

bonized textiles, cane matting not attached to copper, or non-carbonized textiles that were preserved by contact with copper corrosion products but are no longer in contact with an artifact. It is not possible to indicate the amount of overlap of the present sample with samples in previous studies, because the artifacts are not numbered in such a way as to facilitate that comparison. Frequently, the artifacts are identified only by the general site number. Since the current sample was limited to textiles adhering to copper plates, it is a much less extensive sample than those of Church (1984), Hinkle (1984), Song, Jakes, and Yerkes (1996), and White (1987), which also included textiles between glass plates, carbonized textiles, and cane matting.

SAMPLES AND SELECTION CRITERIA

I selected a preliminary list of possible textiles and copper pseudomorphs (inorganic metallic replacements or casts of organic materials)[1] for analysis in 1997, using color prints of artifacts made by Carr, who also provided the numbering system for the artifacts. In the summer of 2000, Wymer surveyed the prints, and a second list of 77 artifacts was derived to guide the analysis of organics and textiles adhering to copper. The use of the color prints helped reduce the unnecessary handling of artifacts during the sample development. These photographs also preserve the appearance of the samples at the time of the photograph and can be consulted to see if any portion has shifted over time. The numbers assigned by Carr will help alleviate the problem of comparison between studies of textiles adhering to copper, since each artifact now has an individual or unique number. His extensive database of photographs includes Ohio Hopewell collections beyond the Ohio Historical Society holdings. The textile analysis was performed upon the artifacts at the Ohio Historical Society facility in Columbus, Ohio, during the weeks of July 26 through August 7, 2000.

METHODS USED

Following the protocol developed by Sibley and Jakes for the analysis of Etowah textiles, a centimeter grid withY-axis rows labeled consecutively from A and X-axis rows labeled consecutively from Number 1 was placed over the photograph of the artifact for the purpose of mapping locations of textiles and organics and computing areal coverage by textiles and pseudomorphs. See Figure 4.2 for an example of the transparency grid placed over the color photograph for recording position of organics and textiles. This grid system allows for the precise designation of locations of observations. First, Wymer analyzed artifacts for organics, and noted possible textile materials. Then I inspected the artifacts and fabric samples by stereomicroscope with a micrometer disc inserted into one eyepiece for measurement of fiber diameter, yarn diameter, and thread counts of textile constructions. All objects were handled only with gloved hands to prevent damage from skin oils, perspiration, and so on. The stereomicroscope had a maximum magnification of 70X power, not great enough in most cases to facilitate identification of fiber types, only general classifications of fiber characteristics.

Following standard ASTM test method procedures, fiber and yarn diameters were averaged from five measurements sampled over the entire fragment. A handheld protractor was used to determine the angle of twist for single and plied yarns. A protractor disc in an eyepiece would have been preferable but was not available. For thread counts (see Definitions) of fabric fragments, five measurements taken by sampling over the entire piece of fabric were made using an ocular micrometer disc, and then averaged. In the case of some fragments, five measurements were not possible due to the small size of the textile; therefore, as many measurements as possible over the entire area of the sample were made and averaged.

With respect to the determination of function of the textile, some estimates of coverage and orientation were made to guide assessment. It was thought that if bagging were the purpose then one textile construction type would leave larger coverage of the artifact on both sides. The orientation of the textile structure would also indicate bagging function, in that broken fragments should be oriented with the warp or sys-

tem A yarns all lying in the same direction on both sides of the artifact. Determination of warp direction is dependent upon existence of a finished edge or selveage. None of the fragments studied had such a finished edge; therefore, no fragments in this study were identified as warp twined, unlike Hinkle's study, which reported 18 warp twining examples, all from the Hopewell site. Since some of the Hopewell artifacts were deposited in stacks, textile remains along the edges of the artifact (while none were on the obverse and reverse sides) could still indicate a wrapping or bagging function, with the artifact perhaps coming from the middle of the stack. Additionally, it was thought that areal coverage of 80 percent or greater would be associated with bagging and wrapping functions. Burial shroud function could also result in large areal coverage but attributes of amount of fiber processing, intricacy of interworking and patterning, and one-sidedness may help differentiate clothing function from bagging and wrapping end uses.

RESULTS

In viewing the 116 prints, 85 (73%) were judged to have textile remains and 38 (33%) to have possible pseudomorphs. Only 2 (1.7%) appeared to have both textile and pseudomorphic evidence. It became apparent during the textile analysis that artifacts could have the macroappearance of a textile grid, but at the microscopic level it could be seen that there was no fiber, yarn, or cloth left on the artifact, and that no pseudomorphs were present. The "textile marks" could be "ghosts" of a previous textile, or a circumstance of the copper mineralization or corrosion, but without any three-dimensional shape (see Figure 5.2). Some fabrics did have sections where copper replacement of organic fibers was complete, as indicated by blue coloration and slightly larger diameters than those in the adjacent natural colored sections; but in other cases mineralization was probably partial. Only chemical testing would indicate that. Of the 39 artifacts upon which I did a detailed textile analysis, 6 had fabric on only one side and 16 had fabric on both sides. On 6 artifacts, only yarns remained; 4 of these had yarns on both sides, and 2 had yarns on one side.

The sample is definitely skewed toward the Seip and Hopewell sites in the Scioto drainage. The other sites produced few examples of textiles adhering to copper. Breastplates provided the most textile evidence. A few celts were associated with textile remains or pseudomorphs. Headplates, originally thought to have evidence of associated textiles, universally proved to have no fabric remains present.

Eighty percent or greater coverage of an artifact side by fabric was a rare occurrence, except for Seip breastplates. Only one celt had fabric on both sides. That, too, originated from the Seip site. Five out of ten breastplates from the

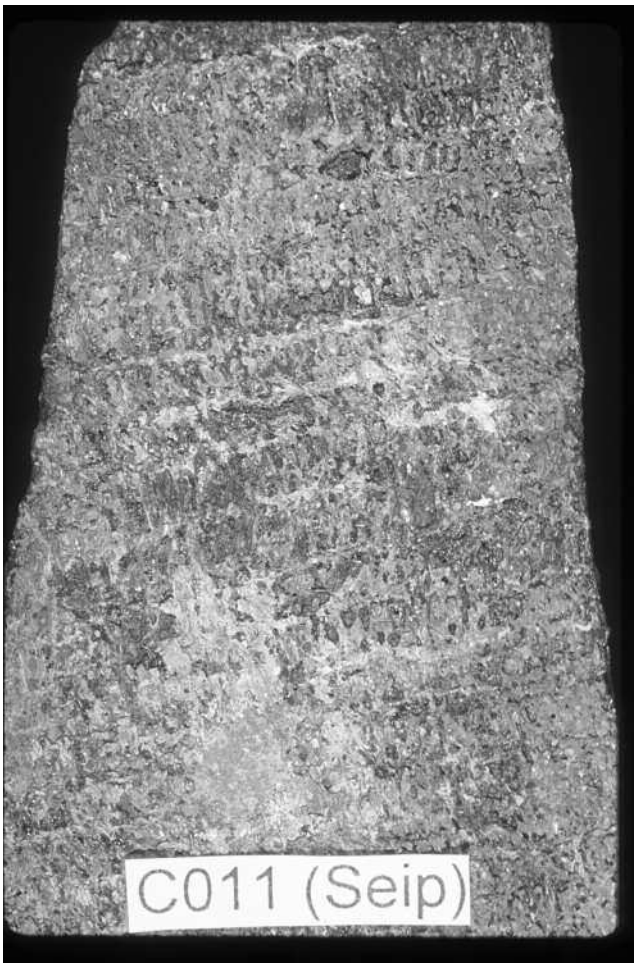


Figure 5.2. Copper celt (C011, Carr designation) with the appearance of a fabric structure at the macro level. However, the apparent yarns are only incomplete remnants, preserved as pseudomorphs. (See also Figure 4.4.) Photograph courtesy of William B. Pickard of the Ohio Historical Society.

Hopewell site had sides with evidence of fabric, but all had less than 80 percent coverage. From Hopewell also came three celts with fabric on 5 percent of the total area of one side only. This would appear to indicate that the textile had not necessarily been used to bag or wrap the artifact. The other sites were represented by only one or two copper items with any amount of fabric coverage, all at considerably less than the 80 percent level. No other signs of bagging, such as drawstrings or casings, were found in association with the copper artifacts.

Thread counts (the number of yarn elements per centimeter; see Definitions) presented some interesting results. In general, Seip textiles had higher thread counts for spaced alternate-pair twining and oblique interlacing than were present at other sites. The range in thread count for spaced alternate-pair twined fabrics was from 17 to 24 inactive elements per centimeter, with 6 to 10 active elements per centimeter. Only a breastplate, which had cremation remains on the obverse side, had a thread count outside of that range (8 inactive wrapped by 4 active elements per centimeter). Hopewell site spaced alternate-pair twining fabric counts ranged from 10 inactive by 4 active elements to 16 by 8 per centimeter. Oblique interlaced fabrics from Seip and Ater had 6 by 6 yarns per centimeter. The Hopewell site oblique interlacing example was coarser, with 4 by 4 elements per centimeter.

Considering possible uses for textiles in contact with artifacts, the question arose of whether more than one fabric construction or fabric type occurred on a given side of an artifact. The presence of more than one type of fabric structure or of the same structure but with different mean yarn diameters and/or thread counts, which would indicate two different fabrics, could be a contraindication of wrapping or bagging. Few artifacts had more than one cloth construction on a given side. One textile was mixed with feather and/or hair or fur fiber (Carr B067). Only the Hopewell site had one breastplate with two identifiably different textiles on one side of the artifact (Carr B020), and also the only example of different fabric structures on obverse and reverse side (Carr B071), which are illustrated in Figure 5.3.

Table 5.2 lists the fabric structures found on the surveyed artifacts. Textile structures found adhering to copper, not including cane matting or hide, were limited to five types: oblique interlacing, spaced two-strand twining,[2] compact alternate-pair twining, spaced alternate-pair twining, and plain weave (Emery 1980:201-202; see Definitions). Spaced two-strand twining was identified only on artifacts from the Hopewell site. There is a possible example of featherwork with feathers attached to a textile substrate on breastplate B030. There is a definite textile-like open grid of orange coloration forming diagonal lines over the entire plate side, but no fibers or yarns are wrapped around the feather shafts. In a few places, the feather shafts can be seen to have been bent in the traditional form for attachment, but no yarns were evident with the bent shafts (see Figure 4.8).

Oblique interlacing was found only on breastplates, from Seip, Hopewell, and Ater. Several samples of oblique interlacing showed pigment coloration in green and maroon (see Figure 4.7). Hinkle also reported fabrics with maroon and green pigmentation. No design pattern could be ascertained from the fragments. Compact alternate-pair twining was found on one breastplate from Seip. Spaced alternate-pair twining occurred on ten breastplates from Seip, one breastplate and one celt from Hopewell, and one breastplate from Rockhold. Spaced two-strand twining was characteristic of only one breastplate from the Hopewell site. Five breastplates from the sites of Ater, Hopewell, Liberty/Harness, and Seip were associated with unidentifiable textile structures.

The fibers used for the spaced alternate-pair twining are cream colored, and at 70X magnification appear to be "Group 1" type fibers, which include nettles, mulberry, dogbane, and milkweed (Jakes et al. 1993). Because the sample is so biased toward Seip and Hopewell, it is not possible to generate any conclusions for between-site and between-artifact-type occurrences. A Liberty/Harness site breastplate (Carr B055) had a second type of fiber that was less refined than "Group 1" types, being darker in color and of a coarser fiber diameter. Yarns were typically two-ply with final Z twist (see Definitions).

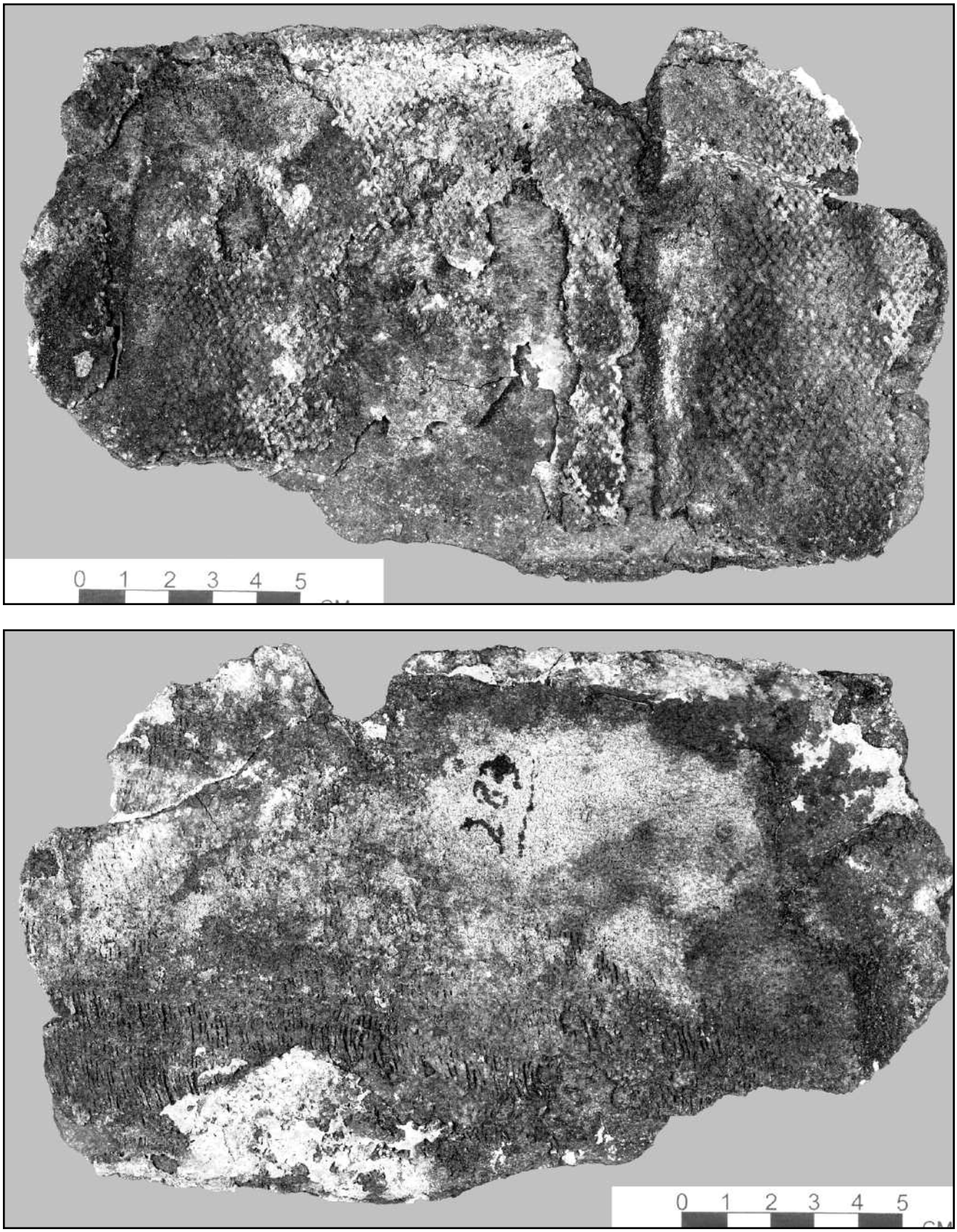


Figure 5.3. Fabrics on obverse and reverse sides of breastplate B071 (Carr designation). Top: Oblique interlacing. Bottom: Spaced alternate-pair twined fabric. Photographs courtesy of Christopher Carr and Andrew D.W. Lydecker. Breastplate courtesy of the Ohio Historical Society, Columbus.

Table 5.2. Incidence of Fabric Structure Types[a] by Site and Artifact Class

Site	Artifact Type	Oblique Interlacing	Compact Alternate-Pair Twining	Spaced Alternate-Pair Twining	Spaced Plain Twining	Unidenti-fiable Fabric	Total Number of Fabrics	No Fabric
Seip	Breastplates	3	1	10	0	2	16	3
	Celts	0	0	0	0	0	0	3
	Headplates	0	0	0	0	0	0	0
Hopewell	Breastplates	1	0	1	1	1	4	3
	Celts	0	0	1	0	2	3	2
	Headplates	0	0	0	0	0	0	1
Ater	Breastplates	1	0	0	0	1	2	2
	Celts	0	0	0	0	0	0	1
	Headplates	0	0	0	0	0	0	1
Liberty	Breastplates	0	0	0	0	1	1	4
	Celts	0	0	0	0	0	0	0
	Headplates	0	0	0	0	0	0	0
Rockhold	Breastplates	0	0	1	0	0	1	0
	Celts	0	0	0	0	0	0	0
	Headplates	0	0	0	0	0	0	0
Fortney	Breastplates	0	0	0	0	0	0	1
	Celts	0	0	0	0	0	0	2
	Headplates	0	0	0	0	0	0	0
Ft. Ancient	Breastplates	0	0	0	0	0	0	2
	Celts	0	0	0	0	0	0	0
	Headplates	0	0	0	0	0	0	0
Totals		5	1	13	1	7	27	25

[a]These numbers represent only the fabric structure types, not the actual number of fragments or pieces of fabric per artifact.

In several cases, multiple layers of the same type of textile were present on one side of the artifact. Some examples were double- or triple-layered, and one had as many as 10 to 14 layers. In some places, one can see the fabric folding back to form another layer. Seip breastplate Carr B040 has multiple layers of cloth, and the variation in yarn twist and ply in the fragments seems to indicate two different fabrics in the spaced alternate-pair twined structure. On several plates, the textile occurs on top of cane matting or hide and at other locations is underneath hide or fur. Without provenience, it is difficult to indicate purpose for this layering; either bagging or wrapping by fabric occurred before the object was laid on a cane mat, or the textile was in contact with the copper first and then it was covered with hide or cane matting. In several cases, the spaced alternate-pair fabrics occurred with feathers. There could be some ritual pairing of materials happening. This is similar to Sibley's findings (1986) for a breastplate from Tunacunnhee Hopewell site in Georgia.

In samples examined for the current study, yarns used for oblique interlacing were of greater diameter than those used for spaced alternate-pair twined fabrics. The yarn diameters from oblique interlacing on copper artifacts are smaller than those reported in the Church sample, which were almost twice as thick as yarns used for other structures. The yarns from oblique interlacing that were examined in the current sample appear to have a configuration that typically would be designated as a "complex" or "novelty" yarn today. The surface was covered by hair fibers, which initially led to a designation by Wymer as "woven fur," but these are not interlaced strips of fur. Rather, the interlaced elements are two-ply yarns into which short hair fibers were incorporated during plying, or around which fibers had been wrapped after plying.

Table 5.3 summarizes singles yarn and plied yarn diameters by sites. The coarser thread count for the breastplate with the cremation remains raises the question of whether differences in fabric fineness may be related to fabric function. The majority of spaced alternate- pair twining found in association with breastplates had fine yarns and high thread counts. Yarns and thread count are coarser in spaced alternate-pair twined fabrics probably used as wrappings to keep cremation remains in place on the plate after the cremation process. Could this indicate that the wrapping function for cremation was of less importance and therefore required less-fine workmanship in the associated fabric? A survey of textiles in association with cremation remains may prove useful.

In reporting results from her study of Ohio Historical Society fabric specimens from three Ohio Hopewell sites, Church (1984:10) noted that "some of the textiles . . . appear to be closely related to the distribution of copper," but did not tabulate fabric differences based on associations with copper. However, data from White's study of Hopewell site fabric fragments in the Field Museum collections (1987) do make that distinction. White noted that "profoundly different frequencies of textile construction are found in the preserved fabrics and [in fabrics visible] on copper" (1987:60). Data from her sample (unlike data from most other published analyses) do not overlap with those of the present study.

Table 5.4 compares frequencies of fabric structure types reported by White (1987) in carbonized textiles and in textiles associated with copper against data from the present study, in which only fabrics associated with copper breastplates and celts were analyzed. The new data corroborate the above observations. It would appear that fabric structure types in association with copper are more limited than the total known types from Ohio Hopewell sites. For instance, in these samples close (compact) plain twining, present in a high proportion of carbonized fabric fragments, is not in evidence among fabrics associated with copper artifacts.

White reported fine oblique interlacing of one-millimeter diameter elements covering both sides of 95 percent of the 1,101 copper artifacts and artifact fragments that she examined. She hypothesized that all the artifacts were wrapped in fine oblique interlacing and that the fabric played a functional role in artifact production. Color images made by Carr of copper items in the Ohio Historical Society Hopewell collections do show fine threads, but one cannot identify any oblique interlacing pattern (Christopher Carr, personal communication 2002).

Table 5.3. Summary of Yarn Diameters[a] by Sites.

Site	N		Single-ply Yarn Diameters		Plied Yarn Diameters	
			Warp (mm)	Weft (mm)	Warp (mm)	Weft (mm)
Seip	25	Range	0.1 - 1.7	0.1 – 0.7	0.47 – 1.7	0.21 – 1.45
		Mean	0.41	0.23	0.69	0.42
Hopewell	8	Range	0.2 – 1.1	0.1 – 1.3	0.4 – 1.38	0.4 – 1.48
		Mean	0.57	0.45	0.65	0.62
Ater	2	Range	0.15 – 0.8	0.15 – 0.2	0.3 – 1.6	0.2 - 1.0
		Mean	0.49	0.175	0.825	0.45
Rockhold	2	Range	0.2 – 0.7	0.15 – 0.3	0.4 – 1.0	0.25 – 0.6
		Mean	0.43	0.22	0.68	0.425

[a]Measurements were taken across "the distance of two imaginary parallel lines tangent to the outer curves of the spiraling plies" (Emery 1980:12; Hurley 1979).

Table 5.4. Types of Fabric Structures in Carbonized Textiles and Textiles Associated with Copper Artifacts.

	Hopewell site textiles in Field Museum[a]						Selected textiles from Ohio Historical Society collections[b]	
	Carbonized fabric fragments		Fabric structures assoc. with all types of copper artifacts and fragments (N=1101)		Fabric structures assoc. with copper celts and breastplates (N=36)		Fabric structures assoc. with copper celts and breastplates (N=52)	
Fabric structures	Number of fabric fragments	% of fabric fragments (N = 35)	Number of copper pieces with assoc. fabrics	% of copper pieces with assoc. fabrics	Number of artifacts with assoc. fabrics	% of artifacts with assoc. fabrics	Number of artifacts with assoc. fabrics	% of artifacts with assoc. fabrics
Close plain twining	23	66%	-	-	-	-	-	-
Spaced plain twining	1	3%	73	7%	4	11%	1	2%
Close alternate-pair twining	-	-	-	-	-	-	1	2%
Spaced alternate-pair twining	4	11%	26	2%	5	14%	13	25%
"Heavy" oblique interlacing	-	-	127	12%	17	47%	5	10%
Fine oblique interlacing ("gauze")	-	-	1041	95%	33	92%	-	-
Interlacing with separate warps and wefts (plain weave)	6	17%	-	-	-	-	1	2%
Loop and twist	1	3%	-	-	-	-	-	-
Unidentifiable							7	13%

[a]From Hopewell site, 1891 excavations (White 1987:79, 86)
[b]From 7 Ohio Hopewell sites listed in Table 5.2

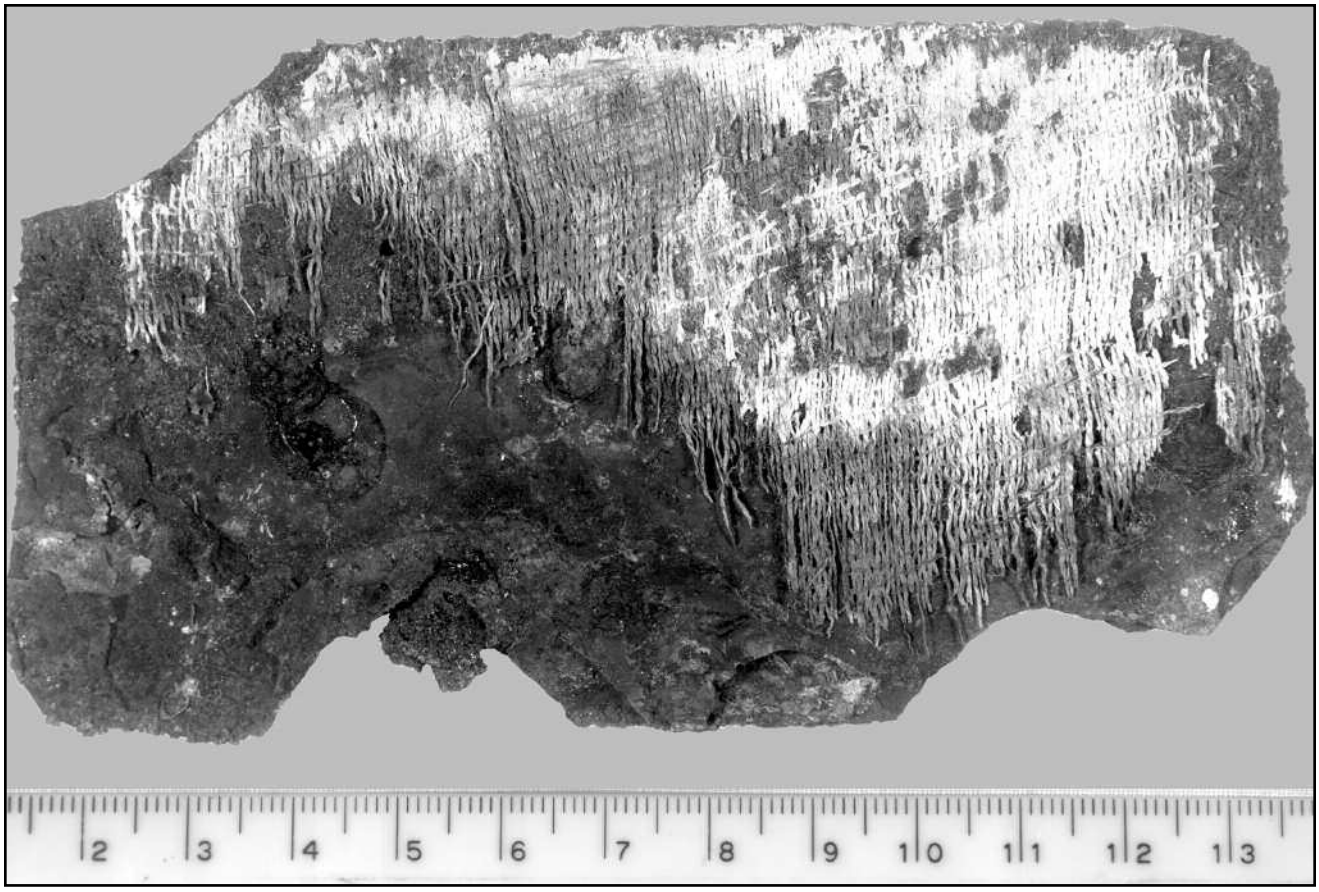
DISCUSSION

Future lines of study for these artifacts would include an effort toward identification of plant fibers as well as of hair, fur, and feather samples. From notes on Hopewell and Mississippian textiles made by the late Dr. Lucy Sibley of the Ohio State University College of Human Ecology, dated April 14, 1987 (provided to me by N'omi Greber), it is apparent that an investigation of the use of milkweed fibers, from seed and/or stem, should be made. Sibley thought fibers associated with breastplate #283/450 (Carr designation B067) might be of milkweed "down" rather than of feather. Magnification greater than 70X is needed to check for feather barbs and other surface characteristics. Bast-like fibers, identified by both Sibley and me, require further investigation before a more specific identification can be made. In comparative samples of milkweed, fibers are easy to extract and have similar structure to those in the study, being light in color, relatively clean, and not fully separated into individual fibrils.

In my observations, some curious anomalies were noted that were not expected from the review of previous research. I found anomalously tightly or loosely twisted yarns within the textiles associated with several breastplates, including Seip breastplate 17, side 2, and breastplate 35, side 1. None of the other researchers investigating Hopewell fabrics have commented on the unequal size of any two singles plied together nor the extreme variation in twist angle of cordage within a single textile fragment. Figures 5.4 and 5.5 illustrate these variations. In Figure 5.4, one can see a more tightly twisted yarn inserted at intervals, and the variation in diameters for yarns with lower twists per centimeter. In Figure 5.5 there is a thick singles yarn plied with a thinner singles yarn. This occurred with three breastplates (B034, B036, and B040). Since the fibers are the same type, the question is, why the twist variation within the same fabric?

These anomalous yarns are being investigated from several different angles. Once a spinner is experienced, the twist per centimeter remains fairly consistent for the yarn type being produced for a particular end use. On these breastplates, the bast-like yarns all appear to be of the same Group 1 fiber type, and are used in the same type of twined structure. It would be expected that yarns would have the same or similar degree of twist per centimeter for the entire cloth if made by one spinner. Most commonly, to obtain a smooth, consistent fabric surface, single elements of the same diameter are twisted together to form a plied yarn, rather than mixing singles of dissimilar diameters. The presence of these varying yarns may indicate that more than one person provided yarn for the textile or that yarns originally prepared for different purposes were incorporated into the structure, due to time constraints for quick preparation. Although diameters varied from yarn to yarn along their lengths, the twists were consistent, probably indicating that the spinner was not a beginner at plying, which is usually evidenced by tightly twisted sections alternating with more loosely twisted sections along the length of the yarn, or by some sections untwisting. Jakes and Tiedemann (Jakes, personal communication 2002) suggest that one explanation for the thick and thin jointures may be the method of plying. They studied craftspeople performing different methods of spinning, finding that the thigh-spinning method typically caused one of the singles yarns to untwist as two singles were being twisted a second time in plying. This untwisting would increase diameter of the yarn as it gained less compression. Yet one might ask why this was not a more common occurrence if thigh spinning were the common method of plying yarns, for the untwisting appears in only five out of seventeen breastplates for Seip.

These yarns of Group 1 fibers are so fine and the thread counts so dense in the alternate-pair twining that tremendous labor would be involved in producing the yarns for the fabrics (Jakes et al.1993). Thousands of hours would be required just for cordage production, from collection of raw materials through extraction from the plant stems to spinning and plying. If yarns were needed quickly, the work of several spinners could be pooled to produce the textile. The volume of fabrics evidenced by those attached to copper and reported by excavators could necessitate such collective behavior. Eight breastplates



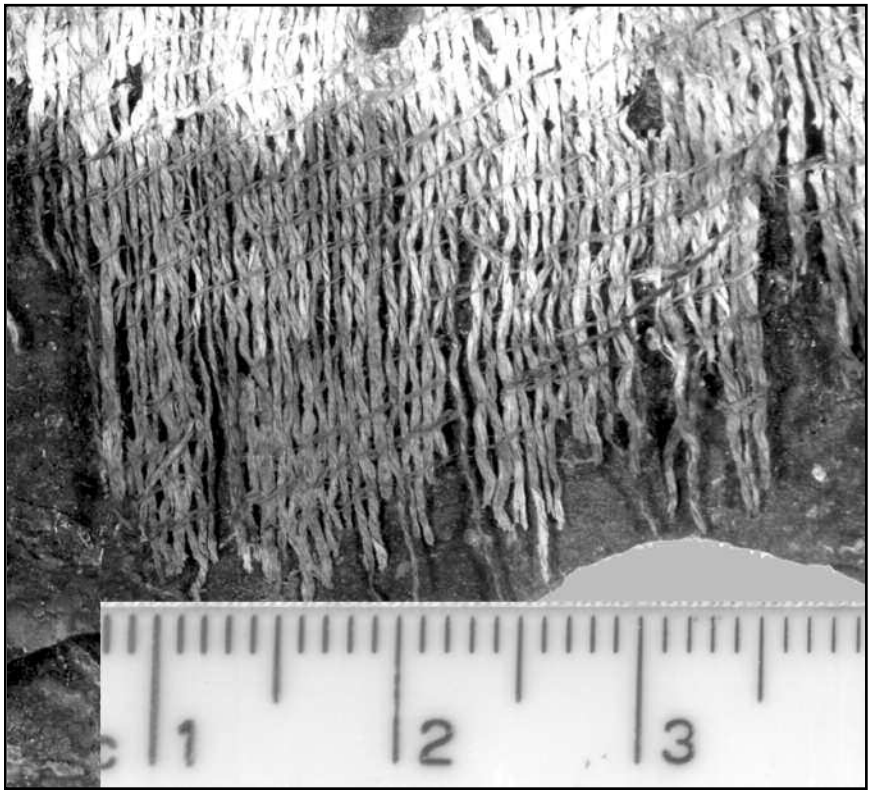


Figure 5.4. Breastplate B035 (Carr designation) with more highly twisted yarns inserted at intervals in the spaced alternate-pair twined fabric. Top: Whole plate. Bottom: Detail. Photographs courtesy of Christopher Carr and Andrew D. W. Lydecker. Breastplate courtesy of the Ohio Historical Society, Columbus.

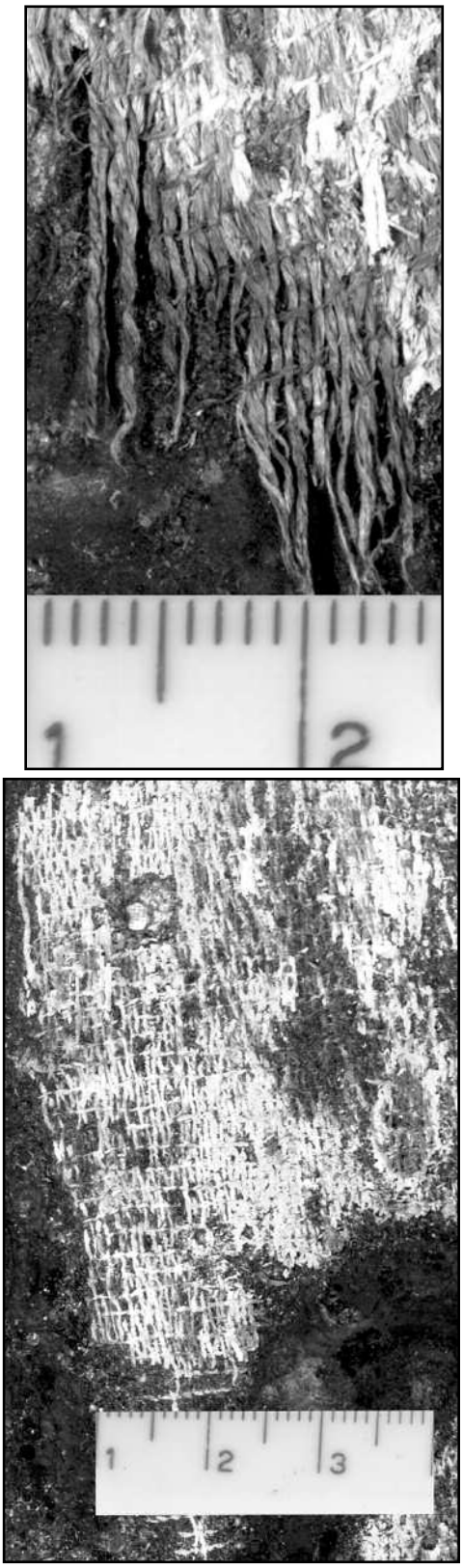


Figure 5.5. Thick and thin singles plied together. Top: Yarns on breastplate B035A (Carr designation). Bottom: Yarns on breastplate B036B (Carr designation). Photographs courtesy of Christopher Carr and Andrew D. W. Lydecker. Breastplate courtesy of the Ohio Historical Society, Columbus.

of the seventeen from Seip and one each from the Hopewell and Rockhold sites have these yarn anomalies (B009, B017, B029, B032, B035, B036, B039, B040, B042, B078). With the lack of provenience for many of the Hopewell artifacts, the yarn anomalies may help to track which artifacts were bagged or wrapped together, or were from the same burial with fragments of the same garment or shroud. While it is recognized that within-site provenience is problematical for the majority of Ohio Hopewell artifacts, information is available for some as to whether they were part of a cache, or individually disposed. Future work will include compiling archaeological proveniences for the copper artifacts studied, to ascertain whether they were in contact with a skeleton or were part of a cache in a crematory basin. Until that information can be added to the textile data, function is difficult to assess. The lack of fabric on both sides for many artifacts may indicate that separate wrapping or bagging was not done. There are examples of textile remains on only the edges of plates that may indicate that breastplates were stacked together and then wrapped to keep them in place. Some plates were associated with two or more layers of the same fabric structure, which may indicate folding of a larger piece of fabric to fit the surface of the plate for ceremonial purposes. Where matting and fabric occur on the same plate, the fabric might be hypothesized to have served as clothing or shroud if it can be established that the plate was found beneath the body where it was lying on a mat.

NOTES

1. In this chapter, the term "pseudomorph" includes mineralized artifacts (see Definitions).
2. Two-strand twining refers to the number of active elements twisting around the inactive elements. In this case, two strands twist around one element at a time, as in Emery's definition (1980:201). In two-strand weft twining, the wefts are known to be the active elements. Without selvages or finished edges, it is difficult to specifically designate warp or weft directions, traditionally vertical

and horizontal directions as the fabric is produced. Analysis of the yarns employed in relation to the weave may indicate directionality with reasonable surety in modern textiles. In one example, there may be thinner and more highly twisted yarns in one direction as compared to thicker, less-twisted ones in the opposite direction. Generally, the thinner, more tightly twisted yarns lie in the warp direction, because they are more resistant to stresses involved in construction.

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CHAPTER 6

POPULATION CONTINUITY AND DISPERSAL: CORDAGE TWIST ANALYSIS AND THE LATE WOODLAND IN THE GLACIATED ALLEGHENY PLATEAU OF NORTHWESTERN PENNSYLVANIA

William C. Johnson and Andrew J. Myers

ABSTRACT

Over the last four decades, analysis of the twist direction of cordage preserved on the surfaces of ceramics in the Eastern Woodlands has been used increasingly to demonstrate ethnic population boundaries and their continuity or change over time. This approach is applied to cordage preserved as impressions on the surfaces of Late Woodland ceramics from the Allegheny Plateau in northwestern Pennsylvania. The resulting data strongly argue for population continuity throughout the last 600 years of prehistory in the glaciated portion of the Allegheny Plateau, despite changes in ceramic technology and decorative modes. As well, these data demonstrate the gradual dispersal of this indigenous population into surrounding unglaciated Allegheny Plateau and contiguous areas during the last half of the 15th and the 16th centuries.

INTRODUCTION

This chapter reports on an ongoing long-term research project, and thus, should be regarded as work in progress. In it, we examine the final twist direction of cordage impressions — either Z or S — on the surface of Late Woodland and Late Prehistoric cord-marked ceramic sherds from the Upper Ohio River Valley of western Pennsylvania. In particular, we focus on the Late Woodland period in both the glaciated and unglaciated Allegheny Plateau section of northwestern Pennsylvania (Figure 6.1). The junior author collected the majority of the data from the interior of the Clarion River and Tionesta Creek drainage basins and from the Indian Camp Run and Taylor sites on the valley floor of the Middle Allegheny River. Richard George graciously provided most of the cordage twist frequencies from the Monongahela culture Johnston phase Johnston, Squirrel Hill, and McJunkin sites for an earlier version of this paper. These data were subsequently published in George (1997). The senior author collected the remainder of the cordage twist direction data presented here.

As an introduction to this chapter, we review previous cordage twist direction and ethnicity studies in the Northeast and Middle Atlantic areas to document the utility of this line of research. We then briefly discuss the methodology used in this study and present a short culture history of the Late Woodland sequence in the glaciated Allegheny Plateau of northwestern Pennsylvania as background to elucidate the problems addressed in this research. After presenting the results of our cordage twist analysis,

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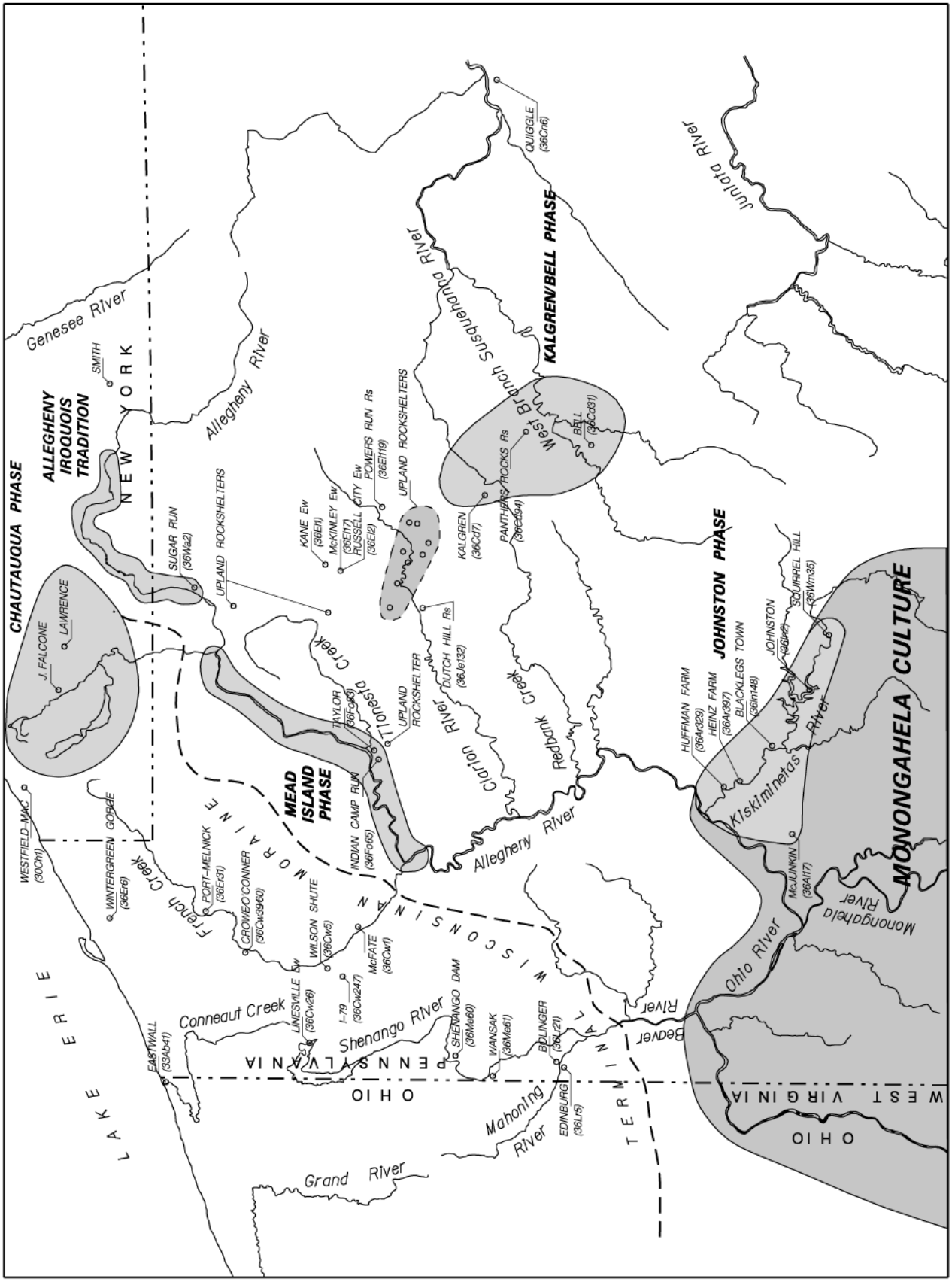

Figure 6.1. Sites, phases, and cultures mentioned in the text and tables.

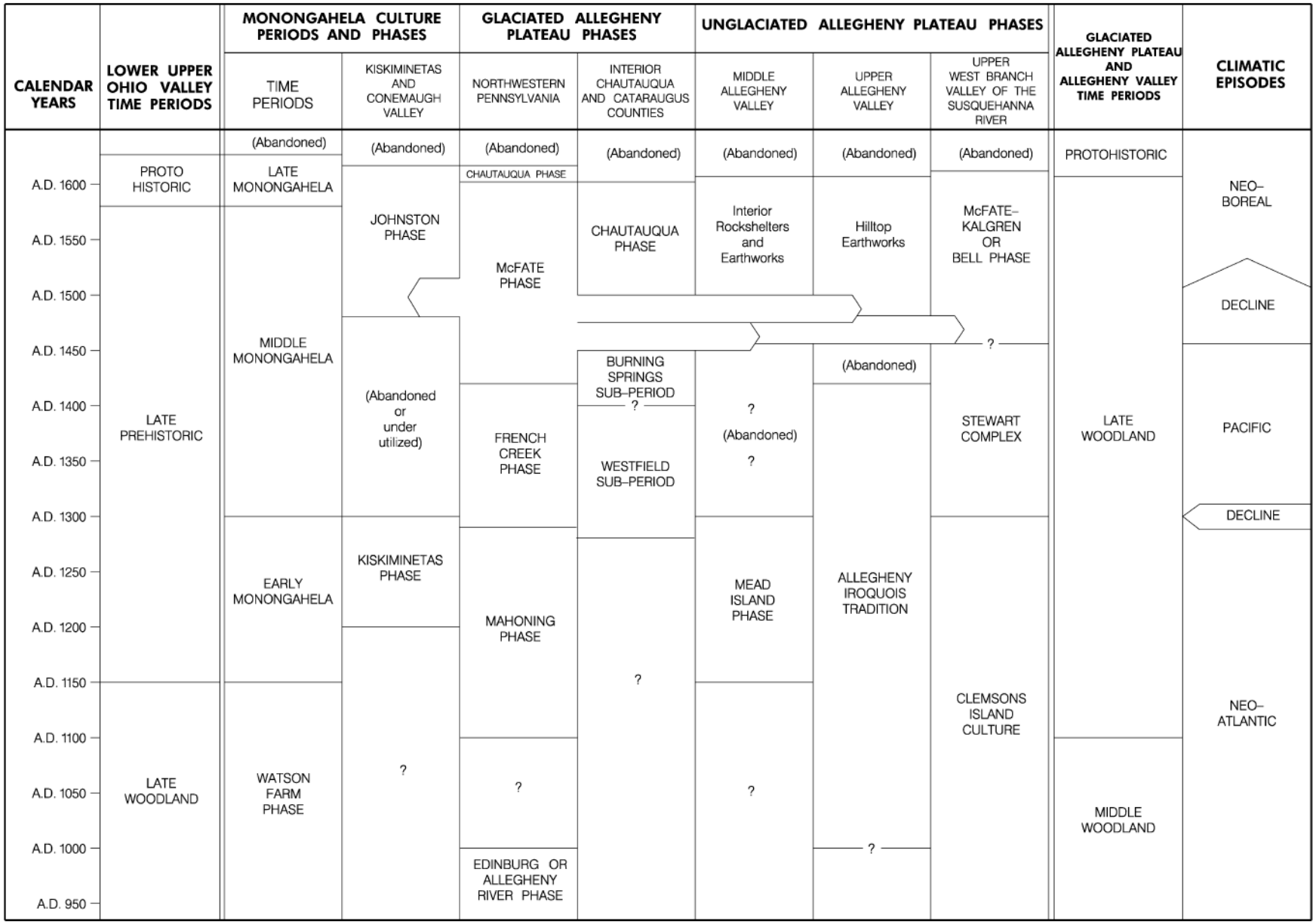

Figure 6.2. Late Woodland culture chronology for northwestern Pennsylvania and surrounding areas adjusted to reflect calibrated radiocarbon ages or calendar years.

we apply these data to two problems. First, we examine arguments for population replacement versus population continuity during the Late Woodland period in the glaciated Allegheny Plateau section in northwestern Pennsylvania. Second, we assess evidence for the apparent gradual dispersal of the late McFate phase people from the glaciated Allegheny Plateau by the early 16th century (see Figure 6.2 for a summary of the time frame). We do this by examining surrounding areas for evidence of the McFate phase peoples' distinctive ceramics as well as other elements of their material culture — specifically the proxy evidence for their presence provided by the preferred twist direction of the cordage preserved as impressions on those ceramics.

In investigating these problems, we employ 1,542 latex casts of cordage impressions on sherds from 31 sites representing 38 terminal Middle Woodland and Late Woodland components in the glaciated and unglaciated portions of the Allegheny Plateau section of northwestern Pennsylvania and the adjacent Lake Erie Plain of Chautauqua County, New York.

CHRONOLOGICAL FRAMEWORK

A word about regionally utilized chronological terminology will be helpful. In New York, northern Ohio, and northwestern Pennsylvania, the "Late Woodland" period is considered to begin around A.D. 1000 in uncalibrated radiocarbon years, which is equivalent to approximately A.D. 1100 in calendar years. It is considered to persist until the appearance of European trade goods or native-made items that can be reasonably assigned to the last decade or two of the 16th and to the early 17th centuries in the lower Great Lakes. In Middle Ohio River Valley parlance, however, "Late Woodland" is generally understood to be the period between about A.D. 400 and A.D. 1050 in radiocarbon years, or approximately A.D. 550 to A.D. 1150 in calendar years. The period from A.D. 1150 to 1580/1590 in calendar years is referred to as the Late Prehistoric period and the short interval to A.D. 1635 and the dispersal of the indigenous population from the lower Upper Ohio Valley as the Protohistoric period.

We use the Middle Ohio Valley terminology with reference to the chronology of the Monongahela culture of the lower Upper Ohio River Valley because the Monongahela archaeological tradition, although not derived directly from the downstream Eastern Fort Ancient culture, is clearly closely related to it. As well, the preceding Late Woodland period in the lower Upper Ohio Valley seems to be more closely related to Late Woodland manifestations in the upper Middle Ohio Valley in settlement pattern, subsistence strategies, and material culture than to either the essentially contemporary late Middle Woodland or chronologically later Late Woodland complexes inside the terminal Wisconsinan glacial moraine.

Thus, for the lower Upper Ohio Valley, the period from ca. A.D. 400–1050 (radiocarbon years) is termed "Late Woodland." It is succeeded by the Late Prehistoric and Protohistoric period Monongahela culture, ca. A.D. 1050–1635 in radiocarbon years or, again, approximately A.D. 1150-1635 in calendar years (see Figure 6.2). Parenthetically, it should be noted that the chronological chart in Figure 6.2 attempts to present phases and events in calendar years rather than uncalibrated radiocarbon years, particularly because the upper end of the various sequences presented are anchored in the Protohistoric period. In the remainder of this chapter, dates are rendered in calendar years.

PREVIOUS CORDAGE TWIST DIRECTION AND ETHNICITY STUDIES

Since the mid-1960s, archaeologists have been sporadically reporting the twist direction of cordage impressions on Eastern Woodland ceramic sherds and noting chronological trends or differences within wares as well as between geographic areas. For example, in Virginia, C. G. Holland (1966) noted that the predominant final cordage twist direction displayed by an assemblage of Keyser Cord-Marked sherds from the Quicksburg site on the North Fork of the Shenandoah River was Z (see Z twist in Definitions). In southwestern Virginia, Holland (1970) also noted that particular cordage twist directions were associated with certain ceramic types,

including Dan River Cord-Marked, Grayson Cord-Marked, Grayson Net and Knot Roughened, and Wythe Cord-Marked. Of even greater interest is the fact that Holland also recognized that the cordage used to construct the nets utilized in the manufacture of Dan River Net-Impressed wares evidenced a final S twist when preserved on sherds derived from sites in the Piedmont but a final Z twist on sherds recovered in the Ridge and Valley province. It now appears that Holland was describing the twist of cord impressions on sherds as they appeared in the negative (impression) rather than as they would have appeared in the positive (original object or cast) before reporting conventions were established (see, e.g., Johnson 2001b).

In the Potomac River basin, several researchers have documented the predominance of final-S-twist cordage on Early, Middle, and early Late Woodland ceramics (see, for instance, Egloff and Potter 1982; Johnson 2001a; Klein 1991; Petersen 1999; Stevens and Klein 1994; YoungRavenhorst 1994). After ca. A.D. 1100, a switch in the preferred final twist direction of cordage to Z is documented in the impressions on succeeding Late Woodland Shepard Cord-Marked, Page Cord-Marked, and Potomac Creek Cord-Impressed ceramics from components in the Potomac Great Valley, Piedmont, and Inner Coastal Plain (e.g., Johnson 1996, 1999b, 1999c, 2001a, 2001b). These data suggest a population replacement in the Potomac River basin early in the Late Woodland period, ca. A.D. 1100–1200, with the simultaneous appearance of new pottery styles and decorative techniques and motifs, including added-on collars and pseudo-cord and direct-cord impressed and incised decoration on local Potomac Valley ceramics. Finally, Johnson (1999b, 2001a, 2001b) has demonstrated a second population intrusion and replacement in the Upper and Middle Potomac River Valley after ca. A.D. 1400, with the appearance of the Luray complex and its diagnostic shell-tempered Keyser Cord-Marked ware. Frequencies of final-S-twist cordage displayed by Keyser Cord-Marked ware from seven components range from 75 percent to 93 percent.

In the upper James River estuary of southeastern Virginia, Johnson and Speedy (1992) and Johnson and Deitrick (2000) recently examined cordage impressions derived from sherds representing three Middle Woodland period cord-marked wares and one so-called "fabric-impressed" variety from four sites in Prince George and Chesterfield counties, Virginia. The cordage impressions displayed by the cord-marked Varina, Prince George, and Mockley wares and by the Prince George Fabric-Impressed variety are predominantly final-S-twist. This suggests population continuity in this area during the entire Middle Woodland period as it is defined there, ca. 500 B.C.–A.D. 800.

The cordage in the nets that had been employed to roughen paddles used to malleate the walls of the net-impressed vessels in all three wares also was examined (Johnson and Deitrick 2000; Johnson and Speedy 1992). Although not as pervasive as the final-S-twist pattern for the cordage impressions in the cord-marked and fabric-marked varieties, the preferred twist direction of the cords utilized in the manufacture of the nets impressed in the exterior surfaces of the three wares was predominantly final Z. Although John Smith and William Strachey (cited in Swanton 1946) reported that women in the Early Historic period Powhatan chiefdom in the Chesapeake Bay vicinity made cordage for both nets and fishing lines, the hypothesis that males made the cordage used in the construction of Middle Woodland nets seemed to be the most parsimonious explanation for the two opposed cordage-making patterns found at the four Virginia sites (Johnson and Deitrick 2000; Johnson and Speedy 1992). As the production of cordage for the construction of nets was assumed to be a male task, the persistence of two parallel cordage-making traditions — female and male — for over 1,300 years strengthened their argument for population continuity across the Middle Woodland interlude.

Final-Z-twist cordage, however, was employed predominantly in the production of cordage used to plait together dowels that were utilized, in turn, to malleate the walls of the Late Woodland Shockoe and Townsend so-called "fabric-impressed" vessels recovered from the same four sites. These data suggest a population replacement in this part of the James River estu-

ary sometime after the end of the Middle Woodland period, ca. A.D. 800. As well, this established Z as the preferred final twist direction of cordage produced by the Weyanock, the Powhatan tribe historically documented in this area (Johnson and Deitrick 2000; Johnson and Speedy 1992).

In northern New England, James Petersen and his colleagues (e.g., Petersen and Wolford 2000) have used cordage twist direction — normally preserved as impressions on the surfaces of prehistoric pottery — to identify final-Z-twist, coastal, and final-S-twist, interior, patterns in northern New England from Massachusetts to Maine. This contrasting pattern appears to have persisted from the Early Woodland to Contact times. Although tentative because of small samples, Petersen and Wolford (2000) also indicated that this pattern conforms to that seen in examples of ethnographic basketry and textiles manufactured with final-Z-twist cordage and weft slant by the coastal Passamaquoddy and those with final-S-twist cordage and weft slants made by the interior Malecite.

Research related to twist direction of cordage preserved on the surfaces of Woodland and Late Prehistoric pottery in the Upper Ohio River has been ongoing for almost 30 years, since the publication of Robert Maslowski's seminal 1973 article documenting the twist direction of cordage on Late Woodland period Watson Cord-Marked ceramics from the Watson Farm type site (Maslowski 1973). Since then, Maslowski (Carr and Maslowski 1995; Maslowski 1984, 1996) and Johnson (1999a, 2001b, 2002; Johnson et al. 1989; Johnson and Speedy 1993) as well as many others, particularly Richard George (1983, 1997, 2002; George et al. 1990) and James Herbstritt (1981; Carr and Maslowski 1995; NPW Consultants, Inc. 1983), have recorded the twist direction of cordage impressions on prehistoric ceramics throughout the Middle and Upper Ohio River Valley.

Recently, Jill Minar's (2000) study of modern hand-spinners has added an important facet to these studies. She demonstrated that handedness (right- or left-handed) has little or nothing to do with the direction of the initial spin and final twist direction of cordage. Nor, in her view, is the direction determined by the inherent properties of the raw material (see also Petersen et al. 2001). Rather, it is simply: Who taught you. In pre-industrial societies, cordage making is taught to juveniles by family or group members, most likely mothers or grandmothers. The direction of twist becomes an ingrained motor habit early in a child's development and is not subject to change. Thus, the cordage twist preference of a family group is perpetuated from generation to generation as long as the group survives. The collective pattern of the band or village to which a family belongs will be recognized across generations by the fingerprint of their collective cordage twist direction preferences, as long as the band or village remains a coherent group.

Regrettably, cordage can only be twisted in two directions, to the right or to the left, so there are limits to the interpretations that one can squeeze out of the data. But clearly, the examination of cordage twist direction is an important key along with other elements of material culture for demonstrating population continuity or replacement in prehistoric societies.

METHODOLOGY

Latex casts of cordage impressions from 1,542 sherds from the Allegheny Plateau and Lake Erie Plain of northwestern Pennsylvania and adjacent Chautauqua County, New York, were examined and typed for this study. Another 137 casts of cordage from the Quiggle site on the West Branch of the Susquehanna River in the Appalachian Mountain section also were analyzed, for comparative purposes. Initial spin and final twist direction, Z or S (see Definitions), are reported as outlined in Maslowski (1973) and Hurley (1979). Spin and twist directions were recorded as the cords appear on the cast and thus as they would have appeared originally in the actual cordage. This is the prevailing convention in North America, rather than reporting the twist as it appears in the impression on the sherd, which is the norm in Japan. The North American reporting convention is extremely important to observe and to report when documenting cordage twist preferences derived from ceramic sherds.

The twist directions derived from cordage impressions from late Middle Woodland Intrusive Mound complex igneous-rock-tempered sherds, and from igneous-rock, mixed-rock-and-shell, and shell-tempered early Late Woodland Mahoning phase and Mead Island phase ceramics in northwestern Pennsylvania, and from igneous-rock-tempered Ontario Iroquois tradition Middleport horizon sherds from the adjacent Lake Erie Plain of New York are presented in the Appendix, Table 6.1. The distribution of these frequencies is displayed in Figure 6.3. Table 6.2 in the Appendix presents the twist direction data from post–A.D. 1250–1300 shell-tempered ceramic components in the same areas of northwestern Pennsylvania and the adjacent Lake Erie Plain of New York. The data from these impressions were derived from traditionally defined Chautauqua Cord-Marked and McFate Incised ceramics from components that can be tentatively assigned to the later Late Woodland period French Creek and succeeding McFate phases. Again, the distribution of the associated frequencies derived from the shell-tempered ceramics is displayed in Figure 6.4.

Cordage twist frequencies from shell-tempered cord-marked ceramics from Late Prehistoric period Monongahela culture village sites in the Kiskiminetas River Valley and adjacent uplands are presented in the Appendix, Table 6.3. The cordage samples from the Johnston (36In2), Squirrel Hill (36Wm35), and McJunkin (36Al17) sites were derived from sherds from essentially pure late Middle Monongahela period Johnston phase components. The remaining four samples represent cordage impressions from shell-tempered cord-marked ceramics from sites with mixed Early Monongahela period Kiskiminetas phase and later Johnston phase components. Generally, the undecorated shell-tempered cord-marked sherds from these latter sites cannot be consistently separated by component, thus the combined totals of the mixed assemblages are presented. The distribution of the twist direction frequencies on shell-tempered ceramics from these sites is displayed in Figure 6.5.

Finally, Table 6.4 presents cordage twist direction frequencies for 4,336 casts from a subset of 32 Late Prehistoric period Monongahela components in the Monongahela River drainage basin, which includes the tributary Youghiogheny River. These latter twist direction frequencies are proffered to emphasize the contrast with the pattern displayed by the contemporaneous Late Woodland period shell-tempered sherds from the glaciated Allegheny Plateau of northwestern Pennsylvania.

OVERVIEW OF THE LATE WOODLAND PERIOD CULTURAL SEQUENCE ON THE GLACIATED ALLEGHENY PLATEAU OF NORTHWESTERN PENNSYLVANIA

To clarify the problems set forth later in this chapter, we review the culture history of the glaciated Allegheny Plateau section during the Late Woodland period, as we presently understand it. While this section is overly long, it should be understood that there has been no published synthesis of the Late Woodland period in the glaciated Allegheny Plateau of northwestern Pennsylvania since Johnson (1976), which was an unedited and unproofed paper that had been presented at a symposium in 1972.

The following will seem to be an overview of the glaciated Allegheny Plateau Late Woodland ceramic sequence rather than a cultural sequence synthesis. It should be noted, however, that many of the late Middle and Late Woodland components from the glaciated Allegheny Plateau mentioned here are known only from recovered ceramic sherds, many without any provenience other than a site number. Many of the artifact assemblages exist only as boxes on museum shelves or in avocational archaeologists' collections. Many of the Late Woodland sites on the glaciated Allegheny Plateau were excavated under the auspices of the W.P.A. and the then Pennsylvania Historical Commission. The actual location of at least one site excavated by the W.P.A., with a small assemblage of recovered artifacts, only recently has been established. Site maps, artifacts, and even excavators are unknown in some cases. With the notable exception of Harry Schoff's (1938) excavation of large portions of three of the four villages at the

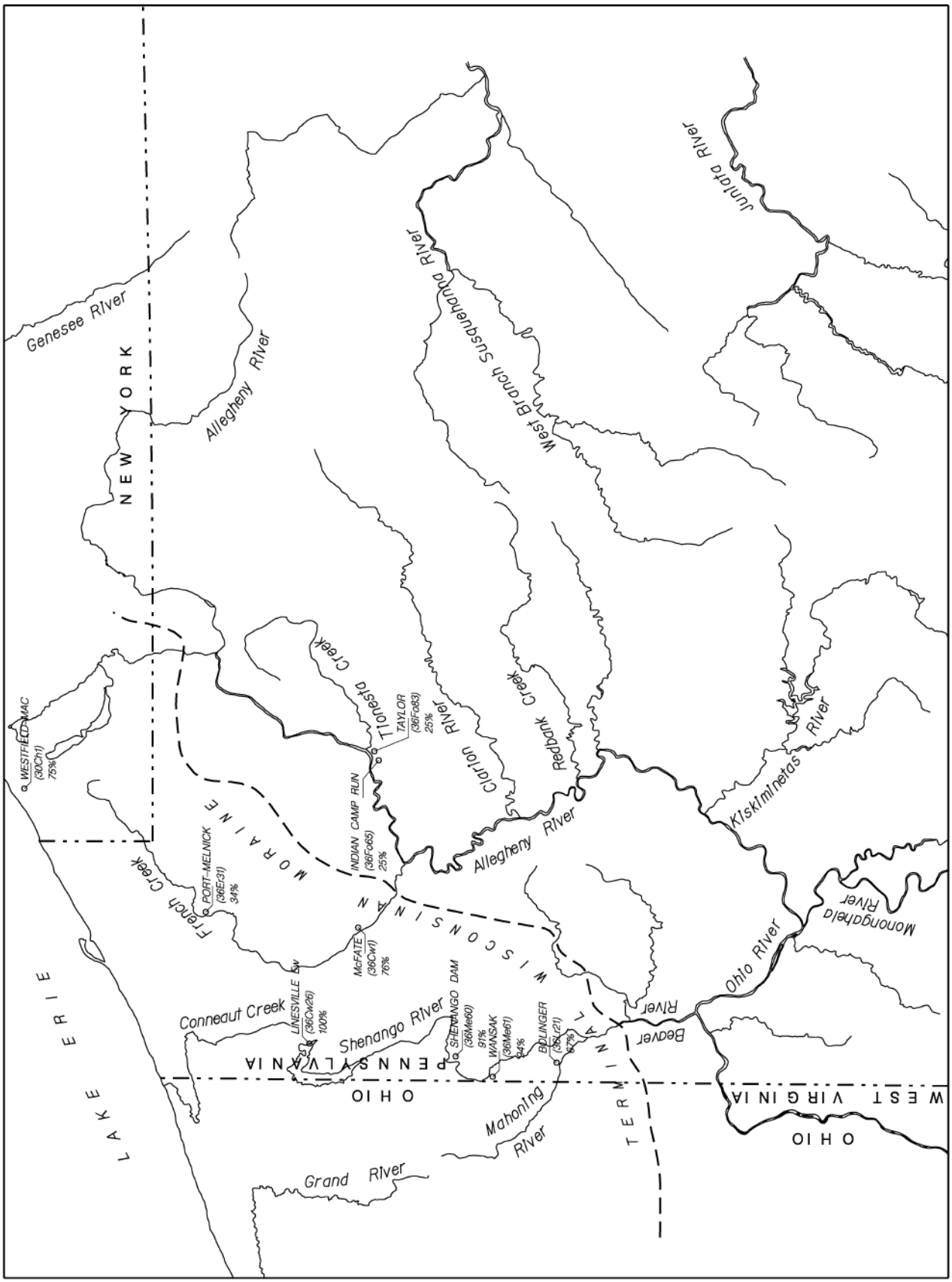

Figure 6.3. Distribution and frequency of final-S-twist cordage on late Middle Woodland period Intrusive Mound complex and early Late Woodland period ceramics.

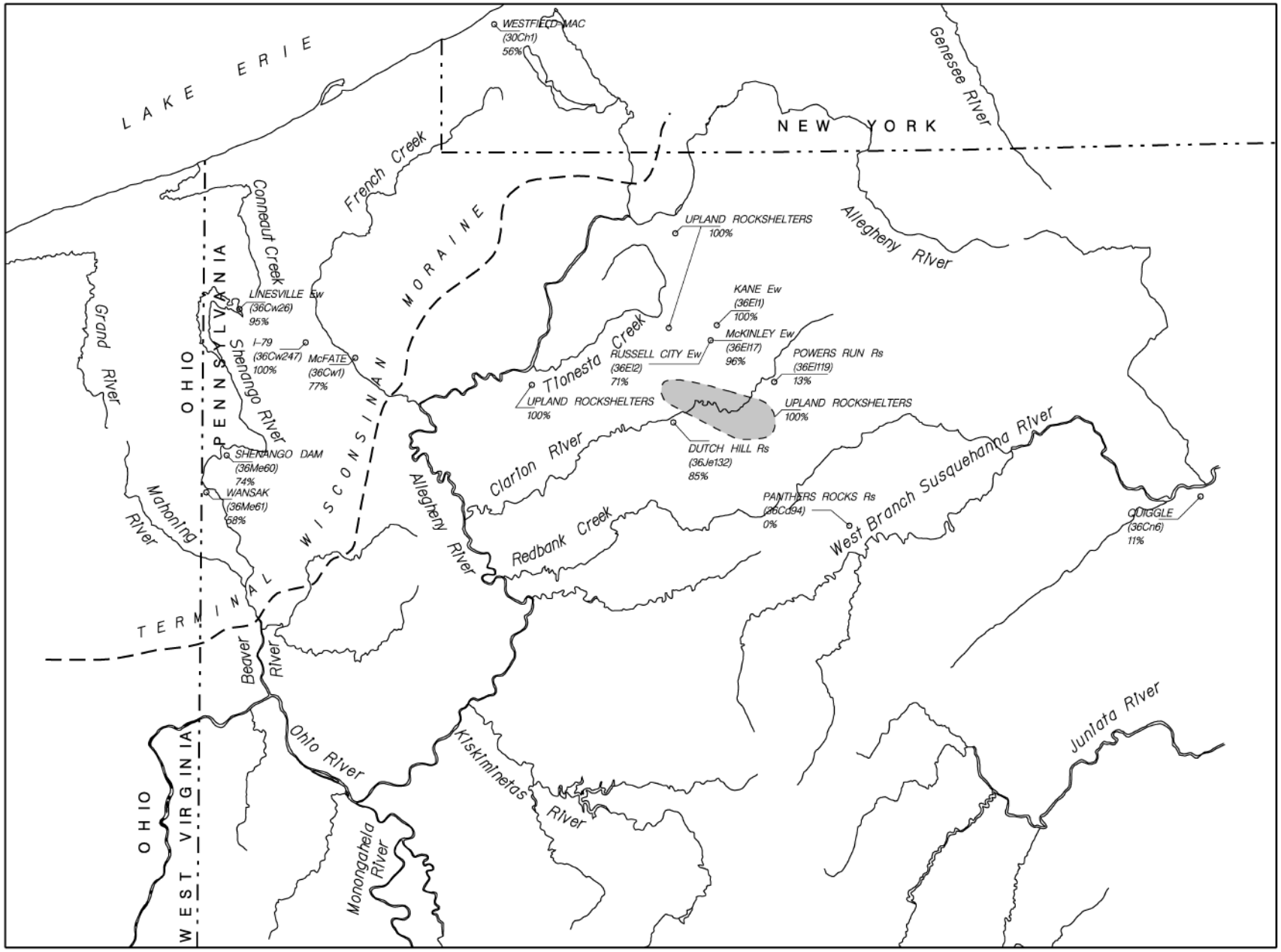

Figure 6.4. Distribution and frequency of final-S-twist cordage on late Late Woodland period French Creek, McFate, Kalgren/Bell, and Quiggle phase ceramics.

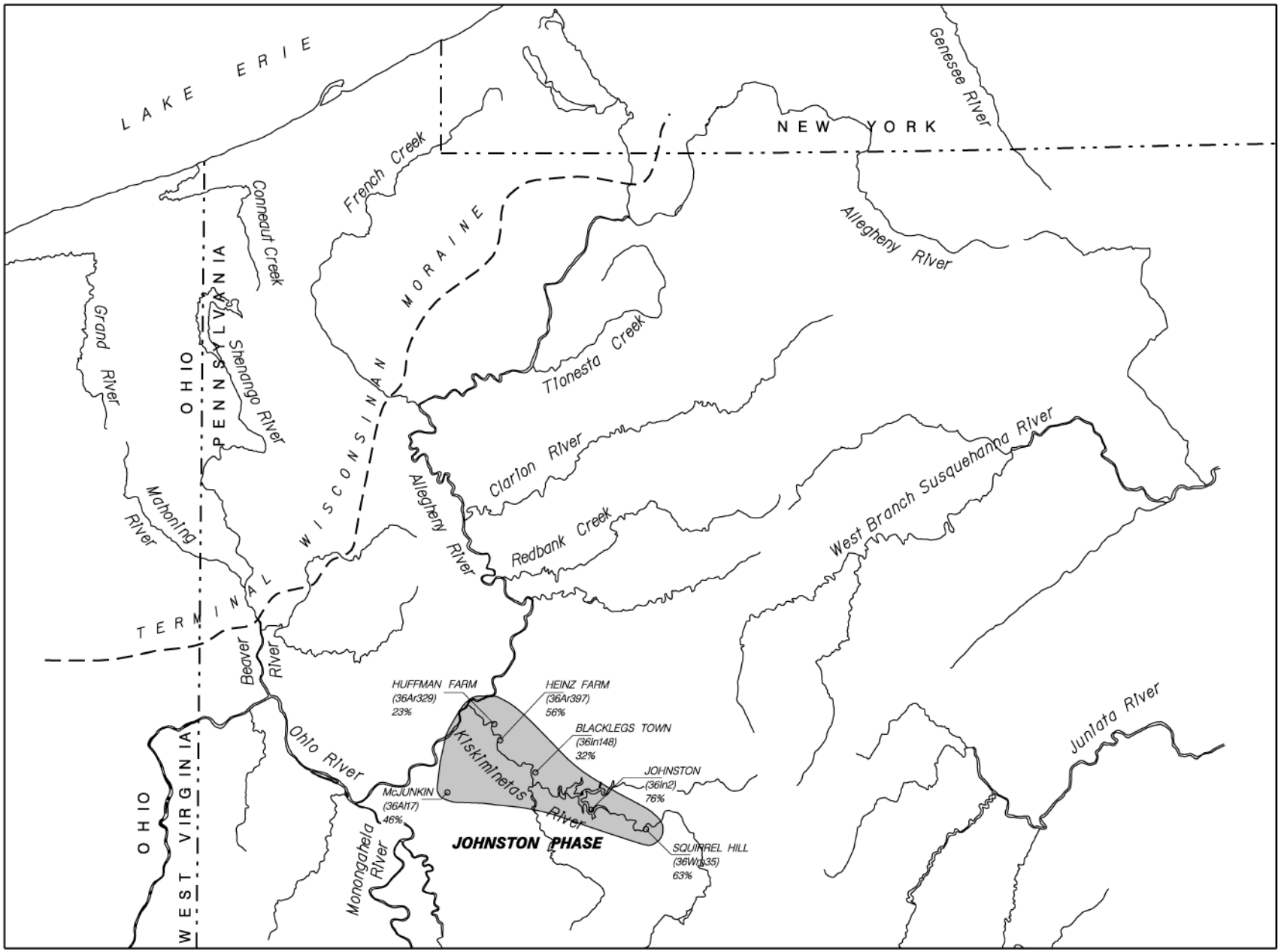

Figure 6.5. Distribution and frequency of final-S-twist cordage on Late Prehistoric and Protohistoric Johnson phase and mixed Kiskiminetas-Johnston phase ceramics.

McFate site (36Cw1) for the Pennsylvania Historical Commission, precise plan view maps, artifact catalogs, and curated artifacts with provenience numbers are generally lacking. Even the important McFate site has only recently reached publication in an important review article (Burkett and Cunningham 1997). While ceramics from several more recent site excavations reviewed below have been excavated with more precision and have site maps and tight provenience control of documented cultural features and recovered artifacts, none have been published. Several ceramics collections were the products of ad hoc salvage excavations that are unanalyzed or unreported. Fortunately, excavations of sites beyond the glaciated Allegheny Plateau of northwestern Pennsylvania have been conducted with more precision, and the results of the investigations and analysis often have been published and certainly more widely circulated.

The analysis of cordage twist direction patterns recovered from ceramic sherds from sites on the glaciated Allegheny Plateau of northwestern Pennsylvania and beyond has proven to be an important tool for discerning cultural continuity in the glaciated Allegheny Plateau as well as establishing, however preliminarily, a hypothesized pattern to the variety of Late Woodland site types in northwestern Pennsylvania and surrounding areas. Thus, we present a review of the Late Woodland period sequence on the glaciated Allegheny Plateau of northwestern Pennsylvania with passing observations on surrounding areas where they are pertinent to better understand the importance of our cordage twist direction data. Without these cordage twist data, many aspects of the Late Woodland sequence in northwestern Pennsylvania could not be demonstrated.

MIDDLE WOODLAND

Middle and early Late Woodland pottery in the glaciated Allegheny Plateau section of northwestern Pennsylvania is generally termed Mahoning ware (Mayer-Oakes 1955). This broadly defined type is tempered with pulverized igneous rock. It is almost exclusively cord-marked.

Most Middle Woodland ceramics from the glaciated Allegheny Plateau are tempered with crushed igneous rock and are cord-marked, undecorated, and generally undiagnostic. Ceramic assemblages of the late Middle Woodland Intrusive Mound complex components in this region, however, often can be recognized by coarse cord-wrapped-paddle edge- or dowel-stamped impressions on the exterior surface in the sublip and/or neck areas of vessels. This decoration is normally in the form of horizontal bands of parallel oblique or opposed stamped impressions. Occasionally, low, thin added-on collars or rim strips — essentially the Jack's Reef Corded Collar type — may be present in some assemblages, particularly on the Mahoning River in the far southwestern corner of the glaciated Allegheny Plateau. These components have been assigned to an *Allegheny River phase* (Lantz 1989) or, informally, by the senior author to an *Edinburg phase* after a site on the Mahoning River with the largest documented Intrusive Mound complex ceramic sample (Johnson et al. 1979; Seeman 1992). Both we and Lantz are referring to the same phenomenon. These components also are characterized by the presence of Jack's Reef Corner-Notched and Pentagonal, Raccoon Notched, and Levanna projectile points (see, for example, Lantz 1989; Seeman 1992).

Only five sites from the study area display Intrusive Mound complex components with associated ceramics, and only two of these appear to exhibit more-or-less pure Intrusive Mound complex ceramic components. This study samples one of these two components, Port-Melnick (36Er31) on French Creek. Data from a second site, Bolinger (36Lr21), located on the Mahoning River directly opposite the aforementioned Edinburg site, are also presented. This latter site, however, exhibits a ceramic assemblage representing at least three Woodland components; therefore, the majority of the cordage twist data, derived largely from undiagnostic cord-marked body sherds, cannot be ascribed specifically to either the Edinburg or the early Late Woodland Mahoning phase components.

LATE WOODLAND

The succeeding early Late Woodland *Mahoning phase* (ca. A.D. 1100–1300 in calendar years) has been proposed as the first of three successive Late Woodland phases that compose the ca. 500–600-year-long Glaciated Allegheny Plateau (GAP) tradition (Johnson 1994a, 1999a) (see Figure 6.2). Associated projectile points appear to be exclusively triangular Levanna and Madison forms. Mahoning phase settlement patterns are not well understood, but current data suggest that known components represent small base camps or hamlets. No nucleated or palisaded villages have been documented.

Components assigned to the Mahoning phase are characterized by relatively high frequencies of igneous-rock-tempered Mahoning Cord-Marked vessels with more prominent low added-on collars or rim strips that are often decorated with a horizontal band of parallel or opposed oblique cord-wrapped paddle edge-stamped or linear-stamped impressions. The continuation of Intrusive Mound complex ceramic decorative modes into the early Late Woodland period suggests but hardly demonstrates population continuity in the glaciated Allegheny Plateau across the Middle to Late Woodland boundary.

Toward the end of the Mahoning phase, approximately A.D. 1250–1275 in calendar years, igneous rock as a tempering agent in Mahoning ware was gradually supplanted by pulverized mussel shell. This new shell-tempered and cord-marked ware is essentially the Chautauqua Cord-Marked type, originally named and described by Alfred Guthe (1958) from a sample derived from the Westfield-Mac site (30Ch1) on the Lake Erie Plain in Chautauqua County, New York. It is generally understood to be undecorated except for the common occurrence of various cord-wrapped-paddle edge-stamped impressions and less frequently incised lines on vessel lips. At two sites, McFate (36Cw1) and Shenango Dam No. 1 (36Me60), components that date from this period of transition in ceramic technology display both igneous-rock-tempered and shell-tempered rim sherds with low added-on collars, both often decorated with horizontal bands of parallel oblique cord-wrapped-paddle edge-stamped impressions or incised or gashed lines. These latter shell-tempered ceramics clearly reflect their derivation from the contemporary Mahoning ware at the same two sites. This period of transition in temper aplastic brings the Mahoning phase to a close (Johnson 1994a, 1999a; Johnson et al. 1979).

The succeeding time period in the GAP tradition has been named the *French Creek phase* (Johnson 1999a). It persisted from ca. A.D. 1275/1300 to A.D. 1400 in calendar years. The French Creek phase is characterized by uncollared Chautauqua Cord-Marked ceramics that are otherwise undecorated except for the high frequency of various cord-wrapped-paddle edge-stamped impressed or incised decoration on vessel lips (Johnson 1999a). These later Chautauqua Cord-Marked ceramics are clearly associated with moderate-sized, nucleated, and palisaded villages in the French Creek Valley, including one at the Wilson Shutes site (36Cw5) and apparently three at the McFate site (36Cw1). Contemporaneous settlements in the Shenango River drainage basin and the Pymatuning Marsh area, however, appear to be small hamlets, farmsteads, or specialized extraction camps (see, for example, Dragoo 1972).

During this same period, essentially undecorated shell-tempered cord-marked ceramics appear on contemporaneous proto-Iroquoian sites in the Upper Allegheny River Valley upriver from the Kinzua Dam, as well as along the Lake Erie Plain from Conneaut Creek in Ashtabula County, Ohio, to Cattaraugus Creek in Erie County, New York (e.g., Brose et al. 1978; Dragoo 1966, 1976, 1977). Johnson et al. (1979) suggested that this phenomenon was best interpreted as an example of economic cooperation between upland hunting and foraging GAP tradition groups and full-time Iroquoian horticultural villagers on the Allegheny River floodplain rather than an antagonistic one represented by endemic warfare and captured women. They argued that this pattern was analogous to the ethnohistorically documented symbiotic economic relationship between various Shield Algonquian groups and primarily the Ahrendarhonon tribe of the Huron Confederation (e.g., Tooker 1964; Trigger 1969). These contrasting settlement patterns and economic strategies exhibited by GAP

tradition groups in the late 13th and 14th centuries appear to be a prelude to even more flexible adaptive behaviors evident in the succeeding 15th and early 16th centuries.

Toward the end of the Late Woodland period, ca. A.D. 1400–1425, shell-tempered and elaborately decorated McFate Incised ceramics appeared on the glaciated Allegheny Plateau and adjacent Lake Erie Plain. This final GAP tradition period is referred to as the *McFate phase*, and it lasted from approximately A.D. 1400 to 1550/1575, after which time the glaciated Allegheny Plateau in northwestern Pennsylvania appears to have been abandoned by the demonstrably indigenous Late Woodland population (Johnson 1999a).

The McFate Incised pottery type is distinguished by rectilinear incised decoration — opposed triangles filled with parallel horizontal lines and separated by plats of parallel oblique lines — on medium to high molded collars of otherwise Chautauqua Cord-Marked vessels. Less frequently, these same motifs appear in the sublip area of uncollared Chautauqua Cord-Marked vessels. The surface finish of the sublip or collar areas of these vessels is predominantly smooth (Johnson 1976, 1994b, 1999a), contrary to the traditional definition of McFate Incised in Mayer-Oakes (1955) and Dragoo (1955). The base of the design frequently is underlined with a horizontal band of parallel oblique or vertical punctations or, very occasionally, short incised lines (Johnson 1999a). The McFate motif — usually on medium to high molded collars — is very reminiscent of approximately contemporaneous late Middleport horizon Ontario Iroquoian tradition ceramics from the Westfield-Mac and Silverheels sites located on the Lake Erie Plain of adjacent southwestern New York. These types appear to be variants of the Pound Blank and Huron Incised types (Johnson 1994b, 1999a). Rim sherds displaying incised decoration in the form of opposed triangles separated by bands of parallel obliques typical of the McFate Incised type occur in both igneous-rock-tempered and shell-tempered mediums at the Westfield-Mac and Silverheels sites. Diagnostic lip decorative motifs characterizing McFate Incised and contemporaneous late Chautauqua Cord-Marked pottery also appear on the lips of the igneous-rock-tempered incised rim sherds from the same two sites. These similarities suggest the direct derivation of early McFate Incised ceramics from late Middleport to post–Middleport Ontario Iroquoian tradition ceramic styles present on the adjacent Lake Erie Plain of southwestern New York (Johnson 1999a). The preceding French Creek phase ceramic industry displays no evolving tradition of low to medium-high molded collars or complex incised decoration that would indicate that these innovations originated in the glaciated Allegheny Plateau rather than along the Lake Erie Plain.

Village No. 1 at the McFate type site, as defined by Burkett and Cunningham (1997), is the latest of four stockaded villages there, and it appears to be the earliest component on the glaciated Allegheny Plateau where McFate Incised ceramics were produced. The proposed early placement of Village No. 1 at the beginning of the McFate phase is based on several attributes of the McFate Incised ceramics documented there. First, the incidence of incised decoration on the sublips of uncollared vessels is relatively high. The addition of molded collars to Chautauqua Cord-Marked vessels was coincidental with the appearance of elaborate incised decorations on vessel sublips and collars. Village No. 1 vessels also display the highest frequency (66%) of the most conservative of the McFate decorative motifs (opposed triangles separated by plats of parallel obliques). As well, a horizontal band of parallel punctations or incised lines forming the lower border of the main incised decoration, which appears frequently on McFate Incised vessels at putatively later sites, occurs on only five rim sherds at Village No. 1. Notably, several collared vessels and rim sherds from Village No. 1 exhibit incised motifs that exceed the height of the collar being decorated and, as a consequence, run down onto the neck of the vessel. This latter peculiarity suggests that the Village No. 1 potters had not completely integrated into their ceramic decorating repertoire the relationship between the incised patterns and the associated collars that they were copying from Iroquois prototypes.

Three ^{14}C AMS assays run by the University of Toronto's Iso Trace Radiocarbon Laboratory on carbonized organic residue from the interiors

of two McFate Incised rim sherds and one Chautauqua Cord-Marked rim sherd with tight Village No. 1 proveniences calibrate to A.D. 1409, 1412, and 1430 calendar years (Johnson 1999a). These dates indicate an early-15th century age for Village No. 1 and the beginning of the McFate phase. Radiometrically dated McFate phase components are rare, but a small McFate phase component at the Eastwall site (33Ab41) on the Lake Erie Plain in Ashtabula County, Ohio, is dated by a calibrated ^{14}C age of A.D. 1448 (Brose 1994; Brose et al. 1978). A nucleated and palisaded McFate phase village at the Wintergreen Gorge site (36Er6), located along the slope of the Portage Escarpment overlooking the Lake Erie Plain, is dated by two calibrated radiocarbon assays, one with three intercepts. They are cal. A.D. 1468 and cal. A.D. 1521, 1590, and 1623 (James T. Herbstritt, personal communication 2002; Stanley W. Lantz, personal communication 2002). A late upland earthwork in the Upper Allegheny River Valley in Bolivar, New York, the Smith site, exhibits shell-tempered smooth-surfaced ceramics and McFate Incised ceramics, as well as igneous-rock-tempered low collared and decorated Iroquoian ceramics (Lounsberry 1977). The Smith site is dated by two calibrated ^{14}C assays with multiple intercepts: cal. A.D. 1522, 1573, and 1627, and cal. A.D. 1531, 1545, and 1635 (Herbstritt, 1998:3; Kelly M. Lounsberry, personal communication 2002). Thus, the Smith site would appear to be the latest radiometrically dated McFate phase occupation in the glaciated Allegheny Plateau.

The GAP tradition and particularly the McFate phase people seem to have displayed a very flexible economic adaptive strategy, reflected in the variety of site types and the broad geographic area where their diagnostic McFate Incised and companion Conemaugh Cord-Impressed pottery appears. The recently defined Conemaugh Cord-Impressed type is a shell-tempered, predominantly cord-marked ware displaying essentially McFate Incised decorative motifs applied with a pseudo-cord-impressed technique as that term is used in the circum-Chesapeake Bay area (Johnson 1999a). Site types include moderate-size, nucleated, and palisaded villages in the French Creek Valley at the McFate and Wilson Shutes sites and at the Wintergreen Gorge site on the Portage Escarpment. Sites interpreted as McFate phase stockaded hunting villages (see below) are recorded along the Pymatuning Marsh and in the headwaters of Tionesta Creek in the interior unglaciated Allegheny Plateau, as well. Numerous small open-air and rockshelter components in the Geneva Marsh, along the Lake Erie Plain, and in the interior unglaciated Allegheny Plateau are attributable to the McFate phase (Johnson 1994a, 1999a; Johnson et al. 1979). These latter sites seem to represent small bivouacs or recurrently occupied specialized extraction camps.

Sugar Run (36Wa2) and a second component in New York present on the floor of the Upper Allegheny River seem to represent villages of unknown size and configuration. Shell-tempered Chautauqua ware seems to be the predominant to exclusive ceramic ware associated with these two sites (Stanley W. Lantz, personal communication 2002). While it is not certain whether these villages represent late French Creek or succeeding McFate phase occupations, they presumably represent one or more late GAP tradition intrusions into the mainstem Upper Allegheny River Valley shortly after the removal from that area of the populous Allegheny Valley Iroquois villagers sometime in the early 15th century. Additionally, McFate Incised and late Chautauqua Cord-Marked pottery have been reported from proto-Seneca village sites as far afield as Portageville and Dansville Flats in the Genesee Valley of western New York (Barber 1965; Johnson 1975; MacNeish 1952) and from the Whittlesey tradition Lyman or Indian Point site (33La2) on the lower Grand River in Lake County, Ohio (Murphy 1971).

The adaptive diversity displayed by the McFate phase people and, indeed, most likely by earlier GAP tradition groups, seems to be analogous to the model recently presented by Madsen and Simms (1998) for the Fremont of the Colorado Plateau and eastern Great Basin. They suggested that during periods as brief as a single generation some Fremont peoples' lives would have been relatively constant, as either full-time farmers or foragers, while others may have shifted from farming to foraging or to various combi-

nations between the two. While severe drought and a decreased availability of subsistence resources would seem to have been the motivating factor in the flexible adaptive strategies exhibited and the range of site types occupied by the Fremont, the decline in the climate and the associated shortening of the frost-free-day growing season at the beginning of the Neo-Boreal climatic episode would seem to be the primary impetus for the range in adaptive responses of the people grouped together under the umbrella of McFate Incised and companion Conemaugh Cord-Impressed ceramics (Johnson 1994a, 1999a).

Madsen and Simms (1998) also suggested that the Fremont hunter-gatherers were closely linked with more sedentary farming groups. They noted that studies of contemporary farmers and hunter-gathering groups who live in relatively close proximity indicate that the hunter-gatherers rarely operated in a vacuum; rather, they tended to form symbiotic relationships with nearby farming communities, thus facilitating economic, social, and ideological exchange. This cooperative behavior allowed each group to maximize the advantages of essentially different but spatially overlapping ecological niches. This analogy may explain the repeated occurrence of undecorated shell-tempered pottery on village sites of full-time horticulturists in the mainstem Upper Allegheny River Valley. This model would parallel the symbiotic relationship of Shield Algonquian hunter-gathers and Huron horticulturists and the residence of these Algonquian groups in Huron villages during the winter suggested by Johnson et al. (1979) to explain the occurrence of shell-tempered pottery on earlier Allegheny Valley Iroquois sites as well as on proto-Erie sites on the Lake Erie Plain. It would also provide a partial explanation for the slightly later occurrence of McFate Incised and Conemaugh Cord-Impressed ceramics on sites around the periphery of the glaciated Allegheny Plateau at a time when the climate would have been slowly deteriorating during the transition from the Pacific to the Neo-Boreal climatic episode. It should be stressed that the groups lumped together under the umbrella of shell-tempered McFate Incised, Conemaugh Cord-Impressed, and late Chautauqua Cord-Marked pottery and perhaps even inappropriately in the McFate phase, were arguably simultaneously practicing a number of the adaptive responses to a deteriorating climate. As with the "Fremont" archaeological construct, these groups may not have been all the same ethnic or linguistic group. Frankly, at this juncture in our research, only the three late ceramic types and the shared pattern of preferred cordage twist holds together these diverse components.

McFate Incised and the companion Conemaugh Cord-Impressed types (Johnson 1994a, 1994b, 1999a; LaBar 1968; Myers 2001; Ritchie 1929; Smith and Herbstritt 1976) have been documented at both earthwork sites and rockshelters in the upland unglaciated Allegheny Plateau east of the terminal Wisconsinan moraine. McFate Incised pottery has been reported from large village sites in the reaches of the upper West Branch of the Susquehanna River drainage basin (Herbstritt and Kent 1990; Matlack 1987). Both McFate Incised and Conemaugh Cord-Impressed ware have been documented from large village sites in the Kiskiminetas River Valley and surrounding uplands (e.g., Dragoo 1955; George 1978, 1997). In fact, McFate Incised ware is the primary diagnostic of the terminal Late Prehistoric Monongahela culture *Johnston phase* (George 1978, 1997).

The appearance of the distinctive McFate Incised and Conemaugh Cord-Impressed ceramics around the periphery of the glaciated Allegheny Plateau toward the end of the Late Woodland period could be attributed to the diffusion of an attractive ceramic decorative style, perhaps symbol-laden, through trade or other social mechanisms. We argue, rather, for the gradual dispersal of the McFate phase people with their ceramic industry from the core area of the glaciated Allegheny Plateau toward the end of the Late Woodland period. Selected calibrated radiocarbon dates from the Bell and Kalgren sites, listed in Herbstritt (1988), and a calibrated ^{14}C age from the McJunkin site (George 1997) suggest the gradual abandonment of the glaciated Allegheny Plateau by the McFate people may have begun as early as the middle to the last half of the 15th century. These dates include cal. A.D.

1445 and cal. A.D. 1481 from the Bell site, cal. A.D. 1448 from the Kalgren site, and cal. A.D. 1481 from the McJunkin site. There are other, earlier radiometric ages from all three sites, but we believe that they are too early to accurately date the appearance of McFate Incised ceramics around the periphery of the glaciated Allegheny Plateau.

There is no evidence for the military expansion of McFate phase people's neighbors, either the terminal Late Woodland Erie or Seneca, at this time. Nor, at that point in time, would the desire to seek a more advantageous position in possible trade between polities in the lower Great Lakes on the one hand and the Middle Ohio Valley or Chesapeake Bay on the other seem to have been a motivating factor *per se*. These facts, in turn, suggest to us that the impetus for the dispersal may lie with a shortening of the frost-free-day growing season at the onset of the Neo-Boreal climatic episode, which would have adversely affected the reliable cultivation of maize (Figure 6.6). The glaciated Allegheny Plateau, including the French Creek Valley, today exhibits a relatively short average and — more importantly — unpredictable frost-free-day growing season (Hasenstab and Johnson 2001; Johnson 1994a, 1999a; Johnson et al. 1979). As well, the recently-documented severe drought during the Pacific and succeeding Neo-Boreal episodes in the Upper Ohio Valley and Middle Atlantic (Blanton 2000; Richardson et al. 2002; Stahle et al. 1998) may have had an impact on the McFate phase villagers' maize-based subsistence already weakened by the shortening growing season. The variety of 15th- and 16th-century McFate phase site types and geographic areas where they occur would seem to reflect the variety of their adaptive responses to a deteriorating climate.

Control of the timing for the appearance of McFate Incised and related ceramics in the small rockshelter and open air loci and earthworks in the interior unglaciated uplands of the Allegheny River Valley as well as in the large horticultural village sites around the periphery of the glaciated Allegheny Plateau is very poor. While the argument favored here is that the appearance of these distinctive ceramics around the periphery is a case of population movement rather than a diffusion of pottery styles, it is not at all certain whether the smaller upland components represent an early shift to foraging by some of the McFate phase people followed by a later major exodus of population to the upper West Branch of the Susquehanna River and the Kiskiminetas River Valley, or whether all of these sites represent components of a more rapid out-migration of the McFate phase groups from the glaciated Allegheny Plateau after the collapse of their maize-based economy.

To the northeast of the McFate phase core area in Chautauqua and adjacent Cattaraugus County, New York, the McFate and Chautauqua Cord-Marked ceramic types are present in relatively high frequencies at the beginning of Jack Schock's (1974) *Chautauqua phase*. A number of McFate Incised rim sherds were documented at the J. Falcone site, the earliest site in Schock's Chautauqua phase. Given the proximity of the Chautauqua phase sites to the Lake Erie Plain and the Westfield-Mac and Silverheels sites, which arguably presented the inspiration for the McFate Incised type, the beginning of the Chautauqua phase would seem to have been at approximately the same time as the beginning of McFate phase to the southwest, that is, ca. A.D. 1400, or a decade or two later. The precise relationship between the approximately contemporaneous Chautauqua phase and McFate phase peoples is not known. Clearly, their ceramic industries were moving along different trajectories (*contra* Johnson 1994a; Johnson et al. 1979). For example, shell-tempering was documented in only 46 percent of the sherds from the J. Falcone site, the earliest village in the Chautauqua phase sequence (Schock 1974). Shell never completely replaced igneous rock as the preferred temper aplastic in Chautauqua phase ceramics even at the Lawrence site, the latest village in the sequence. Simple-stamped surface finishes were already present at a frequency of 10 percent at the J. Falcone site. Simple-stamping rapidly replaced cord-marking as the preferred surface finish and is the primary diagnostic of the Chautauqua phase. At the Lawrence site at the end of the documented Chautauqua phase sequence, simple-stamping was present on 91 percent of

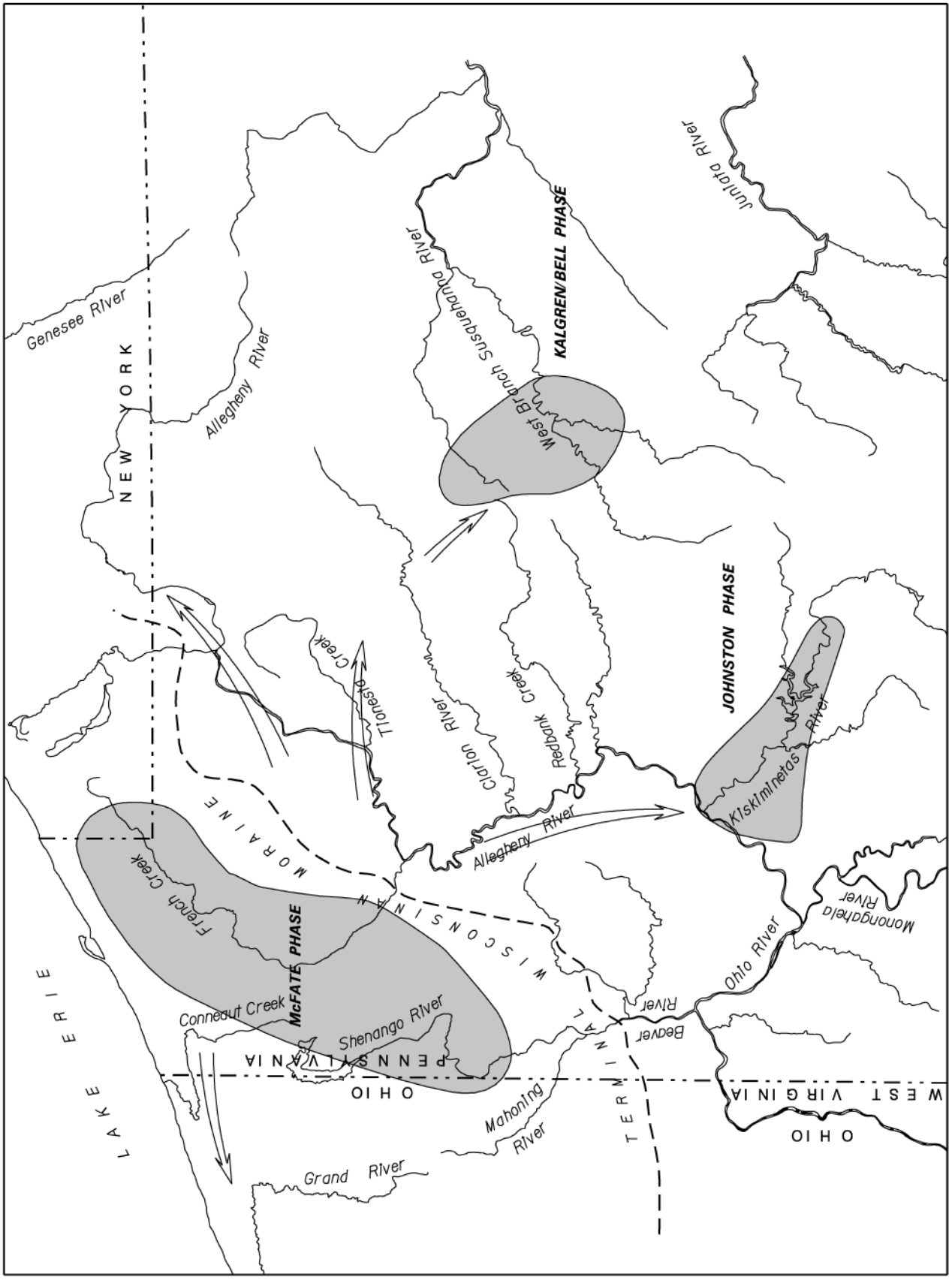

Figure 6.6. Proposed dispersal of the McFate phase population toward the end of the Late Woodland period.

the ceramics (Schock 1974). With one exception, shell-tempered simple-stamped pottery has not been documented at any site on the glaciated Allegheny Plateau of northwestern Pennsylvania.

PROTOHISTORIC

At the Crowe-O'Connor site (36Cw39/61) in the French Creek Valley, shell-tempered simple-stamped and undecorated ceramics with deeply scalloped lips were recovered with fragments of Iroquoian Acorn ring-bowl pipes (Johnson et al. 1979). This site represents the final indigenous Woodland occupation in the glaciated Allegheny Plateau and arguably dates to the Protohistoric period based on the presence of the Acorn or Bulbous ring-bowl pipes (Johnson 1994a, 1999a), which are documented on Protohistoric Seneca sites between ca. A.D. 1585/1595 and 1655 (see Johnson 2001c; Wray et al. 1991). None of Schock's (1974) Chautauqua phase sites display Acorn ring-bowl pipes, nor do any of the hilltop earthworks in the Cattaraugus Creek and Upper Allegheny River Valley (e.g., Guthe 1958; Lounsberry 1997). These facts argue persuasively that the Crowe-O'Conner site component dates to the Protohistoric period and is the latest documented occupation on the glaciated Allegheny Plateau in both northwestern Pennsylvania and adjacent southwestern New York. It is not certain whether this component represents the terminal GAP tradition occupation on the glaciated Allegheny Plateau or, rather, a Protohistoric Chautauqua phase intrusion from the north.

RESULTS OF CORDAGE TWIST ANALYSIS

For this study the authors have analyzed 1,542 cordage casts from 31 sites representing two terminal Middle Woodland and 36 Late Woodland components from the glaciated and unglaciated portions of the Allegheny Plateau in northwestern Pennsylvania and from the Lake Plain in adjacent Chautauqua County, New York (Figure 6.1). An additional 137 impressions from the Quiggle site on the West Branch of the Susquehanna River in the inner Appalachian Mountain section of north-central Pennsylvania were examined for comparative purposes.

All five of the early Late Woodland Mahoning ware components displayed predominantly final-S-twist cordage as did the grit-tempered Westfield Cord-Marked ceramics from the Westfield-Mac type site (Table 6.1). Where samples were adequate, the frequency of final-S-twist cordage on Mahoning Cord-Marked ceramics ranged from 66.7 percent at the Bolinger site to 93.8 percent at the Wansack site (Figure 6.3). Notably, the one sample that deviates from this pattern, and in fact from the predominant final-S-twist pattern for the glaciated Allegheny Plateau, is that derived from the Intrusive Mound complex Port-Melnick site. There, final-Z-twist cordage impressions were documented at a frequency of 65.6 percent. Although the sample from the Port-Melnick site is small and could be skewed, approximately half of the casts were derived from rim sherds each representing a unique vessel. This fact may indicate a diversity of cordage-making traditions associated with the late Middle Woodland groups of this part of the French Creek Valley. If this pattern is duplicated in other, larger Intrusive Mound complex cordage assemblages, it could indicate that there is a population discontinuity between the late Middle Woodland Intrusive Mound complex Edinburg phase groups and the slightly later early Late Woodland Mahoning phase people

Casts of cordage impressions were also analyzed from two contemporaneous Mead Island components on the valley floor of the Middle Allegheny River. In contrast to the pattern manifested by the Mahoning phase components, the aggregate sample for the Indian Camp Run site exhibited final-Z-twist cordage at a frequency of 75.2 percent. This was essentially duplicated by a small sample from the nearby Taylor site (Table 6.1, Figure 6.3).

Casts from six sites with shell-tempered French Creek and McFate phase ceramics from the glaciated Allegheny Plateau of northwestern Pennsylvania and adjacent Lake Erie Plain of Chautauqua County, New York, display predominantly final-S-twist cordage impressions. Where samples were adequate, the frequency of S-twist cordage ranges from 56.5 percent at the

Westfield-Mac site on the Lake Erie Plain to 94.6 percent at the Linesville Earthwork at the edge of Pymatuning Marsh in the headwaters of the Shenango River drainage (Table 6.2, Figure 6.4). Sites in the interior of the unglaciated Allegheny Plateau in the Clarion River and Tionesta Creek drainages displaying shell-tempered McFate Incised and Chautauqua Cord-Marked ceramics and variants of McFate Incised ware that exhibit a variety of temper types and combinations also evidence predominantly final-S-twist cordage impressions. The frequencies of final-S-twist cordage at the three Elk County earthworks ranged from 72.4 percent at the Russell City site to 100.0 percent at the Kane Earthwork. At 16 upland rockshelter and open air sites, the frequency of final-S-twist cordage impressions ranged from 85.1 percent for a large excavated sample from Dutch Hill Rockshelter (Myers 2001) to 100.0 percent for small surface derived samples of 1 to 9 casts from the remaining 15 sites (Table 6.2, Figure 6.4).

Two very small samples from the interior uplands of the unglaciated Allegheny Plateau deviate from the pattern displayed by the earthworks and the balance of the rockshelter samples. A sample of eight casts lifted from quartz-tempered Stewart complex Shenks Ferry Incised ceramics from the Powers Run Rockshelter in the upper Clarion basin exhibit predominantly final-Z-twist cordage. This duplicates the pattern observed but not further documented by the authors on Stewart complex ceramics from the Upper Susquehanna River basin. A single shell-tempered sherd from the Panther Rocks site in the headwaters of the West Branch of the Susquehanna River evidences final-Z-twist cordage as well. This sherd may be ascribable to the Kalgren/Bell phase, which succeeded the Stewart complex in the headwaters of the West Branch of the Susquehanna in the unglaciated Allegheny Plateau (e.g., Herbstritt and Kent 1990; Matlack 1986, 1987).

A large sample of casts from the Quiggle site on the mainstem of the West Branch of the Susquehanna River displayed final-Z-twist cordage at a frequency of 89.1 percent. Herbstritt and Kent (1990) have argued that the shell-tempered, collared, and incised ceramics from the Quiggle site were derived from those of the Kalgren or Bell phase sites in the headwaters of the West Branch and ultimately from the McFate phase sites farther to the west in the Allegheny River basin. In fact, Herbstritt and Kent (1990) include the later Late Woodland horticultural village sites in the upper reaches of the West Branch of the Susquehanna River on the unglaciated Allegheny Plateau in a McFate-Kalgren phase. They refer to the terminal Late Woodland-Protohistoric Quiggle site village farther down the West Branch in the inner Appalachian section as the McFate-Kalgren-Quiggle complex.

PROBLEM ONE: CONTINUITY OF THE LATE WOODLAND POPULATION ON THE GLACIATED ALLEGHENY PLATEAU PROVINCE OF NORTHWESTERN PENNSYLVANIA

As late as the middle 1970s, traditional opinion saw the shell-tempered cord-marked pottery of northwestern Pennsylvania — Chautauqua Cord-Marked and McFate Incised — as the residue of Late Prehistoric period Monongahela culture people from the lower Upper Ohio River Valley who had moved into the upper Allegheny River Valley and the glaciated Allegheny Plateau, replacing the indigenous igneous-rock-tempered pottery-making early Late Woodland Mahoning population (see, for example, Dragoo 1966, 1972; Guthe 1958; Mayer-Oakes 1955). By the mid-1970s, the distinction between the downriver shell-tempered Monongahela ceramics and the shell-tempered ceramics of the French Creek and McFate phases was beginning to be recognized (see Johnson 1975, 1976). The shell-tempered ceramics in the upper Allegheny Valley, however, were still viewed as evidence for a Monongahela population intrusion (e.g., Dragoo 1976, 1977).

By 1975, the senior author (Johnson 1975) had taken a sufficient number of casts of Mahoning Cord-Marked, Chautauqua Cord-Marked, McFate Incised, and contemporaneous Monongahela Cord-Marked from the lower Upper Ohio Valley to demonstrate in a preliminary way that the preferred cordage final twist for both the

igneous-rock-tempered and the shell-tempered Late Woodland ceramics from the glaciated Allegheny Plateau of northwestern Pennsylvania was predominantly S. For the contemporaneous Late Prehistoric period Monongahela culture, the preferred final twist direction was predominantly Z (Tables 6.1, 6.2, and 6.4). These data argue for population continuity between the makers of the earlier initial Late Woodland igneous-rock-tempered Mahoning ware and those who produced the later shell-tempered Chautauqua Cord-Marked pottery. More certain is the fact that the preferred cordage twist direction displayed by both the Late Woodland igneous-rock-tempered Mahoning and shell-tempered Chautauqua wares was the opposite of that generally evidenced by the downriver Monongahela culture cordage-making industry. While another group making shell-tempered pottery and final-S-twist cordage could have seamlessly replaced the Mahoning phase people at the end of the early Late Woodland period, the continuation of late Mahoning ware ceramic styles including added-on collars and horizontal bands of stamped decoration indicate a continuity in decorative ceramic styles across this transition in ceramic technology. Further, at that time, there were no obvious neighboring cultural complexes with both a shell-tempered pottery industry and an S-twist cordage-making tradition that could have supplied a replacement population. The later makers of the shell-tempered Chautauqua Cord-Marked and McFate Incised pottery were definitively not Monongahela invaders or emigrants. The technological innovation of shell-tempering undoubtedly diffused to groups in the glaciated Allegheny Plateau from the lower Upper Ohio Valley, but there is no perceptible evidence for movement of people. The data from our current study supplement the original sample size and number of components, thus greatly strengthening the senior author's original contention that the Late Woodland ceramic sequence in the glaciated Allegheny Plateau was arguably the product of the same indigenous population.

In short, while a large, comprehensive sample of cordage twist directional data from Monongahela culture sites, now totaling over 7,400 casts, demonstrates an overwhelming preference for the production of final-Z-twist cordage by Monongahela cordage makers (Johnson 2002) (see Table 6.4 for a geographic subset of the Monongahela cordage sample), the final twist pattern for the 600-year-long Late Woodland period in the glaciated Allegheny Plateau of northwestern Pennsylvania is predominantly S (Tables 6.1, 6.2). Based on this evidence, we argue that the later GAP tradition potters who made Chautauqua Cord-Marked and McFate Incised ceramics could not have been an intrusive Monongahela population from the lower Upper Ohio Valley.

PROBLEM TWO: DISPERSAL OF THE MCFATE PHASE POPULATION FROM THE GLACIATED ALLEGHENY PLATEAU

The McFate phase people seem to have begun a gradual abandonment of the glaciated Allegheny Plateau by the middle of the 15th century (see Figure 6.6). This conclusion is based on the presence of McFate Incised pottery at the Bell and Kalgren sites on the unglaciated Allegheny Plateau in the uppermost reaches of the West Branch of the Susquehanna River. McFate Incised and the companion Conemaugh Cord-Impressed ceramics also characterize several large Late Prehistoric period Monongahela culture Johnston phase villages on the valley floor of the Kiskiminetas-Conemaugh River and at the McJunkin site on the drainage divide between the Allegheny and Monongahela rivers (see Figure 6.1).

Diagnostic McFate Incised and companion Conemaugh Cord-Impressed ceramics appeared in the Kiskiminetas Valley in southwestern Pennsylvania and at the earthwork sites and in the rockshelters in the Clarion River and Tionesta Creek basins apparently during the late 15th and early 16th centuries. McFate Incised ceramic vessels compose a large number of the reconstructed vessels at the late Bell site in the upper West Branch of the Susquehanna River drainage basin (Matlack 1987). The assignment of these pots to the McFate type is reinforced by the co-occurrence on these vessel lips of the diagnostic

lip decoration peculiar to McFate Incised, Conemaugh Cord-Impressed, and late Chautauqua Cord-Marked vessels farther west in the Allegheny River drainage basin. Although we have not seen the vessels from the Kalgren site, they apparently are McFate Incised or are closely related (James T. Herbstritt, personal communication 2002).

The cordage twist data compiled by Richard George (1997) from the Johnston, Squirrel Hill, and McJunkin sites suggest that the Johnston phase villages were composed of varying percentages of intrusive McFate folk and local Monongahela people (see Table 6.3). The latter population was presumably derived from the Monongahela drainage basin to the south, as the Kiskiminetas Valley seems to have been largely abandoned or, at least, underutilized between the end of the Early Monongahela period Kiskiminetas phase and the appearance of the large late Middle Monongahela period Johnston phase villages (Johnson 2001c; Johnson et al. 1991; Johnson et al. 1979) (see Figure 6.2).

If the Johnston phase population consisted primarily or exclusively of late Middle Monongahela groups who had arrived from the south beyond the Allegheny-Monongahela drainage divide, the expected predominant cordage final twist direction displayed on the cord-marked ceramics would be Z (see, e.g., Table 6.4). The one adequate cordage twist sample from an Early Monongahela period Kiskiminetas phase component in the Kiskiminetas River Valley was derived from the Krafic site (36Ar396). There is no obvious admixture of later Johnston phase ceramics at the Krafic site. The aggregate twist direction for cord impressions from sherds displaying a variety of temper types and mixtures is final-Z-twist, 80.0 percent (Johnson et al. 1991).

At the three sites with essentially pure Johnston phase components, the frequency of final-S-twist cordage (typical of McFate phase fiber production) ranges from 75.9 percent at the Johnston type site to 46.3 percent at the McJunkin site (Table 6.3, Figure 6.5). The frequency of final-S-twist cordage is much lower at the remaining three sites with Johnston phase components, but these percentages may reflect admixture of shell-tempered cord-marked sherds from the earlier Kiskiminetas phase components there. The high to predominant frequencies of final-S-twist cordage on shell-tempered sherds from the Johnston phase sites argues for the actual presence of McFate phase immigrants in the Kiskiminetas River Valley in late Middle Monongahela times. The number of McFate phase immigrants clearly varied from village to village. In fact, the frequency of final-S-twist cordage from the western portion of the excavated Johnston site village was 82.7 percent while that from the eastern portion was only 54.0 percent (George 1997) (see Table 6.3). This suggests that there may have been some physical separation of the mixed McFate-Monongahela population within this Johnston phase village. The cordage twist direction data documented in this study argue for a mixed McFate-Monongahela Johnston phase population rather than an essentially pure late Middle Monongahela group which had incorporated McFate phase ceramics motifs into their pottery-making industry. As well, the data also confirm the earlier suggestion of the senior author (Johnson 1972, 1976) that the Johnston site represented a late population intrusion from the glaciated Allegheny Plateau into the Kiskiminetas River Valley.

A second aspect of the dispersal of the McFate people that our data address is that witnessed by the Elk County earthwork sites in the upper Tionesta Creek drainage, including Kane, Russell City No. 1, and McKinley, and the various rockshelters in these and adjacent drainages. The shell-tempered ceramics from these sites, both McFate Incised and Chautauqua Cord-Marked wares as well as variants of the McFate Incised type displaying various opportunistically collected rock aplastic, also exhibit predominantly final-S-twist cordage impressions on their exterior surfaces. The high frequency of final-S-twist cordage impressions on these late ceramics can be argued to demonstrate the presence in the interior Clarion River and Tionesta Creek drainages of McFate phase people from the French Creek Valley or even from the Allegheny River Valley immediately to the west and north.

After the disappearance of the Mead Island culture from the mainstem Middle Allegheny Valley by the end of the 14th century and the

abandonment of the Upper Allegheny Valley by the Allegheny Valley Iroquois by the early 15th century, a shell-tempered pottery-making population (but not necessarily the French Creek or succeeding McFate phase people from the French Creek Valley) seems to have filled the vacuum (Johnson 1999a; Johnson et al. 1979). These new arrivals may even have been descendants of or otherwise related to the makers of undecorated shell-tempered pottery who had appeared to winter in Allegheny Valley Iroquois villages in the preceding centuries. Sites such as Sugar Run on the floodplain of the Upper Allegheny River and the numerous earthworks lining the uplands around the mainstem Upper Allegheny River in New York can be attributed to this episode. Regrettably, there are no cordage twist direction data available for any of these sites.

The Smith site in Bolivar, New York (Lounsberry 1997), and several rockshelter sites along the Middle Allegheny River between the confluence of French Creek and Brokenstraw Creek display McFate Incised ceramics. The final twist direction of the cordage impressions on the associated shell-tempered ceramics from these sites — a clue to their possible ethnic affiliation — however, is similarly not known. This late occupation of the upper Middle and Upper Allegheny Valley could have provided a closer source for the shell-tempered ceramics that appear on late-15th- and early-16th-century sites in the interior of the Clarion and Tionesta basins.

We believe there are three possible scenarios — and probably a lot more — to explain the appearance of the predominantly shell-tempered McFate Incised, Conemaugh Cord-Impressed and Chautauqua Cord-Marked ware in the interior of the Clarion River and Tionesta Creek drainage basins. First, this shell-tempered ware and related temper variants could represent the end of a local, indigenous pottery-making (and cordage-making) tradition in the interior Clarion and Tionesta valleys. The Late Woodland pottery makers in these interior tributary valleys may have adopted Chautauqua-McFate pottery technology in the form of shell-temper, vessel morphology, decorative modes, and decorative application techniques at the end of the Late Woodland sequence. In effect, they would have become "McFate-ized."

A second alternative explanation could interpret the shell-tempered sherd residue in the earthworks and at the top of the rockshelters in the Clarion River and Tionesta Creek basins and elsewhere along the mainstem Middle and Upper Allegheny River as debris left by hunting forays from the French Creek Valley to the west into the high unglaciated Allegheny Plateau. This expansion of the hunting and foraging territory of the later GAP tradition people seems to have occurred at a time when the authors argue that their adaptive strategies were adjusting to a shortening of the frost-free-day growing season.

This is a particularly attractive explanation for the presence of the relatively closely clustered Elk County earthworks, which Johnson (1999a; Johnson et al. 1979) has argued were fortified hunting camps rather than horticultural villages. Despite the fact that carbonized maize was recovered from two of the earthworks (LaBar 1968; Smith and Herbstritt 1976), the short frost-free-day growing season of the interior of Elk County (less than 100 days) would have prohibited or certainly severely restricted the reliability of maize cropping, particularly at the beginning of the Neo-Boreal climatic episode. As well, the high ratio of documented triangular arrow points to ceramic sherds at the McKinley Earthwork site (Smith and Herbstritt 1976), 1:11 (Johnson 1994a, 1999a), indicates that the primary economic focus at this stockaded site was hunting. As such, it corresponds to the fortified hunting villages of James Fitting and Charles Cleland's "Ottawa biotype" adaptation during the Late Woodland in the Lower Peninsula of Michigan (Fitting 1971; Fitting and Cleland 1971). A similar pattern seems to be evident at the Russell City No. 1 Earthwork, as well (see LaBar 1968). As maize horticulture became increasingly less reliable during the late 15th and 16th centuries, the subsistence strategies of various McFate phase groups seem to have become increasingly reoriented to a focus on hunting and foraging, supplemented by desultory maize cultivation.

The third scenario would see the rockshelters — particularly — as the temporary location of a

portion of the dispersing McFate population in the second half of the 15th century. These stations may have been utilized as small groups moved east to the so-called McFate-Kalgren or Bell phase villages in the upper reaches of the West Branch of the Susquehanna River basin (see Herbstritt and Kent 1990; Matlack 1987, 1992). Although the frost-free-day growing season there is not much longer than that in the interior of Elk County (see Hasenstab and Johnson 2001), the hilltop locations of these sites and presumably their associated maize fields may have buffered the maize crops from the effects of late spring and early fall killing frosts. William Roberts's (1988, 1990) important research regarding frost patterns and Late Woodland site locations in the uppermost Allegheny River basin in nearby Potter County, Pennsylvania, demonstrates that hilltop locations in the unglaciated Allegheny Plateau area of north-central Pennsylvania display a frost-free-day growing season up to 30 and as much as 40 days longer than adjacent valley floors. Matlack (1986) also noted this phenomenon for the headwater area of the West Branch of the Susquehanna River. This fact suggests that maize horticulture may have been a reliable subsistence base in the upper West Branch of the Susquehanna River basin at least into the early portion of the Neo-Boreal episode. As well, Roberts' careful documentation of these patterns (1988) has important implications for the economic strategy of the shell-tempered pottery-making occupants of the hilltop earthwork sites ringing the Upper Allegheny Valley to the north of the interior reaches of the Clarion and Tionesta basins. The regular village layout, the large number of houses, the multiple storage structures and pit features, and the large volume of pottery vessels and residue displayed by these fortified village sites in the upper reaches of the West Branch of the Susquehanna River basin strongly argue for their function as horticultural villages and not fortified hunting camps (see, e.g., Matlack 1986, 1987).

We have casts of cordage impressions from only a few grit-tempered earlier Woodland sherds from the interior Clarion River and Tionesta Creek basins to compare to the cordage impressions on the later shell-tempered ware. The recent excavation of the Indian Camp Run site and the testing of the nearby Taylor site by the junior author (Myers and Myers 2002), however, has provided the first large assemblage of early Late Woodland ware from the mainstem Middle Allegheny River Valley for which cordage twist analysis has been conducted (Table 6.1, Figure 6.3). The primary component at the Indian Camp Run site appears to be a Mead Island phase occupation (Myers and Myers 2002) (Figures 6.2, 6.3). This component straddled the time of the introduction of shell-tempering into that portion of the Allegheny Valley and, thus, provides both rock-tempered and shell-tempered early Late Woodland period sherd and cordage samples. The predominant final twist direction exhibited by both wares is Z (see Table 6.1). Although no diagnostic ceramics *per se* were recovered from the nearby Taylor site, the predominant final twist direction of the cordage impressions from grit-tempered sherds there is also Z (Table 6.1, Figure 6.3). This cordage twist direction pattern exhibited by the grit-tempered and shell-tempered Mead Island phase ware stands in contrast to that displayed by the contemporary early Late Woodland Mahoning phase components on the glaciated Allegheny Plateau to the west, which is final S twist. The twist direction evidenced by the shell-tempered Mead Island ceramics from the Indian Camp Run site is the opposite of that displayed by all the later Late Woodland shell-tempered ceramics from the glaciated Allegheny Plateau to the west as well as the earthwork and rockshelter sites to the east in the interior Clarion River and Tionesta Creek basins. These facts indicate that, minimally, the shell-tempered ceramics documented in the earthworks and rockshelters in these interior tributary basins were not made by the descendants of the Mead Island phase population.

While this sample comes from only one or possibly two Mead Island phase components and was derived from sites on the valley floor of the Middle Allegheny River, it may reflect the cordage twist preferences of the early Late Woodland population of the adjacent interior Clarion River and Tionesta Creek basins. If future research can confirm this pattern, this

would indicate that the shell-tempered McFate Incised and Chautauqua Cord-Marked wares associated with the earthworks and the uppermost levels of the rockshelters represent the residuum of an intrusive population rather than that of indigenous Woodland groups that had putatively adopted shell-tempering and McFate phase decorative modes into their pottery-making tradition toward the end of the Late Woodland period. This finding would strengthen the argument for these late components, characterized by shell-tempered ceramics, as representing a population ultimately dispersing from the glaciated Allegheny Plateau section of northwestern Pennsylvania. The frequency of these components across the interior Clarion and Tionesta basins suggests, at a minimum, a more intensive utilization of this area at the end of the Late Woodland period by either McFate phase people or the local indigenous population. Whether this phenomenon represents a gradual reorientation of McFate phase subsistence strategies at the beginning of the Neo-Boreal episode or a wholesale migration of a population in response to the deteriorating climatic conditions at the beginning of the 16th century, or both, is unknown at the present. An examination of the cordage twist direction of impressions on the ceramics of the various ware groups and components at the McFate-Kalgren or Bell phase sites may offer a more definitive scenario.

Somewhat parenthetically, Herbstritt and Kent (1990) have contended that the McFate Incised ceramics from the earthworks sites and from their McFate-Kalgren or, alternatively, the Bell phase sites are essentially the same collared and incised ware that characterizes the terminal Late Woodland-Protohistoric occupation of the Quiggle site, located below Lock Haven on the lower West Branch of the Susquehanna River (see Smith 1984). This study cannot speak directly to the affiliation of the shell-tempered ware from the Kalgren and Bell sites because there is no published or circulated documentation for the preferred cordage twist manifested by any of ceramic temper types present at either of these two sites (see, e.g., Matlack 1987).

A recent detailed comparison of the McFate Incised and Quiggle Incised decorative attributes and collar and lip morphology (Johnson 1999a), however, clearly indicated that the shell-tempered ware from Quiggle is not McFate Incised *per se*. As well, the predominant final twist direction displayed by the cordage impressions on the shell-tempered ware from the Quiggle site is Z (Table 6.2, Figure 6.4). While it is probable that the McFate phase potters were the source of the attribute of shell-tempering for both the McFate-Kalgren or Bell phase and, ultimately, the Quiggle complex potters, they clearly did not represent a measurable portion of the cordage makers, at least, at the Quiggle site. The direct linking of the McFate phase or a substantial refugee population from the glaciated Allegheny Plateau with the Kalgren-Quiggle complex is no longer defensible.

CONCLUSIONS

The analysis and recording of the twist direction of cordage impressed upon 1,542 sherds from 38 terminal Middle Woodland and Late Woodland components in both the glaciated and unglaciated Allegheny Plateau section of northwestern Pennsylvania and from the adjacent Lake Erie Plain of New York have materially aided the construction of the Late Woodland period sequence there. Most importantly, this research demonstrates an unbroken population continuity from the early Late Woodland Mahoning phase, characterized by igneous-rock-tempered pottery, to the terminal Late Woodland McFate phase groups who made shell-tempered Chautauqua Cord-Marked and McFate Incised ceramics. As well, it demonstrates that the later shell-tempered pottery makers did not represent a Monongahela population intrusion from the lower Upper Ohio Valley.

This research is also beginning to answer questions regarding the presence and affinities of McFate Incised and companion ceramic types at various sites beyond the periphery of the glaciated Allegheny Plateau section of northwestern Pennsylvania. The collection of cordage twist data that may further document the seeming dispersal of the makers of McFate Incised, Conemaugh Cord-Impressed, and Chautauqua Cord-Marked pottery is still in the early stages.

This latter set of information, however, has served to confirm hypothesized population movements into the Kiskiminetas River Valley (e.g., George 1997; Johnson 1972, 1976, 1994a, 1999a) and onto the high unglaciated Allegheny Plateau including the head waters of the Tionesta Creek and the Clarion and West Branch of the Susquehanna rivers (e.g., Herbstritt and Kent 1990; Johnson et al. 1979; Smith and Herbstritt 1976). These data also demonstrate that despite the predominance of shell-tempered collared and incised ware at the terminal Late Woodland-Protohistoric Quiggle site on the floor of the mainstem of the West Branch of the Susquehanna River, there were relatively few McFate phase refugees or their descendants in the Quiggle site population. In short, cordage twist analysis offers great promise as an important tool along with other categories of material culture to facilitate the explication of cultural sequences in the prehistoric Eastern Woodlands.

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APPENDICES

Tables 6.1-6.4.

Table 6.1. Number and Frequency of Final Z- and S-Twist Cordage Impressions on Ceramics from Terminal Middle and Early Late Woodland Period Components in the Upper Ohio River Valley and Adjacent St. Lawrence River Basin by Geographic Area, Period, Phase, and Temper Type.

Geographic Area	Period and/or Phase[a]	Site	Temper	CORDAGE TWIST: Final Z Twist N	Final Z Twist %	Final S Twist N	Final S Twist %	Total	References
French Creek	Middle Woodland, Edinburg phase	Port-Melnick (36Er31)	Igneous Rock and Limestone	21	65.63	11	34.38	32	Johnson (1999a:Table 2).
Mahoning River	Middle Woodland and Late Woodland, Edinburg and Mahoning phases	Bolinger (36Lr21)	Igneous Rock (Edinburg phase)	1	33.33	2	66.67	3	New data analyzed for current project.
			Igneous Rock (Edinburg/ Mahoning mix)	9	32.14	19	67.86	28	
			Igneous Rock (Mahoning phase)	1	50.00	1	50.00	2	
Shenango River	Late Woodland, Mahoning phase	Shenango Dam No. 1 (36Me60)	Igneous Rock	7	8.75	73	91.25	80	Johnson and Speedy (1993:Table 1).
		Wansack (36Me61)	Igneous Rock	2	6.25	30	93.75	32	Johnson and Speedy (1993:Table 1).
	Late Woodland, Mahoning phase ?	Linesville Earthwork (36Cw26)	Igneous Rock	0	0.00	4	100.00	4	Johnson (1999a:Table 2).
French Creek	Late Woodland, Mahoning phase	McFate (36Cw1)	Igneous Rock	6	13.95	37	86.05	43	Johnson (1999a:Table 2).
			Mixed Igneous Rock and Shell	0	0.00	2	100.00	2	
			Shell	12	41.38	17	58.62	29	
			Total	18	24.32	56	75.68	74	

Table 6.1 (continued)

Geographic Area	Period and/or Phase[a]	Site	Temper	CORDAGE TWIST: Final Z Twist N	Final Z Twist %	Final S Twist N	Final S Twist %	Total	References
Middle Allegheny River	Late Woodland, Mead Island phase	Indian Camp Run (36Fo65)	Various combinations of Quartz, Igneous Rock, Sandstone, Gravel and Chert	142	74.74	48	25.26	190	New data analyzed for current project.
			Mixed Shell and Grit	39	68.42	18	31.58	57	
			Shell	34	87.18	5	12.82	39	
			Total	215	75.17	71	24.83	286	
	Late Woodland, Mead Island phase	Taylor (36Fo83)	Various combinations of Quartz, Igneous Rock, Sandstone, and Gravel	7	77.78	2	22.22	9	New data analyzed for current project.
Lake Erie Plain	Late Woodland, Late Middleport horizon	Westfield-Mac (36Ch1)	Igneous Rock	8	25.00	24	75.00	32	Johnson and Speedy (1993:Table 2).

[a]In mixed Woodland period ceramic assemblages, the dominant component relative to the expected number of specimens is presented first.

Table 6.2. Number and Frequency of Final Z- and S-Twist Cordage Impressions on Ceramics from Late Woodland Period Components in the Upper Ohio River Valley and Adjacent Susquehanna and St. Lawrence River Basins by Geographic Area, Period, Phase, and Temper Type.

Geographic Area	Period and/or Phase	Site	Temper[a]	CORDAGE TWIST: Final Z Twist N	Final Z Twist %	Final S Twist N	Final S Twist %	Total	References
French Creek	Late Woodland, French Creek and McFate phases	McFate (36Cw1)	Shell (French Creek/ McFate mix)	110	23.06	367	76.94	477	Johnson (1999a:Table 2).
	Late Woodland, McFate phase	I-79 (36Cw247)	Shell	0	0.00	7	100.00	7	Johnson (1999a:Table 2).
Shenango River	Late Woodland, French Creek phase	Linesville Earthwork (36Cw26)	Shell	2	5.41	35	94.59	37	Johnson (1999a:Table 2)
	Late Woodland, French Creek and McFate phases	Shenango Dam No. 1 (36Me60)	Shell	10	25.64	29	74.36	39	Johnson and Speedy (1993:Table 2).
		Wansack (36Me61)	Shell	10	41.67	14	58.33	24	Johnson and Speedy (1993:Table 2).
Lake Erie Plain	Late Woodland, McFate phase	Westfield-Mac (36Ch1)	Shell	37	43.53	48	56.47	85	Johnson and Speedy (1993:Table 2).
Middle Allegheny River, interior upland Elk County earthworks	Late Woodland, McFate phase	Kane Earthwork (36El1)	Fine Sand	0	0.00	2	100.00	2	Johnson (1999a:Table 2).
			Shell	0	0.00	4	100.00	4	
			Total	0	0.00	6	100.00	6	
		Russell City Earthwork (36El2)	Shell	4	28.57	10	71.43	14	Johnson (1999a:Table 2).
		McKinley Earthwork (36El17)	Shell	2	3.64	53	96.36	55	Johnson (1999a:Table 2).

Table 6.2 (continued)

Geographic Area	Period and/or Phase	Site	Temper[1]	CORDAGE TWIST: Final Z Twist N	Final Z Twist %	Final S Twist N	Final S Twist %	Total	References
Middle Allegheny River, interior upland rockshelters and open air stations	Late Woodland, McFate phase	Ham's Rockshelter No. 1 (36El66A)	Shell	0	0.00	2	100.00	2	Johnson (1999a:Table 2).
		Ham's Rockshelter No. 2 (36El66B)	Limestone	0	0.00	3	100.00	3	Johnson (1999a:Table 2).
			Shell	0	0.00	4	100.00	4	
			Total	0	0.00	7	100.00	7	
		Ham's Rockshelter No. 3 (36El66C)	Shell	0	0.00	1	100.00	1	Johnson (1994a:Table 2).
		Upper Laurel Rockshelter (36El70)	Shell	0	0.00	1	100.00	1	Johnson (1999a:Table 2).
		Hallton Rockshelter (36El79)	Shell	0	0.00	9	100.00	9	Johnson (1999a:Table 2).
		Arroyo Rockshelter (36El80)	Shell	0	0.00	1	100.00	1	Johnson (1994a:Table 2).
		Gurgling Run Rockshelter (36El85)	Shell	0	0.00	1	100.00	1	Johnson (1994a:Table 2).
		Wingates Rockshleter (36El88)	Shell	0	0.00	8	100.00	8	Johnson (1994a:Table 2).
		Bear Creek Rockshelter (36El96)	Shell	0	0.00	1	100.00	1	Johnson (1994a:Table 2).

Table 6.2 (continued)

Geographic Area	Period and/or Phase	Site	Temper[1]	CORDAGE TWIST Final Z Twist N	Final Z Twist %	Final S Twist N	Final S Twist %	Total	References
Middle Allegheny River, interior upland rockshelters and open air stations (cont'd.)	Late Woodland, McFate phase (cont'd.)	Dog Hollow Rockshelter (36El97)	Gravel	0	0.00	2	100.00	2	Johnson (1999a:Table 2).
			Limestone	0	0.00	1	100.00	1	
			Mixed Limestone and Shell	0	0.00	2	100.00	2	
			Shell	0	0.00	2	100.00	2	
			Total	0	0.00	7	100.00	7	
		Belmouth Run No. 2 (36El106)	Mixed Limestone and Shell	0	0.00	3	100.00	3	Johnson (1999a:Table 2).
			Shell	0	0.00	2	100.00	2	
			Total	0	0.00	5	100.00	5	
		Bogus Run Rockshelter (36Fo56)	Shell	0	0.00	2	100.00	2	Johnson (1999a:Table 2).
		Hoffman Farm Rockshelter No. 1 (36Mc44)	Shell	0	0.00	1	100.00	1	Johnson (1994a:Table 2).
		Brooks Rocks (36Wa190)	Shell	0	0.00	2	100.00	2	Johnson (1994a:Table 2).
		Little Tionesta Creek Rockshelter No. 2	Shell	0	0.00	1	100.00	1	New data analyzed for current project.
		Upland rockshelters and open air stations	Subtotal	0	0.00	49	100.00	49	
Clarion River	Late Woodland, McFate phase	Dutch Hill Rockshelter (36Je132)	Limestone	12	13.33	78	86.67	90	Myers (2001:48, Table 3); New data analyzed for current project.
			Mixed Limestone and Shell	0	0.00	15	100.00	15	
			Shell	17	19.10	72	80.90	89	
			Total	29	14.95	165	85.05	194	

Table 6.2 (continued)

Geographic Area	Period and/or Phase	Site	Temper[1]	CORDAGE TWIST: Final Z Twist N	Final Z Twist %	Final S Twist N	Final S Twist %	Total	References
Clarion River	Late Woodland, Stewart complex	Powers Run Rockshelter (36El119)	Quartz	7	87.50	1	12.50	8	New data analyzed for current project.
West Branch Susquehanna River	Late Woodland, Kalgren/Bell phase?	Panther Rocks (36Cd94)	Shell	1	100.00	0	0.00	1	New data analyzed for current project.
West Branch Susquehanna River	Late Woodland, Quiggle complex	Quiggle (36Cn6)	Shell	122	89.05	15	10.95	137	Johnson (1999a:Table 2).

[a]In mixed Woodland period ceramic assemblages, the dominant component relative to the expected number of specimens is presented first.

Table 6.3. Number and Frequency of Final Z- and S-Twist Cordage Impressions on Ceramics from Late Prehistoric Period[a] Components in the Kiskiminetas River Valley by Geographic Area, Period, Phase, and Temper Type.

Geographic Area	Period and/or Phase	Site	Temper	CORDAGE TWIST: Final Z Twist N	Final Z Twist %	Final S Twist N	Final S Twist %	Total	References
Kiskiminetas River	Late Prehistoric[a] Monongahela Johnston phase	Johnston (36In2)	Shell (west trenches)	28	17.28	134	82.72	162	George (1997:40).
			Shell (east trenches)	23	46.00	27	54.00	50	
			Total	51	24.06	161	75.94	212	
		Squirrel Hill (36Wm35)	Shell	14	36.84	24	63.16	38	George (1997:41).
				4	40.00	6	60.00	10	Johnson (1999a:Table 2).
			Total	18	37.50	30	62.50	48	
Allegheny/ Monongahela River divide		McJunkin (36Al17)	Shell (Areas A & F)	128	52.46	116	47.54	244	George (1997:38; 1994, pers. comm.).
			Shell (surface, west side of village)	11	73.33	4	26.67	15	Johnson (1999a:Table 2).
			Total	139	53.67	120	46.33	259	
Kiskiminetas River	Late Prehistoric[a] Monongahela, Kiskiminetas and Johnston phases	Huffman Farm-Cook Pacemaker Company (36Ar329)	Shell (Johnston/ Kiskiminetas mix)	70	76.09	22	23.91	92	New data analyzed for current project.
		Heinz Farm (36Ar397)	Shell (Johnston/ Kiskiminetas mix)	7	43.75	9	56.25	16	New data analyzed for current project
		Blacklegs Town (36In148)	Shell (Johnston/ Kiskiminetas mix)	21	67.74	10	32.23	31	New data analyzed for current project.

[a]In Ohio River Valley parlance, i.e., Late Prehistoric period, A.D. 1050-1580/1590.

Table 6.4. Number and Frequency of Final Z-Twist and S-Twist Cordage Impressions from Late Prehistoric[a] and Protohistoric Period Limestone, Mixed Limestone and Shell, and Shell-Tempered Mononghela Ceramics from Sites in the Monongahela River Valley by River/Tributary Basins in Ascending Order from Downstream to Upstream, Time Period/Phase, and Temper Type.

Site	River/Stream Basin	Time Period/ Phase	Temper	CORDAGE TWIST: Final Z Twist N	Final Z Twist %	Final S Twist N	Final S Twist %	Total	References
Dennison-Pellicione (36Wh46)	Lobbs Run, upland	Middle Monongahela, Unnamed phase	Shell	114	64.04	64	35.96	178	Johnson and Speedy (1993:Table 2).
Bunola (36Al4)	Monongahela River, Holocene terrace	Middle Monongahela, Campbell Farm phase	Shell	65	83.33	13	16.67	78	Johnson et al. (1989:18, Table 5).
36Al9	Monongahela River, upland	Middle Monongahela, Youghiogheny phase	Shell	138	92.62	11	7.38	149	Johnson (2001b:Table 5).
Miller Farm (36Al32)	Fallen Timber/ Douglas Run divide	Middle Monongahela, Campbell Farm phase	Shell	49	80.33	12	19.67	61	Johnson et al. (1989:18, Table 5).
Mon City (36Wh737)	Monongahela River, Holocene terrace	Middle Monongahela, Youghiogheny phase	Shell	412	97.17	12	2.83	424	Hart (1994:22).
Beazell School (36Wh34)	Pigeon Creek, Pleistocene terrace	Late Monongahela, Youghiogheny phase	Shell	95	95.96	4	4.04	99	Carr and Maslowski (1995: 319, Table 9-4).
			Shell	203	97.60	5	2.40	208	Johnson (2001b:Table 5).
			Total	298	97.07	9	2.93	307	
Vesta (36Wh26)	Monongahela River, Holocene terrace	Early and Late Monongahela, Drew and Youghiogheny phases	Shell (Youghiogheny/ Drew mix)	7	100.00	0	0.00	7	Johnson et al. (1989:18, Table 5).
"Brownsville Old Fort" (36Fa8)	Monongahela River/ Redstone Creek divide	Middle Monongahela, Campbell Farm phase	Shell	97	87.39	14	12.61	111	Maslowski (1984:54, Table 2).

Table 6.4 (continued)

Site	River/Stream Basin	Time Period/ Phase	Temper	CORDAGE TWIST Final Z Twist N	Final Z Twist %	Final S Twist N	Final S Twist %	Total	References
Garden (36Fa156)	Redstone Creek, upland	Early Monongahela, Drew phase	Shell	32	82.05	7	17.95	39	Johnson and Speedy (1993:Table 2).
Campbell Farm I (36Fa26)	Redstone Creek, upland	Early Monongahela, Drew phase	Limestone	16	47.06	18	52.94	34	Johnson (2001b:Table 5).
			Mixed Limestone and Shell	30	44.12	38	55.88	68	
			Shell	179	74.90	60	25.10	239	
			Total Drew phase	225	65.98	116	34.02	341	
Campbell Farm II (36Fa26)	Redstone Creek, upland	Middle Monongahela, Campbell Farm phase	Shell (Campbell Farm phase)	88	63.31	51	36.69	139	Johnson (2001b:Table 5).
			Shell (Campbell Farm/Drew mix)	353	78.27	98	21.73	451	
			Total (Campbell Farm/Drew mix)	441	74.75	149	25.25	590	
Novak (36Fa34)	Redstone Creek, upland	Middle Monongahela, Campbell Farm phase	Shell	69	59.48	47	40.52	116	Boyce (1985:42).
Stephenson Farm-Jones (36Gr4)	Tenmile Creek, Pleistocene terrace	Early and Late Monongahela, Drew and Foley Farm phases	Shell (Foley Farm/ Drew? mix)	35	97.22	1	2.78	36	Carr and Maslowski (1995: 319, Table 9-4).
Gessford Farm (36Wh20)	Tenmile Creek, Holocene terrace	Early Monongahela, Drew phase	Shell	27	84.38	5	15.63	32	Johnson (2001b:Table 5).
Varner-John Lapping (36Gr1)	Tenmile Creek, upland	Early and Late Monongahela, Drew, unnamed, and Foley Farm phases	Shell (Drew/ unnamed/Foley Farm mix)	30	71.43	12	28.57	42	Carr and Maslowski (1995: 319, Table 9-4).
Eisiminger-Jesse Lapping (36Gr2)	Tenmile Creek, upland	Late Monongahela, Foley Farm phase	Shell	60	96.77	2	3.23	62	Carr and Maslowski (1995: 319, Table 9-4).

Table 6.4 (continued)

Site	River/Stream Basin	Time Period/ Phase	Temper	CORDAGE TWIST Final Z Twist N	Final Z Twist %	Final S Twist N	Final S Twist %	Total	References
Gensler (36Gr63)	Tenmile Creek, Holocene terrace	Early Monongahela, Drew phase	Shell	18	54.55	15	45.45	33	NPW Consultants, Inc. (1983:50, Table 6).
Throckmorton (36Gr160)	Tenmile Creek, Holocene terrace	Late Monongahela, Foley Farm phase	Shell	68	97.14	2	2.86	70	NPW Consultants, Inc. (1983:149, Table 24).
Hartley (36Gr23)	Muddy Creek, upland	Early and Late Monongahela, Drew and Foley Farm phases	Shell (Drew/Foley Farm mix)	4	100.00	0	0.00	4	Johnson et al. (1989:18 Table 5).
36Fa363	Monongahela River, Holocene terrace	Early Monongahela, Drew phase	Limestone	3	33.33	6	66.67	9	R. Christopher Goodwin & Associates, Inc. (1990: 89, Table 21).
			Shell	5	100.00	0	0.00	5	
			Total	8	57.14	6	42.86	14	
36Fa368	Monongahela River, Holocene terrace	Middle Monongahela, Campbell Farm phase	Shell	43	86.00	7	14.00	50	Johnson (1987:103). Archaeological and Historical Consultants, Inc. (1990:97).
			Shell	78	100.00	0	0.00	78	
			Total	121	94.53	7	5.47	128	
Donley (36Gr60)	Dunkard Creek, upland	Middle and Late Monongahela, unknown phase and Foley Farm phase	Shell (unknown phase/Foley Farm mix)	174	95.60	8	4.40	182	Carr and Maslowski (1995: 319, Table 9-4).
LaPoe No.2 (46Mg20)	Dunkard Creek, Holocene terrace	Late Monongahela, Foley Farm phase	Shell	119	92.97	9	7.03	128	Johnson (2001b:Table 5).
Turkeytown (36Wm62)	Sewickley Creek, upland	Middle Monongahela, Youghiogheny phase	Shell	35	92.11	3	7.89	38	Johnson (2001b:Table 5).
Kirshner (36Wm213)	Sewickley Creek, upland	Middle Monongahela, Youghiogheny phase	Shell	183	80.62	44	19.38	227	Babich et al. (1996: Table 4).

Table 6.4 (continued)

Site	River/Stream Basin	Time Period/ Phase	Temper	CORDAGE TWIST Final Z Twist N	Final Z Twist %	Final S Twist N	Final S Twist %	Total	References
Sony (36Wm151)	Sewickley Creek, upland	Early Monongahela, Drew phase	Limestone and mixed Limestone and Shell	3	100.00	0	0.00	3	Davis and Wilks (1997: Appendix 9).
		Middle Monongahela, Youghiogheny phase	Shell (Youghiogheny/ Drew mix)	176	96.70	6	3.30	182	
Household (36Wm61)	Youghiogheny River, Pleistocene terrace	Late Monongahela, Youghiogheny phase	Shell	96	96.00	4	4.00	100	George et al. (1990:50).
Fullers Hill (36Fa17)	Washington Run, upland	Early, Middle and Late Monongahela, Drew, Campbell Farm and Youghiogheny phases	Shell (Campbell Farm/Drew/ Youghiogheny mix)	254	88.50	33	11.50	287	Johnson (2001b:Table 5).
Quaker Church (36Fa38)	Washington Run/Little Redstone Creek divide	Middle Monongahela, Campbell Farm phase	Shell	32	88.89	4	11.11	36	Johnson (2001b:Table 5).
Howarth-Nelson (36Fa40)	Dickerson Run, upland	Middle Monongahela, Campbell Farm and Youghiogheny phases	Shell (Campbell Farm/ Youghiogheny mix)	209	91.27	20	8.73	229	Johnson (2001b:Table 5).
Reckner (36So7)	Youghiogheny River, upland	Early and Middle Monongahela, Somerset and Youghiogheny phases	Limestone	18	94.74	1	5.26	19	New data analyzed for current project.
			Shell (Somerset)	1	100.00	0	0.00	1	
			Total (Somerset)	19	95.00	1	5.00	20	
			Shell (Youghiogheny/ Somerset mix)	20	74.07	7	25.93	27	
			Shell (Youghiogheny)	37	94.87	2	5.13	39	
Gnagey No. 3 (36So55)	Casselman River, Holocene terrace	Middle Monongahela, Somerset phase	Limestone	196	98.00	4	2.00	200	George (1983:29).

[a]In Ohio River Valley parlance, i.e., Late Prehistoric period, A.D. 1050-1580/1590.

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CHAPTER 7

CORDAGE, FABRICS, AND THEIR USE IN THE MANUFACTURE OF EARLY LATE PREHISTORIC CERAMIC VESSELS IN NEW YORK

Christina B. Rieth

ABSTRACT

Cord-marked vessels belonging to the Point Peninsula and Owasco ceramic traditions are found at early Late Prehistoric (A.D. 700–1300) sites in New York. Although many archaeologists have recognized differences in the stylistic attributes of these vessels, an analysis of the technological attributes of ceramic containers from 16 early Late Prehistoric sites suggests that prehistoric potters used similar cordage and fabrics throughout this period. Vessels exhibiting different cordage and fabric attributes were often determined to be non-locally manufactured and may represent the interaction of regional groups.

INTRODUCTION

Cord- and fabric-impressed sherds are considered a defining characteristic of the early Late Prehistoric period (A.D. 700-1300) in the Northeast (Ritchie and McNeish 1949). Although studies associated with the physical construction and stylistic design of these containers are readily available in the archaeological literature (e.g., Chilton 1999; Lizee et al. 1995; Pretola 2000; Prezzano 1986; Rieth 1997, 2002b), few studies have addressed questions concerning the relationship between fabrics and pottery manufacture (but see Browning 1974; Dincauze 1975:5-17; Petersen 1996). This is due to the fact that many archaeologists consider cord and fabric impressions to be nothing more than "pretty designs," which are of limited use in reconstructing prehistoric behavior. Compounding this problem is the belief that all cord- and fabric-impressed designs are the same and exhibit limited variation across time and space (e.g., Ritchie and MacNeish 1949; Whallon 1968). When cord- and fabric-impressed designs are considered important, however, researchers are often reluctant to study variation in cordage attributes since whole pots (and/or larger rim sherds) are not available (McPherron 1970; Whitney and Travers 1987:1-9).

Recently, I have considered these issues as part of an ongoing research project designed to study early Late Prehistoric interaction in the Susquehanna Valley of New York. As part of this project, I examined cord- and fabric-impressed sherds from 16 late Middle Woodland (ca. A.D. 700–1000) and early Late Woodland (A.D. 1000–1300) sites to assess changes in ceramic manufacturing techniques as a reflection of interaction patterns during this period. Although I also recorded other technological and stylistic attributes, some of the most interesting results derive from the study of cord and fabric impressions on these sherds. Another important aspect of this project was the use of trace element

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analysis to assess individual vessels' areas of origin and the reciprocal exchange of vessels throughout the region (Rieth 2002b).

In this chapter, I provide a brief overview of the results of my research in order to show how cordage and fabric attributes can be used in conjunction with other ceramic attributes to reconstruct the manufacturing techniques of early Late Prehistoric potters in the Susquehanna Valley of New York. The results of this project suggest that early Late Prehistoric potters in the Susquehanna Valley of New York utilized similar types of materials throughout this 600-year period.

BACKGROUND AND PROJECT OVERVIEW

This research was completed as part of a larger project designed to reconstruct the interaction patterns of early Late Prehistoric populations in the Susquehanna Valley of New York (Rieth 1997). The early Late Prehistoric encompasses a dynamic period in Northeast prehistory that bridges the late Middle Woodland Point Peninsula and the early Late Woodland Owasco traditions. As discussed elsewhere (e.g., Hart and Rieth 2002; Prezzano and Rieth 2001; Rieth 2002b; Ritchie 1994; Snow 1980), this period is often defined by the adoption of maize horticulture, the transition from a mobile to a semi-sedentary lifestyle, and important changes in material culture. Archaeologists also speculate that many of the cultural behaviors practiced by later Iroquoian groups have their antecedents in the early Late Prehistoric period (Prezzano 1986; Ritchie 1994; Ritchie and Funk 1973; Snow 1995).

One question that currently is being debated among archaeologists centers around the identity and interaction patterns of these Early Late Prehistoric groups. In recent years, Northeast archaeologists have argued that the period dating between A.D. 800 and 1200 is characterized by the migration of Iroquoian (Owasco) groups into south-central New York between A.D. 700 and 900 (Dincauze and Hasenstab 1989; Niemcyzcki 1994; Snow 1995). The result of this migration would be the absorption and/or displacement into surrounding areas of local non-Iroquoian Point Peninsula groups.

Snow (1995) suggests that evidence of this migration can be seen in changes in the artifacts manufactured by these prehistoric populations. Among the most visible changes are the replacement of poorly constructed coil manufactured pots by more refined paddle and anvil manufactured pots. Cord-marking continues to be the primary type of decoration used on these containers. However, Snow (1995) suggests that differences in the types of cordage used by Point Peninsula and Owasco groups can be expected.

EARLY LATE PREHISTORIC CERAMICS

The ceramic containers used by these early Late Prehistoric groups are associated with two different ceramic traditions: Point Peninsula and Owasco (Ritchie and MacNeish 1949). Late Point Peninsula containers, namely those from sites radiocarbon dated between A.D. 700 and 1000, exhibit cord-marked motifs around the exterior rim and lip and bodies that are either plain or in some instances cord-roughened (Prezzano 1986; Ritchie 1994; Ritchie and Funk 1973). Decorative motifs often were applied using a cord-wrapped stick or paddle. As discussed later in this chapter, impressions from nets and other woven fabrics are present on these sherds and may indicate that a wider range of materials also was used.

According to Ritchie and MacNeish (1949), Point Peninsula containers were often manufactured by coiling, based on evidence of clay fillets and coil breaks visible in many sherds. Many Point Peninsula containers exhibit a coarse grit temper largely consisting of quartz, quartzite, and gneiss inclusions. These containers are often friable and have thicker vessel walls than their Owasco counterparts (Prezzano 1985; Ritchie and MacNeish 1949).

Owasco containers are usually found on sites radiocarbon dated between A.D. 1000 and 1300. These vessels resemble Point Peninsula containers, generally exhibiting an outflaring rim and flat lip shape (Ritchie and MacNeish 1949). Like Point Peninsula vessels, these containers are embellished with cord-wrapped stick and paddle motifs, which are placed on either a plain or a corded surface. Popular motifs include hori-

zontal, oblique, and vertical lines, chevrons, and herringbones. Horizontal and oblique lines often adorn the interior rim and lip of the container.

Most Owasco vessels contain a fine grit temper with inclusions ranging in size from fine to coarse (Prezzano 1985; Rieth 1997, 2002b; Snow 1995). Limited amounts of shell-tempered pottery also have been recovered from sites in the Susquehanna Valley (Ritchie 1944). Owasco vessels have thinner walls than Point Peninsula containers (Rieth 1997). Prezzano (1985) suggests that these differences may be related to changes in container use following the adoption and regular use of maize horticulture.

PERISHABLES AS EVIDENCE OF GROUP IDENTITY

Fabrics, and other types of perishables, are well suited for addressing questions relating to group identity and interaction. The way an artifact is made often can be directly correlated with a particular cultural group (e.g., Adovasio 1986; Adovasio and Andrews 1980; Chapman and Adovasio 1977; Maslowski 1996; Petersen 1996). For instance, Adovasio (1986:46) argues that a detailed study of basket attributes can be used to "distinguish the work of individual ethnographic basket makers within the same socio-political entity . . . Similarly, it is possible to separate the products of two culturally and linguistically disparate groups of basket makers." Maslowski (1996:89) similarly argues that twist patterns of cordage used to construct fabrics

> result [from] highly standardized, culture-specific motor habits. Such motor habits are learned . . . and are transmitted from generation to generation within family groups or work groups. Hence, cordage twist patterns often have greater temporal continuity than decoration or environmentally influenced attributes of material culture

Studies examining cord and fabric impressions on ceramics have provided important information about the manufacture of vessels and fabrics in the prehistoric Northeast. Studies by Dincauze (1975), Doyle et al. (1982:4-21), Drooker (1990, 1992), Maslowski (1973, 1984, 1996), Petersen and Hamilton (1984:413-445), and others highlight the range of fabrics used in the production of prehistoric containers and document the spatial and temporal variation in fiber perishables among Native groups. Finally, as demonstrated by Petersen and Hamilton's (1984:431-438) and Petersen and Wolford's (2000) studies of ceramic and fiber perishables from sites in New England, an analysis of the fiber impressions left on prehistoric ceramics not only has merit in and of itself, but, when combined with other types of data, can provide important information about the settlement and ceramic development patterns of Northeast prehistoric populations.

METHODOLOGY

RESEARCH QUESTIONS

This project addresses two questions about the relationship between ceramic manufacture and fabric production. First, were the early Late Prehistoric ceramics recovered from Point Peninsula and Owasco sites manufactured using similar types of cordage and fiber perishables? To investigate this question, attributes of cordage associated with Point Peninsula and with Owasco containers were analyzed to determine whether they differed temporally or geographically. Second, if differences in cordage attributes are evident, were the containers on which these different types of cordage were impressed manufactured at different locations? This question was addressed through trace element analysis of ceramic materials providing a framework against which the interaction of prehistoric groups could be determined.

SAMPLE DESCRIPTION

For this project, I examined ceramic assemblages from 16 early Late Prehistoric sites (Figure 7.1). Four of these sites (Street, Fortin II, White, Ouleout Creek) contained components dating between A.D. 700 and 1000 that are associated with the Point Peninsula archaeological tradition (Table 7.1). All four sites have been interpreted as small seasonal camps (Funk 1993; Hartgen Archaeological Associates, Inc. 1989;

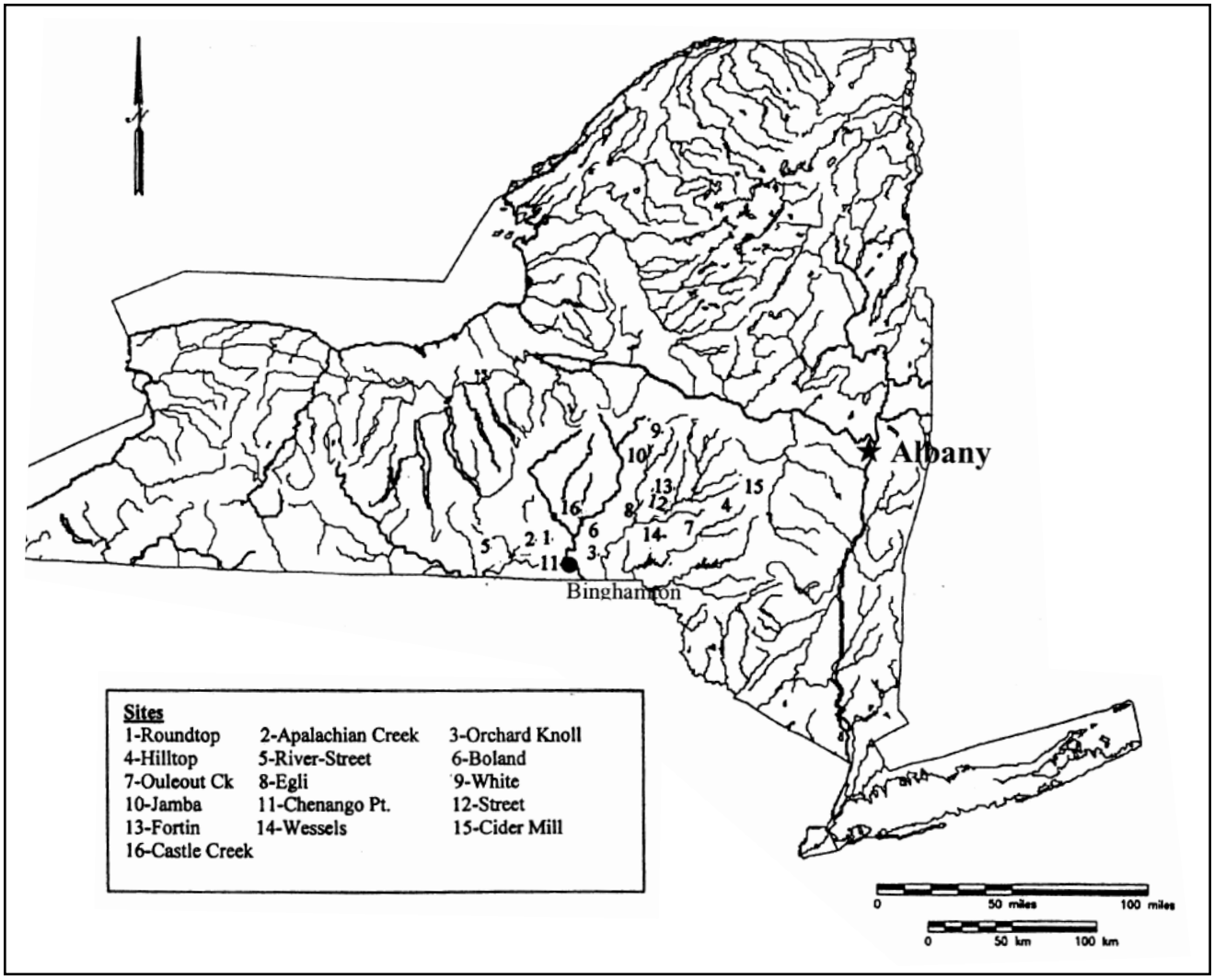


Figure 7.1. Map showing the location of sites in the project area.

Whitney and Gibson 1987). The remaining 12 sites (Table 7.2) are associated with the Owasco tradition. Boland (Prezzano 1992; Prezzano and Rieth 2001), Chenango Point (Wurst and Versaggi 1993), Apalachian Creek (Shapiro n.d.), Orchard Knoll (Moorehead 1938), Roundtop (Ritchie and Funk 1973), and Castle Creek (Prezzano and Rieth 2001; Ritchie 1934, 1994) are large village sites. Wessels (Oskam 1999), Egli (Hesse 1975), Jamba (Whitney 1975), Cider Mill, Hilltop (Hill 1938; Ritchie 1994), and River-Street (Versaggi and Jones 1988) are small seasonal camps and resource-processing stations.

These 16 sites are concentrated along the main branch of the Susquehanna River and its major tributaries (Figure 7.1). Two clusters of sites exist within the larger valley. One cluster of sites is found near the modern city of Oneonta, along the valley floor, valley walls, and surrounding upland areas. As I have argued elsewhere (Rieth 2002a), this area probably served as an important resource procurement area for the native populations of the Susquehanna Valley. The area contains several smaller microenvironments that would have provided a diverse array of resources, including tubers, reeds, and grasses that could have been collected for use as food and medicinal items, and for the production of mats and baskets. Feathers and hides from birds and mammals living in the region could have

Table 7.1. Summary of Cordage and Fabric Attributes Found on Point Peninsula Vessels.

Site	# Vessel Lots	Temper Size, Type	Cordage Attributes						Fabric Attributes			
			% Single-Ply	% Double -Ply	% S-spin Direction	% Z-spin Direction	% Final Z Twist	% Final S twist	% Open Twining	% Closed Twining	% Z-twist Interlinked	% S-twist Interlinked
Street	18	2-3 mm, grit	20%	80%	76%	24%	84%	16%	75%	25%	66%	33%
Fortin II	19	2-3 mm, quartz and grit	33%	67%	37%	33%	63%	37%	100%	---	50%	50%
White	19	0-1 mm, grit	---	100%	70%	30%	70%	30%	60%	40%	55.5%	44.4%
Ouleout Creek	5	2-3 mm, quartz and grit	32%	68%	81%	19%	50%	50%	100%	---	---	100%

Table 7.2. Summary of Cordage and Fabric Attributes Found on Owasco Vessels.

Site	# Vessel Lots	Temper Size, Type	Cordage Attributes						Fabric Attributes			
			% Single-Ply	% Double-Ply	% S-spin Direction	% Z-spin Direction	% Final Z Twist	% Final S Twist	% Open Twining	% Closed Twining	% Z-twist Interlinked	% S-twist Interlinked
Boland	16	1-2 mm, grit	22%	78%	79%	21%	65%	35%	100%	---	100%	---
Chenango Point	19	0-1 mm, grit	25%	75%	60%	40%	66%	34%	83%	17%	75%	25%
Wessels	15	1-2 mm, grit	26%	74%	68%	32%	>50%	<50%	100%	---	67%	33%
Egli	9	0-1 mm, quartz	17%	83%	---	---	66%	33%	90%	10%	25%	75%
Jamba	19	0-1 mm, grit	33%	66%	65%	35%	78%	22%	60%	40%	73%	27%
Cider Mill	16	0-1 mm, grit	29%	71%	50%	50%	59%	41%	68%	32%	6%	94%
Hilltop	16	0-1 mm, grit	30%	70%	18%	82%	---	---	100%	---	---	100%
River-Street	16	0-1 mm, grit	52%	48%	57%	43%	50%	50%	65%	35%	20%	80%
Apalachian Creek	22	0-1 mm, grit	10%	90%	90%	10%	77%	23%	33%	66%	80%	20%
Orchard Knoll	18	0-1 mm, grit	37%	63%	---	---	75%	25%	83%	17%	60%	40%
Roundtop	42	0-1 mm, grit	20%	80%	80%	20%	63%	37%	87%	13%	22%	78%
Castle Creek	10	0-1 mm, grit	27%	73%	67%	33%	69%	31%	40%	60%	80%	20%

also been collected and used in the production of pliable fabrics (Whitney and Gibson 1987).

Downstream, a second cluster of sites can be found near the present-day city of Binghamton near the confluence of the Susquehanna and Chenango rivers (Figure 7.1). Although the area does not contain the diverse microenvironment found at the northern end of the valley, secondary streams and other lowland areas would have been important gathering areas for raw materials used to manufacture fabrics. The location of large village sites along the floodplain of the Susquehanna River also could have provided native populations with resources that were not available at the northern end of the valley.

One thousand sixty-three ceramic sherds representing 273 vessels were examined (Tables 7.1 and 7.2). Assessment of vessels was carried out through the examination of both body and rim sherds with 212 vessels (77.6%) assigned to the Owasco ceramic tradition and 61 vessels (22.3%) assigned to the Point Peninsula ceramic tradition. Tables 7.1 and 7.2 summarize the total number of vessels analyzed from each site.

Figure 7.2. Plasticine cast (left) and cord-marked sherd (right) from Owasco Herringbone type vessel from the Apalachian Creek site. Attributes of the cordage (including the twist direction, diameters of the individual cords, and number of twists per centimeter) used to produce the herringbone motif are visible in the cast.

ANALYTICAL TECHNIQUES

Casts of impressed cordage/fabrics were made from 205 (75% of the sample) sherds using Sculpey III Modeling Compound (Figure 7.2). Casts were not made from the remaining vessel lots due to artifact fragility, museum restrictions on the use of casting materials, and the likelihood that residues from casting materials would alter the trace element composition of the sherd (see below, "Problems Encountered"). For these vessels, cordage information was recorded directly from the surface of the sherd. Measurements taken directly from the sherd were noted as such and treated separately from information collected from casts, since the impressions on the sherds would automatically be the opposite of that recorded from casts.

Cordage attributes recorded for each vessel include cord diameter, number of cords per centimeter, cordage final twist direction, angle of twist, number of plies, type of object from which the impression was made (e.g., netting, basket, cord-wrapped paddle, etc.), fabric structure (e.g., close twining, open twining, etc.), portion of the vessel decorated, and fabric size. Fabric structure was described following the categories described in Adovasio (1977), Emery (1966), and Hurley (1979). Vessel attributes that were recorded included rim and lip shape, wall thickness, manufacturing technique, surface finish, and temper size and type. Recording of these attributes followed procedures outlined in Prezzano (1986), Rieth (1997), and Whallon (1968). Attribute data from all of these sources were entered into a relational database, and statistical analysis of the data was carried out using the SPSS/PC+ (Version 4.0) computer program (Norusis 1990).

One hundred ninety-eight vessels were subjected to x-ray fluorescence analysis (XRF) at the Department of Physics Accelerator Laboratory at The University at Albany, SUNY, to determine the trace element composition of the containers. The trace element profiles of the vessels were compared with clay samples from the Susquehanna and adjacent valleys to determine the location of manufacture of these artifacts. A more extensive discussion of the collection of clay samples and the analytical technique used to record trace element data from ceramic sherds is provided in Rieth (2002b).

PROBLEMS ENCOUNTERED

Assessment of the chemical composition of ceramic sherds presented a unique challenge during this project, because the casting material used to record cordage attributes left residues on the exterior surface of the sherds. Since trace element composition was measured from the exterior surface, residues left by the casting materials had the potential to alter the measured chemical composition of a sherd by inflating concentrations of some elements and deflating concentrations of others. In one test case, the residues left by the casting material resulted in a compositional profile that was completely unrelated to the composition of the sherd (Figure 7.3).

For the purpose of this project, the solution to this problem was trifold. First, trace element composition was recorded from the sherd before a cast was made. This allowed sherds to be analyzed without the threat of other materials being introduced into the analysis process. Second, the number of sherds from which casts were made was reduced from that initially proposed, reducing the number of affected sherds. In instances where individual vessels were represented by single sherds, no casts were made. Instead, cordage attributes were recorded from the surface of the sherd as previously described. Third, a comprehensive list of all of the cast sherds was prepared and left with each collection so that future researchers would be aware of potential alterations to the sherd after excavation.

While I am not proposing that archaeologists abandon the use of casts in the study of cordage and fabrics impressed on pottery, I would encourage other researchers to be conscious of the effects that particular methods have on the collection of other types of data and what impact these methods could have on future ceramic studies. Potential detrimental effects include contamination of a sherd's chemical composition and, with some non-solid casting materials, physical penetration of the sherd surface. When the collection of one type of data has the potential to hinder collection of some other type of data, it may be necessary to choose between them.

RESULTS

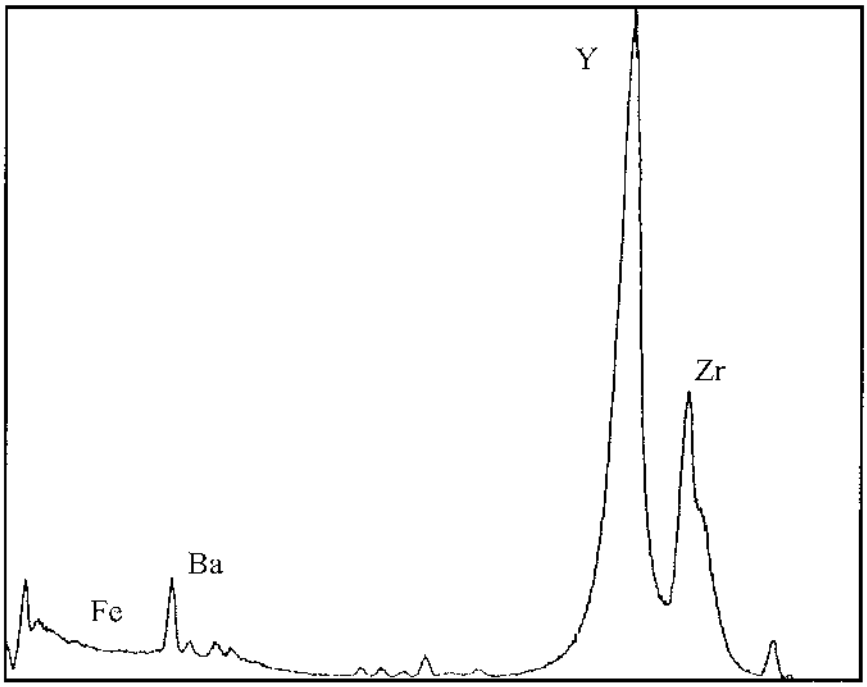
The results of this project generated important information about the cord and fabric impressions found on early Late Prehistoric vessels in the Upper Susquehanna Valley of New York. The following section summarizes the results of this work and presents information regarding the fabrics identified on both Point Peninsula and Owasco vessels.

POINT PENINSULA CERAMICS

Point Peninsula vessels are largely cord-marked and fabric impressed containers with outflaring rims and a round or "beveled" lip shape with a coarse (2-3 mm) grit and crushed crystalline (e.g. quartz, quartzite) temper (Table 7.1). Thirty-four percent of the containers exhibit evidence of "coil breaks," suggesting that these containers were constructed by coiling (Rice 1987). Although the majority of the containers exhibit cord-marked designs, additional types of decoration, including dentate stamping, were identified on four vessels from the White and Ouleout Creek assemblages, suggesting that potters may have used multiple techniques.

More than half of the vessels contain one or more cord-marked designs around the neck and exterior rim of the vessel. In a few instances, the interior rim of the container also contained oblique lines that were probably applied using a cord-wrapped paddle or stick. The cords used in the decoration of these containers are fairly homogeneous, with double-ply cords appearing twice as often as single-ply cords (Table 7.1). As seen in Table 7.1, each of the assemblages contains a preponderance of cords that were largely S-spun with a final Z twist (see Definitions). The average cord diameter was 1.94 mm. Most of these cords contained a moderate angle of twist, with the number of twists per centimeter ranging from three to eight.

The majority of the designs appear to have been impressed using a cord-wrapped stick or paddle (Figure 7.2). A vessel from the White site contains evidence that cords were wrapped around a much larger, unidentified object (per-



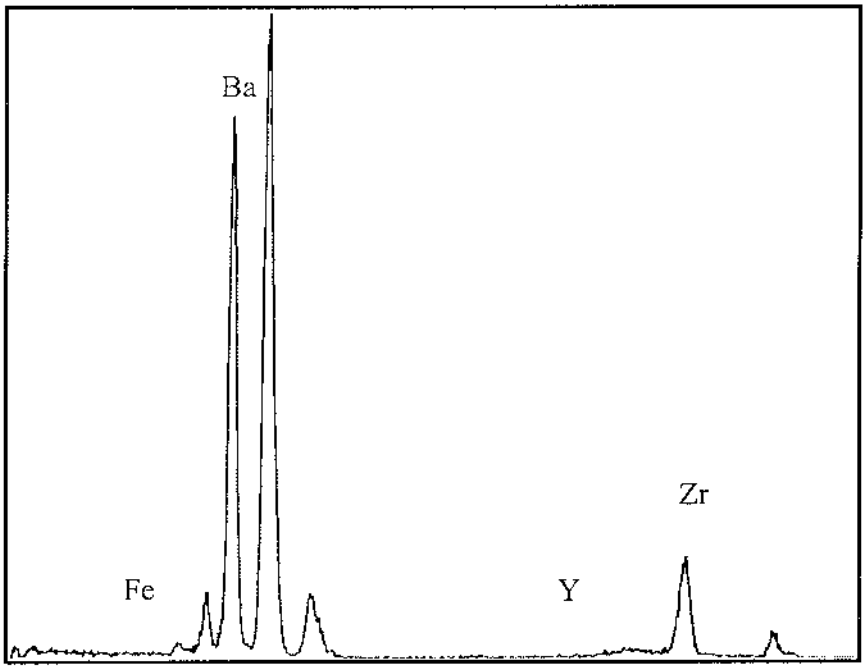


Figure 7.3. Differences in trace element profiles of two sherds from the same vessel. The profile from the uncasted sherd is shown at the top. It displays concentrations (as represented by peak counts of elements) similar to those found in other non-casted sherds. The profile from the casted sherd is shown on the bottom. It displays inflated concentrations of some elements and decreased concentrations of other elements. The elements represented in both profiles include yttrium (Y), iron (Fe), zirconium (Zr), and barium (Ba).

haps a bunch of sticks). Although Theodore Whitney (personal communication 1999) suggests that a series of cord-wrapped cords also may have been used to decorate some vessels at the White site, evidence of such an object has not been identified in the archaeological record.

Fabric impressions on the exterior body and base of Point Peninsula pots include both twined and interlinked structures (see Interlinking and Twining in Definitions). More than 75 percent of the fabrics identified on the bodies of these containers are simple-twined fabrics. As summarized in Table 7.1, over 60 percent of the pots impressed with twined fabrics exhibit a spaced (open) twining in which twining rows do not touch each other (Scholtz 1975:185). Between 25 and 40 percent of the pots are impressed with compact (close) twining, in which the twining elements appear to touch each other, concealing the warp elements.

Trace element analysis indicates that one-quarter of the containers exhibit compositional profiles that do not match known clay deposits within the Susquehanna Valley, suggesting that these vessels may have been manufactured within groups residing elsewhere. Many of these "foreign" containers (13%) are impressed with cordage that is single-ply and has a final S twist, as opposed to the double-ply cords with final Z twist that predominate the assemblages at these sites. The presence of such containers at the Street, Fortin II, and Ouleout Creek site may indicate interaction with groups living outside the Upper Susquehanna Valley in eastern and central New York.

OWASCO CERAMICS

Initially, the Owasco vessels examined were considered to be different from the Point Peninsula containers in terms of both shape and overall construction. Unlike Point Peninsula vessels, a rounded base, outflaring rim, and flat lip shape characterize the Owasco containers analyzed during this project. These pots generally have thinner walls than Point Peninsula vessels, and utilize a fine (0-1 mm) or medium (1-2 mm) grit temper (Table 7.2). Over 47 percent of the Owasco containers examined exhibit evidence of "coil breaks," suggesting that these containers, like the Point Peninsula vessels, also were manufactured by coiling (Rice 1987).

When the cordage attributes of Point Peninsula and Owasco containers are compared, it appears that the makers of these containers utilized many of the same structural forms. Over 90 percent of the Owasco vessels are decorated with cord-marked and/or fabric-impressed designs (Figures 7.4, 7.5, and 7.6). Cord-marked designs are generally found on the exterior rim and neck of the container. A significant proportion (54%) of the vessels also exhibit cord-marked vertical or oblique lines along the interior rim and/or lip of the container. In 18 percent of the vessels, cord-marking appears on top of a cord- or fabric-impressed surface.

The majority of the cords that were used in the construction of these designs were double-ply and were impressed using a cord-wrapped paddle or stick (Figure 7.6). However, an exception was observed at the River-Street site, where roughly equal distributions of single-ply and double-ply cords were found. The site also contained roughly equal numbers of S- and Z-spun cords and cords exhibiting a final S and Z twist (Table 7.2). As discussed below, the proportions of these attributes may be related to the geographic position of this site along the western boundary of the project area.

In general, the diameters of the cords on

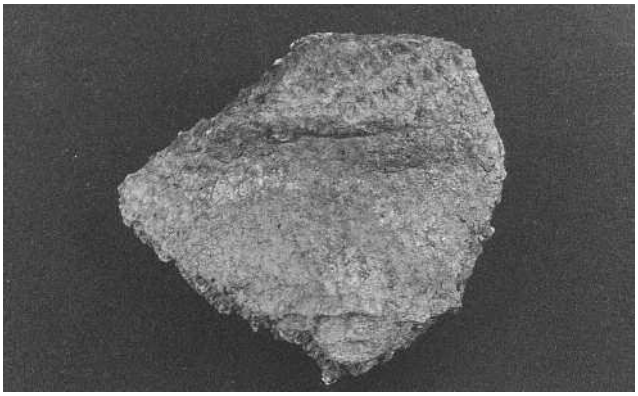


Figure 7.4. Cord-marked rim sherd from the Fortin II site. The cordmarked motifs around the rim of this vessel were impressed with a cord-wrapped stick or paddle. (Photograph reproduced with permission of the New York State Museum.)

Figure 7.5. Owasco Corded Horizontal vessel from Feature 52 at the Street site. (Photograph reproduced with permission of the New York State Museum.)

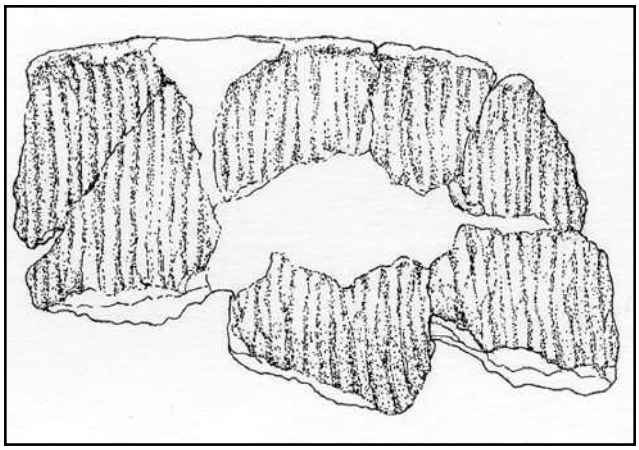


Figure 7.6. Drawing of Levanna Cord-on-Cord vessel from the Apalachian Creek site.

Owasco vessels were slightly smaller than recorded for Point Peninsula containers, with the average being 1.74 mm. Although cords with a moderate angle of twist impressed the largest number of vessels (43%), tightly twisted cords appear on approximately one-quarter (24%) of the vessels. The number of twists per centimeter is slightly less than for Point Peninsula containers and ranges between 2 and 7.

Like the Point Peninsula vessels, the majority of the Owasco containers exhibit impressions of twined or interlinked fabrics along the body and base of the container. Twining, which appeared on approximately 85 percent of the containers, is the most common fabric structure found on the vessels (Table 7.2). Although open twining was most common, close twining was observed on some pots. Weft-faced (close-twined) fabrics are most numerous on vessels from the Apalachian Creek and Castle Creek sites. Most of the cords that were used in the construction of the interlinked fabrics contain a final Z twist.

The trace element profiles of the pots suggest that most of these containers were locally manufactured, with the largest number of foreign manufactured pots appearing at the Cider Mill and River-Street sites. The sites are located near the eastern and western boundaries of the Susquehanna Valley along the "fringe of the Owasco territory" (Figure 7.1). Given the short geographic distance to other neighboring river valleys, it seems possible that the occupants of these sites may have maintained important relationships with neighboring groups residing in north-central Pennsylvania and eastern and central New York. This is suggested by the large number of foreign pots that were recovered from these sites and impressions of fabrics with non-local attributes that were identified on these containers.

In summary, the results of this project suggest that the early Late Prehistoric occupants of the Susquehanna River Valley utilized a diverse array of cordage and fabrics to decorate ceramic vessels. On both Point Peninsula and Owasco vessels, double-ply cords and cords with a final Z twist predominate over single-ply cords with a final S twist. Analysis of non-cordage attributes suggests that both ceramic assemblages were predominantly manufactured by the coiling technique. The inclusions in most sherds from both assemblages consist of fine- and coarse-textured grit. The trace element profiles of these containers suggest that most vessels were manufactured from local clays.

DISCUSSION

The preliminary results of this project suggest that a variety of fabrics were used by the early Late Prehistoric occupants of the Susquehanna Valley. Despite this diversity of fabric techniques, many of the same attributes were favored by both Point Peninsula and Owasco groups. These included final-Z-twist direction, preference for double-ply cords, use of cord-marking around the rim of the container, and use of fabric-impressed designs around the bodies of containers. All appear to have been continuously used in this region from the late Middle Woodland to the early Late Woodland period. While the results of this study cannot be used to conclusively refute assertions that groups migrated into the Susquehanna Valley during this period, they provide no evidence to support the belief that there was a substantial shift in the manufacturing techniques, type and size of inclusions, and/or impressed cordage attributes of Owasco and Point Peninsula containers.

In general, the cordage attributes identified for Point Peninsula and for Owasco groups show little variation over distance within the larger Susquehanna Valley (Tables 7.1 and 7.2). Overall, there are no major differences between the types of materials used by groups residing at the northern and southern ends of the valley. Likewise, there are also few differences between the ceramic assemblages recovered from sites located in lowland and upland settings. Although the ceramics from small camps at the northern end of the Susquehanna Valley appear to have contained greater quantities of quartz and quartzite than ceramics elsewhere, these differences may be related to the available resources in a particular area and not differences in vessel use or the cultural affiliation of the manufacturers.

The results of this project also suggest that the Middle Woodland and Late Woodland occupants of New York were not isolated but probably interacted with other local and regional groups. Several of the sites located along the perimeter of the Susquehanna Valley produced vessels impressed with fabrics that were different from those found at other sites in the region. The presence of pottery with these attributes may suggest either that occupants of these sites were interacting with neighboring groups on a regular basis or that "foreigners" were being incorporated into villages as a result of warfare, marriage, or other unidentified processes. While it is not currently known under what circumstances or with whom interaction took place, future studies of cord- and fabric-impressed sherds in neighboring river valleys may help archaeologists understand the prehistoric behaviors of these populations.

CONCLUSION

Cord- and fabric-impressed ceramic sherds recovered from early Late Prehistoric sites in the Northeast contain important information. Comparison of the ceramic assemblages from 16 sites in the Susquehanna Valley of New York suggests that early Late Prehistoric potters continued to use many of the same manufacturing techniques throughout this period. The presence of similar manufacturing techniques was surprising and is in opposition to current beliefs about the replacement of Point Peninsula containers with Owasco containers during this period.

Trace element analysis was used to assess the location of manufacture of these early Late Prehistoric vessels. Comparison of the trace element profiles of the ceramics with known clay deposits from the Susquehanna Valley suggests that most of the containers recovered from these sites were locally manufactured and do not represent artifacts that were reciprocally exchanged by prehistoric groups. Vessels that were identified through trace element analysis as being non-locally manufactured generally exhibit different cordage attributes from other vessels. These may represent items procured through interaction with neighboring groups.

ACKNOWLEDGMENTS

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CHAPTER 8

IN THE LAND OF "MAWOOSHEN": NATIVE AMERICAN PERISHABLES FROM TWO CONTACT PERIOD SITES ON THE CENTRAL MAINE COAST

James B. Petersen and Malinda S. Blustain

ABSTRACT

Analysis of samples of Native American textiles and other organic perishables excavated by Warren K. Moorehead from several sites in coastal Maine was undertaken at the Robert S. Peabody Museum of Archaeology in preparation for repatriation of the remains to culturally affiliated tribes. Fragmentary specimens preserved due to association with copper/brass artifacts at the Sandy Point and Walker's Pond sites reveal something of the diversity of indigenous clothing, ornaments, and utilitarian artifacts during the late 16th and early 17th centuries at the time of initial European contact on the Maine coast. Based on stylistic and technological evidence, both sites date to approximately A.D. 1580–1600. This chapter summarizes these details and places these rare finds within a broader northeastern North American framework.

INTRODUCTION

Textiles and other organic artifacts of any age are rarely preserved archaeologically in northeastern North America. Thus, we have very little information about early Native American (First Nations) material culture made from perishable organic materials, even though their use was undoubtedly important. However, where unusual preservation conditions pertain, the intricacies and sophistication of such artifacts reveal important information about the Native American past.

Based on reconstructions of perishables preserved through proximity to copper and/or brass at the Contact period sites of Sandy Point and Walker's Pond, the present research provides a view into the early history of the central Maine coast. Situated near Penobscot Bay (Figure 8.1), both preserved are examples of "copper kettle burials" of a type that is more common and better known in contemporaneous sites of the Maritime Provinces of Canada and elsewhere in the Northeast. These historic burials typically include whole or fragmentary reworked copper/brass[1] kettles that sometimes were interred with numerous other mortuary offerings (Bourque 2001:Fig. 5.7; Bradley 1987:Fig. 13; Gibson 1980; Hadlock 1947; Kent 1984:203-210; Kenyon 1982; Kidd 1953; Mason 1986:Pl. 13.16; Quimby 1966; Whitehead 1991, 1993:23).

In addition to other artifacts of Native American and European manufacture, at Sandy Point and Walker's Pond several types of perishable goods were associated with at least four human burials dated to ca. A.D. 1580–1600. The burial assemblages included fabrics, cordage, and pre-

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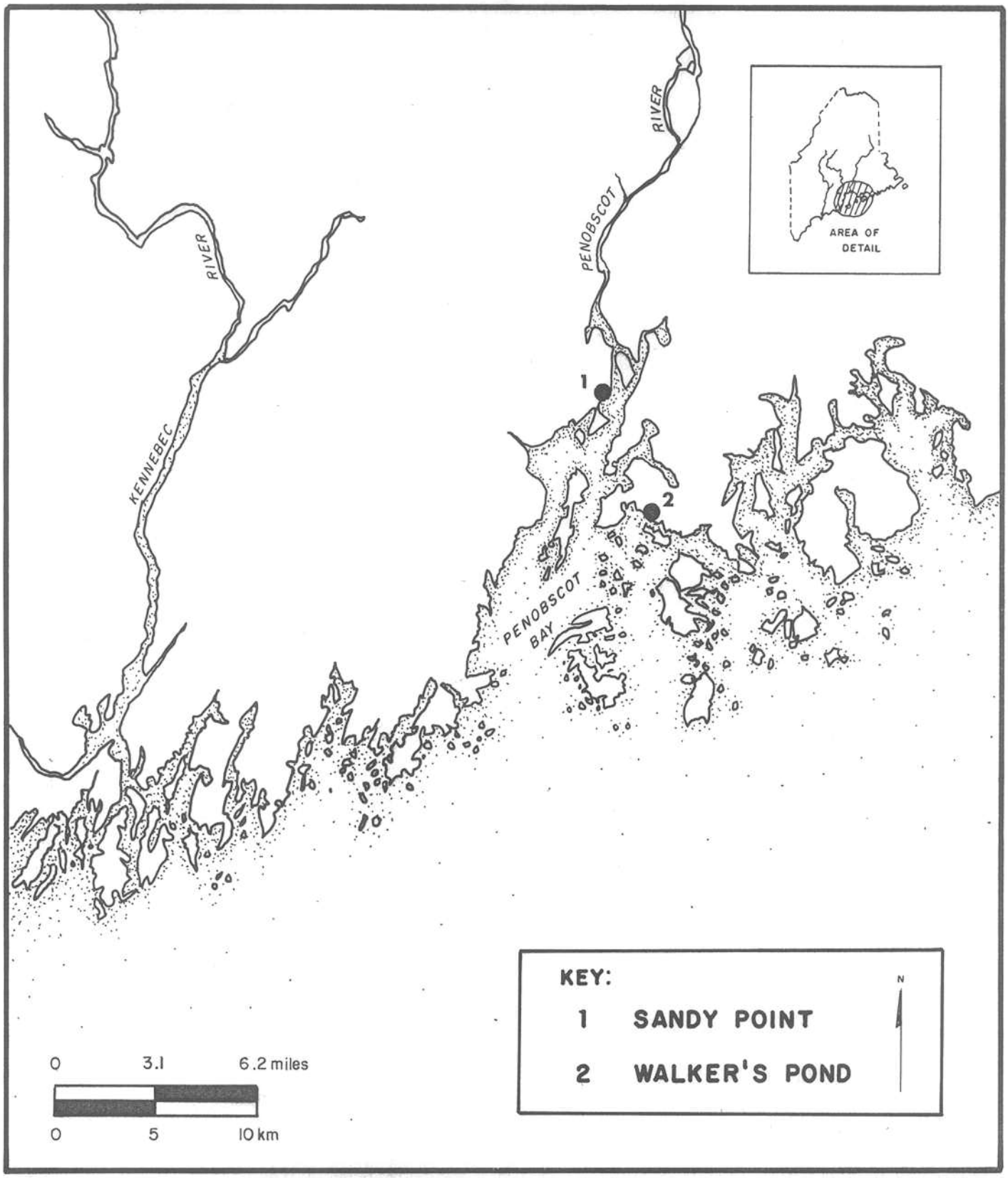

Figure 8.1. Map of the central Maine coast, showing the locations of the Sandy Point and Walker's Pond sites.

sumed hide/leather clothing;[2] ornaments of copper/brass, marine shell, and bark; copper/brass and iron fragments, an iron axe, lithic tools, and glass beads. The recovery and analysis of the human remains are reported elsewhere (Bradley et al. 1994; Erickson 1996).

The Sandy Point site (41-10 ME) is located on a point of the same name in the town of Stockton Springs, Waldo County, Maine. Sandy Point is a tidal setting on the western side of the Penobscot River near Penobscot Bay proper. The Walker's Pond (or Grindel) site (42-20 ME) was discovered near the western shore of a pond of the same name. It was initially reported to be in the "Sargentville" district of the town of Sedgwick, but the actual site location is within Brooksville, Hancock County, Maine. Walker's Pond is relatively close to Eggemoggin Reach, which connects East Penobscot Bay and Blue Hill Bay. Sandy Point and Walker's Pond lie about 20 km apart "as the crow flies." Both sites were excavated during the early 20th century by field parties directed by Warren K. Moorehead, under the auspices of the Robert S. Peabody Museum of Archaeology at Phillips Academy, Andover, Massachusetts.

Moorehead excavated a single burial at the Walker's Pond site on one day in July 1912. In August 1914, he exhumed approximately 10 graves with "eleven skeletons" during the course of "about a week" at the Sandy Point site. Much of what we know about these sites is based on written documentation in the form of sketchy field notes and portions of a publication by Moorehead (1922:145, 147, 219-220). More complete details were never presented for either site. The surviving field documentation, human remains, and associated mortuary goods resided in the collections of the Robert S. Peabody Museum of Archaeology for more than eighty years.

In the early to mid-1990s the then Director of the Museum, James W. Bradley, invited Petersen to study the perishable specimens from these and other sites. Given the likelihood that these collections would be repatriated under the conditions of the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990, the need for analysis became increasingly pressing over time. Petersen, working as a volunteer Research Associate, undertook research on perishables with the regular help and advice of Blustain (then Curator) during multiple visits to the Museum that spanned a period from 1994 to 1996.

Given that the assemblage would otherwise receive little attention before repatriation, the research expanded to include all aspects of the European and Native American mortuary goods, once their full importance was realized. The collections have subsequently been repatriated to a consortium of culturally affiliated tribes in Maine and New Brunswick, Canada.

As the entire assemblage is to be described elsewhere (Petersen et al. 2004), this analysis concentrates on selected aspects of the perishables inventory, specifically fiber specimens or "textiles " and other bark and hide constructions. All records, color slides, and original black-and-white negatives are curated at the Robert S. Peabody Museum of Archaeology.

ETHNOGRAPHIC/ETHNOHISTORIC CONTEXT

The ethnographic context of the Sandy Point and Walker's Pond sites is important since both sites are attributable to the early Contact period and were very likely related to one or another historically recorded Native group in coastal Maine. Although it is debatable just when contact between Native Americans and Europeans began in the Gulf of Maine and the central Maine coast in particular, Bruce Bourque has emphasized that substantial and regular contact did not begin locally until ca. A.D. 1600 (Bourque 1989, 2001). Giovanni Verrazano was the first documented European visitor to Penobscot Bay, in 1524. Unrecorded European travelers might have preceded him. Later others came, including Samuel Champlain, who may have passed directly by both sites in 1604 while sailing through Eggemoggin Reach and up the lower Penobscot River (Bourque 2001:Fig. 5-1; Quinn 1994:52, Fig. 17). Burials at the two sites were interred sometime between 1580 and 1600, perhaps before Champlain, but at about the time that regular European visitation to the region began.

At the time of European arrival, culturally related Native tribes in coastal and non-coastal

Maine and nearby areas were collectively the "Wabanakis," or "People of the Dawn," as known today. These included groups presently known as the Abenaki, Maliseet-Passamaquoddy, Micmac (Mi'kmaq), and Penobscot, although not all of these names appear in the earliest accounts. As recorded by Champlain in the early 1600s, the western and more southerly groups were horticulturalists, while those to the east of the Kennebec River in central Maine and farther eastward, including Penobscot Bay and the Sandy Point and Walker's Pond sites, were hunter-gatherers. This has been borne out by recent archaeological work in the region (Petersen and Cowie 2002).

Champlain and others recorded farming among the Abenaki and a poorly known horticultural people called the "Almouchiquois" to the west and south of the Kennebec River. The hunter-gatherer "Etchemin" occupied the central Maine region. In time, they became the Maliseets and closely related Passamaquoddys, and apparently also were ancestral to the Penobscots, as described by Champlain. Farther east in the Maritime Provinces of Canada lived the "Souriquois," or ancestral Micmacs (Mi'kmaq). By the mid-1500s, if not earlier, the Micmacs had direct and sustained contact with Europeans in the Gulf of St. Lawrence, serving as Native "middlemen" in the trade between Europeans and other Native groups in the far Northeast (Bourque and Whitehead 1994:132-135; Prins 1994). Although copper kettle burials are more typical of Micmac territory, Sandy Point and Walker's Pond were situated within the area controlled by the Etchemin and may be connected with the ancestral Maliseet, Passamaquoddy, and/or Penobscot. As recorded ca. 1605 and 1609, this region was known as "Mawooshen," reportedly the homeland of a broad Native confederacy that covered a large expanse of the Maine coast and that might have included 10,000 or more people. Mawooshen was "fortie leagues [96-184 miles] in bredth, and fiftie [120-130 miles] in length [comprising] nine rivers," apparently reaching from Schoodic Point (near Mt. Desert Island) to Cape Neddick and the Union River to the Saco River, but also perhaps extending to Lac Megantic in Quebec and southwestward to Massachusetts (Bourque 2001:115, 119; Prins 1994:110-111; Quinn 1981:60-63, 1994:50).

Inevitably, with the beginning of substantial European contact and intertribal trade came severe epidemics of European disease that after ca. 1580–1600 decimated Native groups along the Atlantic coast in Maine and elsewhere across the region. Epidemics occurring in 1610, 1616–1619 and 1633–1634 were especially devastating, and the indigenous population never completely recovered (Bourque 2001:118-120; Bourque and Whitehead 1994:143-145; Whitehead 1991:265-266). In fact, early instances of such illnesses may have contributed to or caused the deaths of the individuals interred at Sandy Point and Walker's Pond.

ARCHAEOLOGICAL CONTEXTS

Relatively little documentation is available for reconstructing the archaeological contexts of these two unusual and highly significant archaeological sites. Despite this, examination of the physical evidence enables a fine-grained, if fragmentary, window into a time when Native Americans in coastal Maine were encountering the first European visitors to their shores. Native material culture was soon in flux. The combination of traditional and newly introduced technologies present together in the burials at Sandy Point and Walker's Pond, including European trade goods such as metal kettle pieces, an iron axe, and glass beads and indigenous stone, shell, fiber, and leather or hide artifacts, exemplify the interaction and change so characteristic of the Contact period. The European artifacts suggest a date of ca. 1580–1600 for Sandy Point, and Walker's Pond is assessed as roughly contemporaneous (James Bradley, personal communication 1994, 2002; Petersen et al. 2004).

SANDY POINT

Moorehead (1922:219) presents us with very tantalizing information about his investigations at the Sandy Point site (41-10 ME). His brief report (with emphasis added) states:

> There is an Indian site of some size on the west bank of the [Penobscot] river at a place known as Sandy Point. In August, 1914, the

survey went down there from Bucksport and spent about a week in excavating along a sloping sand ridge. Eleven skeletons were discovered within a space ten meters in extent, but all were very much broken and decayed. They lay not more than thirty-five or forty centimeters below the surface. These were interesting burials in that they *seemed to mark contact between Indians of the stone age and Europeans*. There were great quantities of ordinary shell *wampum* [discoidal and less common columella beads] strewn over four of the bodies. The exact number of pieces has not been determined, but *there were originally between 20,000 and 25,000 of these beads*. From the position of some of them we conclude that they were strung on thongs and worn as necklaces and that others were used in fringing deerskin jackets or were woven on belts. A few large shell beads were found with the smallest skeleton, that of a child. With one skeleton were two rude flint knives and a large, rough, iron axe weighing at least seven pounds. It seems too heavy to have seen service as a tomahawk and was probably a camp axe. Large iron kettles [*sic*; they were certainly iron-fitted copper/brass kettles] were placed over the heads of two of the burials and these have decayed except the handles and portions of the thicker upper parts. There were many cylinders of brass [tubular beads] but no native copper. Two of the bodies had been wrapped in beaver and moose hides and there were traces of bear skin. Where the hair came in contact with the brass enough of it was preserved to permit identification. It is to be regretted that there are no photographs of these interesting burials. Our field camera was in Bucksport being repaired at the time.

This is the entirety of Moorehead's published report about his discoveries. Many artifacts were not mentioned, and there is little information about the human remains. In fact, this is effectively all that has been ever published about the Sandy Point site, although Charles C. Willoughby (1935:234, 236, Fig. 126i) later presented additional information that apparently was based on his own examination of the collection:

> A . . . sheet copper band, twelve and one half inches in length, . . . with serrated edges, was taken from the grave of a child by Dr. Moorehead at Sandy [P]oint . . . This grave [Burial 205] contained also twenty-seven tubular beads of sheet copper and an iron axe. The beads were lying side by side on a piece of well dressed buckskin which had been colored red and which was perfectly preserved, owing to contact with the copper. There were also a few white and blue discoidal beads of shell strung alternately on thong or sinew.

Willoughby (1935:276) also reported:

> In the archaeological museum at Andover are upwards of five thousand white discoidal beads approximately one half of an inch in diameter, and a very few massive tubular beads, all of which came from a grave [Burial 199] in the small cemetery at Sandy Point . . . Similar small beads were found with three other skeletons.

Michael Gibbons analyzed the human remains from the Sandy Point site in the early 1990s. His preliminary analysis reports 12 individuals from the 10 "burials" excavated by Moorehead (Bradley et al. 1994). More detailed analysis by Harley Erickson later identified a mimimum of 17 mostly fragmentary individuals in the 10 graves, representing 5 adults and 12 children. The oldest child was 10 to 11 years old. Considered with other forensic evidence, the high mortality rate of juveniles (representing over 70% of all individuals) suggested to Erickson that this was "a population that was stressed and in poor overall health" (1996:32).

WALKER'S POND

Possibly because there was only a single burial, more precise information about the archaeological context is available for the Walker's Pond site (42-20 ME). Moorehead (1922:146-147) reported:

> In 1912 some members of the expedition went to Sargentville in the town of Sedgewick [*sic*] and explored the shores of Walker's pond. . . . On July 9th pits were sunk on a knoll twenty meters from the lake

on the land of Mr. Grindel. The place is called "the Indian burying ground." On the very top of this knoll, in dry, stony soil, were found the remains of a single skeleton, accompanied by copper and shell beads. Only such bones were left as were preserved by the copper. Of the skull, only the lower jaw and teeth remained. At the neck were found two rolled copper cylinders about eight centimeters long, still strung together on a piece of thong. The remains of a third cylinder were also found. Resting upon what had been the chest of the body was a rectangular copper plate, about 22 x 5 centimeters, containing three small, irregular perforations along the middle line. Beneath this was a well-preserved sheet of hide, of leathery texture. Upon this being carefully removed, a layer of white and black shell beads, still in order was disclosed. They consisted of one long string and many shorter ones at right angles to this. They all rested on another fold of hide. About them occurred shreds and lumps of bark or matting. Five or six of the cervical vertebrae, all stained green, were preserved. Some of the smaller ribs were likewise preserved. Apparently some copper object had rested upon the body, as several splinters of copper were wedged among the vertebrae. Parts of the scapella [*sic*] and humerus remained. The white beads were comparatively thick and probably of clam shell (*[V]enus mercenaria*?) while the black or more properly purple beads were very thin and were sometimes strung double. A number of loose beads were found, and all the earth coming from the grave was sifted through the fingers before being thrown aside. In working out the grave beyond where the objects occurred it was sometimes possible to trace discolorations in the clayey soil, marking the decay of the larger bones or of the bark or matting wrapping. No stone objects were found with this burial, nor any trace whatever of other metal than copper. The body was about thirty-three centimeters below the surface, and as nearly as could be determined lay north and south at full length and with the head to the south, and the bones were those of a young person. Subsequent pitting on this knoll and adjacent areas revealed nothing further. An analysis of the copper proves it to be European rather than native American.

Michael Gibbons analyzed the human remains from the Walker's Pond burial during the early 1990s. He reported a single partial skeleton of a male child about 7–8 years old with no observed pathologies or anomalies. The cause of death is unknown (Bradley et al. 1994). Based on Petersen's observation (not confirmed by an osteologist), a second child, apparently an infant, may also have been in this burial. Combining the data from Walker's Pond and Sandy Point, a total of 13–14 children are represented at the two sites, or 72–73 percent of the total number of individuals.

Isotope values for the primary Walker's Pond burial and four of the Sandy Point burials were calculated as part of a broader study of human bone isotopes from Maine conducted by Bruce Bourque and Harold Krueger. The results suggest that the local Native diet at the onset of the Contact period was midway between one high in marine protein and one high in terrestrial protein. Although the isotope values differ notably from those of earlier, more unequivocal hunter-gatherers in the same area, it appears that diet along the central Maine coast at the beginning of European contact had little, if any, dependence upon maize (Bourque and Krueger 1994:200, 205). Perhaps the slight variance between the earlier and later values indicates a late prehistoric subsistence shift toward a diet partially based on horticulture (Petersen and Cowie 2002).

ANALYTICAL PROCEDURES

All fiber perishables from Sandy Point and Walker's Pond were studied using systematic methods, although some specimens were so unusual that new methods were developed to analyze them. This was particularly the case for some of the birch-bark, quill, and hide/leather artifacts, not all of which are presented in full detail here. This chapter concentrates on the plant-fiber constructions, including basketry,

flexible fabrics, and cordage, in addition to other perishables from the two sites.

Except where noted otherwise, Adovasio's (1977) nomenclature for textile structures is used in this discussion. The designations "textile" and "fabric" are applied interchangeably to describe a potentially diverse range of interlaced and twined artifacts (see Definitions, "Textile," "Fabric"), including blankets, bags, garments, shrouds, and straps, among many other forms. As items manually produced without a loom or frame, these objects also meet the criteria suggested by Adovasio for basketry.

"Twining" and "plaiting" are two subclasses of fabrics that were identified among the fiber perishables from Sandy Point and Walker's Pond. Twining typically employs two or more "active" elements that twist around, or engage, single or multiple "passive" elements (see Definitions, "Twining"). The arbitrary designation of active elements as "wefts" and inactive elements as "warps" is useful for fragmentary archaeological specimens in which the original relationship of warps and wefts cannot be ascertained (Adovasio 1977:15). In cases where the original structure is more complete and the orientation of the active and the passive elements (whether along the "transverse," or "weft" axis, or along the "longitudinal, or "warp," axis) can be seen, both "weft twining" and "warp twining" may be identified (Emery 1990:75-77, 196-201). However, because warp and weft orientation often cannot be determined, these attributes frequently go unrecorded.

Twining is used in a wide variety of finished forms. In the Northeast these are typically flexible (see, for instance, Chapter 11, this volume), but elsewhere twining also is used to make more rigid structures (e.g., Petersen and Wolford 2000:Figs. 6.4, 6.5). Plaiting involves the interaction of at least two sets of elements that alternately pass over and under one another without engagement (i.e., interlace). Since none of the elements remain stationary, all are classified as "active" (Adovasio 1977). Plaiting is used to produce flat mats or three-dimensional containers that can be pliable or rigid, depending on the materials used (Adovasio et al. 2001). When the elements are sufficiently fine and flexible, plaiting can be used to manufacture pliable fabrics. Two forms of twining and one form of plaiting were identified in this analysis.

Following Adovasio and Andrews (1980:54), cordage comprises "a class of elongate fiber constructions, the components of which are generally subsumed under the common terms 'string' and 'rope.'" Cordage can be assigned to structural types based on the number of plies, the direction of initial spin of individual elements ("S" or "Z"), and the direction of final twist (see Definitions). Standard classification criteria have been described elsewhere (e.g., Adovasio 1977; Adovasio et al. 2001; Emery 1980:10-13; Hurley 1979:6). Two structural types of cordage were identified in the overall sample: two-ply, S-spun, Z-twist cordage and braided cordage.

Selected attributes of the fabrics, including width or diameter of individual and composite elements, number of elements per centimeter, and other details, were measured and recorded. (For the sake of brevity, not all data are presented herein.) The fabrics were assigned to structural types based on the number and configuration of warp and weft elements. For cordage, measurements of overall diameter, twists per centimeter, and helix angle were made using procedures specified by Emery (1980:11). Additionally, each fragment was examined for splices, knots, repairs, and other characteristics. Finally, a preliminary assessment of the raw materials for all fabric and cordage specimens was made, and other unusual conditions such as staining were noted.

The relatively small size and highly fragmentary condition of the fiber perishables hampered the scope of the analysis; at times it was difficult to ascertain how many separate constructions were represented. Other factors confounded the analysis as well. The description published by Charles Willoughby illustrates the fact that Sandy Point yielded a large and interesting collection that has been repeatedly examined since its recovery. Museum staff and researchers investigating the collection during the 1990s to determine cultural affiliation and to document the finds noted obvious admixture of the burials. Some of this was attributed to confusion of nearby skeletons at the time of excava-

tion, or shortly thereafter. However, articulating pieces of broken artifacts were also found stored with materials from different graves. Rather than field error, we suspect that these represent unnumbered items that were mixed up during examination of the collection well after its recovery, and are specimens that were not returned to the correct provenience. The final obstacle to the analysis was that, due to the sensitive nature of the remains, examination could not be completely comprehensive. Perhaps more could have been learned by removing material that obscured detail in the organic masses especially, but at the request of affiliated tribes, care was taken not to disturb them further.

That the original inventory of fiber perishables made and used by the people who buried their dead at Sandy Point and Walker's Pond was large has been obvious for some time. A primary objective of the present analysis was to assess the overall number of structural types in the collection. The reported totals within types reflect conservative estimates of the actual quantity of original items, and in some cases more, or many more, discrete objects (cordage specimens, for example) may have been represented.

Only a partial representation of the complete range of material culture was likely to be interred with a given individual, and perishable materials were clearly degraded by the postdepositional environment. Consequently, while the available samples provide an intriguing glimpse into perishable technologies, they document a less than fully representative inventory of the original range of perishable items used in Maine coastal communities approximately 400 years ago.

CONTACT PERIOD PERISHABLES

Each surviving perishable specimen contributes toward cumulative understanding of prehistoric and early historic Native American material culture. The key to the preservation of perishables across the far Northeast appears to be the presence of metal, especially copper (although iron also will serve), in close proximity to organic remains. In the burial environment, certain metals degrade in the aqueous solution formed during the decay of the body, producing a biocide that selectively cancels deterioration of normally perishable substances. The materials from the Sandy Point and Walker's Pond sites were almost certainly preserved through the action of antibiotic properties of degrading European copper/brass trade goods interred with the burials (Figure 8.2).

The Sandy Point and Walker's Pond specimens are summarized below in three categories: fabrics, cordage, and "other composite constructions." The latter include quill (n=1), bark and hide/leather (n=1), and hide/leather (n=1) specimens. Full details of these perishables and a few more-equivocal ones, shell ornaments, stone tools and flakes, European trade goods, and human remains from the two sites, are not presented here. They are fully described in a more comprehensive upcoming report (Petersen et al. 2004). Although photographs, notes, and other documentation remain at the Robert S. Peabody Museum, the collection is no longer physically available for study.

FABRICS

Three twined fabrics were identified in the Sandy Point inventory. No fabric was recovered at Walker's Pond. Given such a small sample size, the specimens receive individual description followed by general comment. Each is identified by the Warren K. Moorehead burial number plus a second number added to distinguish individual components of burial lots.

Because it was not discovered during the first inventory of the combined collection, the "Burial 198" fabric, or Fabric No. 1 (Figures 8.3 and 8.4), was one of the greatest surprises encountered during the analysis. It was revealed only when a large organic block containing the remains of a 2- to 3-year-old child was inverted. The fabric was visible on a large portion of the back of the mass, suggesting that the burial had been lying on fabric that once had been much larger, but no longer was fully present. Fabric No. 1 is interpreted to have been part of a large cloth, mat, or bag.

Overlying Fabric No. 1 was a hide fragment with adhering animal hair. On top of this was a layer of shell beads (white quahog alternating

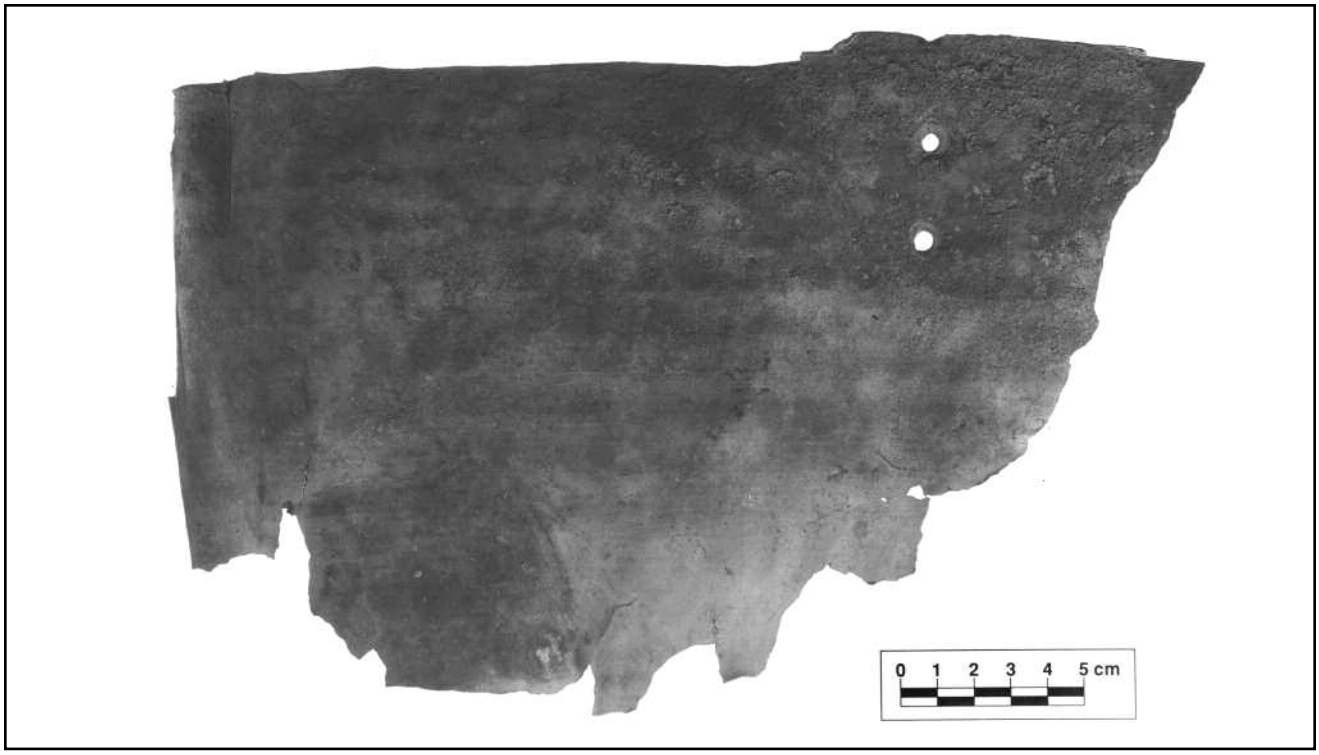

Figure 8.2. Fragment of a copper/brass kettle from Burial 207 at the Sandy Point site. Note holes for bail, score mark (toward the left), cut marks (top and left), hammer marks from manufacture, and burned-on food across surface.

with purple mussel?) and cordage, then the child's skeleton (perhaps clothed in a hide/leather garment?), followed by additional (or the same?) strand of shell and long copper/brass tubular beads. As preserved, another hide covered the mass, with the hair topmost. This configuration suggests that the child had been wrapped with strings of beads and, based on modern comparisons, blanketed above and below with moose hides. Finally, the wrapped body was placed on Fabric No. 1. The organic mass, including the fabric, exhibited copper/brass staining and was undoubtedly preserved because of the large copper/brass beads or a larger specimen of copper/brass, no longer present.

Fabric No. 1 measured about 188 mm across the weft rows and 62–140 mm or more across the warp rows. It was the largest fiber perishable preserved at either site, although one of the composite hide and bark constructions was close to it in size. The weft rows in Fabric No. 1 ran directly perpendicular, and the warps parallel, to the axis of the child's body. This suggests that the piece may have been constructed, in part, with weft twining (Figure 8.3).

Fabric No. 1 was a combination of open simple twining and simple plaiting (see Definitions). Every third weft row was twined (see Figure 8.4). Between twined rows were two plaited rows. All of the weft and warp elements were of comparable dimensions and none appeared to have been spun. The rows of twining were spaced 14.90–18.30 mm apart (mean spacing=16.50 mm). The plaited (interlaced) wefts were more closely spaced, 0.0–11.15 mm apart, with a mean value of 5.38 mm.

Individual weft elements were 1.45–3.45 mm in diameter, with a mean value of 2.22 mm. The combined set of two twining elements was 2.90–4.70 mm in diameter, with a mean of 3.54 mm. The plaiting elements parallel to the twining rows interlaced in a simple over-one, under-one (1/1) structure. Individual diameters were 1.85–3.20 mm, with a mean value of 2.54 mm. Thus, as preserved, this specimen incorporated

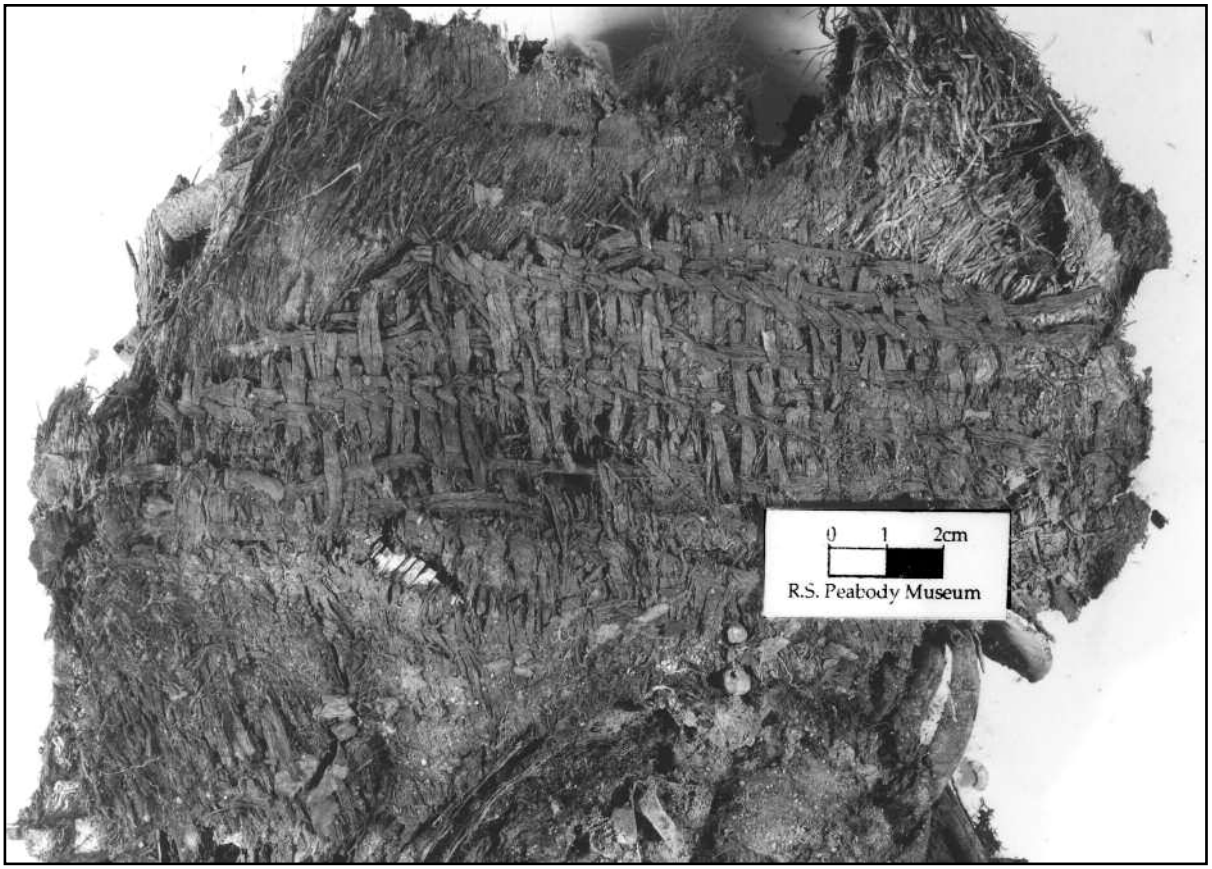

Figure 8.3. Overview of Fabric No. 1 from Burial 198 at the Sandy Point site.

open simple twining combined with plaiting. The warp elements perpendicular to the twining ranged from 1.55 to 4.70 mm in diameter, with a mean value of 2.99 mm.

The twining wefts were twisted together in the Z direction (i.e., had a Z weft slant). The raw material of all elements seemed similar, appearing to be some sort of inner bark. Originally, these elements might have been retted or otherwise disaggregated before use. Some of the longitudinal splitting and cracking of the fibers may have been due to degradation and weathering in the archaeological environment. Based on visual comparison with modern samples, this fabric appears to have been made using a cedar-like inner-bark fiber, perhaps white cedar (*Thuja occidentalis*). There was no observable "start," center, or selvage, but it was obvious that the plaited (interlaced) wefts were simply laid in as desired under a "warp" (plaited) element, twisted approximately 45°, then obliquely tucked in under two "warps." Among the weft crossings in the two preserved weft rows (n=22 and n=33), no obvious evidence of weft splices was discerned. Given the nature of the fibers employed and the loose construction, this was once a somewhat delicate, open, and flexible fabric. Comparable specimens exhibiting combinations of fine open twining and plaiting are known from several other Contact period sites in Massachusetts and Rhode Island, where at least one has been called a "mantle" (Bower 1980:Fig. 77; Gibson 1980:140-141; Willoughby 1935:247, Fig. 133d).

The "Burial 205" fabric, or Fabric No. 2, was preserved as a much smaller fragment than Fabric No. 1, only about 47.80 x 15.25 mm in size (Figure 8.5). Association with other artifacts or human remains had been lost by the time it was examined, and it is impossible to ascertain any relationship to the three children in Burial 205 (aged newborn to several months, several months to 1.5 years, and 2.5–3.5 years). It was preserved by proximity to a copper/brass headband, long tubular copper/brass beads, and/or

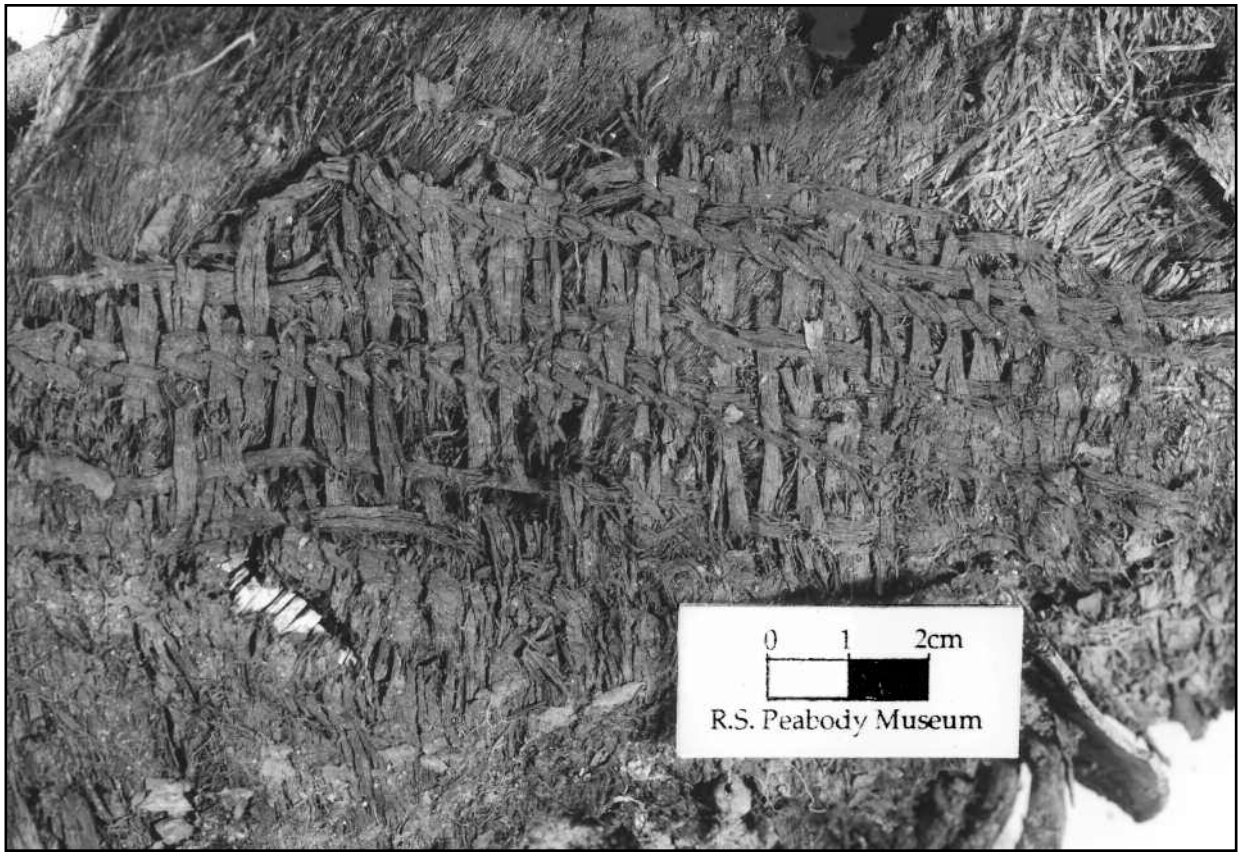

Figure 8.4. Detail view of Fabric No. 1 from Burial 198 at the Sandy Point site.

an iron trade axe found in this burial, but the details of this association have been lost (see Willoughby 1935:234).

Fabric No. 2 contained one weft row with twining twists that engaged eight warp elements, but only small fragments of warp elements remained. It appears that all elements were of uniform size (Figure 8.5). Given the lack of preserved wefts on either side of the single preserved weft row, it is probable that Fabric No. 2 was an open simple twined construction. Weft and warp elements were not twisted. The two weft elements were twined around single warp elements, with a Z weft slant. Individual weft elements ranged from 1.10 to 3.50 mm in diameter, with a mean value of 2.26 mm. The combined diameter of the weft row ranged from 3.10 to 4.75 mm, with a mean value of 3.71 mm. The warps ranged from 1.30 to 3.00 mm in diameter, with a mean value of 2.12 mm. Fabric No. 2 appeared to have been made from a bark-like material, probably white cedar like Fabric No. 1. As originally constituted, it would also have been delicate, open, and flexible. Other examples are known within the region, although they are of variable size and coarseness (e.g., Willoughby 1935:Fig. 133a).

The "Burial 206" fabric, or Fabric No. 3, was the smallest fabric specimen in the sample, and although it has been described as a "fabric" here, it might more properly be called a selvage (Figure 8.6). This specimen, too, was found separated from any human remains, so its location relative to the two children in Burial 206 (aged 3.5 to 4.5 and 4 to 5 years) is unknown. It is likely that preservation was due to the proximity of tubular copper/brass beads.

Fabric No. 3 was only about 17.15 x 14.40 mm in size. It was a composite construction consisting of cedar-like elements twined around worked hide or leather elements. Only four hide/leather "warps" and one fiber weft row were preserved. The hide/leather warps seem to have been attached to a larger piece of solid

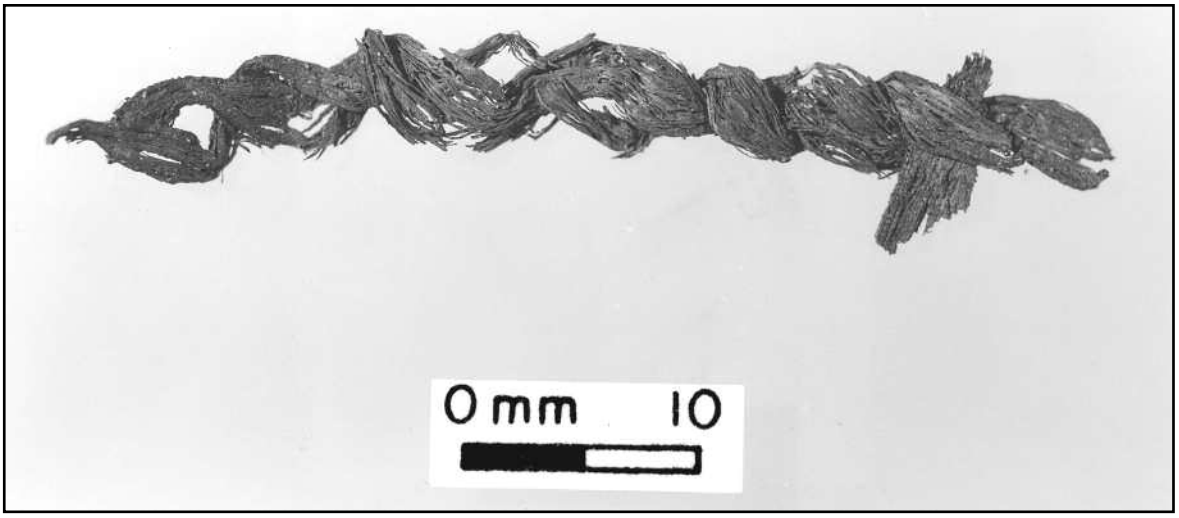

Figure 8.5. Detail view of Fabric No. 2 from Burial 205 at the Sandy Point site.

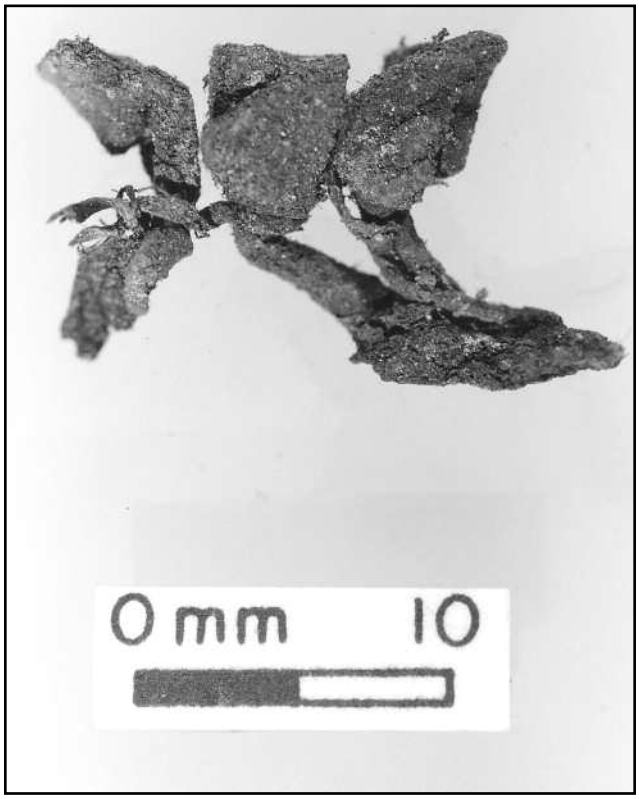

Figure 8.6. Detail view of Fabric No. 3 from Burial 206 at the Sandy Point site.

hide/leather that may have been part of a more complex construction, possibly a garment. Considering the solid hide/leather piece to which the "warps" were connected, "Fabric" No. 3 may have represented a fringe on the garment, with the twined elements utilized to maintain consistent spacing, or the twining may have functioned as a side or end selvage. In any case, the hide/leather "warps" had been cinched inward by the plant fiber wefts used to twine them together. If more than one twining row originally had been present, the weave structure would have been open twined. The individual cedar-like weft elements were very thin, 0.15 to 0.40 mm in diameter, with a mean value of 0.25 mm. The twining row made by the paired weft elements was likewise very delicate, ranging from 0.60 to 0.85 mm in overall diameter, with a mean value of 0.72 mm. The cinched hide/leather warps ranged from 1.15 to 3.85 mm in diameter, with a mean value of 2.45 mm. The weft slant was down to the left, or Z. The individual vegetal-fiber weft elements were probably white cedar, and exhibited no twist. Roughly comparable Contact period analogues, although employing only vegetal fibers and not hide/leather, are known from the region (e.g., Kenyon 1982:24, Pl. 25; Willoughby 1924:17, Fig. 20, 1935:Fig. 132f).

In summary, all fabrics identified from the Sandy Point site exhibited a cedar-like raw material for the wefts. Warps were more variable. Fabric No. 3 had hide/leather warps, although the other two fabrics retained use of vegetal fiber in both warps and wefts. All three forms incorporated open simple twined structures with a Z

weft slant. Fabric No. 1 exhibited a combination of simple twining and simple plaiting. All three fabrics clearly were constructed to be flexible; two might have been part of a bag, mat, or textile. The third may represent a leather garment selvage or comparable construction.

CORDAGE

Both cordage and hide/leather thongs were present in the Sandy Point and Walker's Pond inventories. The majority of specimens appeared to have been used to stitch or string together marine shell and copper/brass beads. Although hide/leather thongs were more common in the samples and directly analogous in function to the fiber cordage, only the vegetal-fiber cordage is described here.

All of the 41-plus individual specimens of vegetal-fiber cordage appeared to be made from raw material similar to the fiber in the three fabrics described above, tentatively identified as white cedar (*Thuja occidentalis*). All cordage fibers had the appearance of having been retted or otherwise processed prior to use.

Two major structural groups were identified: two-ply, S-spun, Z-twist cordage (Type I), to which the majority of specimens belonged, and three-element braided cordage (Type II).

Type I cordage was comprised of a two-ply, S-spun, Z-twist group that included a minimum of 39 individual specimens (composed of a larger number of pieces) and likely many more (Figure 8.7). Type I cordage was recovered where copper/brass artifacts facilitated its preservation in Sandy Point Burials 198, 205, and 206. Individual pieces tended to be very short and fragmentary; the longest was about 180.30 mm in total length. Cordage diameter ranged from 0.70 to 7.20 mm at Sandy Point (n=24), with a mean value of 1.86 mm.

At Walker's Pond, all cordage originated in the single burial. The length of many pieces could not be measured because they were embedded in the large organic mass. The longest measured piece was 132.75 mm, as preserved. Diameters for Type I cordage specimens at Walker's Pond (n=15) ranged from 0.95 to 1.35 mm, with a mean value of 1.00 mm. Although rare as extant specimens, comparable cordage is known from prehistoric contexts and from various coastal Contact period sites (e.g., Willoughby 1935:242, 248, Figs. 127b, 127e, 127f, 133c, 133e).

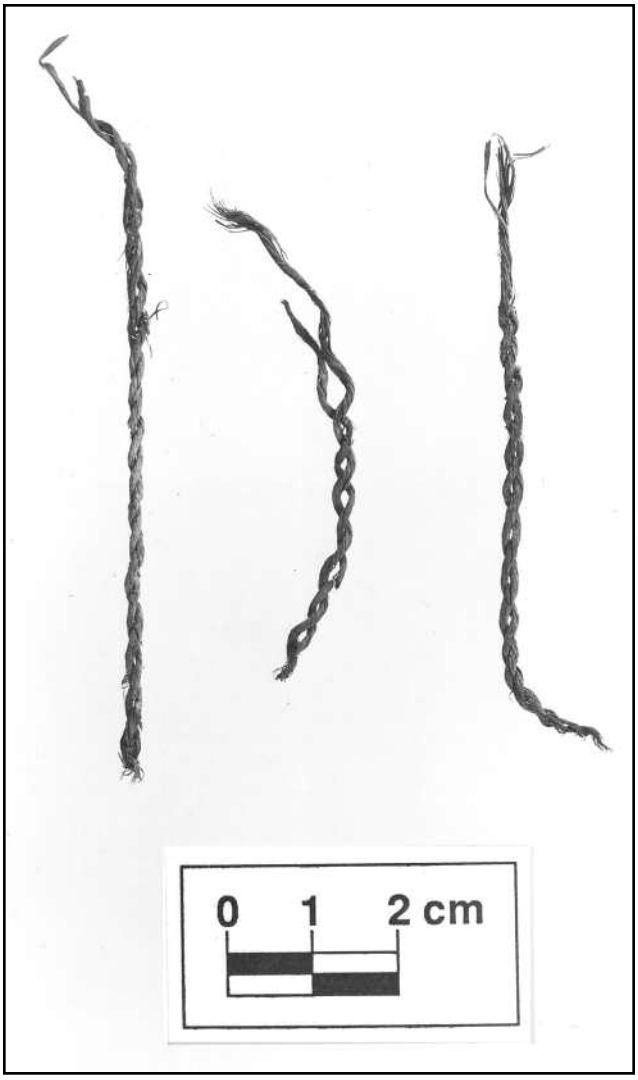

Figure 8.7. Three specimens of Type I two-ply, S-spun, Z-twist cordage from Burial 206 at the Sandy Point site.

Type II three-element braided cordage was recovered only from the Walker's Pond site, and included two specimens. These specimens were 29.00 and 40.35 mm long, as preserved. Overall diameters of both ranged from 2.45 to 4.40 mm, with a mean value of 3.18 mm. Comparable cordage is known from Contact period sites in the region (e.g., Willoughby 1935:248, Fig. 133f).

In summary, two forms of cordage were rep-

resented at these two sites, but the vast majority was of the first type, two-ply, S-spun, Z-twist, including a total of 39 out of 41 specimens, or about 95 percent. Rather remarkably, of the 39 specimens of two-ply cordage, 100 percent were S-spun and Z-twist in construction, a point that we will return to below.

OTHER COMPOSITE CONSTRUCTIONS

By virtue of their construction, three other perishables bear consideration here. These include two specimens from Burial 205 at the Sandy Point site and one from the Walker's Pond site. A fourth vegetal-fiber-and-hide/leather structure from Sandy Point Burial 206 was described earlier as Fabric No. 3.

The unique qualities of the composite and apparent composite constructions warrant detailed description. Of particular note are a construction of cut bark, worked hide/leather, copper/brass beads, and cordage, and a very rare fragment of porcupine quill that had been wrapped around a now-missing foundation. Both were associated with Burial 205 at Sandy Point. Likewise of interest is part of a presumed garment made from hide or leather ornamented with copper/brass and marine-shell beads that was recovered at Walker's Pond. This was unique in local and regional contexts. Each specimen is described below.

The composite bark, hide/leather, and metal bead specimen from Burial 205 at Sandy Point ("Other Composite Artifact No. 1") represents a decorative object that may have been worn as a breast plate (Figures 8.8 and 8.9). Although this artifact was not mentioned by Moorehead (1922), Willoughby (1935:234, 236) later published the description of it cited above. Copper/brass beads were strung horizontally over the exterior face of this object in at least two vertical rows. The beads were secured by stitches sewn through hide or leather backed with birch bark (the latter not mentioned by Willoughby). The bark backing was apparently added to stiffen the construction and consisted of two articulating sections approximately 1.65–2.80 mm thick. They exhibited at least one cut end that, due to the orientation and terminus of the beads,

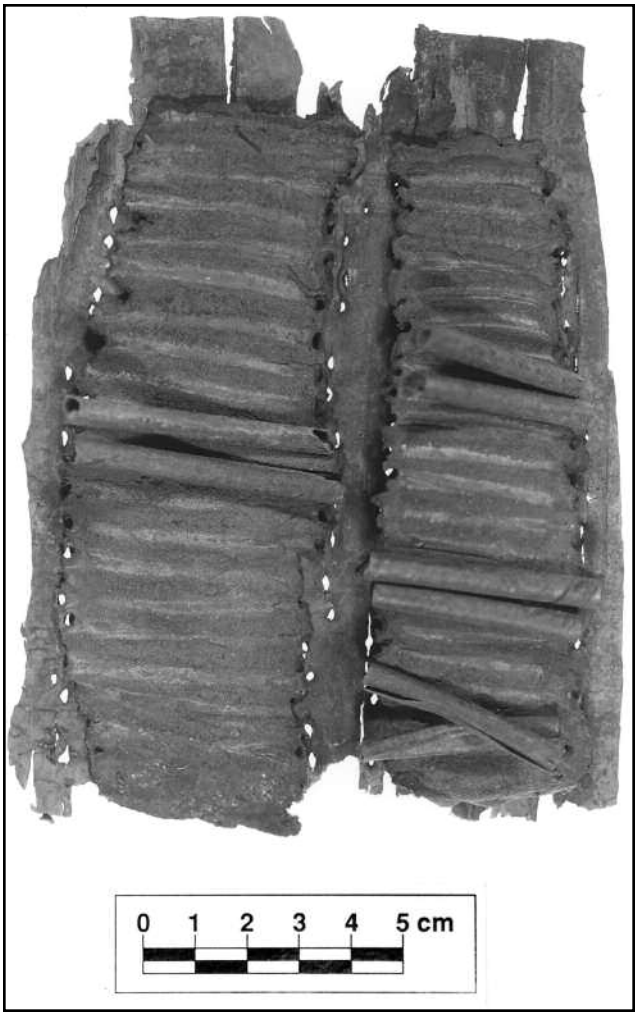

Figure 8.8. Other Composite Artifact No. 1 from Burial 205 at the Sandy Point site, showing a combination of copper/brass beads, hide/leather backing, and birch-bark back plate.

is interpreted to have been at the top (Figure 8.9). Although the other three edges were incomplete, the piece was probably originally rectangular. As preserved, the bark backing was at least 163.00 mm long and 124.00 mm wide, with four roughly parallel rows of punched holes for attachment of two vertical columns of beads. The two more central rows of punched holes were closely spaced and all four rows showed the termination of the holes toward the cut (top?) end, but the holes were abruptly truncated on the opposite (bottom?) end. Approximately 70 holes were observed, many of them paired. In most cases, the holes had been punched through the birch

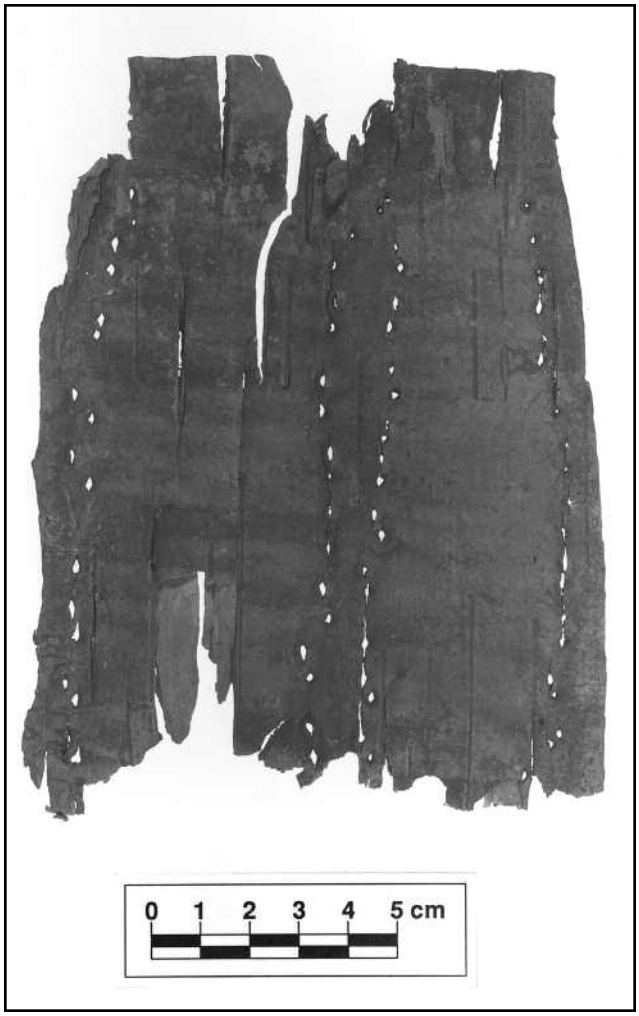

Figure 8.9. Birch-bark back plate without copper/brass beads and hide/leather backing, Other Composite Artifact No. 1 from Burial 205 at the Sandy Point site.

bark from its "obverse"/outer-facing surface and only a few had been punched through in the opposite direction. A small human clavicle epiphysis was adhered to the back of the bark, indicating that this piece was originally lying on top of one of the three children in Burial 205.

Originally serving as the ground onto which the copper/brass beads were sewn, the hide/leather section was probably once the same size as the bark backing. By the time it was studied, the hide/leather had broken into large fragments and portions had been lost. The two surviving sections were respectively 136.70 x 46.65 mm and 139.80 x 52.65 mm in size. No original outer edges were detected. Several tubular copper/brass beads were still attached on the obverse/outer surface of each fragment, indicating that the hide/leather was preserved from stitch to stitch following the extent and configuration of the beads and not far beyond (see Figure 8.8). The hide/leather was roughly 1.10–1.70 mm thick in cross-section and its reverse/interior surface was rough relative to the obverse. The obverse had a heavy greenish copper stain that had soaked completely through to the other side. As noted by Willoughby (1935:236), a lighter and more localized reddish stain, possibly red ocher, was also evident.

The copper/brass beads had been attached onto the hide/leather horizontally, one above the other, in two parallel vertical rows, creating an effect similar to bone hairpipe breastplates worn by Plains groups during the 19th century. The beads were manufactured from thin, rolled sheet metal that had probably originally been part of a kettle. They had large (7.5–8.2 mm) and small (3.8–5.8 mm) outer diameters and ranged between 24.25 and 54.75 mm in length. Notably, several beads still attached to the hide/leather backing had a purplish, wax-like paste applied over the open ends of beads that terminated a set, possibly to seal them and improve their appearance and/or to immobilize them. A presumably contemporaneous fly pupa was found within one of the beads, suggesting death and burial during the warm season.

The stitching medium for most beads on this artifact was hide/leather thong, averaging 1.15 to 1.85 mm in diameter. However, as described above, some Type I fiber cordage was associated with a few beads. Unfortunately, no hide/leather or cordage remained in the holes through the bark backing. Unidentified animal hair adhering to copper/brass bead exteriors indicates that the ornament and the child beneath had been covered by an animal skin.

Generally similar sets of stitched or strung copper/brass beads were widespread during the early historic Contact period in the Northeast, although they apparently did not occur earlier. Where an original structure has been identified at all, most researchers have labeled comparable Contact period bands of beads as "belts" or

"bandoliers," due to the presence of the hide/leather thongs that string them together, although their location with respect to a buried individual rarely has been reported (e.g., Gibson 1980:Figs. 110, 150; Spiess and Cranmer 2001; Willoughby 1935:233, 240-241, Figs. 126, 127; Wray et al. 1987:Fig. 3–19). The bark-backed specimen reported here seems unique, although something similar may have been recovered from a Contact period burial in Rhode Island (Willoughby 1935:236). Regardless, this specimen from Sandy Point represents a sophisticated and ingenious combination of trade goods and indigenous materials.

The "Other Composite Artifact No. 2" originally was associated with Burial 205, although it was found loose in a larger sample. It is a section of flattened, wrapped, and stitched porcupine quill that was golden brown in color, as preserved (Figure 8.10). The piece measured about 23.75 mm in length, although it undoubtedly once was much longer. The flattened quill was about 1.95–2.10 mm wide. It had been wrapped about something and twisted, producing an elliptical cross-section that was approximately 5.65 mm wide overall. The original foundation had been lost, but given the shape and size of the cross-section, it must have been delicate, perhaps as thin as 1.0 mm. Each wrap of the quills passed around the foundation and was then twisted around once (in a half hitch?) and passed onward so that the quill was turned over for each wrap.

This artifact must represent some sort of decorative quilled construction, possibly an edging similar to those described and illustrated in various historic and even modern Native constructions. The latter are primarily garments such as leather shirts and moccasins, plus leather bags and other items. The technique most closely resembles "quillwork stitchery" and either hide/leather or wood may have served as the missing foundation (e.g., Whitehead 1980:11-12, 1982:13-15). We are not aware of other evidence of quill wrapping quite as old as this example, although near-contemporaneous analogues preserved in museums are known from northern New England and elsewhere (e.g., Dodge 1959).

The third and final composite specimen ("Other Composite Artifact No. 3") seems even more certainly to have been part of a garment. By virtue of the combination of hide/leather and beadwork, this specimen from the Walker's Pond burial was similar to Other Composite Artifact No. 1 described above, although in this case the beads were shell and not metal. In fact, the Walker's Pond specimen may have represented a frontal section of a leather shirt or similar garment

Figure 8.10. Other Composite Artifact No. 2 from Burial 205 at the Sandy Point site, showing porcupine quill that had been wrapped or stitched around a now-missing foundation.

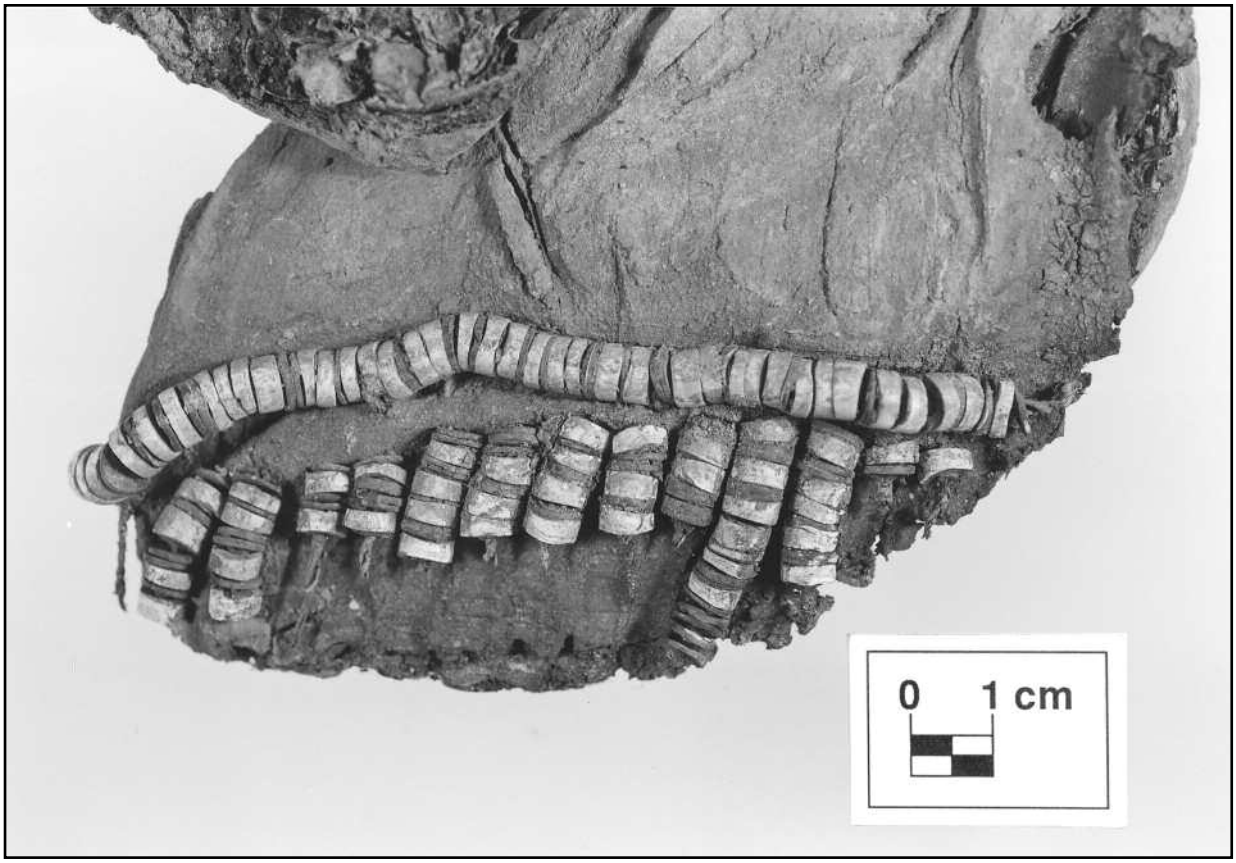

Figure 8.11. Other Composite Artifact No. 3 from the Walker's Pond site, showing alternating white quahog and purple mussel shell beads stitched onto a probable garment, situated across the chest of a child.

decorated with marine shell beads stitched directly onto it (Figure 8.11). It was preserved as a relatively large organic mass, about 146.70 x 88.10 mm in overall size, and was intimately associated with the remains of two children, one aged 7–8 years and the other apparently an infant. Once again, copper/brass staining covered outer portions of this specimen, indicating that association with copper/brass was the preservative agent. Another hide/leather covering apparently encased the "garment," since at least one relatively large fragment was present that had evidence of red ocher on its presumed exterior and the impressions of fine shell beads on its interior. This covering was visible on the exterior of the mass in a few places. Fragments of a copper/brass kettle and tubular copper/brass beads with this burial help account for the fine quality of its preservation.

The younger child's mandible was preserved *in situ* on one (upper?) end of the organic mass. The hide/leather may have been overlapped and tucked beneath the chin of the child to enfold its post-cranial remains. At least ten ribs, two clavicles and a sternum indicate that the upper torso of one child was present. In fact, it may be that Other Composite Artifact No. 3 represents a shirt or tunic worn by the child at burial. The hide/leather varied from 1.00–1.30 mm in thickness, and possibly more across its full extent. Although more could be learned by further dismantling the mass, it was left undisturbed at the wishes of the culturally affiliated tribes.

Perhaps the most remarkable attribute of this probable garment was preservation of a complex pattern of marine shell beads stitched onto its obverse/outer surface. The shell came from two marine species, fashioned into thick white specimens that were presumably *Mercenaria mercenaria* or quahog, and thin, purplish beads from the mussel *Mytilus edulis*. Identification of the pur-

plish beads was based on overall delicacy and sharp curvature relative to the quahog beads, which were substantially larger and two to three times heavier. The beads had been sewn in a horizontal row across the hide in the neck area of the young child. The individual beads were oriented vertically and attached with Type I fiber cordage every few centimeters. Opposing vertical rows were added beneath the single horizontal row. All rows had an alternating pattern of white and purplish beads. Bead color sequences in the longest preserved row were, from left to right and starting at a cordage tie, 3 white, 1 purple, 1 white, 1 purple, 1 white, 1 purple, 1 white, 2 purple, 4 white, 2 purple, 2 white, 1 purple, and 1 white shell bead against a tied cordage terminus. The beads were so firmly stitched to the garment that they left deep furrowed impressions in the hide/leather beneath.

Of note, quahog and mussel shell beads forming similar patterns in several parallel rows were discerned on a small portion of the obverse of the large organic mass in Burial 198 at Sandy Point. Fabric No. 1, the open simple twined and plaited textile described above, was preserved on the reverse of this specimen. Given their positioning, these beads may have been sewn onto a ground, perhaps a garment; however, neither cordage stitches nor possible garment fragments survived. Several other less equivocal hide/leather garment fragments with shell and/or copper/brass beads were found in Burials 205 and 206 at Sandy Point, suggesting that hide/leather garments, some with bead decoration, may have been common there. All these possible garments are described in a more comprehensive upcoming report (Petersen et al. 2004).

As hide or leather clothing, the Walker's Pond piece and the possible specimens at Sandy Point are highly unusual discoveries. Garments in general are extremely rare in northeastern archaeological contexts and elsewhere (e.g., Heckenberger et al. 1990, Heckenberger et al. 1996; Willoughby 1924:7; Wray et al. 1987:125-127). That the Walker's Pond specimen and at least one other from Sandy Point were also decorated using patterned rows of marine shell beads is even more extraordinary. It is quite possible, of course, that these specimens were not uncommon in their day. However, few such examples survive, and it is purely through accidents of preservation that we can glimpse something of the subtlety and beauty of Native garments as they were made and worn 400 years ago.

CORRELATIONS AND IMPLICATIONS

The Sandy Point and Walker's Pond perishable fiber constructions and possible hide/leather garments show continuity with what is known from earlier prehistoric examples recovered within the broad region, in terms of technology, structural types, and degree of workmanship. Although rare, these correlates range from fragmentary specimens recovered at archaeological sites in the region, to historic garments, baskets, bags, mats, and other textiles preserved in museums.

The prehistoric analogues showing continuity include rare extant examples of highly fragmentary twined fabrics and "ghost impressions" of fiber perishables from several Late Archaic period finds in the region. The Hartford and Overlock (Harts Falls) cemetery sites in Maine, both locally ascribed to the Moorehead phase/tradition dating from 3000–1800 B.C. (Blustain et al. 1999; Whitehead 1987:Appendix 2), yielded twined fabric pseudomorphs and ghost impressions of fiber containers that once had encased stone tools. A cordage specimen at the Millbury III site in eastern Massachusetts is attributable to the subsequent Susquehanna tradition, ca. 1800–1000 B.C. (Largy and Leveillee 1995; Leveillee 2002). Older examples of fiber perishables have been recovered elsewhere in eastern North America (Adovasio et al. 2001; Andrews and Adovasio 1996), but the oldest known fiber perishables in the far Northeast date only to the Late Archaic period, as cited above for the Moorehead phase/tradition (Blustain et al. 1999).

Comparable extant fabrics and cordage are known from Adena-related Middlesex complex sites of the Early Woodland (Ceramic) period in the far Northeast, including, for example, Boucher (Vermont), Mason (Maine), and Augustine Mound (New Brunswick) (Gordon 1995:13;

Heckenberger et al. 1996; Whitehead 1980:11). These are broadly dated to between 1000 and 100 B.C. Birch-bark basketry also has an established regional antiquity of at least the Early Woodland period on the basis of a small sample recovered at a "waterlogged" fish weir site on Sebasticook Lake in the Maine interior. One fragment of a container found there has been directly AMS dated to 300 B.C. (Petersen et al. 1994:211-212).

Although there are a few examples of extant prehistoric analogues from later times in the region, Middle and Late Woodland (Ceramic) period finds of fiber perishables are unusual. This may be explained as due to the paucity of copper and other preservative agents in use at the time (Petersen et al. 1987). Nonetheless, the Sandy Point/Walker's Pond artifacts fit well within the context of known late prehistoric and earlier examples. These specimens also are consistent with other contemporaneous (but incompletely reported) early Contact period fiber perishables known elsewhere in Maine and the broader Northeast. These include archaeological mortuary goods from Rhode Island, eastern Massachusetts, and coastal Maine, as well as a few complete ethnographic specimens (e.g., Bower 1980; Dodge 1959; Jeppson 1964; Turnbaugh 1984; Willoughby 1905, 1924, 1935).

The finds from southern New England and the Gulf of Maine exhibit widespread similarities with others, ranging from "copper kettle" burials of the Maritime Provinces (e.g., Gordon 1993, 1995; Hadlock 1947; Whitehead 1980, 1987, 1993) to analogous and generally contemporaneous specimens from many other areas, including New York, Ontario, Pennsylvania, Michigan, the Mid-Atlantic states, and beyond (e.g., Curry 1999; Kent 1984; Kenyon 1982; Kidd 1953; Mason 1986; Quimby 1966; Wray et al. 1987). Unfortunately, precise comparison is hampered by the rarity and poor condition of all such discoveries.

Beyond correlations for the fiber specimens, the available overall artifact sample from Sandy Pond and Walker's Pond demonstrates broad-based continuities with other perishables, particularly marine shell beads. Precise correspondences can be seen in the forms, apparent sizes, and materials of the many thousands of shell beads from these two sites when compared with contemporaneous examples. Although sometimes collectively labeled as "wampum," as when Moorehead described shell beads from Sandy Point, the various types of shell ornaments at these sites predate the more familiar small-diameter tubular wampum. The small discoidal quahog and mussel beads reported here were apparently the most common and widely used type made in the Northeast until the 1620s, when tubular wampum became popular after it was adopted as a curency and metal tools began to be used in its manufacture (Ceci 1977:15-18, 1989:63; Thomas 1979:180-181; Willoughby 1924:13).

In fact, generally comparable discoidal shell beads date to as early as the terminal Late Archaic (ca. 3000–1000 B.C.) and Early Woodland (ca. 1000–100 B.C.) periods, but these earlier examples are substantially larger and thicker than the Contact period style. Smaller, more delicate examples like those from Sandy Point and Walker's Pond may have occurred as early as the Middle Woodland period in New York, but they certainly became more widespread during late prehistoric and protohistoric times. Nearly identical examples are known for protohistoric and historical Algonquian-speaking Native groups from the Maritime Provinces, elsewhere in Maine, southern New England, and the Mid-Atlantic states. They are also found among the Iroquois proper and other Iroquoians in New York, Ontario, and beyond (e.g., Ceci 1989; Curry 1999; Quimby 1966; Whitehead 1980:14, 1993:43, 67, 77, Figs. 114, 116, 117; Willoughby 1935:264-274).

Still other perishable artifacts from the burials, like the shell-decorated hide/leather garment and the composite hide/leather, birch-bark, and copper/brass-beaded breastplate, are more difficult to correlate with previous finds due to exceedingly rare preservation and recovery. However, another hide/leather garment is known from the Early Woodland period Boucher site in Vermont (Heckenberger et al. 1990:Fig. 21), and others are likely represented in broad contexts (e.g., Quimby 1966:54-63). Still more, along with other perishables, may be lurking in unanalyzed museum collections.

Represented among the non-perishable artifacts at Sandy Point and Walker's Pond were

copper/brass kettle fragments, copper/brass beads made from kettle fragments, and more unusual trade items such as an iron axe and blue glass beads. These resemble examples known from elsewhere in coastal and interior areas of the Northeast, all of which have been dated between 1550 and 1575, if not earlier. Such metal items were key to the preservation of perishable organic items during this time period. The presence of European trade goods demonstrates that by A.D. 1580–1600, Native people were incorporating European artifacts and components into their material culture inventory. Moreover, along with typical pre-European-contact mortuary offerings like marine shell beads, these items were "worthy" of inclusion in human burials as grave goods. In fact, because they were novel and exotic, such European-derived items might even have been "preferred" mortuary goods.

One final category of correlation bears mention here. Although fiber perishables and other forms of perishables are rare in archaeological contexts in the far Northeast, there is a growing corpus of data on fiber perishables that are preserved through negative impressions on pottery and other substances, in addition to the small but significant numbers of extant organic specimens. These combined data reveal some striking patterns in the regional record. Again, we see the long-term presence of differences in cordage twist and twining weft-slant patterns between the coast and the interior throughout the Gulf of Maine and adjacent areas in the far Northeast (Doyle et al. 1982; Gordon 1993, 1995; Petersen 1996; Petersen and Hamilton 1984; Petersen and Wolford 2000; Whitehead 1987, 1993). The coastal pattern was consistently Z-twist cordage and Z-weft-slant twining over time, while the non-coastal, interior pattern was consistently S-twist and S-weft-slant. This patterning includes all prehistoric periods from at least the Early Woodland period onward, extending to the last such specimens manufactured during the Contact period. Thus, a minimum of about 2,700 years of continuity within each area and discontinuity between them (ca. 1000 B.C. to A.D. 1700 or so, and perhaps earlier) is demonstrated. Likewise, a comparable distinction apparently pertained between Iroquoian-speaking and Algonquian-speaking populations in late prehistory and early historic times, but this patterning is less well documented.

Although the significance behind regional variations in cordage twist and twining weft slant patterns continues to be debated, it seems reasonable that such consistent patterning represents Native social distinctions on some level, perhaps even discernable social identities in local and broad regional contexts. Habitual preference and long-term continuity expressed in the production of twining and cordage typically pertain within many, many archaeological contexts worldwide. Broad examination of this issue in various regions of North America where fiber perishables are preserved directly and/or indirectly has become one means of assessing local and regional continuity and discontinuity over time (Petersen 1996; Petersen and Wolford 2000). Moreover, an ongoing analysis of thousands of ethnographic specimens from the Amazon has demonstrated comparable group-level twining and cordage construction preferences and resultant patterning among a sample collected from over 90 individual tribes and their language families, sometimes over huge distances (Petersen et al. 2001; Petersen and Wolford 2000).

It is therefore not at all surprising to discern this patterning within the available sample from the Sandy Point and Walker's Pond sites. However, the consistency in twist direction shown among the twined fabrics and cordage specimens is remarkable. Although various other construction details differ, all three twined fabrics share a common Z weft slant. Perhaps even more surprising, among the 39 specimens of non-braided two-ply cordage, 100 percent of the sample shares a consistent initial S spin and final Z twist. This uniformity occurs despite the fact that although one or another final twist or weft slant usually dominates within any given sample, generally there is also minority representation of the opposite final twist or weft slant.

The cordage and fabrics from Sandy Point and Walker's Pond reaffirm previously reported Z-twist and Z-weft-slant pattern preferences on the coast and clearly represent continuation of this pattern into the early Contact period. In fact, during the Contact period, the coastal pattern of Z-twist cordage and twining rows extended over a large area of the northeastern coast, from at

least Nova Scotia to Maine, Massachusetts, and Rhode Island. This widespread commonality provides further evidence of long-distance social interaction among Native peoples during the Contact period and earlier, much like that observed for marine shell beads. These data support the idea that basic fiber-perishable construction techniques can mark unconscious, or "isochrestic," style and social identity within local and broad regional contexts (Minar 2000:95-99; Petersen and Wolford 2000:107-108).

CONCLUSIONS

The present research demonstrates the utility of fine-grained artifact analysis in northeastern archaeology, especially as applied to fiber perishables and other perishable categories. Unfortunately, it is impossible to fully reconstruct any one of the perishable specimens from either Sandy Point or Walker's Pond. Even the pattern of colored beads is difficult to reassemble with confidence, because individual constituents, not final forms, were preserved. Nonetheless, the objects described herein provide highly significant glimpses into the richness of indigenous material culture during early contact between Native and European peoples in the land of "Mawooshen."

The composition and stylistic attributes of artifacts from these two sites reveal broad-scale connections with other areas of the Northeast. Although the people of "Mawooshen" faced the European arrivals as members of a distinct cultural entity or a closely related set of tribal entities, they were at the same time broadly connected to other Native communities in both littoral and non-littoral areas of the Gulf of Maine, as well as more distant Native groups to the south, west, and north.

Although the earliest historical trading may have been centered to the north in the Gulf of St. Lawrence area, European traders soon visited the Atlantic coast along the Gulf of Maine in New England and the Maritimes. The ancestral Micmacs (Mi'kmaq), and perhaps others before them, experienced "positive" effects of trade with Europeans that spread far beyond the Micmac homeland. The wealth of Native traders in the region must have been tangible, if short-lived in relative terms.

Tragically, interaction also carried overwhelmingly negative consequences that were equally widespread. Late-16th- and early-17th-century trading was almost certainly the vehicle for disseminating European disease and its devastation well beyond the Native communities who first met the Europeans directly. During the period between 1550 and 1600, regular foreign visitation to the central Maine coast was undoubtedly responsible for the introduction of pandemic disease of European origin. A period as long as 50 to 70 years may have passed before the French and English actually colonized the area in the early 1600s. Consequently, the initial devastation of introduced disease may have gone undocumented. The earliest epidemics surely appeared before the recorded epidemics of 1616–1619, at which time the decimation of many Native coastal communities from Cape Cod northward to the central coast of Maine was widespread. The earlier Sandy Point and Walker's Pond sites almost certainly provide evidence of unrecorded European-induced trauma in this part of the Gulf of Maine. That more than 70 percent of the individuals interred were children, many suffering from poor health, suggests a population with very different mortality statistics than are indicated by pre-European-contact Native populations in local and regional contexts.

Given the availability of European goods, it might seem surprising that "traditional" Native manufactures were still being produced in coastal Maine ca. 1580–1600, albeit accompanied by new forms incorporating European trade goods. However, it is clear that much of the material culture in this region was still based on indigenous forms, whether or not non-indigenous materials were utilized. It is regrettable that it is so difficult to recreate the final forms expressed by the fragments of perishable artifacts from Sandy Point and Walker's Pond. Nevertheless, careful examination does inform us of the creativity, sophistication, and resilience of the people who produced them in the face of unimaginably catastrophic change during the Contact period.

NOTES

1. Because highly corroded copper and brass artifacts such as those from the Sandy Point and Walker's Pond sites cannot be differentiated without fine-grained analysis, the material is generalized as "copper/brass" throughout this chapter. The 16th-century Maritime Province sites from which came the name "copper kettle burials" typically contained copper vessels, many with iron fittings (e.g., Whitehead 1993:23-31); brass vessels became more common during later years.
2. All of the animal-skin materials are described as "hide/leather" since it is unclear to what degree they were worked, although some degree of working seems very likely.

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CHAPTER 9

TEXTILES AND LEATHER IN SOUTHEASTERN NEW ENGLAND ARCHAEOLOGICAL SITES

Margaret T. Ordoñez and Linda Welters

ABSTRACT

Archaeologists in southern New England occasionally find textiles and leather adhering to metals in Native American burials and existing in microenvironments such as coffins and privies. Textiles are listed and described in New England site reports dating from the 1920s. Archaeologists describe layers of textiles covering skeletal remains in cemeteries, yet often only miniscule fragments have been recovered. Perishables have a history of being difficult to recover from sites with variable climatic conditions, as in New England, so they have been neglected in the archaeological record. In recent years archaeologists have recognized the importance of textiles and leather, and have consequently improved their methods of excavation and treatment. With recent attention to issues of gender and the importance of the body, textiles and leather for apparel are recognized as an important part of material culture. This chapter provides an overview of the conditions that contributed to preservation, on-site and laboratory treatments, and analysis of textiles and leather from five 17th- to 19th-century sites in southern New England.

INTRODUCTION

During the past two decades, textiles and leather from three cemeteries and two privies located in southern New England (Figure 9.1) have been analyzed at the University of Rhode Island (URI). Spanning three centuries, these five sites have provided yarns and fabrics that add much to the written record in regard to source, variety, quality, and use. Pieces of leather, animal skin, or sinew came from four sites. No other known southern New England sites have yielded such a quantity and variety of fibrous materials.[1] This chapter is a compilation of the treatment and research of the textiles and leather from these sites.

FIVE SOUTHERN NEW ENGLAND ARCHAEOLOGICAL SITES

Three of the sites date from the middle of the 17th century; these are discussed first beginning with two Native cemeteries followed by the older of two privies from Boston's Big Dig. The last two sites are younger, one dating around the turn of the 18th century and the other mid-19th century.

RI 1000, A NARRAGANSETT CEMETERY IN NORTH KINGSTOWN, RHODE ISLAND[2]

After accidental disturbance of this cemetery by a bulldozer in 1982, members of the Narragansett Tribe and a team of archaeologists from the Rhode Island Historical Preservation Com-

Perishable Material Culture in the Northeast, edited by Penelope Ballard Drooker. New York State Museum Bulletin 500.

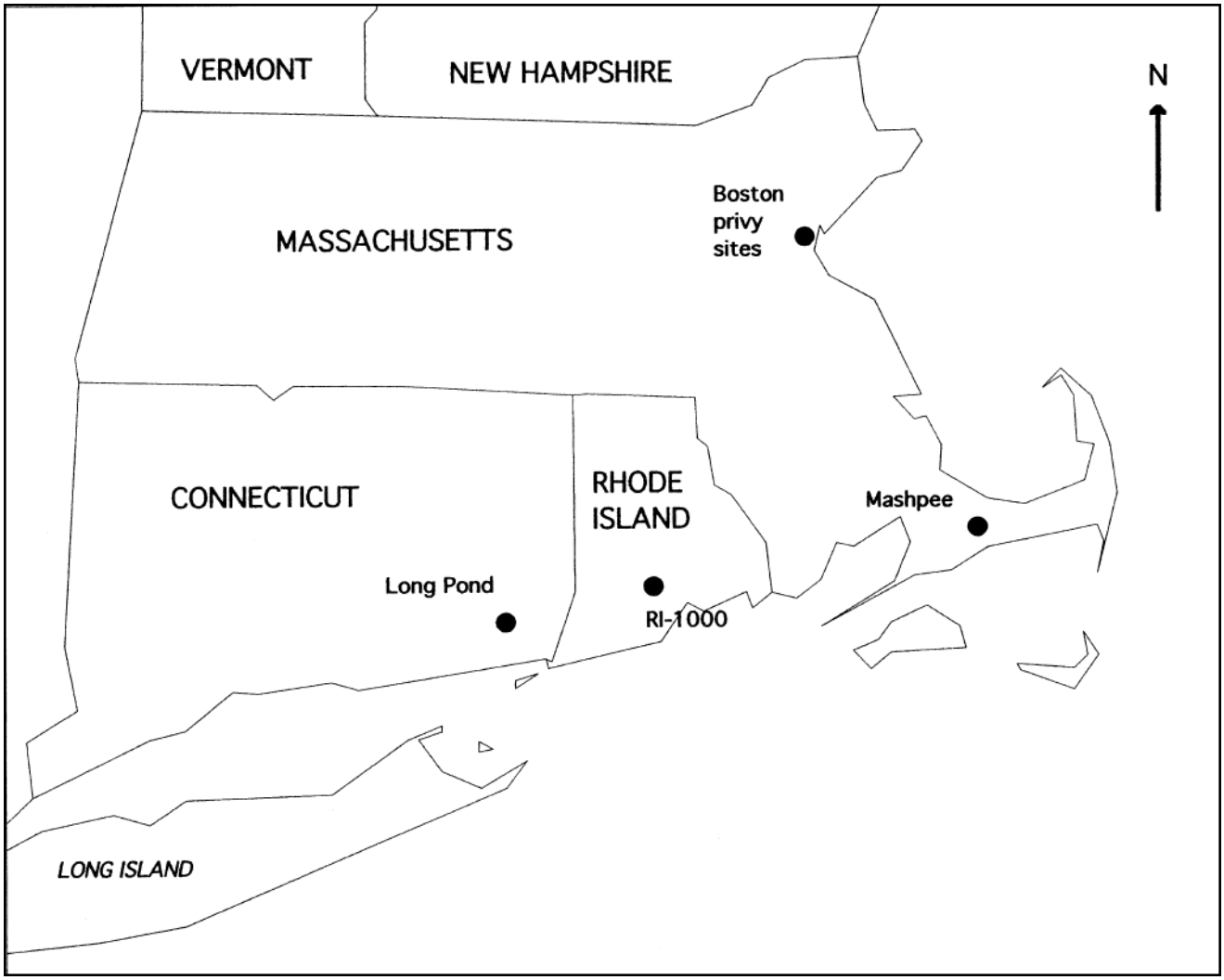

Figure 9.1. Locations of five southern New England archaeological sites from which archaeologists retrieved textile and leather fragments.

mission and Brown University excavated the graves of 56 individuals buried between 1650 and 1670. The RI 1000 site yielded a wide variety of Native-made and European textiles, plus a piece of deerskin. These survived due to proximity to copper and iron objects, which mitigate microbial degradation. The surviving textiles included wool, cotton, and native plant fibers.

At the site, the textiles were wetted with a 5 percent aqueous glycerin solution, bagged, and refrigerated in preparation for freeze-drying. In the lab, the textile fragments were humidified to flatten them, soaked in an aqueous thymol bath to kill bacteria, washed in a 5 percent ethanolic glycerin solution, consolidated with ethyl hydroxyethyl cellulose solution, and stored in individual mounts, which have protected the fragments very well.

Linda Welters (1985) analyzed the European-made textiles from the site using a simplified version of the "Textile Attribute Dimensions" form presented in Chapter Two of *Beyond Cloth and Cordage: Archaeological Textile Research in the Americas* (Kuttruff and Strickland-Olsen 2000:43-50). Welters identified 32 different fabrics from the 80 fragments. Most of these are plain- and twill-woven wool; a few, such as the fragment shown in Figure 9.2, were cotton. After comparing the fabrics with documentary sources, Welters associated them with contemporaneous

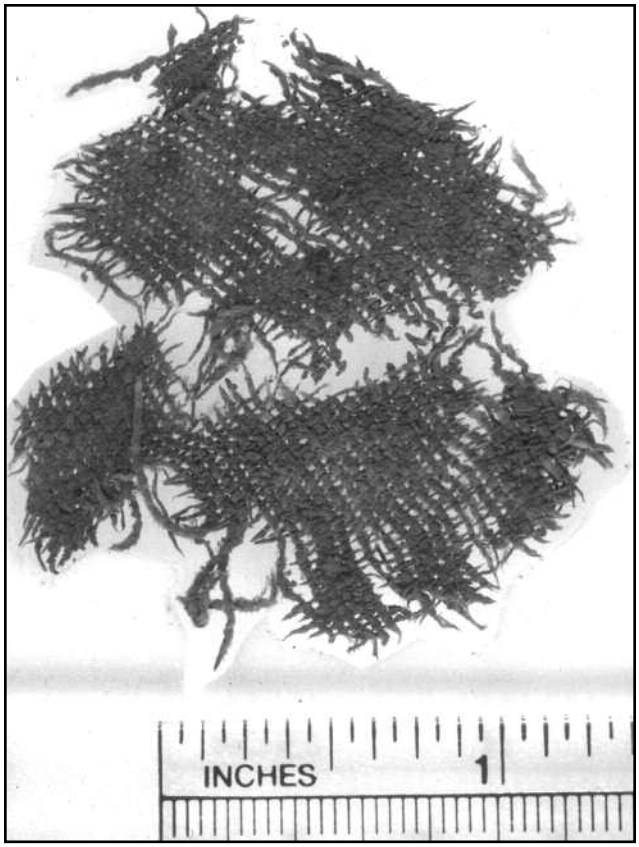

Figure 9.2. Plain-weave cotton fragment (RI 1000 82-48).

names such as duffel, trading cloth, baize, and shag. A detailed explanation of these fabric names and characteristics is in the Winterthur publication *Historical Archaeology and the Study of American Culture* (Welters et al. 1996).

The Native-made fragments include close-twined and plaited containers and mats (McNeil 2003). In her master's thesis, Cameron McNeil observed that degradation of the native plant material fragments is greater where they had contact with wool. This contact is frequent since the Narragansetts used matting layered with wool fabrics as liners inside the graves. McNeil suggests that the wool may have acted like a sponge and soaked up water, thus increasing the breakdown of the plant material. Whether this degradation occurred in the graves or afterwards as a result of the various treatments deserves more attention.

Two other aspects of the RI 1000 artifacts — color and mineralized fabrics — have been analyzed. Although most of the archaeological fragments are various shades of brown, some have a deep blue cast. Also, individual fibers viewed under a light microscope often reveal colors such as red, yellow, blue, and green — from a

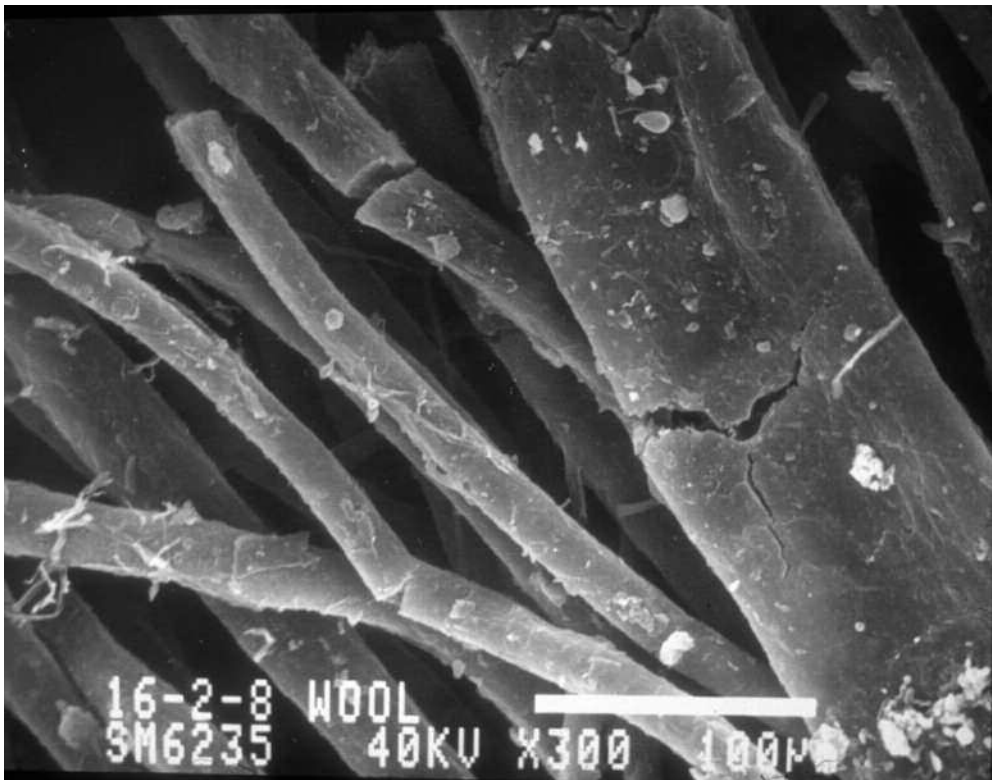

Figure 9.3. Degraded wool fibers with no cuticular scales intact; note variety of fiber diameters (Long Pond 16-2-8).

combination of yellow and blue. Rebecca Johnson-Dibb and Margaret Ordoñez (1996) analyzed 91 of the RI 1000 fragments representing a variety of colors from 14 graves. Using chromatography and spectrophotometry for mordant dyes and a reduction test for indigotin, they identified indigotin in 28 specimens, madder in 27, and possibly kermes in 2 (see Definitions for named dyestuffs). The historic record confirms that Native Americans had a preference for blue and red fabrics (Gookin 1970 [1792]:17; Montgomery 1984:159, 228).

Some of the fabrics from RI 1000 survived due to the mineralization process. Both positive and negative pseudomorphs[3] (see also Definitions) had formed on iron and copper alloy objects as well as non-metallic surfaces such as matting and pipes (Coho 1996). Sometimes both forms of pseudomorphs occurred in the same fragment indicating different microenvironments in close proximity. The surfaces of some negative pseudomorphs preserve impressions of scales on wool fibers, meaning that the scales remained intact during the process that formed the molds around the fibers.[4] Most scales on the extant wool fibers in the two 17th-century cemetery sites had been degraded completely by conditions in the soil (Figure 9.3). The surfaces of the positive pseudomorphs are similar to those of the unmineralized fibers. The pseudomorphs duplicated some of the extant fabrics identified by Welters (1985) and also preserved others that had not survived in the graves.

LONG POND, A MASHANTUCKET PEQUOT CEMETERY IN LEDYARD, CONNECTICUT

Located above a lake on the Mashantucket Pequot Reservation that had been established in 1667, this cemetery dates from 1670 to 1720. Again, construction equipment revealed burials, destroying as many as 20 of them before the Public Archaeology Survey Team at the University of Connecticut and the Mashantucket Pequot Tribal Council received notification. This team excavated 21 graves that could have been disturbed by further construction. The excavated fragments received no conservation treatment because the Tribal Council planned to re-inter the contents of the graves.

The Mashantucket Pequots used European textiles and some Native-made matting as shrouds and grave linings (Ordoñez et al. 1991). The 122 extant European textile fragments were of coarse- to medium-quality wool. The wool fibers included a variety of diameters with a greater percentage of large fibers (Figure 9.3) than would be seen in European fabrics a century later (Welters et al. 1996). The most frequently observed colors of fibers under a light microscope were red and green (blue dyed over yellow). All of the fragments were plain weave except for two twill weaves and four stockinette-stitch knits. A protein matrix adhering to the surface of two matting fragments could have come from skins or furs.

The locations of wampum band fragments in the graves implied that they had served as headbands, sashes, and bracelets (Figure 9.4). Sinew made up the longitudinal elements of the wampum bands with pairs of two-ply, Z-twist Indian hemp yarns holding copper and quahog shell beads in place between the rows of sinew.

This site produced mineralized wool (Figure 9.5) and cotton fabrics (Ordoñez 1992). The plain-weave cotton fragments were similar to those in the seventeenth-century privy that will be discussed next. The finest wool textile from the Long Pond site survived because of corrosion products that covered the surface of the fabric before the fibers degraded (Welters et al. 1996:225-228). Found inside the bowl of an iron ladle, the fabric was wrapped around a bear claw and a folded page from a London edition of a King James Version Bible (Figures 9.6 and 9.7) (Hugh Amory, personal communication 1992).

Tarleton and Ordoñez (1995) surveyed published reports for methods to treat archaeological textiles, and set up experiments to compare ways of cleaning, consolidating, and drying burial textiles from wet sites. Using wool fabrics degraded by burial in representative southern New England soil, they found that wet cleaning them with a non-ionic surfactant removed more soil and mold than water or ethanol, but the abrasion created by moving the cleaning solution around the fabric and rinsing three times

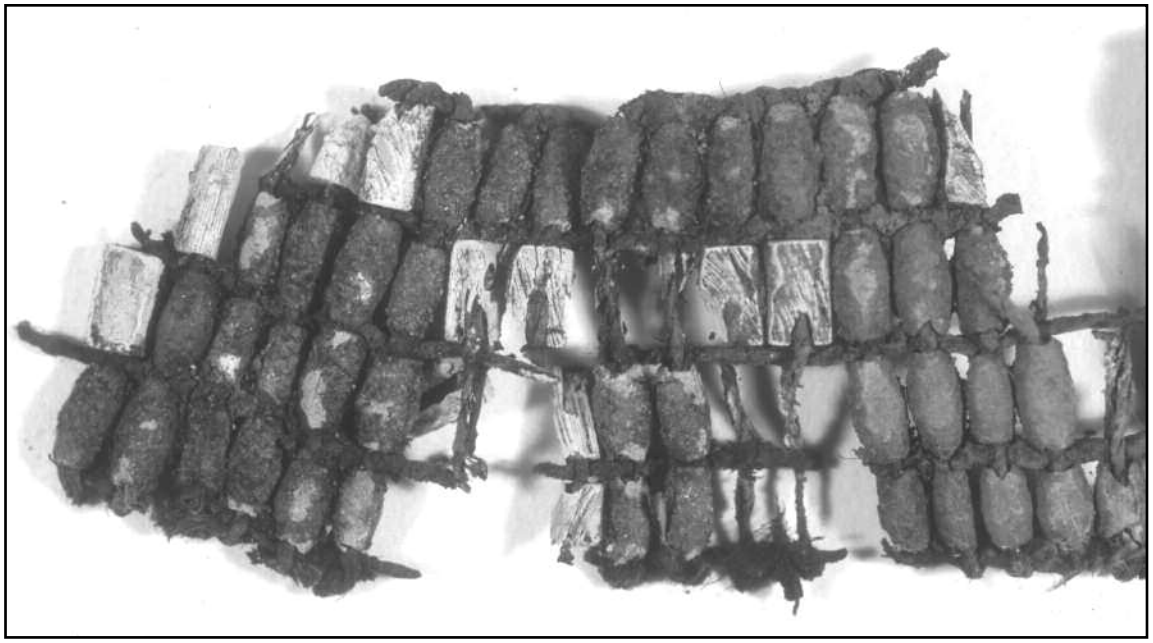

Figure 9.4. Segment of a wampum headband of Indian hemp, sinew, degraded quahog beads, and copper beads (height 3.7 cm) (Long Pond 18-2-83).

weakened the textiles. All treatments that involved immersion of the burial textiles in a liquid resulted in soil redeposition, with the solvent method causing the most repositioning of soil between fibers. The researchers also tested wool fabrics soaked in a 1.0 percent ethyl hydroxyethyl cellulose (Ethulose) solution. This consolidant added structural stability to the samples, but also coated clumps of soil and mold on the textiles. All of the air-dried samples became stiffer and experienced more shrinkage than those that were freeze-dried.

An investigation of freeze-drying layers of wet new wool fabric versus air-drying found

Figure 9.5. Plain-weave wool fabric preserved by corrosion products (scale below fragment is 1 inch square) (Long Pond 19-12-12B).

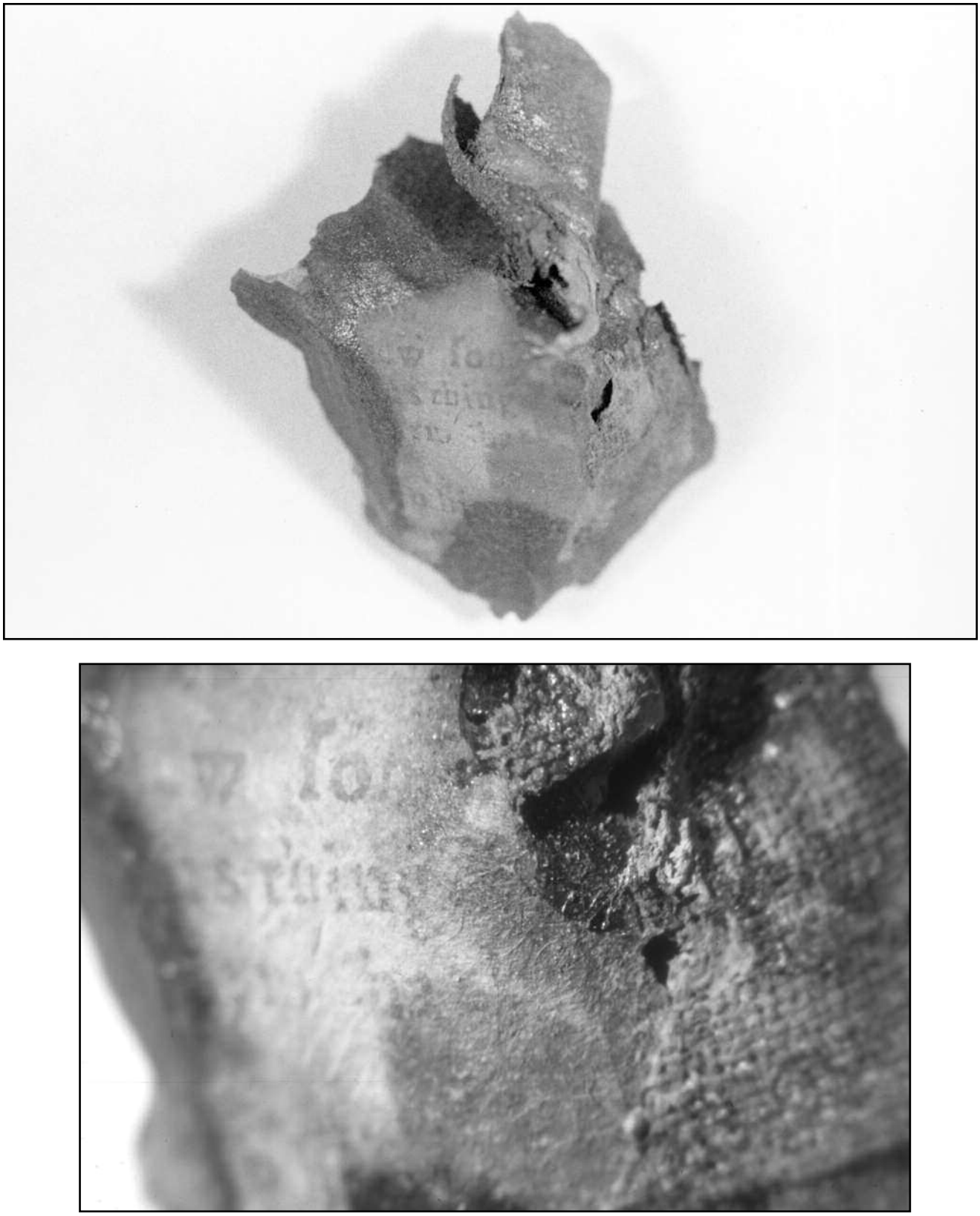

Figure 9.6. Coating of corrosion products preserved the shape of a fine wool fabric covering a page of a Bible (height of letter “W” is 1.0 mm) (Long Pond 18-2-72). Bottom: Detail.

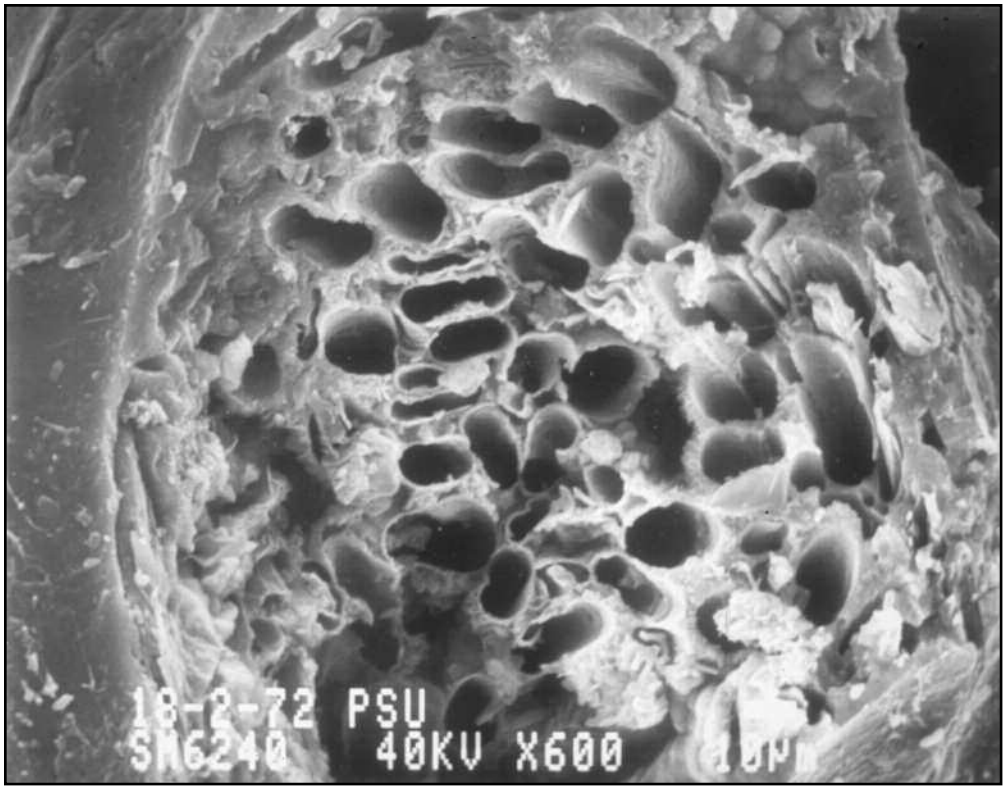

Figure 9.7. Scanning electron photomicrograph showing a cross-section of a yarn preserved by iron corrosion products; the casts of cuticular scales identify fibers as wool (Long Pond 18-2-72).

that air-drying without freezing caused less fiber damage and fabric shrinkage (Fischer 1998). Freezing wet wool to -85°C caused surface damage to fibers. When air-drying is not feasible, vacuum drying at 30°C drying temperature and freeze-drying by freezing to -20°C with a 30°C shelf temperature are acceptable drying methods.

CROSS STREET BACK LOT PRIVY, BOSTON, MASSACHUSETTS

An archaeological survey in 1992 for the Central Artery Project — the "Big Dig" — located this privy in Boston's North End (Lewis 2001). The well-to-do family of Katherine Nanny Nailer used the privy from the 1660s until a clay seal was installed in 1709. The excavating team from Timelines, Inc., and John Milner Associates, Inc., did not expect to find textiles in the large brick-lined vault and had not budgeted for the recovery of leather and fabrics. They found 161 fragments from 82 textiles, 20 yarns, and over 60 leather pieces.

Microenvironments sealed by layers of clay probably produced separate contexts that mineralized cellulosic materials and preserved wool, silk, and leather (Doug Currie, personal communication 2002). The presence of silk was particularly surprising. Silk from New England archaeological sites is rare. Known examples include one strip of silk trim with a silver-wrapped-core yarn that survived from a 1650–1675 Wampanoag cemetery at Burr's Hill in Warren, Rhode Island (Gibson 1980:153), and a few silk fragments from another Big Dig privy, discussed below.

The fibrous materials were kept wet until they were consolidated with an ethyl hydroxyethyl cellulose solution and polyethylene glycol (molecular weight (1450) and frozen prior to freeze-drying. Concreted fragments were treated with a chelating agent (EDTA) to remove iron corrosion products.

The 14 wool fabrics are of high quality, with high fabric counts (Figure 9.8), tightly spun yarns, and/or heavy fulling — a finish that compacts a woven wool fabric to increase its density (Ordoñez and Welters 1998). Finding 35 different silk fabrics corroborates the fact that the economic status of the family was high enough for

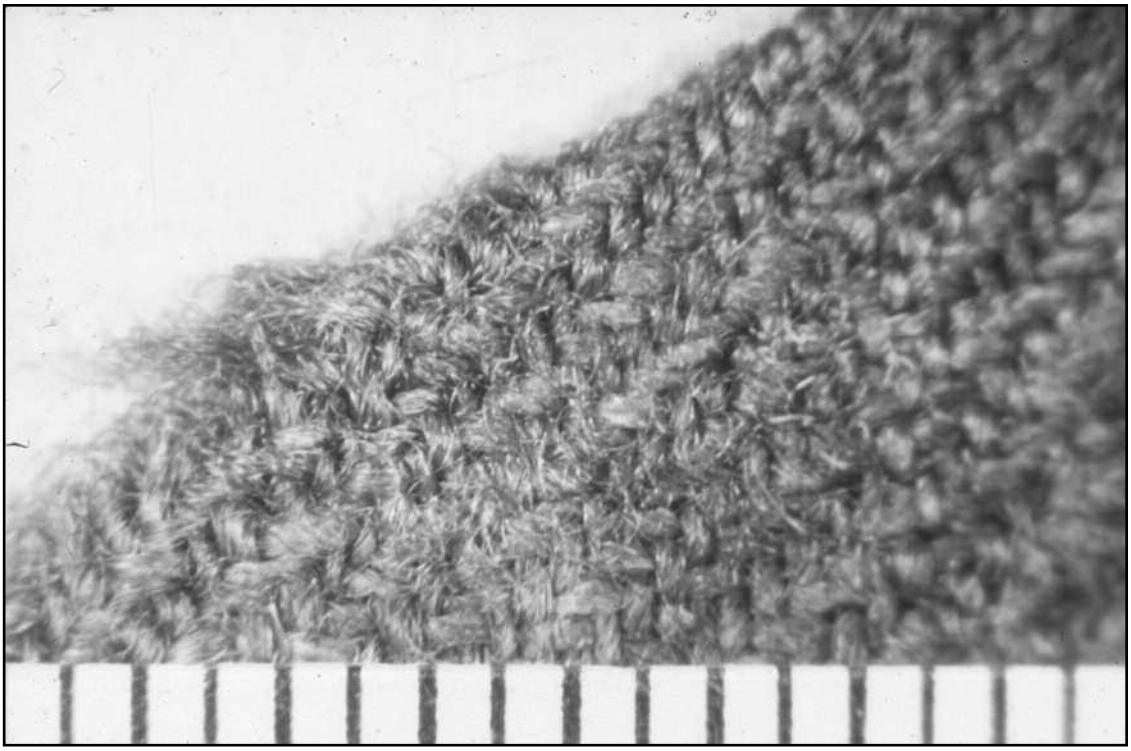

Figure 9.8. Wool 2/2 twill-weave fabric (scale in mm) (Cross Street 6519/38,004).

them to wear silk lawfully in a Puritan town regulated by sumptuary laws. Further support of the hypothesis that this was a fashion-conscious family includes fragments such as a silk gauze, a silk knit, a patterned silk ribbon with metallic trim (Figure 9.9), and a strip of silk bobbin lace, plus expensive mixtures of silk and wool (Figure 9.10) and silk with either cotton or flax (the missing cellulosic fibers precluded identification). Many of the 22 types of ribbons are short scraps with straight-cut ends, suggesting that they came from trimming dresses and accessories (Figure 9.11). The silk ribbons and two-thirds of the silk fabrics are unbalanced plain weaves probably called taffeta or lustring (Figure 9.12).

Unlike the fabrics from the two 17th-century sites discussed earlier, the wool and silk fabrics from the privy include many elements of clothing construction. Someone sewed seams (Figure 9.12), pleats, hems, and trims with two-ply silk thread in a variety of stitches. One lightweight silk fabric fragment resembles the lower section of a full sleeve.

Mineralization of fibers by corrosion products occurred in sections of the privy as it had in the two 17th-century cemeteries. Most of the pseudomorphs had been wool fabric; more unusual were the pseudomorphs of cotton cloth (Figure 9.13). Merchants imported cotton fabrics to Boston in the second half of the century (Baumgarten 1975:230-233). Corrosion products preserved six plain-weave cotton fragments but no linen, although bast-fiber sewing thread in soles of shoes survived due to mineralization (Figure 9.14).

From the 60 pieces of leather from the privy, Jeffrey Butterworth (1998) reassembled three children's and two adults' shoes. Working in the Textile Conservation Laboratory at URI with guidance from Doug Currie, he reassembled parts of shoes that are among the earliest extant examples of American footwear, representing both high and common styles (Figure 9.15). Butterworth carved ethafoam mounts and covered them with fabric to support each of the reconstructed shoes. He also reassembled a working man's shoe and an elegant boot from another North Boston site, the 19th-century Mill Pond.

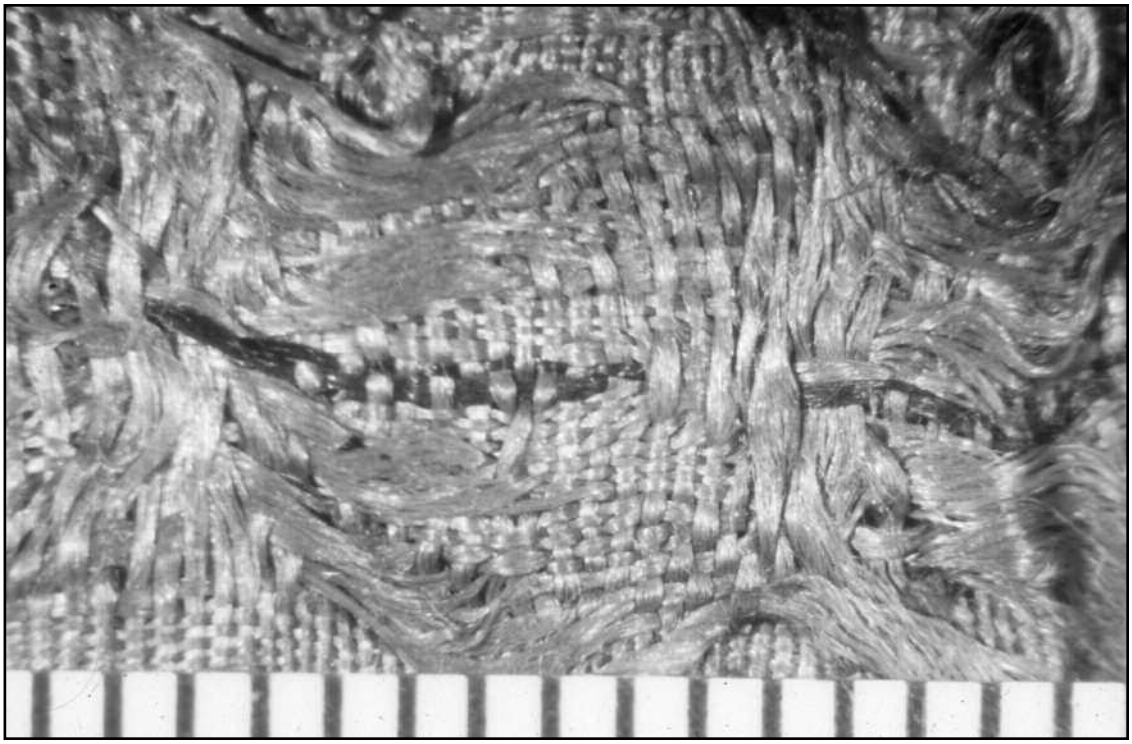

Figure 9.9. Three-colored patterned silk ribbon (scale in mm) (Cross Street 6660/38,031C).

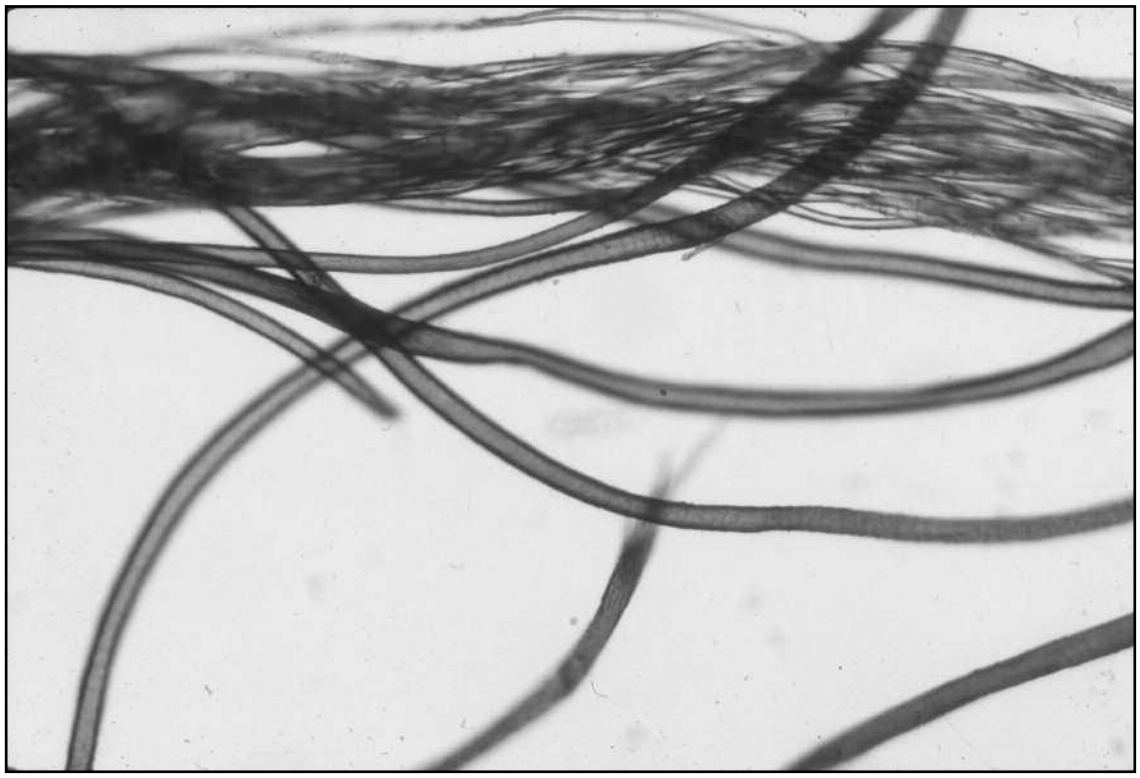

Figure 9.10. Single wool fibers and grouped silk filaments of a 2-ply yarn (diameter of silk filaments averages 0.013 mm) (Cross Street 6647/38,123).

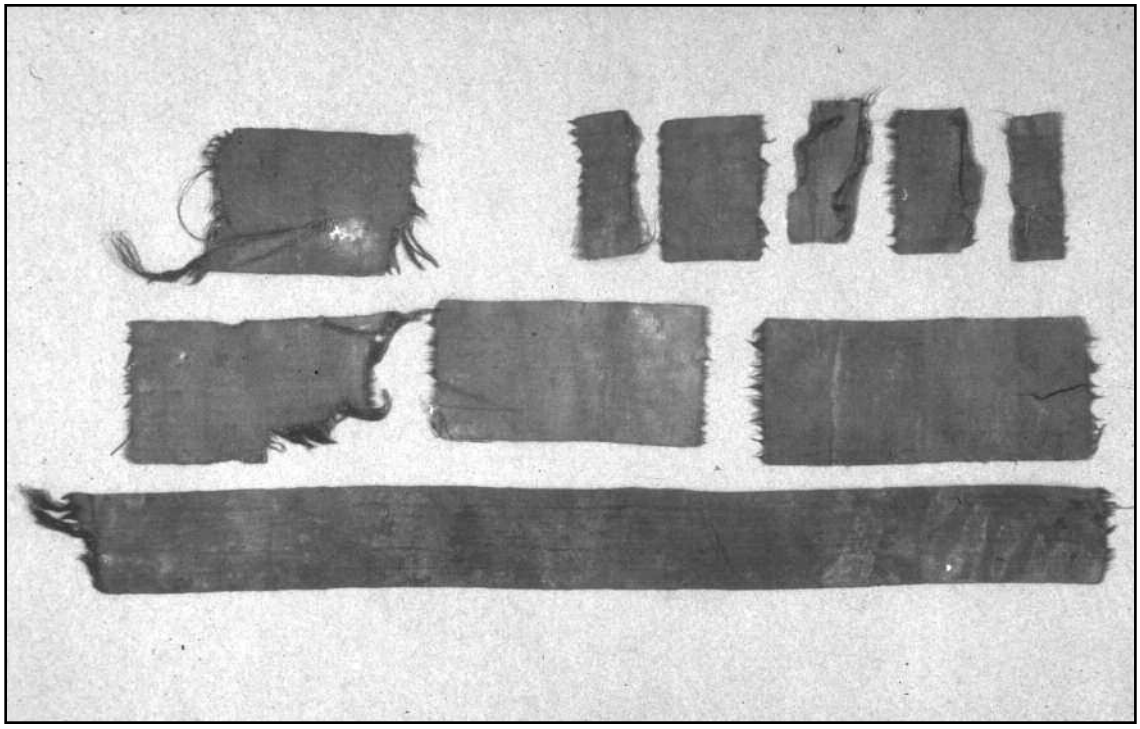

Figure 9.11. Ribbon fragments with cut edges, left over from trimming gowns or accessories (greater widths are 3.4 cm) (Cross Street 6863/38,132).

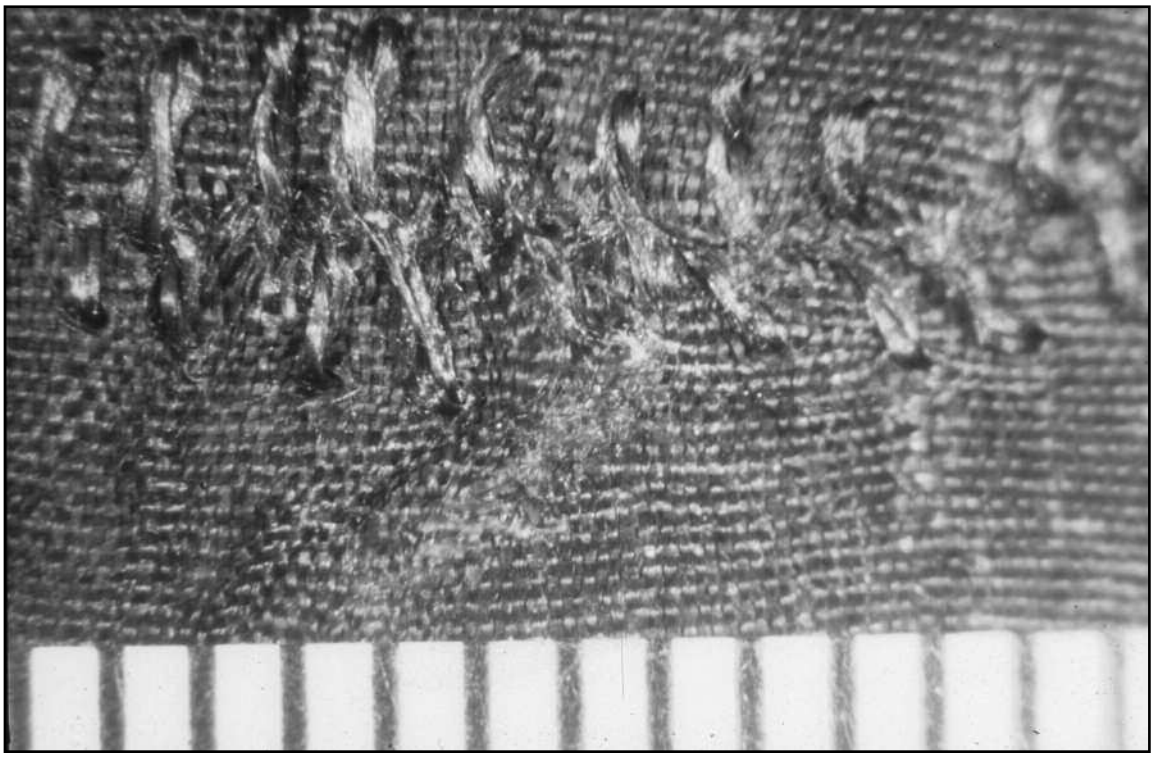

Figure 9.12. Figure-eight stitch along a butted seam of an unbalanced plain-weave silk fabric; note horizontal rib created by high warp yarn count (scale in mm) (Cross Street 6467/37,783).

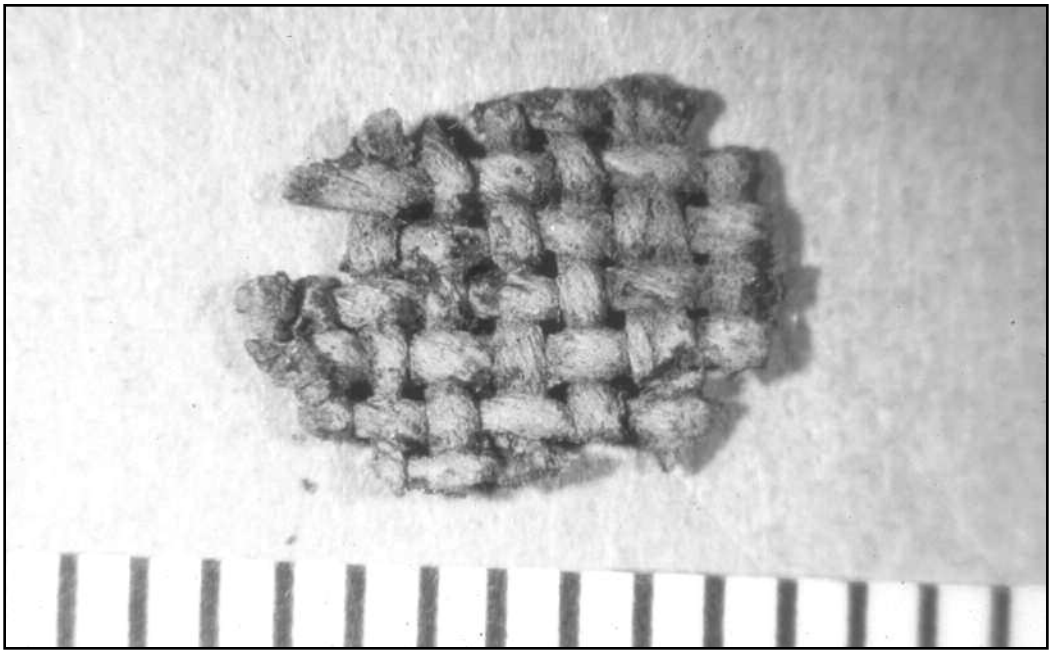

Figure 9.13. Mineralized cotton plain-weave fabric; very similar to cotton pseudomorphs from the Long Pond site (scale in mm) (Cross Street 6690/38,198A).

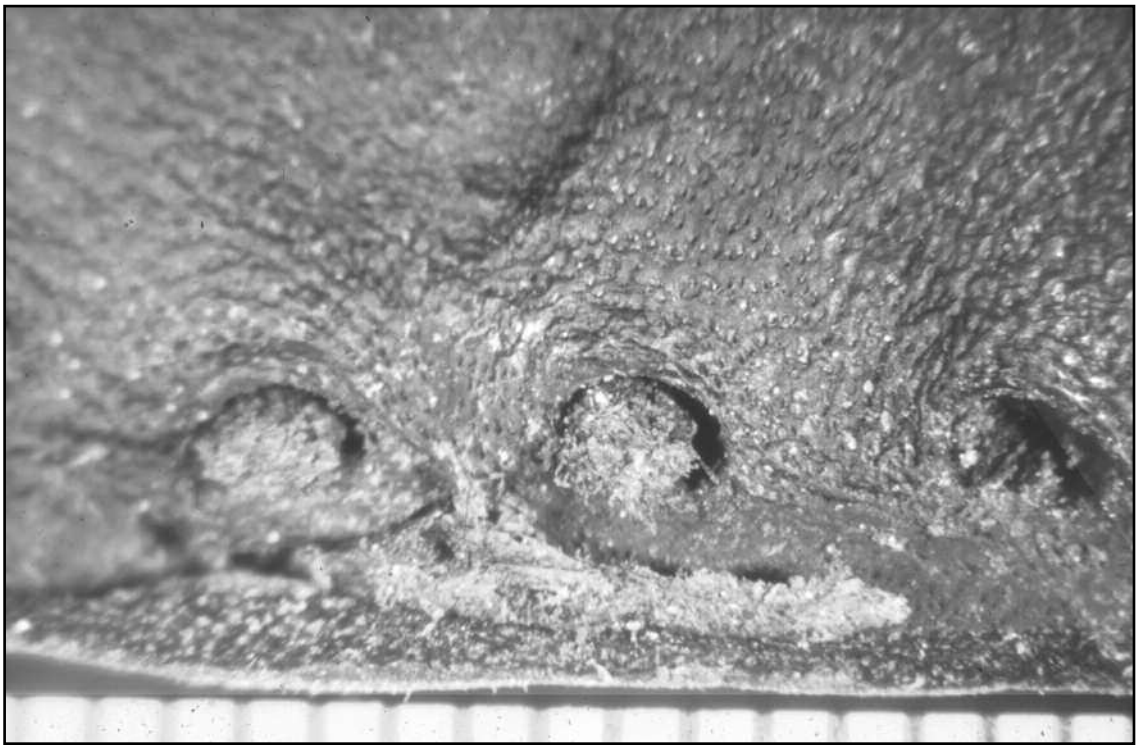

Figure 9.14. Mineralized bast-fiber yarns in stitch holes of shoe sole (scale in mm) (Cross Street 6662).

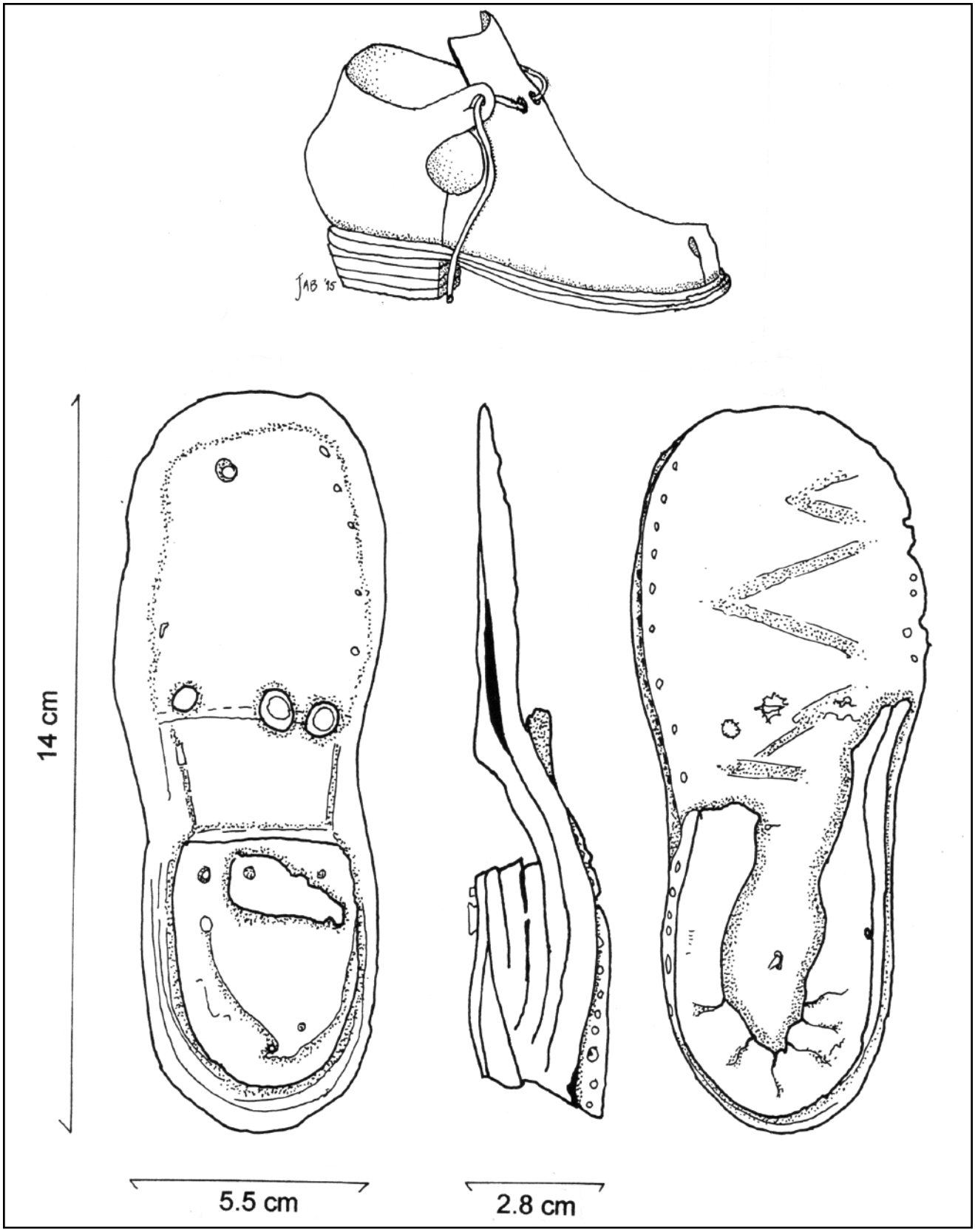

Figure 9.15. Drawing of child's shoe sole with heel (6662/36,089) and reassembled shoe (drawings by Jeffrey Butterworth).

The question arises of why these textiles and leather pieces were in a privy. Possible reasons include someone's deliberately using the privy as a receptacle for refuse or accidentally knocking clothing or an accessory into one of the holes in the outhouse seat. Considering the number of children in the house, this latter possibility is worth consideration.

WAMPANOAG SENECA ROAD BURIALS, MASHPEE, MASSACHUSETTS[5]

Again, construction unearthed burials, but in this case, the soil had been moved from its original location on Seneca Road in Mashpee, Massachusetts. On a rainy day in 1989, Massachusetts Historical Commission archaeologists salvaged skeletal remains, wood and nails from coffins, and fabrics from what probably had been two graves containing three individuals. Welters and Ordoñez (Chapter 10, this volume) removed roots and some soil before rinsing the wet wool textiles in ethanol. Microscopic examination of the 718 fragments determined that they are pieces of 83 different wool fabrics. Sixty-three percent of the fabrics are plain weave, 22 percent twill. The remaining fragments include knits, a braid, and a fabric woven of wool yarns and cellulosic yarns that did not survive burial conditions. Stitch holes and hems indicate construction, but many fragments have clean-cut edges with no sign of stitching. These fragments, along with the large number of different fabrics in the graves of just three people, led to the conclusion that one or more of the individuals had a pillow filled with fabric scraps placed under his or her head.

Another unique characteristic of the fabrics from this site is that a number of fragments are narrow (< 1/2 inch) shaped strips adhering to heavier fabric. The strips may have been sewn to the ground fabric, but no stitching threads survive. The authors believe these are appliques (Chapter 10, this volume). Based on a number of factors including the quality of the wool in the yarns, fabric weight, hand sewing with cellulosic threads that no longer exist, and the appliques, the burials probably date from the very late 18th to early 19th centuries.

27/29 ENDICOTT STREET PRIVY, BOSTON, MASSACHUSETTS[6]

The occupants of 27/29 Endicott Street included females, possibly prostitutes, from 1852 to 1867, and William F. Padelford (a homeopathic doctor), his wife (formerly one of the prostitutes), his step-son, and various boarders from 1867 to 1876. This was a lower-middle-class neighborhood near the red-light district of North Boston (Benes 1995:40). The site was outside the officially identified perimeter of the Mill Pond site, a location also found during the Central Artery Project archaeological survey by Timelines, Inc., in 1992. Archaeologists who had been working on the Mill Pond site volunteered to excavate the privy that, like the 200-years-older Cross Street latrine, contained textiles and leather.

The Endicott Street privy yielded 18 textile fragments, 61 buttons, and 134 pieces of leather (Stevens 2000). Stevens found differences in artifact patterns based on the composition of the two households. The prostitute household had a greater amount and variety of artifacts in all three categories. Like the Cross Street assemblage, this collection includes fragments with evidence of clothing construction, such as intact sewing thread and stitching holes. Similarly, a fabric that had been a protein-cellulose mixture survives as a group of parallel wool yarns with undulations left by a missing set of cotton or flax yarns.

Archaeologists located glass, shell, bone, metal, and rubber buttons dispersed among various levels of the privy. Only plain shell and glass buttons came from the levels that corresponded to the time of Dr. Padelford's occupation of the site, while those from the prostitutes' earlier use of the privy were more varied and decorative.

The pieces of leather from shoes also illuminate the different occupants of 27/29 Endicott Street (Stevens and Ordoñez 2002). Nine to ten women lived in the houses before 1867 and lost or threw away more shoes of a greater variety in style than the doctor's family. Many of their castoffs were turned shoes that would have had fabric uppers; only the soles of these indoor slippers survive. Extant soles reveal the construction

of the shoes; style was more evident from the leather uppers. One type of shoe made with wooden pegs is typically working-class footwear and is rare in historical collections.

DISCUSSION AND CONCLUSION

Archaeologists excavated plain- and twill-weave European wool fabrics from each of the five sites discussed here (Figure 9.8). Imported silk fabrics in plain, twill, and satin weaves came only from the two privies. All three Native American cemeteries contained imported low-fabric-count cotton plain-weave textiles (Figures 9.2 and 9.13). These survived at Long Pond and the Cross Street privy due to mineralization, which also preserved bast-fiber stitching in shoe soles from the Cross Street site (Figure 9.14). At Long Pond, Indian hemp yarns survived in wampum bead constructions that contained copper beads (Figure 9.4).

Few high-quality fabrics came from the Native cemeteries. Generally, the wool fabrics from the Native cemeteries equal the poorest quality in the Cross Street privy. The fashion-conscious, well-to-do family of Katherine Nanny Nailor also left the greatest quantity of fancy fabrics, which included patterned silk ribbons (Figure 9.9), a leno-weave gauze (see Definitions, "Gauze weave"), a complicated silk float weave, and expensive mixtures of silk and wool (Figure 9.10) or silk and a cellulosic fiber that is now missing. Only the later sites at Seneca Road and Endicott Street had fabrics of mixed fibers such as these.

The Narragansett and Mashantucket Pequot tribes in the 17th century followed traditional burial practices but used European textiles in place of furs for grave linings and burial shrouds. Strong evidence of clothing construction came from the other three sites. The variety of seam types (Figure 9.12) and methods of controlling fullness shown in fragments from the 17th-century privy are especially valuable because few extant New World garments exist from that period. For the same reason, extant shoes or shoe fragments from that early time contribute significantly to our knowledge (Figure 9.15).

Similarly, extant pieces of wampum necklaces, sashes, and bracelets from Long Pond furnish a useful record of materials — Indian hemp, sinew, wampum, and copper beads — and construction methods (Figure 9.4). The Native textiles, especially the earliest ones from RI 1000, provide a unique opportunity to learn more about mats and containers.

The variety of textiles preserved by corrosion products in the three 17th-century sites is amazing (Figures 9.5-9.7, 9.13). They are recent formations compared to the more famous silk pseudomorphs on Chinese Han Dynasty swords. The presence of both positive and negative pseudomorphs, especially in the same fragment, is inspiration for more research on the process.

These studies show the value of taking the time to treat and study archaeological textiles and leather from the historical period. Such fragile artifacts provide information on availability and consumption of products used in everyday life. This is especially important for the earlier 17th-century sites because so little has survived from that time period. For later sites, the ability to identify artifacts with known persons, occupations, and economic levels is valuable.

NOTES

1. A comparatively smaller collection of European textiles from excavations at Burr's Hill, Rhode Island, included 73 wool fragments plus one of cotton and one long strip of silk and metallic trim (Dillon 1980:100).
2. The Rhode Island Historical Preservation and Heritage Commission, formerly the Rhode Island Historical Preservation Commission, is the repository of the objects from the RI 1000 site.
3. In this chapter, "positive pseudomorph" is used synonymously with "mineralization" (see Definitions), and "negative pseudomorph" may be used synonymously with "pseudomorph," "mold," or "cast" (see Definitions).
4. Mineralization of fibers occurs within days of deposition in the burial environment and acts to preserve the fiber morphology (Gillard et al. 1994).

5. The University of Rhode Island Textiles, Fashion Merchandising and Design Department is the repository of these textiles (see Ordoñez et al. 1992).
6. Care and storage of the objects from the Cross Street and Endicott Street privies are the responsibility of the University of Massachusetts Boston.

ACKNOWLEDGMENTS

Dennis Piechota was the conservator for the RI–1000 textiles, and Doug Currie for the Boston privy artifacts. Martin Dudeck, Laboratory Director at Timelines, Inc., is the principal investigator of the Endicott Street Privy artifacts. URI graduate students who assisted with analyses included Claudia Iannuccilli, Tora Sterregaard, and Katherine Tarleton. Support for analyses came from the Rhode Island Historic Preservation Commission, the Mashantucket Pequot Tribal Council, Timelines, Inc., URI Grant-in-Aid, URI Research Office Development Grant, and the URI College of Human Science and Services.

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CHAPTER 10

BLUE ROOTS AND FUZZY DIRT: ARCHAEOLOGICAL TEXTILES FROM NATIVE AMERICAN BURIALS

Linda Welters and Margaret T. Ordoñez

ABSTRACT

When bones, coffin nails, and textile fragments mixed with roots were found in fill dirt from the accidental disturbance of an unmarked, undated Mashpee Indian cemetery on Cape Cod, the Massachusetts Historical Commission (MHC) performed an emergency salvage operation. MHC asked the authors to analyze the textiles and establish a probable date.

All 718 fragments were wool; cellulosic fibers once present had degraded. In previous work with 17th-century textiles from Native American burials, wool fragments contained large-diameter coarse fibers. The predominance of fine- to medium-diameter wool fibers at the Mashpee site indicates a date after sheep breeding improved wool quality in the first half of the 18th century.

Eighty-three different fabric types exhibited a range of weights, thread counts, constructions, and textures. Evidence of apparel included hand-sewn hems and seams, braids, appliques, knotted tape closures, and parts of stockings. These characteristics point to tailored, European-style clothing. Comparison to extant examples in New England collections indicates a late-18th- to early-19th-century date for the clothing, and consequently for the burials. These conclusions are corroborated by written records, which mention spinning and weaving skills of Mashpee Indians.

INTRODUCTION

In 1991, at the Winterthur conference on historical archaeology and the study of American culture, Stephen Mrozowski of the University of Massachusetts Boston mentioned an early-17th-century site called Sandy's Point on Cape Cod that had an entire level of what appeared to be "blue roots." Eventually, the blue roots were identified as indigo-dyed wool twill fabric (Mrozowski 1993). About that same time Edward Bell, an archaeologist at the Massachusetts Historical Commission, called us to arrange analysis of samples from a layer of "fuzzy dirt" compressed over the body of an adult male Native American from the Santuit Pond site in Mashpee, Massachusetts. The fuzzy dirt proved to be a napped plain-weave woolen fabric.

We have long argued that "blue roots," "fuzzy dirt," and other archaeological textiles from the post-Contact period in southern New England provide valuable information about the culture of the people who used them. For Native American culture, "perishable" textiles are especially important because documentary evidence is so scarce.

In this chapter, we use a material culture approach to research a group of textiles from an

Perishable Material Culture in the Northeast, edited by Penelope Ballard Drooker. New York State Museum Bulletin 500.

accidentally disturbed Mashpee cemetery on Cape Cod; this approach includes identification, analysis, and interpretation. (This collection also is discussed in Chapter 9, this volume.) The absence of other funerary objects left precise dating of the burials to the textiles.

SITE DESCRIPTION

In May 1990, house construction on Heron Drive in Mashpee, Massachusetts, uncovered human bones in fill dirt. (See map, Figure 9.1.) The dirt had been trucked in from a nearby house lot on Seneca Road close to John's Pond. An emergency burial salvage was undertaken by Edward L. Bell, Leonard W. Loparto, and Peter Mills of the Massachusetts Historical Commission (MHC), at which time it was determined that the Seneca Road site was a Native American cemetery of the historical period (Massachusetts Historical Commission 1990). This cemetery was unmarked and did not appear in any historical records (Edward Bell, personal communication 1993). The presence of iron alloy nails and wood from coffins indicated that the individuals had been given Christian burials. The backfill yielded numerous textiles, but no buttons, pins, or other fasteners.

Along with the textile fragments, the MHC recovered the skeletal remains of three individuals. Michael Gibbons, an anthropologist at the University of Massachusetts Boston, analyzed the skeletal remains (Gibbons 1992). He determined that the bones came from three individuals. The first was a 4-foot-tall child, approximately 6 years old, probably female, whose remains exhibited developmental problems. She may have suffered from malnutrition and was unhealthy when she died. Copper stains on her hair imply the use of copper head or hair ornaments, or perhaps shroud pins. The second individual was an adult male, 45–50 years old, who was 5′ 6″ tall. His skull also displayed the fragments of a copper headband. The third individual was an adult female, 40–45 years old, whose remains were very fragmentary. The remains of her hair also indicated that copper head or hair ornaments had been present.

Unfortunately, most of the textile fragments were no longer associated with particular individuals. MHC personnel bagged the textiles where they were found, noting in the field report that the textiles seemed like "pockets of material within otherwise sterile dirt," possibly scoopfulls from the backhoe (Massachusetts Historical Commission 1990). One of the bags contained textiles found near the child's remains. The field report indicated that all textiles had the characteristics of "wet and rotting cloth." The location of the graves on an elevated knoll with good drainage accounts for the preservation of the textiles, even though they were wet. The pH of the soil was acidic but was too mixed up by the backhoe to get an accurate reading.

MHC asked the authors to analyze the textiles and establish a probable period of manufacture and use. In the words of Brona Simon, the state archaeologist, "analysis of the textiles could provide an idea of the date of the burials, as well as cultural information on burial practices, manufacturing technology, and dress" (Brona Simon, personal communication 1990). Simon hoped that: "the textiles could provide the most cultural information on the people interred at the cemetery."

PROCEDURE

As indicated, the textiles were wet when recovered on May 23, 1990. The recovery team placed them in two medium-sized sealable plastic bags and refrigerated them until they could be transported to the University of Rhode Island. The textiles arrived on July 27, 1990, in their plastic bags. They were in clumps mixed with cranial fragments, hair, roots, and soil. The hair and cranial fragments were removed and boxed for safekeeping. The textile fragments were soaked in ethanol to remove soil and then carefully separated. Some layered fragments remained intact for examination. The textiles were placed on plastic plates marked with identifying information and dried.

Graduate student Kathryn Tarleton studied fiber, yarn, and fabric construction using Olympus stereo and polarizing microscopes. She identified fibers, measured the diameter of yarns, performed a yarn count, noted yarn con-

struction and direction of twist, and determined textile construction, recording all the details on worksheets. She also drew pencil sketches of the textiles. Longitudinal views of fibers were studied under the light microscope with both white and polarized light. For wool fibers, scales, fiber width, and medulla width were observed. Overall dimensions of fragments were noted. When possible, color was observed, although all textiles had taken on a chocolate brown hue.

For those fragments with an underlying deep blue hue, a yarn sample was extracted and placed in a small test tube. Equal amounts of sodium thiosulfite and concentrated ammonia were added to cover the yarn. The test tube was heated to boiling in a water bath. An equal amount of butanol was added, and the mixture was shaken. If indigo was present, the butanol layer that rose to the top appeared blue.

Fragments were grouped according to fabric type, then pinned to foam core boards with brass pins. Tape handles were attached for easy handling. The boards were placed in specially constructed acid-free boxes and stored in the Historic Textile and Costume Collection at the University of Rhode Island, where they remain today per agreement with the Massachusetts Historical Commission (Brona Simon, personal communication 1990).

RESULTS

The emergency recovery yielded a total of 718 samples, exhibiting 83 different fabric types or varieties (Table 10.1). All of the fragments were wool. The wool fabrics contained fibers of fine to medium diameter as well as large diameter. Any cellulosic fibers once present — whether stitching thread made of linen or cotton, or yarns used in fabric mixtures — had degraded in the acidic soil. Stitch holes along seams and hems indicated hand sewing; however, the thread, which must have been cotton or linen, was missing. In some samples cellulosic warp yarns had disappeared, leaving wool weft yarns with impressions of missing warps.

Some yarns had been spun with Z spin, while others had S spin (see Definitions). Many fabrics had only Z-spin yarns; others had only S spin, while a third group had both S- and Z-spin yarns. Nearly all of the woven fabrics contained singles rather than plied yarns, which is characteristic of apparel-weight fabrics. A few of the knit samples had two-ply yarns, which is typical of hand-knitted stockings. The yarns ranged from fine glossy worsteds made from long-staple wool to coarse woolens (see Definitions). Yarn twist ranged from very low to high.

Table 10.1. Classification of Textile Fragments (wool).

Fabric Structure	No. of varieties	No. of fragments
Plain weave, Z-twist yarns	23	321
Plain weave, S-twist yarns	20	181
Plain weave, S- and Z-twist yarns	9	57
Twill weaves	18	87
Knits	8	29
Other constructions	5	43
Total	83	718

The fabrics included 52 types of plain weaves, 18 different twill weaves, eight knits, and five other constructions. The largest category of plain weaves (23 varieties with a total of 321 fragments) had Z-spun yarns, including one example with over 100 fragments (Figure 10.1). This category included balanced weaves, checked fabrics, and rib fabrics. The second-largest category of plain weaves (20 varieties with a total of 181 fragments) had S-spun yarns. This category included fabrics with paired wefts. Half of the 20 varieties were thick, dense fabrics with evidence of napping and fulling. The plain-weave fabrics made from S-spin and Z-spin yarns sometimes alternated "S" and "Z" in the warp, and other times had warps of one type of spin (usually Z) with wefts of the opposite direction. This category included numerous fragments of a two-color check. Eighteen different kinds of twills included 2/1, 2/2, twill stripes on plain ground, and a fancy twill (Figure 10.2). The twills included both worsted and woolen fabrics. Coarse fabrics displayed woolen yarns in 2/2 twill weaves while smooth, glossy fabrics in unbalanced twill weaves had worsted yarns. The

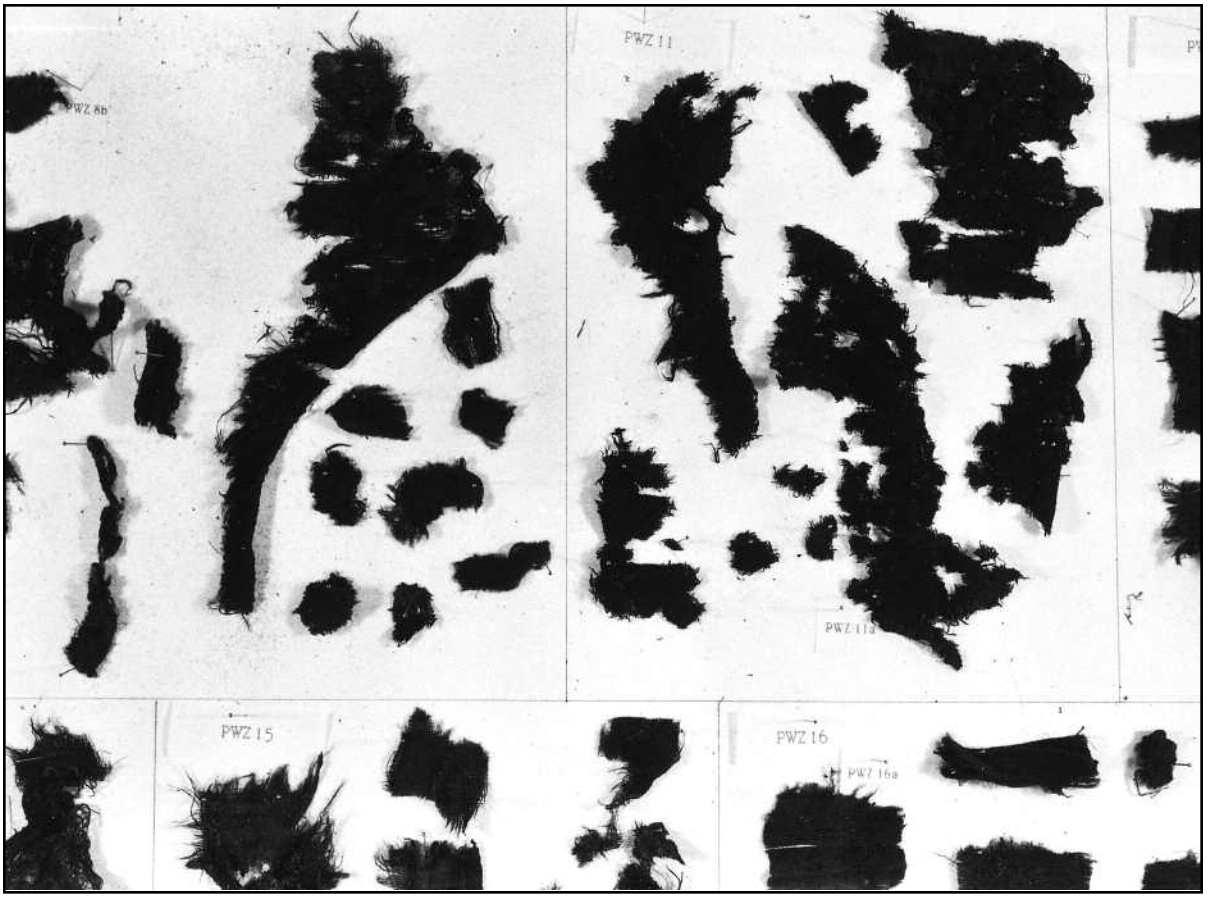

Figure 10.1. Fragments of plain-weave fabric with Z-twist yarns.

knit fabrics, which varied in fineness, displayed mostly stockinette stitch with just one rib stitch. Some of the knitted fabrics were once part of stockings, as evidenced by top edges and shaped areas to fit around the ankle and heel of the foot (Figure 10.3). Some areas of the knit fragments showed heavy wear, including a darned section. The category labeled "other constructions" included one braid as well as another narrow fabric that might have been a trim. Selvages were present in 13 fragments.

In general, the fabrics exhibited a wide range of weights, thread counts, and textures. Some fabrics appeared to be homespun, as they displayed highly twisted, irregular yarns. Others were probably commercially produced. Thick woolens with napped and fulled finishes may have been broadcloth, a popular men's coating fabric of the 18th and 19th centuries.

All of the textiles initially appeared to be uniformly brown, the color of the soil. On closer

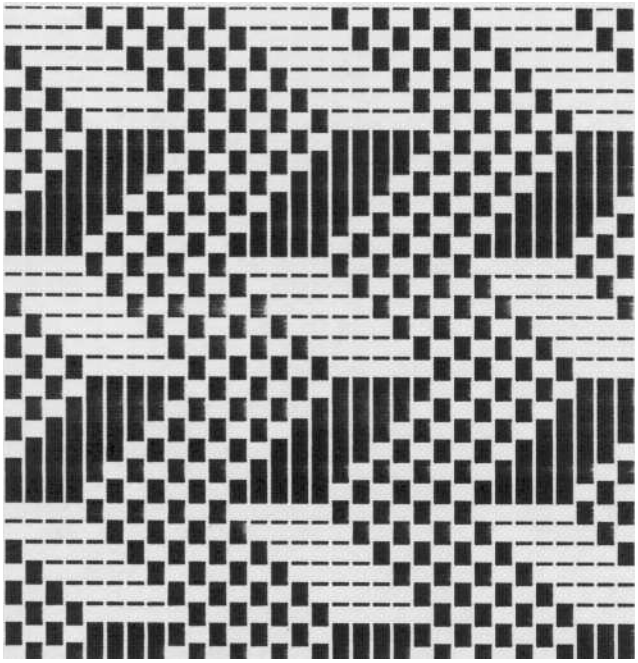

Figure 10.2. Diagram of fancy twill weave.

Figure 10.3. Knitted stocking fragment showing shaped area at heel.

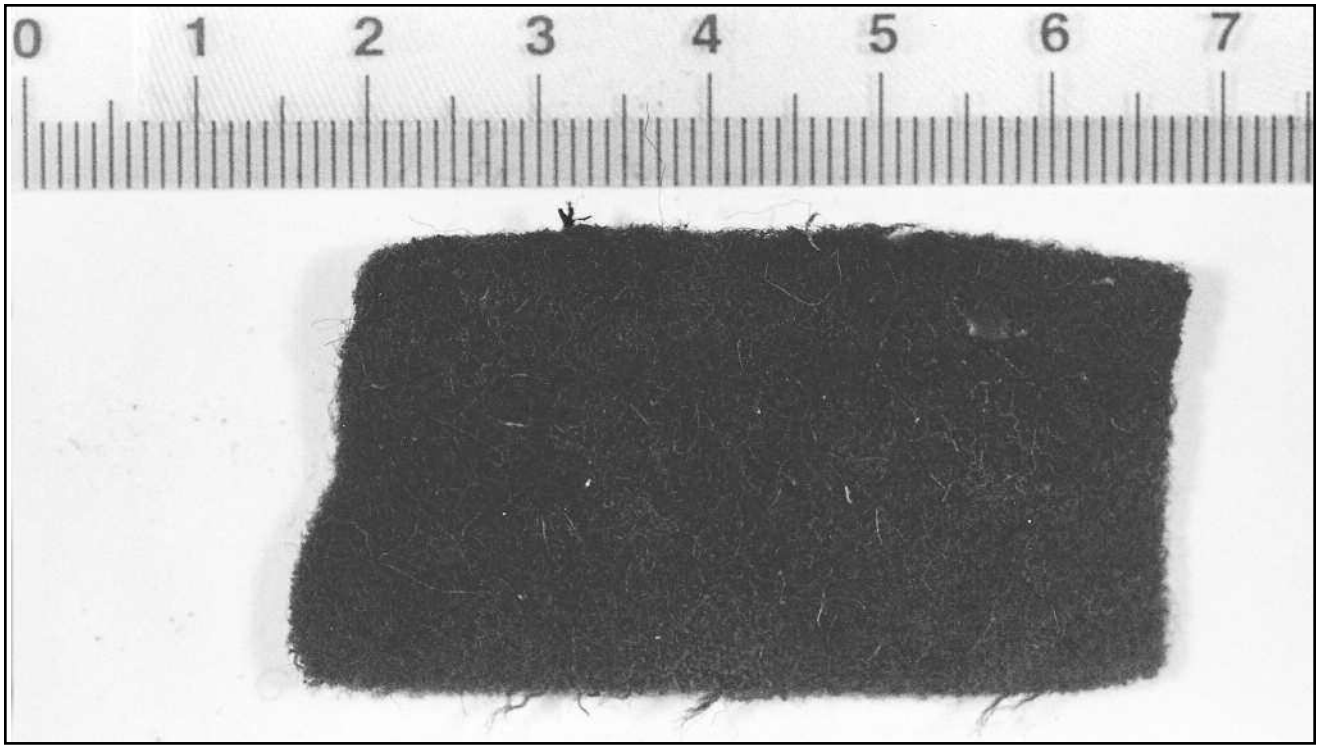

Figure 10.4. Rectangular fragment with cut edges.

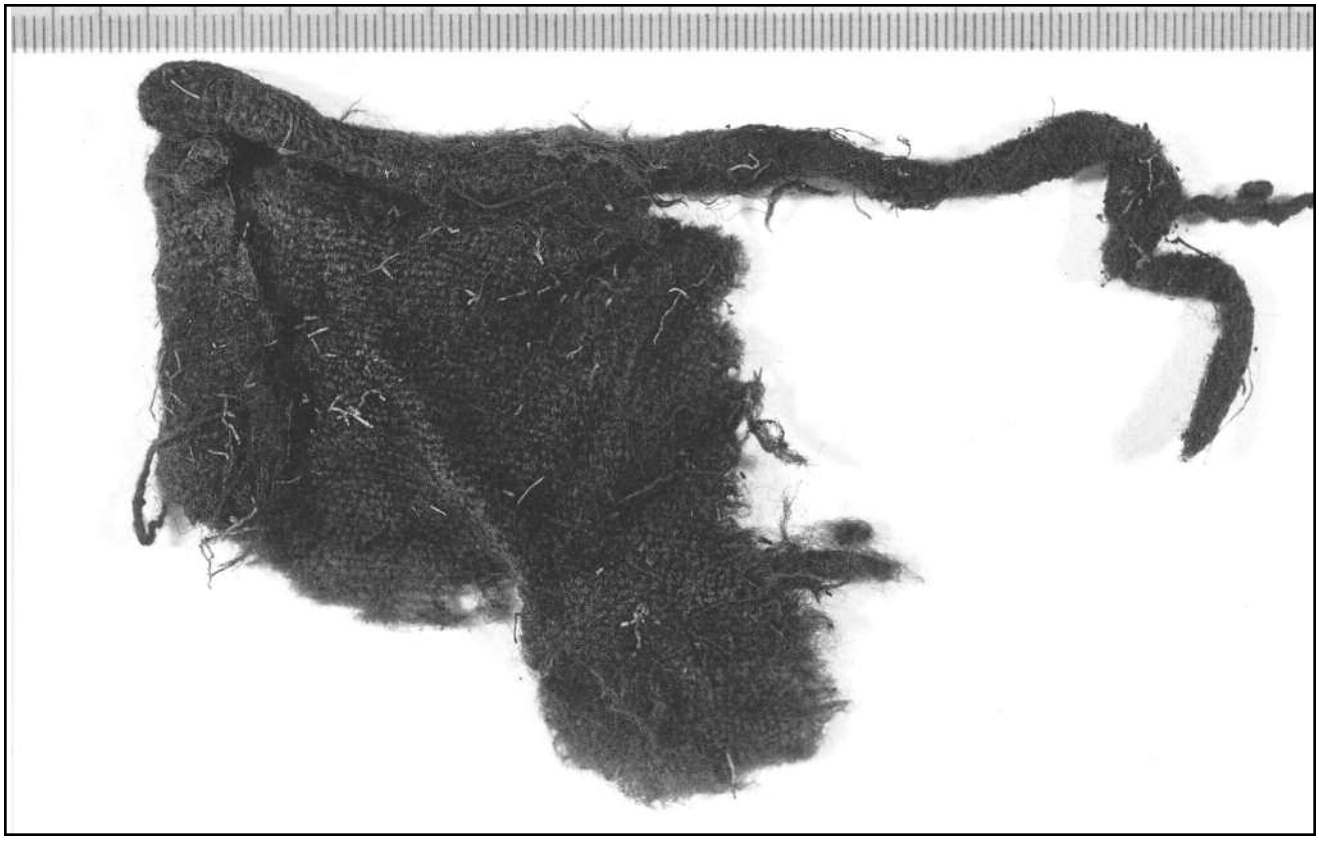

Figure 10.5. Fragment of a hem.

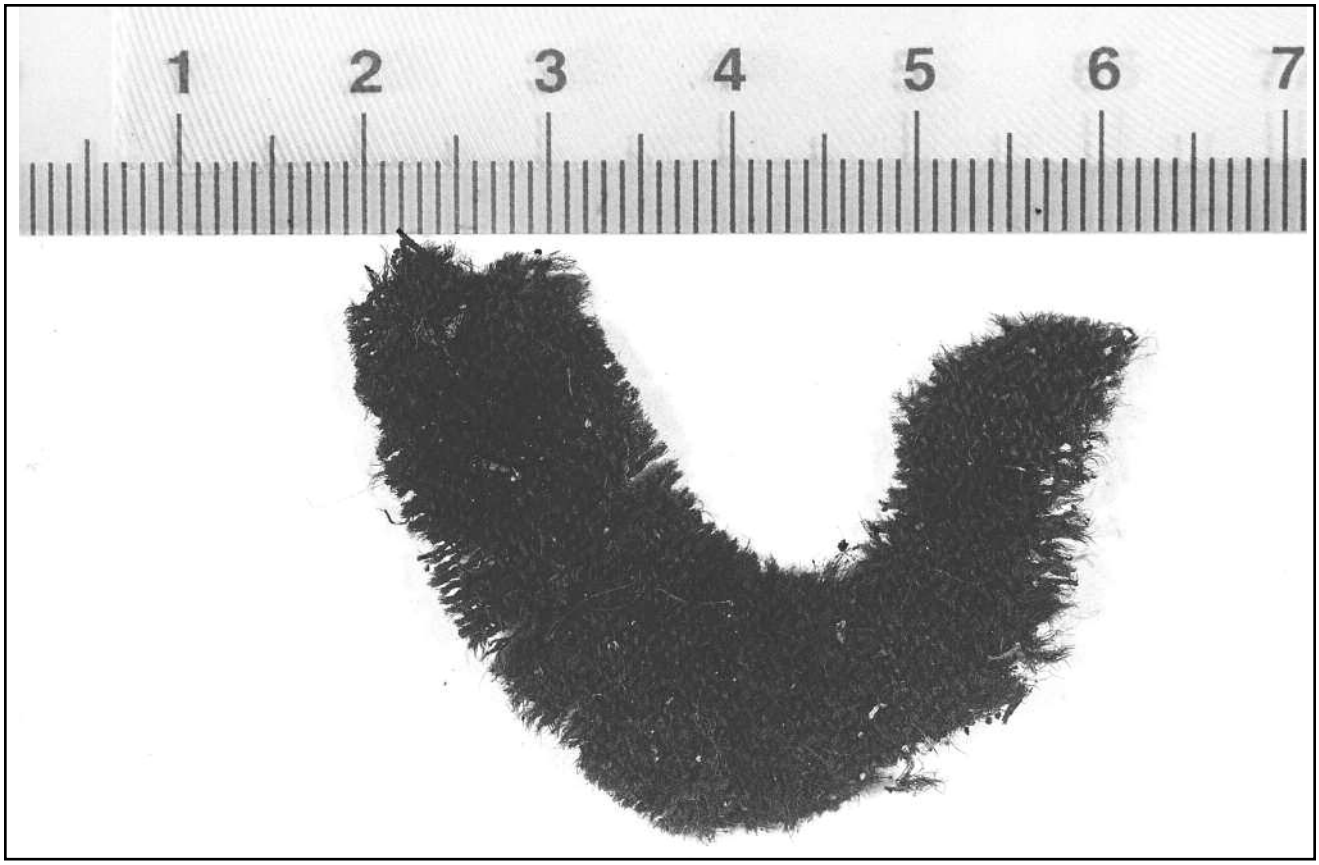

Figure 10.6. Cut-out applique.

examination, the brown hues ranged from buff to brown-black. Some of the checked fragments had yarns of two or three colors. A few of the napped fragments appeared reddish-brown. Samples with a dark blue cast tested positive for indigo.

A number of samples were almost intact, with little degradation. Their edges looked freshly cut along the grainline with no deteriorated sections (Figure 10.4). They looked as if they had once been sewing scraps, as some were irregularly shaped, perhaps left over from cutting out a tailored garment. These clean-edged samples had been layered on top of one another in the plastic bags, so may have once been sandwiched together in the burials.

Many of the fragments were once apparel items. Evidence of apparel included seams, hand-sewn hems, braids, appliques, knotted tape closures, and stockings. Seam allowances typically measured 3/8″. Hems had been rolled or folded (Figure 10.5). The folded edges displayed abrasion, as could be expected from a cuff or a hem, sometimes containing lint in their folds. Many samples had stitch holes. Others had multiple layers of the same textile or composites of two textiles. Braid fragments were found along seamlines. The appliques are particularly interesting. Some were deliberately cut into bias strips to form triangles or curved shapes (Figure 10.6), while others were cut into small squares or circles. Several square fragments had been folded and stitched, as if to form tab-like trimmings. The knots may have been closures, a possibility made more likely by the absence of other types of fasteners. The numerous textile fragments raise many interesting questions about the clothing styles of the Mashpee Indians at the time of the burials.

DISCUSSION

To place the textile fragments in context, a brief review of the history of the Mashpee Indians is necessary. As members of the Wampanoag tribe, the Mashpee had a long history of interaction with the English colonists. In the 17th century, Mashpee became one of 14 praying towns in the Massachusetts Bay Colony established by John Eliot (Campisi 1991). Eliot aimed to "civilize" the Indians by regrouping them into separate settlements. Richard Bourne, the first minister at Mashpee, arrived in 1658 and began the process of conversion of the so-called praying Indians to English customs, including appearance. Eliot's plan met with initial resistance. He did not succeed in teaching the women to spin and weave; instead he relied on donations of clothing from England (Salisbury 1974). But changes slowly took hold. By 1698, a delegation from the Society for the Propagation of the Gospel visited Mashpee and reported that "they are in general well clothed" (Campisi 1991: 80-81).

A series of disputes over property rights in the 18th century left the Mashpee Indians settled on reservation land where they farmed and fished. Much of the settlement occurred around ponds, including the area around John's Pond where the burials were disturbed. Over the course of the 18th century, the Indians at Mashpee adopted shingled houses instead of wigwams, as well as the Christian custom of burying the dead extended instead of in a flexed position (Hutchins 1979; Salisbury 1974).

Adoption of English-style tailored clothing continued. For women this would have meant shifts, stays, petticoats (skirts), short gowns, caps, stockings, and cobbled shoes. For men, shirts, waistcoats, breeches, and coats along with stockings and cobbled shoes constituted the typical 18th-century outfit. An 18th-century portrait of Samson Occom (1723–1792), the Mohegan preacher who initiated the Brothertown movement, shows him attired in coat, waistcoat, and breeches, probably of wool broadcloth. Gideon Hawley, minister at Mashpee from 1757 to at least 1802, reported in 1802 that the women were good spinners, combers, and weavers, and clothed themselves and their husbands "in everyday homespun . . . in the English mode," fashioning "very decent and showy" apparel for Sunday church services (Hutchins 1979: 68). He also noted that some women manufactured wool for their families' clothing, but many made brooms and baskets for sale to their white neighbors (Hawley 1968 [1815]).

In the 19th century, settlement moved outward from the ponds. The people continued farming, fishing, cranberry-picking, and manufacturing brooms and baskets. As the whaling industry developed, many men joined whaling voyages. The Mashpee were ministered to by William Apes, a Pequot preacher who helped them achieve self-governance in 1834 (Peters 1987). Although the Wampanoag and other Indians of southern New England dressed in European-style clothes for the most part, as seen in surviving photographs (Figure 10.7), ethnic markers include long hair for men and headbands (Welters 1993).

Returning to the textiles, 83 is an unusually large number of different textiles to be associated with just three individuals. Although some of the fragments no doubt once comprised the burial clothing of the deceased individuals, another explanation is necessary. When we opened one of the bags of textiles that contained substantial amounts of hair, we observed that the hair samples were adjacent to a depressed part of the fabric and that the fabric appeared to have been rolled. When burial customs are studied, the possibility arises that the corpses' heads rested on pillows.

Little is known about how Christians in New England laid out the deceased in the late 18th and early 19th centuries; even less is known about how the praying Indians buried their dead. Secondary sources report that burials in New England took place fairly soon after death because the body was not embalmed (Larkin 1988; Nylander 1993). The body was laid out, dressed in a shroud or other grave clothes, then placed in a coffin (usually pine) for viewing. The closed coffin was transported to the cemetery covered with a black fabric "pall." Some shrouds from the first half of the 19th century survive in the region's collections. Made of inexpensive cotton cambric, their loose stitching reveals hasty construction.

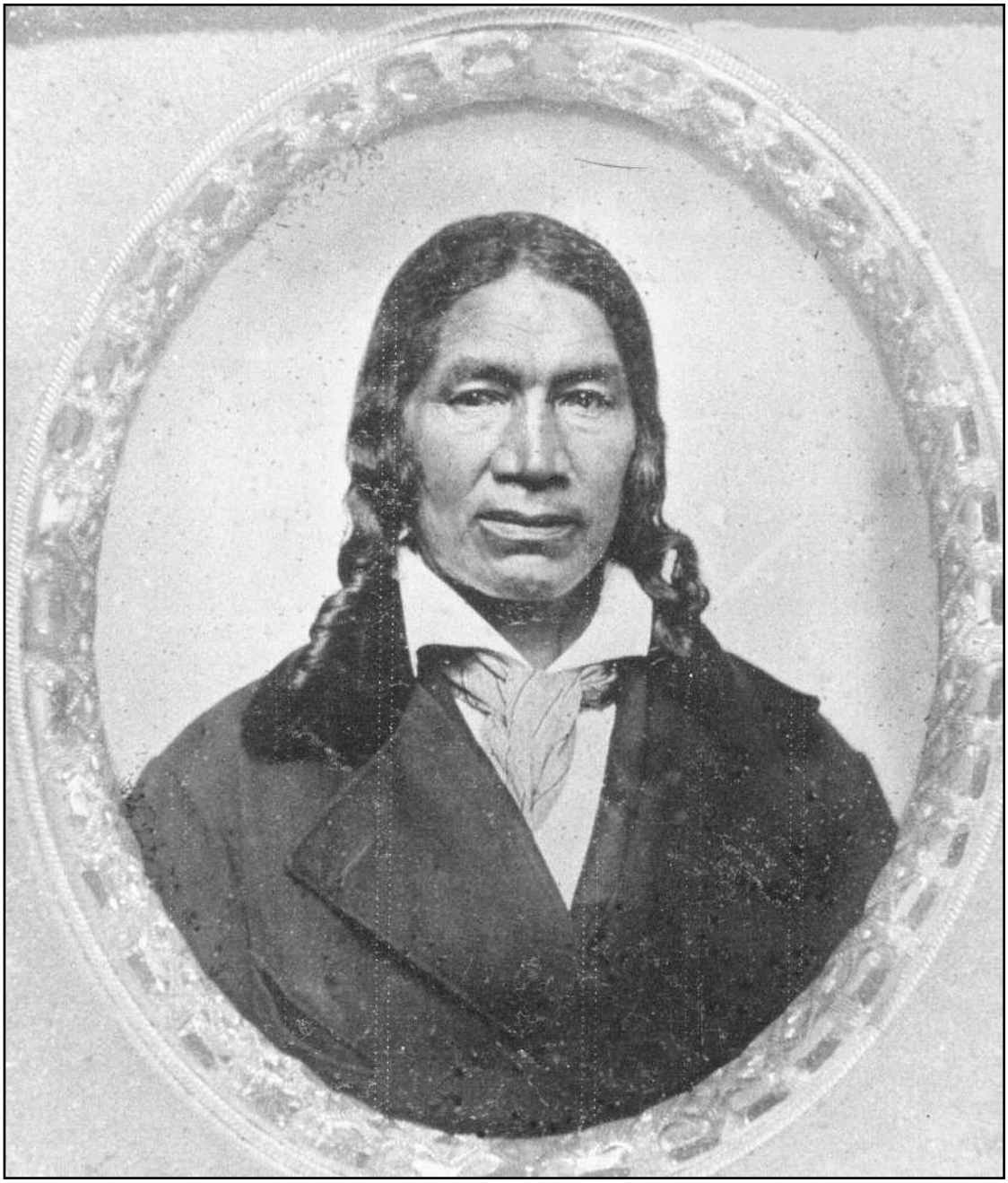

Figure 10.7. Deacon Simon Johnson, ca. 1856-1860. Wampanoag preacher at Martha's Vineyard. Ambrotype. Unknown photographer. Courtesy of the Martha's Vineyard Historical Society.

To find evidence for the use of pillows, we had to go further afield. The exhumation of two mid-19th century burials on a Louisiana plantation revealed that the bodies of the deceased were laid out in the typical clothing of the period, then covered in a shroud and/or winding sheet, with the heads resting on pillows (Brantley 2000; Welker and Kuttruff 2000). In one case, the pillow was stuffed with cotton fiber, which makes sense given the location of the burials on a southern plantation. Pillows and bolsters had been common in New England households since the 17th century (Earle 1969). The better ones were stuffed with feathers, but wool scraps also sufficed (Bogdonoff 1975). Given the large variety of textiles in the burials

from Seneca Road, we believe these Mashpee Indians most likely were laid to rest with their heads elevated on homemade pillows stuffed with wool scraps.

To return to the question about the date of the site, the skeletal analysis and the documentary evidence point to a late-18th-century date. Gibbons (1992) estimated the skeletons to be approximately 200 years old, placing the site at approximately 1790. He speculated that the remains of the girl could have been older. Bell, in researching land records, maps, and local histories, concluded that the burial ground was used sometime before the early 19th century (Edward Bell, personal communication 1993).

The fabrics themselves provide further clues to help date the site. The varieties of wool fibers in the fragments ranged from fine to coarse, but the relatively few coarse hairs present indicate a date well into the 18th century when sheep breeding improved the quality of wool. Seventeenth-century Native American sites we have studied yielded mostly coarse woolens rife with large-diameter fibers from hairy fleeces (Welters et al. 1996). Such cloth, known as duffles or trucking cloth, was made expressly for trade to Native Americans. This was not the type of cloth found in these burials.

The textile fragments are similar to the fabrics found in clothing worn by rural New Englanders during the late colonial period and into the early Republic. Clothing made of certain homespun fabrics was worn in southern New England until about 1830. After that, the factory-made textiles produced in area textile mills were so affordable that homespun clothing became a thing of the past. Simple plain-weave homespuns, checks, and plaids could have been made by the native women of Mashpee. Some fabrics, such as broadcloth, may have been acquired for waistcoats or coats. The fulled wools (see Definitions) approximated apparel-weight fabric rather than the heavier material used in hats.

New Englanders still knitted their own stockings well into the 19th century because such garments wore better than factory-made stockings (Ulrich 2001). Braided or knitted garters tied above the knee held up the stockings. The knotted tape mentioned previously could have been a garter. As far as other types of fasteners are concerned, garments could have been closed with fabric-covered buttons, as these are characteristic of the period before 1830. Made of cloth over wood, bone, or other stiff base material, this type of button has a much lower chance for survival in the archaeological setting than ceramic, glass, or metal buttons.

Because the fragments indicate hand sewing rather than machine stitching, the burials cannot be dated after the mid-19th century. Clothing was sewn by hand until the widespread adoption of the sewing machine. This occurred by 1860, judging by surviving clothing of southern New Englanders.

Some of the clothing, particularly the coats, could have been issued by government-appointed overseers. Massachusetts Bay Colony legislation in 1660 instituted a program of awarding coats to children who entered apprenticeships with white families (Salisbury 1974). Wool coats had been traded to Native Americans by Europeans since at least the early 17th century. Some of these coats are described in the historical record as "laced," which means trimmed with specially woven tapes and braids (Welters 1993). A tailored coat has numerous layers of cloth near the neck — collar, lapel, and facing. Coat styles from about 1790 to 1830 had unusually high collars, creating a substantial mass of material around the neck (Figure 10.8). Surviving coats from the period are made of dense wool fabrics which have been heavily fulled. Given the large amounts and layers of fulled wool among the Seneca Road fragments, the adult male could have been buried wearing a tailored wool coat.

In the case of the Mashpee textiles, the appliques and cut-out trims represent something uniquely native. Among the textiles associated with the young girl, triangular motifs on a seamed fragment imply that her body was laid out in an outer garment unlike those that survive in collections. The only garments that suggest the use of wool appliques are 19th-century outer garments and bags made by Woodland Indians. The beaded outfit worn by Caroline Parker, a Seneca woman (Figure 10.9), illustrates the decorative clothing worn by some Eastern Woodland Indians in the mid-19th century. Photographs from the late 19th and early 20th century reveal

Figure 10.8. Wool tailcoat, circa 1820. University of Rhode Island Historic Textile and Costume Collection. 1953.23.03.

Figure 10.9. Caroline G. Parker wearing traditional Seneca clothing made by herself. Photograph copy of a lost hand-tinted daguerreotype with the image laterally reversed, taken slightly before 1850. Courtesy of the Southwest Museum, Los Angeles (Photo #N24963).

that numerous tribes employed applique as a decorative technique. For instance, a 1912 image in the collections of the Smithsonian Institution shows a Western Niantic woman named Mercy Nonsuch Matthews holding an appliqued and beaded pouch of curvilinear motifs similar to those on Caroline Parker's clothes. Along with the copper headbands, such decorated textiles signify Native American cultural practice among the Mashpees.

CONCLUSION

The 718 textile fragments from Seneca Road could easily have been overlooked since their color was the same as the soil and roots had grown through them, giving them the appearance of "fuzzy dirt." These fragile wool fabrics provide information about sewing techniques, apparel materials, native textile production, and unique Indian modifications to English style apparel. The presence of so many fabrics with evenly cut edges suggests that Mashpee Indians used pillows stuffed with wool in mortuary practice. Close examination of the textiles helped to confirm the dating of the site to late 18th to early 19th century.

ACKNOWLEDGMENTS

The exacting process of examining and categorizing the textiles was performed by Kathryn Tarleton through a URI research assistantship. Thanks to Edward Bell of the Massachusetts Historical Commission for providing site information and related references.

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CHAPTER 11

SUSANNAH SWAN'S "WAMPUM BAG"

Penelope B. Drooker and George R. Hamell

ABSTRACT

This chapter discusses the materials, techniques, and convoluted history of a late 17th century New England twined bag, one of the earliest extant historical examples from this region.

INTRODUCTION

The art of making patterned twined bags, once widespread in the Northeast, withered and gradually disappeared during the two centuries after the advent of Europeans. Only hints of this skill and its products have survived in the archaeological record (see Chapter 1 and "Comparisons" below), but a handful of extant historical examples provide hints as to what has been lost.

One such patterned twined bag, from late-17th-century New England (Figure 11.1; previously published in Dongen 1996:194 and Ulrich 2001:49-50), is described below. The quality of preservation compared to that of twined materials from the archaeological record provides a window into an almost unknown pre-European-contact body of work. The "life story" of the bag, as pieced together by George Hamell from family tradition and written documents, contains some gaps and some inconsistencies between oral and written history. Technical analysis of the bag (carried out by Penelope Drooker) complements its history, and provides additional information about its likely place of origin.

Figure 11.1. Side view of bag.

HISTORY

Hamell was introduced to the bag in 1992 by its owner, an Albany, New York, area resident who had received it from his paternal grandfather, Walden Denison Brough. Three documents accompany the bag, recording information and a family tradition about its origin. The first, dated 1896, was penciled on a cardboard insert cut from a hat box to stiffen the bottom of the bag. The second probably dates to the turn of the 20th century. The third, written on letterhead of a Schenectady business perhaps by Mr. Brough himself, is a later 20th century document. (See

Perishable Material Culture in the Northeast, edited by Penelope Ballard Drooker. New York State Museum Bulletin 500.

Appendix 1 for annotated transcriptions of these documents.)

In these documents, the twined bag is characterized as a "wampum bag," and identified with a "Susan Swan," an ancestor who had been captured by the Indians during the "Connecticut War" over 200 years earlier. According to the family tradition, "Susan Swan" made her escape after two years of captivity with the assistance of an old Indian woman, identified in one of the documents as "the chief's mother." This woman gave "Susan Swan" a "wampum bag" containing food, along with a blanket, and provided directions to a nearby Euro-american settlement.

During the 19th century, holes in the bag were mended and it was converted into a "sewing basket." A circular cardboard disk was covered with fabric on one side and inserted into the bottom of the bag to flatten and stiffen it (Figure 11.2), the top edge was bound with fabric, and a fabric strap was added.

Figure 11.2. Cardboard insert for bottom of bag, covered with chintz.

According to the late-19th–early-20th-century documents, not only the bag but also the blanket were extant, the bag preserved in the Walden family, from which probably came Walden Denison Brough's first name, and the blanket in the Gallup family. The earliest of the three documents further links "Susan Swan" and the bag with the Ball family, and probably the Miner [or Minor] family. It was written on the underside of the cardboard insert (Figure 11.3), cut from a hatbox that bears the stamp of a Schoharie County, New York, hatter and furrier, J. H. Boyce & Son, in business during the mid-19th century (Child 1873). Among the penciled notes is the statement that "Susan Swan" was the "great great great great great great / Grand Mother" of Mr. William Miner Ball. The cardboard also bears the notation, "Wm M Ba[ll] / Mrs / H F Bal[l] / 1896."

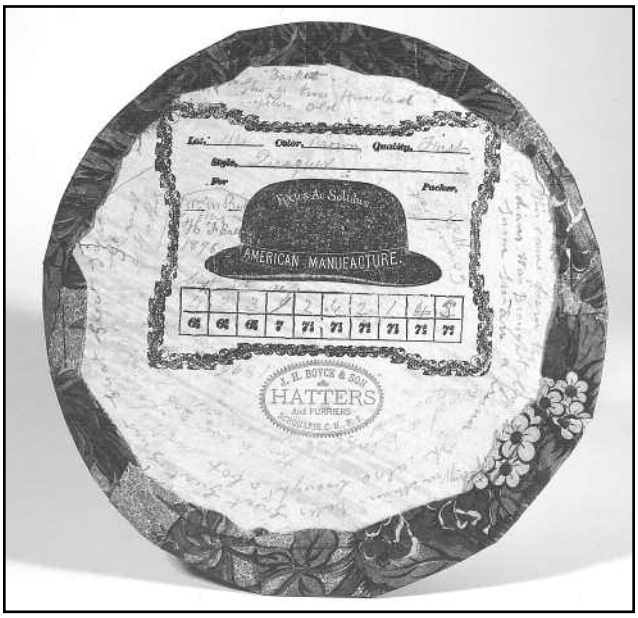

Figure 11.3. Reverse side of cardboard insert, showing identification marks and handwritten remarks.

Thus, although the family tradition places the origin of the bag in the captivity and escape of a female ancestor during the 17th-century Indian wars in New England, internal evidence from the documents themselves suggests that it has been in the possession of Albany area descendents for at least the past 100 years. This inference is corroborated by genealogical research.

The bag now has been identified with the captivity of Mrs. Susannah Wood (1673-1772), daughter of Phillip Eastman (1644–died before 1714) and resident of Haverhill, Massachusetts (Rix 1901, I:10, 19-20) (see Appendix 2). During

the French and Indian attack upon that northern frontier community on March 15, 1697, Susannah Wood was taken captive by the Indians, and her husband Thomas and daughter Susannah were killed. Susannah Wood was among many captives taken in the attack on this vulnerable frontier community, most notably among them the infamous Hannah Dustin (Coleman 1925, I:337, 342-345). The release of Susannah and other New England captives among the Narridgawag [Norridgewock], Narrackomagog [Rocameca], and Amassacanty [Amaseconti] bands of Abenaki was secured two years later at a treaty at Marepoint (now Brunswick), Casco Bay, Maine (Coleman 1925, I:77-79).

Shortly after her release, Susannah married John Swan of Haverhill, where they continued to reside until about 1709 (Rix 1901, I:19-20). During the French and Abenaki Indian attack on Haverhill in late August 1708, the now Susannah Swan, armed with the fireplace spit, reportedly skewered the first of two Indians attempting to force their way through the doorway of the family home (Mirick 1832:123-124; White 1842:95-96). By 1709, Susannah and her husband had moved to Stonington, Connecticut, where she died on 20 December 1772, in her hundredth year. Although the Eastman genealogy states that Susannah Wood/Susannah Swan had been twice captured by the Indians (Rix 1901, I:10), historical records document only the one incident of 1697–1699.

Plausibly the bag descended in the Swan lineage, at least into the early 19th century, passing from Susannah's son John Swan (1710-?), to his son Joshua Swan (1736–1802). Joshua Swan and family moved from Stonington to the Albany area in 1788, settling in Saratoga County, which abuts Albany County to the north. Joshua Swan died in the town of Milton, Saratoga County, in 1802.

While this genealogical reconstruction allows for the bag's subsequent family descent within the Albany area, genealogical research has failed to directly link the Swan family to Walden Denison Brough, grandfather of the present owner. Research does suggest an indirect linkage by means of two other Stonington families, the Denisons and the Gallups, members of which played prominent roles in King Philip's War, and descendents of whom also emigrated to the Albany area in the late 18th and early 19th centuries, settling in Schoharie County, New York (Denison 1963; Gallup 1893). Denison and Gallup family genealogies (e.g., Denison 1963; Gallup 1893) document the frequent intermarriages of these two Schoharie County families. More significantly, while resident in Stonington, Susannah Swan's son John Swan, and three of her grandchildren, including Joshua Swan, married members of the Denison family, which also linked them to the Stonington Gallup family (Rix 1901, I:*passim*). The Walden family surname (Mr. Brough's given name) and the Miner [Minor] family surname (see Appendix 1, Document 3) also appear in Denison and Gallup family genealogies of the 19th century. However, a marriage sometime in the first half of the 19th century of a male Swan family descendent into the Ball and/or Miner [Minor] families is also suspected, but has not been attested to date.

The identification of the bag as a "wampun bag" in the late-19th-century and turn-of-the-20th-century recorded traditions of the bag's significance. There is nothing about the bag itself that would identify its use as such. Certainly, loose wampum beads, wampum strings, and wampum belts could have been stored or carried about in basketry bags or other containers. Given this bag's original form and large size, its dedicated use to store or transport wampum seems very unlikely.

Undoubtedly, survival of the twined bag into the 19th century can be traced to the tradition of captivity identified with it. Susannah Eastman Wood Swan lived into her hundredth year, dying 75 years after her captivity and release. She undoubtedly repeated her story many times to her children and grandchildren, which accounts for its survival as a family oral tradition well into the 19th century and the anonymous written accounts of it dating to around the turn of the 20th century.

Contributing to the bag's survival was its conversion into a sewing basket sometime during the last half of the 19th century, at which time it was mended and stabilized. However, the

additions made to the bag at that time also obscured some of the original details of construction, as discussed below.

ANATOMY OF A TWINED BAG

Susannah Swan's bag is one of an extremely small group of extant 17th-century New England decorated twined bags (see comparison below). Its complex geometrical pattern, fine-scale cordage, and consistent, skillful execution earmark it as the product of an experienced, meticulous craftsperson. Its materials, structure, and design can inform us of details of its history not touched upon by the documentary evidence.

SIZE

The bag was difficult to measure because of its present somewhat-distorted shape. It is approximately 21 cm high by 28 cm wide (equivalent to a diameter of about 18 cm). Its now-flattened bottom originally might have been at least somewhat rounded, adding to its height. Because of the fabric binding, it is unknown whether the current top edge is at the same level as the original; it might possibly be worn down or cut off.

ORIGINAL MATERIALS

The warp and weft elements of this bag are of plant materials, more highly processed in the warps than the wefts.

The reddish-brown warp elements, approximately 2 mm in diameter, consist of two S-twist singles cords plied together with a Z twist (see Definitions). This cordage is well made and consistent in diameter except where damage to the bag has resulted in fraying or untwisting. The material is basswood; "individual elements are flat strips" (Welters and Ordoñez 2002).

The dark weft elements consist of untwisted, unplied flat strips of basswood (Welters and Ordoñez 2002), with color varying from medium to very dark brown. This color variation appears random, rather than intended to create a planned pattern. The lighter, straw-colored wefts are hollow plant stems, possibly rush (Welters and Ordoñez 2002). No twist direction is apparent in either weft material. These elements, too, are approximately 2 mm wide, but flattened in cross section compared to the cordage.

LATER ADDITIONS

Three industrially woven fabrics were added to the bag at a later date.

Damage to the bag was repaired by patches of a brown, denim-like fabric with one set of white and one set of brown elements as warp and weft. In combination with the uneven twill-weave structure (see Definitions), this results in a different coloration on each side of the fabric. The darker side, showing a greater proportion of the brown elements, is oriented to the outside of the bag. The fibers have not been analyzed, but are likely cotton. Alternatively, the fabric might be a combination of cotton and wool ("jean") or linen and wool ("linsey-woolsey"). A circle of this fabric was sewn into the severely damaged bottom of the bag (Figures 11.4 and 11.5). There also is a small patch covering a hole in the side (Figures 11.6 and 11.7). A small slit in the side was sewn together rather than being patched (Figure 11.8).

Figure 11.4. Bottom view of bag, damaged and repaired.

A glazed cotton chintz was used to bind the edge of the bag, and also to cover the circular

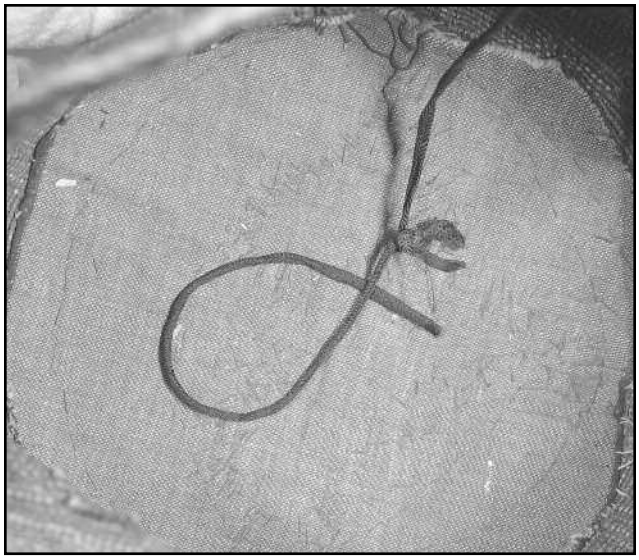

Figure 11.5. Interior bottom of bag, showing large patch of twill fabric.

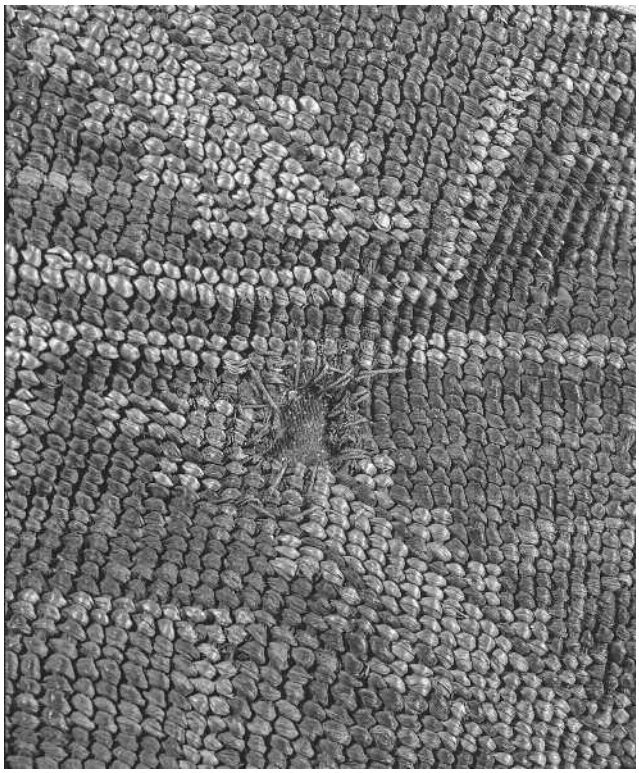

Figure 11.6. Patched hole in side of bag, exterior.

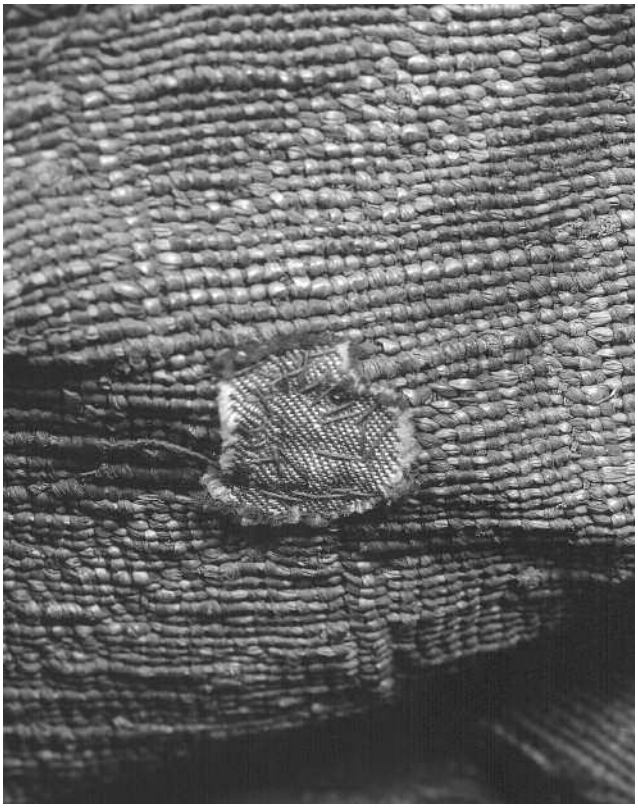

Figure 11.7. Patched hole in side of bag, interior.

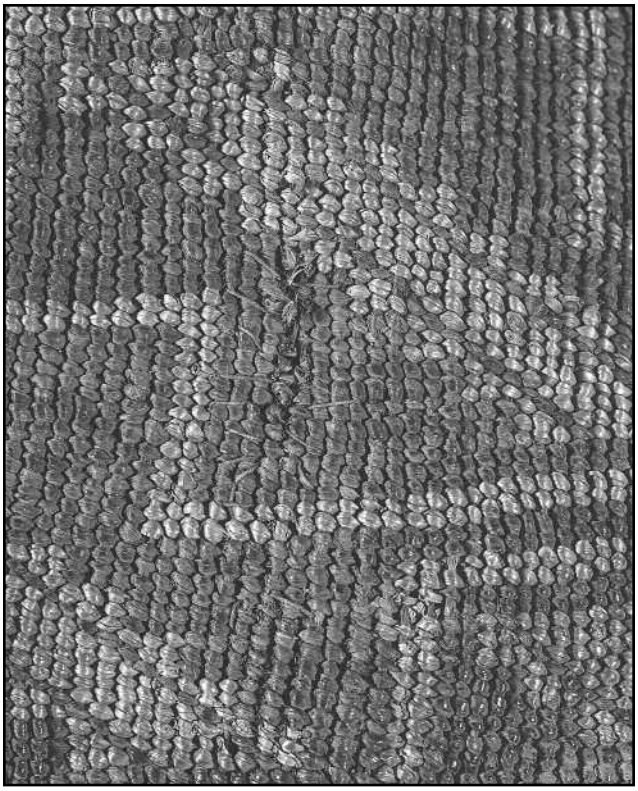

Figure 11.8. Mended small slit in side of bag, exterior.

Figure 11.9. Top edge of bag, bound with chintz fabric, interior.

Figure 11.10. Side view of bag, showing silk ribbon strap.

cardboard liner employed to stiffen and flatten the bottom of the bag (Figures 11.2 and 11.3). The chintz pattern — a bird amid branches, leaves, and flowers, rendered in brown, deep reddish-brown, olive green, black, and white — is consistent with products of the first half of the 19th century such as an 1831 roller-printed design with flowers and birds "copied directly from Audubon's *Birds of America*" (Robinson 1969:Pl. 45; see also Montgomery 1970:328-329, Pl. II). According to Diane L. Fagan Affleck (personal communication 2002), the pattern on this fabric does not appear to be any later than the 1830s, although similar designs were cyclically popular both earlier and later than that decade. She suggests that this textile probably was an English import. The base fabric is balanced plain weave with approximately 30 elements per cm (Figure 11.9). The yarn elements appear to be single-ply with a Z twist.

A deep blue silk ribbon, woven in herringbone twill (see Definitions), was sewn to each side of the bag to act as handle (Figure 11.10). It now is in two pieces, tied together at the center, and has torn away from one side, leaving a small rectangle of ribbon still attached (Figure 11.11). The silk yarn is two-ply, with initial S and final Z twist.

All of the repair and other sewing were carried out using the same light-brown two-ply, S-twist thread, 0.5 mm in diameter. The fiber has not been analyzed, but appears to be cotton or linen, not silk. Stitches are expedient rather than neatly consistent (Figures 11.4–11.9, 11.11).

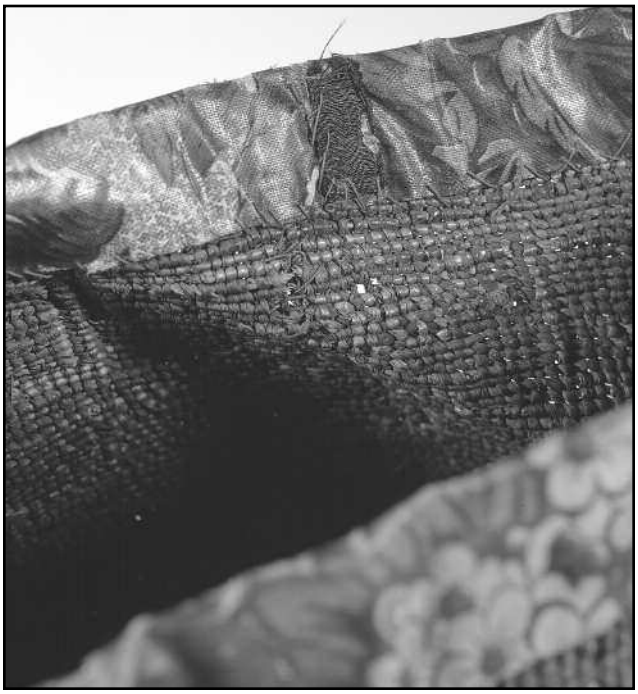

Figure 11.11. Closeup of silk twill ribbon fragment attached to interior of rim.

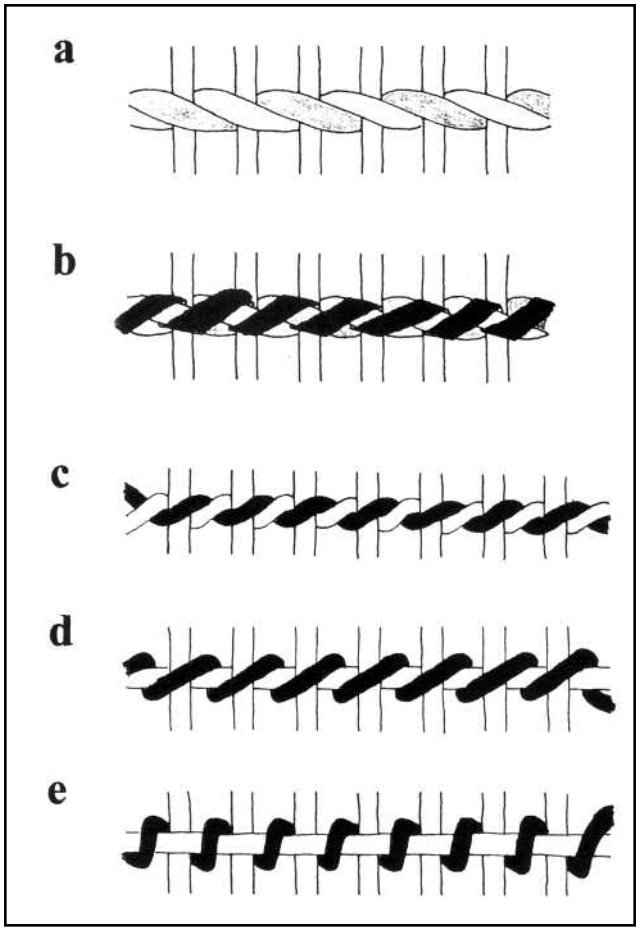

Figure 11.12. Twining structures mentioned in the text. a. Plain twining (Z-twist). b. Plain twining with "false embroidery." c. Full-turn twining (S-twist). d. Wrapped twining (full-turn twining with one element held rigid), front side. e. Wrapped twining, back side. (After Fraser 1989:Diagrams 50, 83, 84.) See also Definitions.

FABRIC STRUCTURE

Structurally, the bag is weft-faced, combining plain (half-turn) twining and full-turn twining (Figures 11.12a, 11.12c; see also Definitions) to form a geometric design on the sides. Much of the patterned area fits the definition of "wrapped twining," in which one twining element is held rigid (Figures 11.12d, 11.12e); thus, the inside of the bag has a different texture than the outside (e.g., Figures 11.6 and 11.7). The twining rows are twisted in the Z direction.

To start the bag, 14 bundles of warp elements were bound together in the center of the bottom, then fanned out in a radial pattern. Around these "spokes," plain twining was carried out in a tight spiral (Figure 11.4). Because of damage to the bottom of the bag, it is not possible to count the exact number of weft rows, but after approximately 6 rows of twining, the warp bundles were split in two. This was repeated at intervals of 10–15 rows, resulting in a total of 266 warps (not an exact multiple of 14). After the last increase in warp ends, straight sides were maintained, and the structure changed to patterned wrapped twining. On the sides of the bag, there were approximately 3.5 warp elements per centimeter and 4.5 weft rows per centimeter.

Due to the fabric binding, the top edge structure cannot be seen. In some places, what seems like the intact rim can be felt through the cloth; in other places, the rim feels trimmed. The assumption is that this area of the bag, like the bottom, was significantly damaged.

DESIGN

At bottom center of the bag, 5 rows of dark weft form a central "bulls-eye." Across the remainder of the bottom, a striped pattern was maintained (Figure 11.4), with single rows of dark weft alternating with 5–6 rows of light-colored weft.

The geometric design on the sides of the bag combines stepped lines with serrated-edge diagonals (Figures 11.1, 11.13). The design, which incorporates a motif with 180° rotational symmetry, is built on diagonal translation (displacement or shift) of the pattern motif (Washburn and Crowe 1988:44-50, 128-131, 164-167, 184-186). This is a sophisticated pattern, requiring advanced planning and careful counting of twining twists between color changes. In fact, the total number of warp ends did not allow an integral number of pattern unit repeats around the bag, so the maker "fudged" on one side, placing two sets of diagonal elements instead of one within one set of stepped lines (Figure 11.14; cf. Figure 11.1).

The intricate design coupled with the fine scale of the twining result in a product that probably took hundreds of hours to make (see non-patterned twining time estimates in Drooker 1992:164-169).

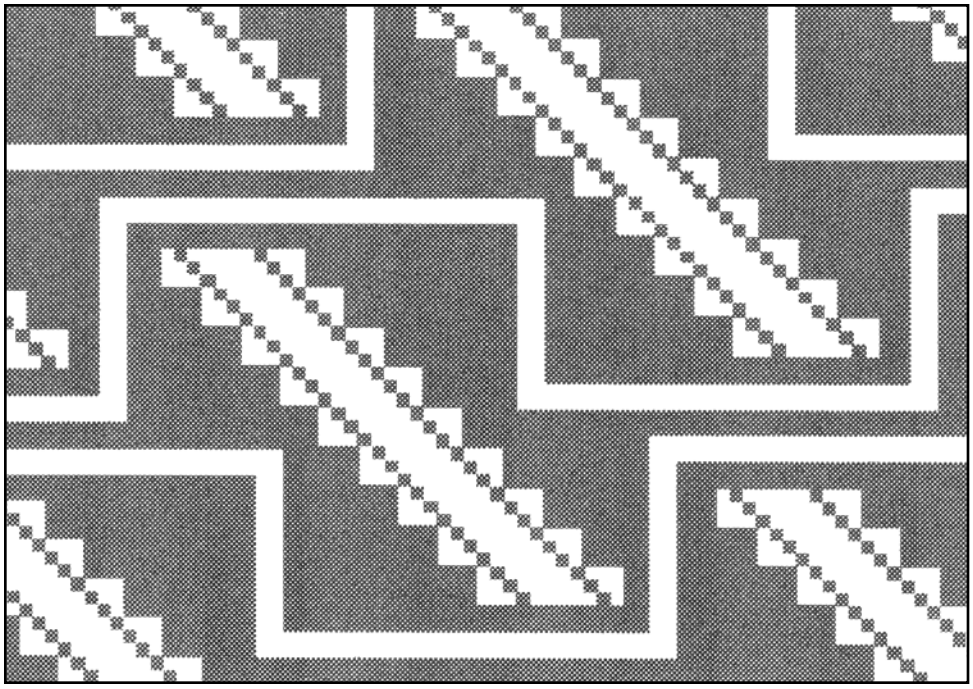

Figure 11.13. Diagram of Swan bag design motif.

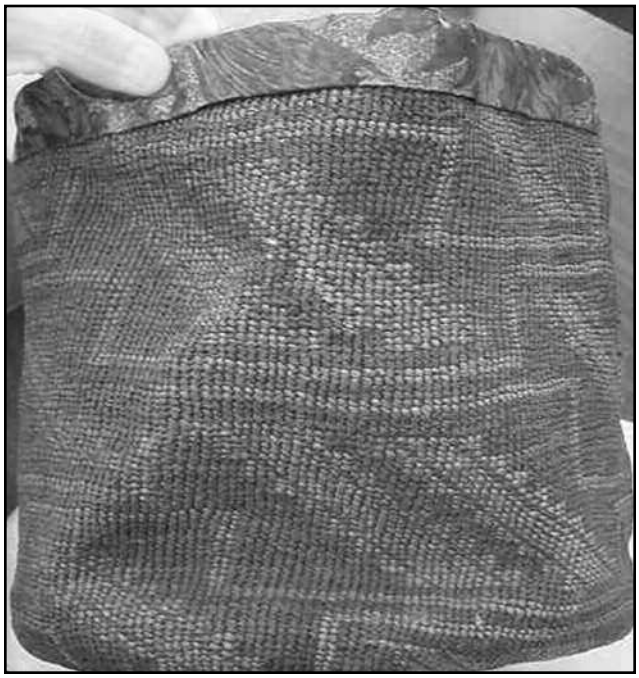

Figure 11.14. Side of bag, showing doubled design motif.

NORTHEASTERN PATTERNED TWINED BAGS

Within the Northeast, bags with colored patterns rendered in variations of compact weft twining are known both from historical contexts and, much more rarely, from archaeological contexts. Two different structures, one utilizing two wefts and the other utilizing three, are known from New England.

BAGS PATTERNED WITH "FALSE EMBROIDERY"

Most extant 17th-18th century patterned twined bags from the Northeast were constructed in the technique known as "false embroidery," in which a supplementary colored weft is wrapped around the two structural twining weft elements (Figure 11.12b; see Definitions). Color changes in the supplementary weft can be used to form design motifs. This technique is particularly well suited to short supplementary materials such as porcupine quills or moose hair, since the ends of the supplementary elements can be hidden easily within the structural twining.

Early bags decorated with "false embroidery" that are attributed to Algonquian groups include a possibly cylindrical Mohegan bag from the Tocamwap family of Connecticut, said to have been 300 years old in 1842; an early-18th-century cylindrical bag, possibly Ojibway; and a late-18th-century, envelope-shaped "pocketbook," formed from a flat fabric, which was made by Marie Agathe (Molly Ocket[t], "Mollocket"), a Pigwacket Abenaki woman who lived in New England ca. 1740–1816 (see Table 11.1 for summary information and references; see Ulrich 2001:248-276 for detailed information on the historical context and literary embellishment of events in which Molly Ocket took part and on the European and Native contributions to the form, materials, and production technique of the pocketbook; and see McBride:1999:43-67 for a more personal exploration of Molly's life and travels). All of these containers were decorated with multicolored geometrical designs contained within horizontal bands.

Brasser discusses a group of flat, rectangular Iroquoian pouches from the St. Lawrence Valley decorated with moosehair "false embroidery," which are dated to 1720–1740 (see Table 11.2, which summarizes information about those that he illustrates). He notes that, in contrast to the banded designs often found on Algonquian bags, most of these Iroquoian pouches exhibit decorative designs that fill a rectangular space (Brasser 1975:39). An undecorated archaeological example from the 1670–1687 Seneca Iroquois Boughton Hill site south of Rochester, New York (Figure 1.3), is close to identical in shape, size, and braided edge finish (Drooker 1996).

Brasser also illustrates a cylindrical bag from the St. Lawrence region, an extremely rare example of a cylindrical decorated bag from a presumed Iroquoian provenance. It exhibits two thin, separated horizontal bands containing geometric designs worked in "false embroidery" on a background of "hexagonal" twining (Brasser 1975:77; see Definitions), a very unusual combination. The "hexagonal" twined structure is known from Delaware Indian, upper Great Lakes Algonquian, and trans-Mississippi River contexts (e.g., Brasser 1975:82; Drooker 1992:70; Whiteford 1977a:54), so perhaps this bag actually is Algonquian rather than Iroquoian in origin.

BAGS PATTERNED WITH FULL-TURN TWINING

One small decorated basket, curated at the Rhode Island Historical Society (Brasser 1975:64, 73, 97; Gordon 1997:36, 99-100 [n. 12]; McNeil 2003; Sturtevant 1992; Turnbaugh and Turnbaugh 1997:121; Ulrich 2001:42-74; Willoughby 1935:251, 252, 254), is the closest known in construction, pattern design, and shape to the Swan bag (Table 11.3). It is recorded as having been received from "a squaw, a native of the forest" by Dinah Fenner at what is now Cranston, Rhode Island, and was long dated as contemporaneous with King Philip's War of the mid-1670s. However, Ulrich's research into its history makes an early-18th-century date more likely (2001:42, 61, 71-73).

Like the Swan bag, the structure of the Fenner basket is Z-twist wrapped twining (Figures 11.12d, 11.12e), but due to the deterioration of some of the weft elements, the pattern design is now incomplete (Figure 11.15a). Because of the missing wefts, it has sometimes erroneously been described as having a banded design, or an open twined structure. The single-ply (McNeil 2003), S-twist warps are of bark, perhaps basswood (Ulrich 2001:72). The basket's weft materials included corn husk or some other light-colored plant fiber, and red, blue, and black woolen yarns (Turnbaugh and Turnbaugh 1997:121; Ulrich 2001:47, 72). Only fragments of the wool yarns remain, mostly on the interior of the container. It is possible that not only the darker-colored wool yarn but also some of the lighter-colored plant-fiber weft elements are missing. If so, the pattern design might well bear more than a passing similarity to that of the Swan bag (e.g., Figure 11.15b). Rather than geometric pattern motifs contained in horizontal bands or motifs centered within a rectangular shape, the design motifs of the Fenner bag, like those of the Swan bag, likely formed a continuous pattern of stepped and diagonal lines around the sides of the cylindrical container.

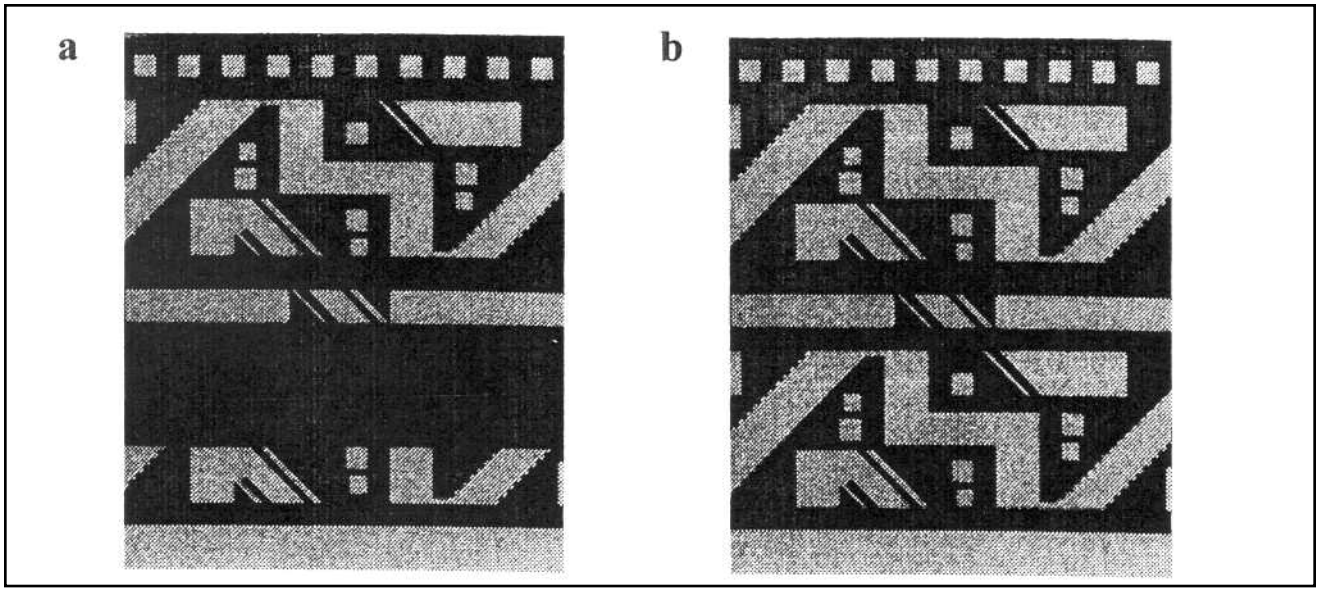

Figure 11.15. a. Pattern design from Fenner bag, Rhode Island, late 17th-early 18th century (Ulrich 2001:48, drawing by Mindy Chiou; used with permission). Dark areas indicate missing wefts or (at the top of the bag) darker wefts. b. Partial reconstruction of complete pattern motif of Fenner bag. (The uppermost extant pattern area, the bottom of which is identical to the lowermost extant pattern area, has been superimposed upon the latter.)

Besides the design format, points of similarity between the Fenner and Swan bags include a cylindrical shape built upon radial warps, a fabric structure of Z-twisted wrapped twining, two-ply bark warps, single-ply plant-fiber wefts, and the general time period.

Although rare in the archaeological record, the wrapped twining structure is known from 11 fragments of two different fabrics from the Early Woodland (ca. 1000–100 B. C.) Boucher site in northwestern Vermont (Heckenberger et al. 1996:54-55, 62, 63; for site location, see Figure 1.3). In the Boucher examples, the active twining elements were animal-hair yarn, while the passive (rigid) element was vegetal. On one fabric, two varieties of hair yarns were utilized as active elements to form a geometric design.

During the 19th and early 20th centuries, full-turn twining with paired active wefts (Figure 11.12c) was utilized by members of Algonquian and closely related Siouan groups living in the upper Great Lakes region to make flat, rectangular bags decorated with geometric patterns contained in horizontal bands (e.g., Gordon 1997:Fig. 23; Phillips 1989; Whiteford 1977b), many of which still survive. Flexible woolen yarns in contrasting bright colors were used for the twining wefts.

GENERAL COMPARISONS

Tables 11.1–11.3 summarize similarities and differences among the 17th-18th century bags mentioned above and Susannah Swan's. Common among the five Algonquian examples in Tables 11.2 and 11.3 is a weft-faced Z-twist twining structure. All but one — which was made for a Euro-American in the then-popular form of a pocketbook (Ulrich 2001:263, 265) — exhibit a cylindrical shape underpinned by radial warps. All but Susannah Swan's bag are taller than wide. It is possible that the Swan bag originally was, as well. The Swan and Fenner bags share the patterning technique of weft wrapping as well as stepped-line and diagonal pattern motifs. The other two Algonquian cylindrical bags, decorated with "false embroidery," both were made from plant-fiber yarns with porcupine quill supplementary wefts, and exhibit pattern designs based on small geometric motifs within horizontal bands.

Table 11.1. 17th-18th Century Algonquian Bags and Pocketbook Decorated with "False Embroidery"

	Tocamwap Family Bag	Archiv der ... Wörtlitz Bag	Mollocket Pocketbook
Reported geographical/ ethnic origin	Connecticut; Mohegan	attributed to Great Lakes region); possibly Ojibway[c]	Maine; Eastern Abenaki
Estimated date	mid-16th century?[a]	early-18th century[c]	ca. 1785
Size (cm)	33.7 H x 23.5 W[a]	22 H x 13.4-17.2 dia[d]	27.5 L (unfolded) x 15.9 W[e]
Shape	flat, perhaps originally cylindrical; bottom structure unknown due to damage[a]	cylindrical; radial warps[d]	flat rectangle, folded into an envelope shape
Edge finish	twisted? "eyelets" for drawstring[a]	twisted "eyelets" for drawstring[d]	fabric liner; terminal edge finish not visible
Twining twist direction	Z; "false embroidery" wrapping in S direction[b]	Z; "false embroidery" wrapping in S direction[d]	Z?; "false embroidery" wrapping in S direction[f]
Patterning technique	"false embroidery"[a]	"false embroidery"[c]	"false embroidery"[f]
Pattern symmetry	translation, rotation	translation, reflection, rotation	translation, reflection, rotation
Pattern motifs	diagonals (grouped to form diamonds) and triangles within horizontal bands	triangles, diamonds, horizontal and vertical lines, within horizontal bands	diagonals, diamonds (smooth and stepped), horizontal lines, within horizontal bands
Warp materials	Indian hemp[a]	plant fiber[c]	bast (Indian hemp?)[f]
Weft materials	Indian hemp, porcupine quills[a]	plant fiber, porcupine quills[c]	bast, moose hair[f]
Location	Connecticut Historical Society	Archiv der Staatlichen Schlosser und Garten Wortlitz, Oranienbaum, Germany	Maine Historical Society, Portland; on long-term exhibit loan to Maine State Museum, Augusta
References	Brasser 1975:64, 72, 97; Gordon 1997:31, 34, 36; McMullen and Handsman 1987:8; Turnbaugh and Turnbaugh 1997:121; Ulrich 2001:48-49; Willoughby 1935:253-255	Gordon 1997:39-41	Brasser 1975:64, 76, 98; Gordon 1997:36, 37; Ulrich 2001:248-276; Willoughby 1935:256-257

[a] Ulrich 2001:48-50, 427[n. 20]
[b] Extracted from Ulrich 2001:48, 49 illustrations
[c] Gordon 1997:39, with quote from Ruth Phillips
[d] Gordon 1997:Figs. 20, 21
[e] Holly Hurd-Forsyth, personal communication 2003, from Maine State Museum conservation report
[f] Gordon 1997:36, 37, Fig. 18

Table 11.2. 18th Century Iroquoian Pouches and Bag Decorated with "False Embroidery"

	Huron Pouch	Iroquoian Pouch 1	Iroquoian Pouch 2	Iroquoian Pouch 3	Iroquoian Pouch 4	Iroquoian Bag
Reported geographical/ ethnic origin	St. Lawrence Valley; Huron[a]	St. Lawrence Valley[a]	St. Lawrence Valley[a]	St. Lawrence Valley[a]	St. Lawrence Valley[a]	St. Lawrence Valley[a]
Estimated date	ca. 1720[a]	ca. 1730[a]	ca. 1740[a]	ca. 1740[a]	ca. 1740[a]	ca. 1740[a]
Size (cm)	13 H x 13 W				10 H x 12 W	13 H x 16 W
Shape	rectangular flat "pocket"	Rectangular flat "pocket"	rectangular flat "pocket"	rectangular flat "pocket"	rectangular flat "pocket"	cylindrical?; radial warps?
Edge finish	braided "eyelets" for drawstring	braided "eyelets" for drawstring			braided "eyelets" for drawstring	braided "eyelets" for drawstring
Twining twist direction	Z?; "false embroidery" wrapped in S direction[b]					
Patterning technique	"false embroidery"	"false embroidery"	"false embroidery"	"false embroidery"	"false embroidery"	"false embroidery"
Pattern symmetry	reflection, translation, rotation	reflection	glide reflection	reflection, translation	none (due to color placement)	translation, glide reflection
Pattern motifs	stepped blocks, straight lines, diagonals	diagonals, triangles	stepped lines, serrated lines, horizontal lines	stepped lines, serrated lines, vertical lines	diagonals, serrated lines, hor. lines, triangles, diamonds	stepped lines, within horizontal bands
Warp materials	plant fiber (hemp?)	plant fiber (hemp?)	plant fiber (hemp?)	plant fiber (hemp?)	plant fiber (hemp?)	plant fiber
Weft materials	plant fiber (hemp?); moosehair	plant fiber (hemp?); moosehair	plant fiber (hemp?); moosehair?	plant fiber (hemp?); moosehair?	plant fiber (hemp?); moosehair?	plant fiber; moosehair
Location	British Museum, London	Rijksmuseum voor Volkenkunde, Leiden	Museum fur Volkerkunde, Berlin	Musee de l'Homme, Paris	Musee de l'Homme, Paris	Musee de l'Homme, Paris
References	Brasser 1975:6, 64, 78, 99; Gordon 1997:42	Brasser 1975:6, 64, 79, 100; Dongen 1996:195, 231	Brasser 1975:6, 64,100	Brasser 1975:6, 64,101	Brasser 1975:6, 64, 80, 101	Brasser 1975:6, 65, 77, 99

[a] Brasser 1975:64, 99-101; Dongen 1996:231 attributes Iroquoian Pouch 1 to 17th-18th century North America
[b] Gordon 1997:Fig. 22

Table 11.3. 17th–18th Century New England Bags Worked in Wrapped Twining

	Susannah Swan Bag	Dinah Fenner Bag
Reported geographical/ ethnic origin	Maine/Abenaki? Connecticut?	Cranston, RI
Estimated date	1690s	late 17th-early 18th century
Size (cm)	21 H (min.) x 18 dia (28 W)	11.4 H x 10.2 dia[a] 12.7 H x 8.9 dia[b]
Shape	cylindrical; radial warps	cylindrical; radial warps[b]
Edge finish	unknown	straight edge formed by "two bands of braiding"[b]
Twining twist direction	Z	Z[b, c]
Patterning technique	wrapped twining	wrapped twining[a]
Pattern symmetry	translation, rotation	translation
Pattern motifs	stepped line, diagonal line	stepped line, diagonal line
Warp materials	basswood bark	bark (basswood?)[a]
Weft materials	basswood bark, plant stem (rush?)	wool[a], plant fiber (cornhusk?[a,d], bast?[b])
Location	privately owned	Rhode Island Historical Society

[a] Ulrich 2001:42, 47, 72
[b] Sturtevant 1992
[c] Extracted from Ulrich 2001:48, 49 illustrations
[d] Gordon 1997:100, quoting Joanne Segal Brandford; Willoughby 1935:254

Baskets from New England were fashioned from a variety of materials. Charles Willoughby quotes a description of baskets made by Massachusetts Indians from a 17th century manuscript by Daniel Gookin:

"Several sorts of baskets were made, both great and small. Some . . . are made of rushes, some of bents (coarse grass), others of maize husks, others of a kind of silk grass, others of a kind of wild hemp, and some of the barks of trees, many of them very neat and artificial with portraitures of birds, beast, fishes and flowers upon them in colors." (Willoughby 1935:250; from Gookin 1792)

The Swan bag is consistent with this description, as are the other bags discussed above; the use of colored wool in addition to local plant materials would be a logical extension. None of the extant New England containers, however, contain depictions of plants or animals.

The Z-twist twining direction and final Z twist of warp cordage in the Swan bag are consistent with a 2,750-year record of predominantly Z-twist cordage and twining direction along coastal Massachusetts, Maine, and the Maritime Provinces that has been documented by James Petersen and Jack Wolford (Petersen 1996; Petersen and Wolford 2000:101-107), based on thousands of impressions of cordage on pottery. This contrasts with the typical S-twist cordage

and twining direction used at interior sites throughout much of the non-Iroquoian Northeast, including areas north and west of the Gulf of Maine, and various locations within the Connecticut River and Lake Champlain drainages.

A number of 16th- and 17th-century archaeological examples of weft-faced twined bags are known from New York, several of which are cited in Chapter 1. None has a visible pattern motif, nor do any that Drooker has examined exhibit either of the patterning structures discussed above. The non-archaeological 18th century patterned examples summarized in Table 11.2 all utilize the "false embroidery" patterning technique. 16th–18th century Iroquoian twined bags, patterned and non-patterned, are almost exclusively in the form of flat rectangles rather than cylinders, a form that they share with bags from the upper Great Lakes (e.g., Phillips 1989; Whiteford 1977a, 1977b, 1978). Most of the archaeological fragments of twined fabrics from New York that Drooker has examined have Z-twist twining, like the bags with known twining twist directions that are listed in Tables 11.1–11.3 (see also Petersen and Wolford 2000). The vast majority of 17th-19th-century Chippewa/Ojibway, Ottawa, Potawatomi, Sauk/Fox, and Winnebago Great Lakes twined bags, however, are twined in the S direction (for example, see examples illustrated in references cited above).

Thus, Susannah Swan's bag is consistent in materials, structure, and patterning with a New England origin; twist direction points toward a coastal rather than interior venue. Although this bag has a very large number of similarities to the small basket from Rhode Island, because of the paucity of comparative examples it is impossible to pinpoint its exact place of origin or ethnic affiliation.

CONCLUSION

Besides its fascinating historical connections, Susannah Swan's bag is remarkable for its uniqueness — one of only four known New England twined patterned bags — and for its intricate design and skill of execution. Oral history, documentation, and technical analysis all contribute to our knowledge of this special object. In turn, they contribute to our understanding of the few and fragmentary remains of twining from the archaeological record of the Northeast. If this bag is typical of work being done by 17th-century New England craftspeople and their ancestors before them, we can only lament the loss of so much beauty.

APPENDIX 1

This appendix contains transcriptions of three documents pertaining to the twined bag's family history, annotated by George Hamell. The endnotes refer to word insertions and deletions in the original, and to clarifications of ambiguous sections of the text suggested by him. Hamell added bracketed periods [.] to indicate apparent sentence breaks. In doing so, he did not in turn capitalize the initial letter of the first word of the resulting sentence.

DOCUMENT 1

The earliest document consists of numerous penciled notations on the bag's cardboard liner, which was cut from a hatbox (Figure 11.3). All appear to have been made by the same person, but not necessarily at the same time, which might account for slight differences in the handwriting and in the stated age of the bag, and in the relative lightness or darkness of the notations themselves.

Occupying most of the area of the cardboard is a printed hat supplier's order form for bowler or derby hats in sizes 6-5/8 to 7-3/4. It features a large image of a bowler or derby, upon which appear the legends "*Exus Ac Solidus*." across the crown and "AMERICAN MANUFACTURE." around the headband. Below this, the local hat retailer's identification appears in a smaller oval stamp, which reads: "J. H. BOYCE & SON / HATTERS / And FURRIERS / SCHOHARIE C.H., N.Y." Within the hat supplier's printed order form are penciled notations relating to an order, which have not been transcribed here.

With the printed manufacturer's and retailer's information in proper reading orientation, the penciled notations relating the bag's family

history appear above (at the 12:00 position), to the right (at the 3:00 position), below (at the 6:00 position) and to the left (at the 9:00 position). Two additional annotations appear just within the border of the hat supplier's order form.

Within the order form, to the left of the bowler or derby, is penciled: "Wm M Ba[ll / Mrs / H F Bal[l] / 1896".

Within the order form, to the right of the bowler or derby, is penciled: "Conneticut War".

In the space above the order form is penciled: "Basket / this is two Hundred / years old".

In the 3:00 position, to the right of the order form, is penciled: "This came from the / Indians[.] Was Brought by / Susan Swan a prisoner".

Beginning in the 6:00 position, below the order form, and running through the 9:00 position to the left of the order form, is penciled: "Mr[.] Wm Miner Balls great great great great great great / Grand / Mother".

Also at the 6:00 position, below the first half the previous notation, is penciled: "She also brought a box [indecipherable] food / and a Blanket[.] this is over 200 years / 200 and 30 or 40 years old / 1896".

DOCUMENT 2

Following is a line-by-line transcription of the second of three written family traditions identified with the twined bag. This document may be contemporaneous with the notations in Document 1.

Miss[1] Susan Swan was taken by the Indians[.]
after her capture and while with the
Indians she was Set[2] in the Cornfields
to watch the Corn from the Bears with
a fire Brand[.] she had the Tommyhawks
shook over her[3] head a good many times
and told that her turn would come
next[.] the Indians would go off on
a hunting Expedition and if they came
home without good success they would
kill one of their prisoners and then
have a pow Wow + Dance over it[.][4]
and at the time that Miss Swan Left the
Indians they had gone off on a hunting
Expedition and an[5] old squaw Living with
the Indians helped Miss Swan off out of
the way[6] of the Indians. She[7]
filled a wampum Bag with something
to Eat on her[8] Journey through the woods
and then went with her through the[9] woods
some ways and directed her the best way
she Could so that she got Home all safe[.]
She[10] Slept in Halow Logs day times
and Traveled Nights as the Old [squaw][11]
told her[.]
the Old Squaw gave her a Blanket
and I think it is in Possession of the
Gallups yet[.] this bag is 200 and 30
or 40 years,old[.][12] it was in Connecticut war.

DOCUMENT 3

Following is a line-by-line transcription of the third of three written family traditions identified with the bag. It postdates Document 2, and is handwritten in ink on letterhead, printed: "BROUGH'S TOY WORKS / W. D. BROUGH, PROP. / 927 STANLEY ST., SCHENECTADY, N.Y." Beneath that header is the following account.

Record of the captivity of Mrs Susan Swan.

Mrs Susan Swan was taken by the indians after
they had killed her husband & hired man - +
set fire to the barn - Their camp was 2 days
journey away. Thro' woods fording rivers [+c.]
While with the indians she was set to watch
the corn from the bears with a fire brand.
When they had war dances - around burning

victims she had the tomahawk shaken at her +

was told her turn would soon come - The indians

would go off on a hunting exposition[13] & if they

came back without good success they would kill

a prisoner & then have a powow[14] & dance over it.[15]

After 2 years captivity the chief's mother directed

Mrs Swan & helped her escape - She[16] filled a wampum

bag with food & then went with her[17] thro the woods[,]

directing her to follow a star - travelling only by

night. She slept in hollow logs by day - The

second morn. she spied a white settlement a

long way off as the squaw had directed her.

The squaw gave her a blanket which is in the

possession of the Gallup family & the wampum

bag is with the Waldens - between 200 & 300 years

old.

APPENDIX 2

Susannah Eastman's family is remarkable for the many members taken captive during the New England Indian wars. In addition to the brief family tradition of Susannah's captivity, three other family members left narratives of their Indian captivity: Mary Neff, Susannah's aunt and Hannah Dustin's nurse, also taken captive in Haverhill in 1697; another aunt, Hannah Eastman, taken captive in Haverhill in 1703; and a second cousin, Amos Eastman, Hannah's son, then residing at Concord, New Hampshire, who was taken captive in 1752.

Phillip Eastman (1644–1714) [Susannah's father] also was taken captive in the French and Indian attack on Haverhill on March 15, 1687, but subsequently made his escape. He had earlier served as a soldier in King Philip's War (Rix 1901:I:10).

Thomas Eastman (1646–1688) [Phillip's brother and Susannah Eastman's uncle] also had served as a soldier in King Phillip's War. Thomas was killed in an Indian attack on Haverhill on April 29, 1688, and his wife, Deborah Eastman (1655–?) [Susannah's aunt], was taken captive. Following the attack, John Eastman (1640–1720), Philip and Thomas's brother [and another uncle of Susannah], was appointed guardian of Jonathan Eastman, then age 8, the only son of Thomas Eastman and of Deborah Eastman then in captivity (Rix 1901:I:9, 10-11).

Sarah Eastman (1683–1697), Jonathan's sister and daughter of Thomas and Deborah Eastman [and cousin of Susannah Eastman], was killed during the March 15, 1697, attack on Haverhill during the so-called "Dustin massacre" (Rix 1901:I:10-11).

Deborah Eastman (1655–?), Thomas Eastman's wife [and Susannah Eastman's aunt], was the daughter of George and Joannah Corlis of Haverhill. Deborah's oldest sister, Mary Corlis [another aunt of Susannah], married William Neff. Mary Neff, by then a widow, was serving as Hannah Dustin's nurse when both were taken captive during the French and Indian attack on Haverhill on March 15, 1697 (Rix 1901:I:10-11). Hannah Dustin and Mary Neff's captivity was brief, but their escape by tomahawking their sleeping Indian captors with the help of Samuel Lenorson, a boy taken captive two years before, is infamous in the captivity literature. In 1699, Cotton Mather published the earliest account of the Dustin party's captivity, escape, return to Haverhill, and subsequent celebrity (Coleman 1925:I:342-343; Lincoln 1913:263-266; Lossing 1875).

Hannah Eastman (1701–?), born Hannah Green on Dustin Hill, Haverhill, married Jonathan Eastman, the only son of Thomas and Deborah Eastman above [and cousin of Susannah Eastman]. Hannah Eastman was captured, and their infant daughter, Abigail, was killed during the Indian attack on Haverhill on February 8, 1704. Hannah's probable St. Francis Abenaki captors carried her off to the Three

Rivers area, pausing first at Ossipee Lake and then at the "Ox-Bow" in Newbury, Vermont. Continuing on their way, they tarried briefly at Cowass, where Stephen Williams saw them. At Three Rivers (St. Francis), a French woman from a nearby French community saw Hannah and arranged her escape, secreting Hannah for three years in her home. Hannah was eventually reunited with her husband, whom she recognized passing by the French woman's house, ending his three-year search for her. She left a brief narrative of her captivity (Coleman 1925:I:349-350; Rix 1901:I:28-33).

Amos Eastman (1719–1808), son of Jonathan and Deborah Eastman [and a second cousin of Susannah Eastman], was born in Haverhill, but later removed with his father to Concord, New Hampshire, where they resided in 1746. While hunting and trapping along Baker's River near Rumney, New Hampshire, on April 28, 1752, Amos Eastman, John and William Stark, and David Stinson were attacked by a party of St. Francis Indians. William escaped and Stinson was killed. However, Amos Eastman and John Stark were carried to St. Francis, where both ran the gauntlet, during which Eastman suffered and Stark seized a club and knocked down Indians left and right. Eastman was sold to a French master. Stark was treated kindly by the Indians, who liked him. Both men were redeemed six months later (Coleman 1925:II:291-294; Rix 1901:I:84-86).

One final genealogical note of art-historical interest: Captain Seth Eastman, "pictorial historian of the Indian" during the 19th century, was the great-great-great grandson of Captain Ebenezer Eastman (1681–1748), one of the two sons of Philip Eastman and a younger brother of Susannah Eastman (McDermott 1961:6; Rix 1901:I:10, 20-26).

NOTES

1. "Miss" is spelled with long "s's" here and elsewhere in the document, as are other words ending in double-s. At a later date and in another hand, "Miss" was crossed out, and "Mrs" added above the line.
2. Between "Set" and "in," a caret was inserted below and "her" was inserted above the line in the original document, in the same hand.
3. A caret was inserted below the line and "her" was inserted above the line in the original document and in the same hand.
4. I.e., the body of the slain prisoner.
5. Here a caret was inserted below the line and "an" was inserted above the line in the original document, in the same hand.
6. Immediately following "of the way," this phrase was repeated in the same line in the original document and in the same hand, but subsequently deleted.
7. The referents of the pronouns "she" and "her" throughout this sentence are potentially ambiguous. However, it seems probable that the "old squaw" filled the "wampum Bag" with something to eat for "Miss Swan," that the "old squaw" went with "Miss Swan" through the woods, and that the "old squaw" directed "Miss Swan" safely home.
8. "Miss Swan" is referenced here.
9. Here a caret was inserted below the line and "the" was inserted above the line in the original document and in the same hand.
10. I.e., "Miss Swan."
11. There is evidence of erasures and overwriting at this end of the line. In any case, it is certain that the word "squaw" [or "woman"] was omitted in the original.
12. Without the use of a caret, "old" appears to have been inserted after the comma, after the fact, in the original document and in the same hand.
13. I.e., "expedition."
14. I.e., "powwow."
15. I.e., the body of the slain prisoner.
16. The chief's mother is apparently referenced here.
17. The pronominal referent here, and those following, is "Mrs Swan."

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DEFINITIONS[1]

Balanced weave. Interlaced fabric in which warp and weft are "equal in size, spacing, and count" (Emery 1966:76). An alternative definition does not require equal-sized warp and weft yarns, only approximately the same number of warp elements as of weft elements per unit measure (Kadolph and Langford 1998).

Bark cloth. Beaten bark cloth is a fiber construction analogous to wool felt. It is made from layers of inner bark that are soaked, "then beaten or pounded into a flat coherent fabric" (Emery 1966:20-21).

Bast fiber. Fiber derived from the stems of certain plants, including hemp and flax; "part of the inner bark (phloem) of the stem of a dicotyledonous plant" (Wilson 1979:11).

Cambric. During the 18th century, a lightweight linen fabric first made in Cambrai, France; in the 19th century, "a plain weave cotton glazed on one side" (Wilson 1979:244, 281).

Cast. An object formed in a mold or impression. Sometimes called a "positive mold" or "positive impression." See also Impression, Mold.

Chintz. A printed and glazed plain-weave cotton fabric; originally, a painted, resist-dyed cloth made in India.

Chromatography. A method to separate complex mixtures by percolating them through a selectively adsorbing medium (Morris 1969:240).

Cloth. Pliable, fibrous fabric made by any process, including but not limited to weaving, twining, looping, linking, knotting, and felting.

Coiling. Basket-making technique in which the foundation element forms a spiral or coil horizontal to the base and is secured in place by a linking or looping element.

Cord. A replied yarn.

Cordage. A rope-making term referring to cords or ropes (see discussion in Emery 1966:13-14). Sometimes used to refer to assemblages of yarns, cords, or ropes not serving as elements of fabric construction.

Element. A component part of the structure of an interworked fabric: yarn, thread, strand, cord, sinew, thong, or whatever material is interworked to form the fabric. Components of a "set of elements" are functionally undifferentiated and trend in the same direction (Drooker 1992:244-245; Emery 1966:27).

Fabric. "The generic term for all fibrous constructions," from the Latin *fabricare*, to make or fabricate (Emery 1966:xvi). It subsumes the term "textile" (see Textile, below).

Fabric count. Elements per square centimeter of a fabric (sum of warp elements per centimeter plus weft elements per centimeter, including any supplementary elements) (Kuttruff 1993:130). See also Thread count.

False embroidery. A basketry term denoting "the embellishment of a weft-twined structure during the twining process by means of additional elements." The supplementary elements are wrapped around "each twining element as it comes to the surface . . . and . . . do not appear on the reverse side" (Emery 1966:211; see Figure 11.12, this volume). Technically, this is not embroidery, which is carried out with needle and thread on a previously made backing.

Float. A warp or weft element of an interlaced fabric that goes over or under more than one element at a time. A warp float is in the warp direction. A weft float is in the weft direction.

Fulling. "A cleaning, shrinking, and felting operation that [gives] wool fabrics a softer surface . . . and [makes] them thicker and more weather resistant" (Wilson 1979:84).

Gauze weave. A weave in which "warp elements are crossed over other warp elements, retained in the out-of-line position by the interlacing of weft elements, and … [then] re-crossed to their original order" (Emery 1966:180). Leno is a related term that sometimes is used to indicate a combination of gauze and plain weave (Emery 1966:190-191).

Heddle. Device on a loom for lifting or depressing selected warp threads.

Impression. Depression made in a plastic substance by pressing something into it. Occasionally termed a "negative impression," in contrast to a "positive impression" [cast]. See also Cast.

Indigotin. A blue crystalline chemical compound, the primary coloring matter of indigo.

Interlacing. Technique (and the fabric formed by it) in which each element passes over and under other elements that cross its path (Emery 1966:62). Interlaced fabric can be constructed from a single set of elements (oblique interlacing), or from two or more sets (weaving). In plain (simple) interlacing (1/1 interlacing), elements pass over and under each other one at a time. In twill interlacing, elements pass over and/or under more than one element at a time, with a characteristic diagonal alignment of floats. See also Plaiting, Plain weave, Twill weave, Warp, Weft.

Interlinking. A linked structure formed by interworking a single set of elements, rather than by manipulating a single element as in linking. Also called plaiting (Emery 1966:60).

Interlooping. A looped structure consisting of "loops of a single continuous element drawn through other loops . . . formed by the same element" (Emery 1966:39).

Kermes. A genus of insect and the dried bodies of females of the species, used to make a red dye.

Knitting. Vertically aligned interlooping, with construction carried out by means of a set of needles or sticks, or the process of making it (Emery 1966:40-42, Figs. 38-41). In plain knitting, all loops in a given row are on the same side of the fabric. In stocking or stockinette stitch, looping in all rows is on the same side of the fabric; in garter stitch, loop direction alternates between rows.

Knotting. Fabric formed by "a tightened interworking of flexible elements" that effect "a fastening or 'tie'" (Emery 1966:225-226), or the process of creating this. Knotted netting is an open fabric with mesh dimensions fixed by knots at intervals.

Linking. One of the structures formed by interworking a single element. "In simple linking, successive rows of . . . 'open loops' are formed by a stitch like that known in sewing as overcasting or whipping... Each row is formed by a progressive spiraling of the element round the portions between the stitches of the previous row" (Emery 1966:30).

Loom. A device that holds warp elements parallel and provides tension to them, and which usually also includes a shedding device to create an opening between selected sets of warp elements (a shed) through which the weft can be inserted in the production of warp-weft interlacing (Barber 1991:5; Broudy 1979:14; Emery 1966:75). Looms with integral shedding devices frequently are designated "true looms" (e.g., Wilson 1979:289), to distinguish them from simple tensioning frames.

Looping. A single-element structure built up by the repeated interworking of loops, the latter produced by doubling an element back on itself so as to leave an opening through which another element may pass (Emery 1966:30-31).

Madder. A plant (any of several from the genus *Rubia*), the root of which yields a red dye.

Mineralization. A process in which an original material is gradually replaced by something else, replicating both the exterior form and the inter-

nal structure of an object (e.g., the formation of petrified wood) (Gillard et al. 1994). "Mineralization" is sometimes used as an umbrella term to include either the replacement of an object's original material or the formation of pseudomorphs. See also Pseudomorph.

Mold. A form for shaping fluid or plastic material inserted into it.

Mordant. A chemical substance used in dyeing (such as a salt of aluminum, iron, tin, or chrome), that combines with both the dyestuff and the material being dyed to deposit insoluble color on the fiber (Wingate 1979:398).

Netting. "Open textured single-element fabric with meshes of fixed dimensions secured by knots," or, used loosely: "an open-meshed net-like quality" (Emery 1966:46). See also Knotting.

Octagonal openwork. A term probably coined by Miner (1936:182, 187) to describe plain twining combined with transposed interlinked warps, a decorative structure with an open, lacy appearance (Drooker 1992:247, Figs. 9i, 27).

Plain weave. 1/1 interlacing with two perpendicular sets of elements (warp and weft). Balanced plain weave has warp elements and weft elements that are approximately the same diameter and number per unit measure (Emery 1966:76). See also Balanced weave, Interlacing.

Plaiting. In basketry, this term is used to denote "a sub-class of basket weaves in which all elements are active. Single elements or sets of elements, called strips, pass over and under each other" (Adovasio 1977:99). Structurally, this is equivalent to interlacing. Outside of basketry, this term has been applied to a wide range of fabric structures including interlinking, bobbin lace constructions, and braiding (interlacing with a single set of elements rather than a separate warp and weft, more specifically termed oblique interlacing) (Emery 1966:60, 68-69). According to Emery (1966:68), even within basketry terminology, "plaiting" refers to construction utilizing a single set of elements. Although Adovasio states that "Plaiting is equivalent to braiding in weaving," implying the use of only a single set of elements, he states that some plaited basketry is constructed with two sets of elements (1977:99, Figs. 122, 124). Simple plaiting refers to plaiting with a 1/1 interlaced structure. In the present book, interlacing (with the number of sets of elements specified) is preferred as the more general term, but plaiting is employed by several authors; see their individual definitions. See also Weaving, Interlacing.

Plied yarn. A yarn formed by "twisting together two or more single yarns" (Emery 1966:10). A "two-ply" (double-ply) yarn is made of two single elements, a "three-ply" yarn incorporates three single elements, and so forth. The term "plied" often is restricted to yarns constructed of spun fibers (Emery 1966:10); in this book, it also is used to describe yarns made by twisting together any two or more elements, whether they are spun or unspun. Analysts employ a variety of shorthand notations to describe the structures of plied yarns. For example, a two-ply Z-spun S-twist yarn (in which two Z-spun elements are twisted together in the S direction) might be denoted as 2z-S, Z2S, or S z/z, among other possibilities. See also Replied yarn, Spun yarn.

Porcupine twist. A weave structure utilized on some wood splint baskets, in which a three-dimensional effect is created by twisting a weft splint before it is reinserted under a warp element. Some variants are "twist weave," "thistle weave," and "wart weave" (Turnbaugh and Turnbaugh 1997:18, 20, 83).

Pseudomorph. A mineral, usually a metal corrosion product, that completely covers and replicates the form of a perishable object such as a yarn or feather (Janaway 1985:30). See also Mineralization.

Reduction test for indigo. Method of identifying indigo dye. Blue yarn is treated with an alkaline sodium dithionite solution and heated. When a solvent such as n-butanol or ethyl acetate is added, shaken, and then allowed to separate from the dithionite solution, the test is positive for indigo if the upper solvent layer is blue.

Replied yarn. A yarn formed by twisting together two or more plied yarns (Emery 1966:10). Structurally equivalent to cord.

Retting. The process of soaking plant materials in water as a step toward the separation of

fibrous material from woody material. Retting relies on the activity of microorganisms or the addition of chemicals to aid in the decortication process.

Selvage. Edge of a fabric "closed by loops formed by a change in direction . . . of the elements making up the fabric" (Drooker 1992:246, after Kuttruff 1988:187).

Semiotics. Study of "how meaning is conveyed and generated by texts[,] . . . objects, . . . and material culture in general." Concerns the interpretation of signs: "anything that can be used to represent or stand for something else" (Berger 1992:17).

Single yarn. An element consisting of one strand of spun fibers. Also called "single-ply" yarn, although the latter is at odds with some definitions of "ply" (Emery 1966:9, 13). A "strand of unspun fibrous material," either untwisted or twisted, is called a single (Emery 1966:9)

Slant. See Weft slant.

Spectrophotometer. Instrument for measuring the relative amounts of radiant energy as a function of wavelength; can be used in identification of dyes by matching absorbance spectra of dye solutions or reflectrance spectra of dyed fabrics with reference spectra.

Splice. To join two pieces of rope or yarn by interworking the ends. The place where parts have been spliced.

Spun yarn. "Yarn formed from fibers of limited length that have been arranged more or less parallel, drawn out into a continuous strand, and twisted together" (Drooker 1992:246; see also Emery 1966:9).

S spin. A term that refers to the direction of twist of fibers in a single, spun yarn. In some chapters of this book, this term is used to designate the initial twist of elements in a double-plied cord (e.g., a "S-spun, Z-twisted" cord), whether or not the single elements are made from short-staple fibers. See Spun yarn, S twist.

S twist. One of two possible directions of twist. If an S-twisted strand, yarn, cord, or rope is held vertical, its elements slant diagonally down from upper left to lower right, like the center portion of the letter S (Emery 1966:11). The final twist is most visible. Elements that have been plied together usually have their own internal twist, which is usually but not always the reverse of the final twist.

Textile. According to Emery, this term refers specifically to a woven (warp-weft interlaced) fabric, from the Latin *texere*, to weave (Emery 1966:xvi). However, it often is used more generally to refer to cloth (pliable, fibrous fabric) constructed by interworking elements. Many of the authors in this book use this term in the latter sense.

Thread count. "Number of warp and weft elements to the linear unit of measure" in a fabric (Emery 1966:76). Sometimes this is expressed as separate warp and weft counts, and sometimes, particularly in the textile industry, it is expressed as the sum of warps per unit of measure and wefts per unit of measure. See also Fabric count.

Twill weave. Twill interlacing formed by two sets of elements. In twill weaves, warp and weft elements float over two or more elements of the other set in a progressive succession of diagonal alignments (Emery 1966:75, 92). For example, in 2/2 twill, weft elements interlace over 2 warp elements and under 2; in 4/1 twill, wefts interlace over 4 warps and under 1, and so on. In an uneven twill (e.g., 2/1, 4/1), "no element passes over the same number of elements it passes under" (Emery 1966:99). Straight twill has its floats aligned in a continuous diagonal; herringbone twill incorporates zig-zag diagonals. See also Interlacing.

Twining. The process or result of enclosing one or more elements within the twisting of two or more other elements around each other; the latter are called the active elements. In two-strand twining, there are two active elements (see Figure 11.12); in three-strand twining, there are three (Emery 1966:Figs. 315, 316). In S twining, twining elements are twisted in the S direction (see S twist). In Z twining, twining elements are twisted in the Z direction (see Z twist). In countered (chevron) twining, rows of Z twining and S twining alternate (Emery 1966:Figs. 307, 308,

311). In plain (simple) twining, two elements twist around one element at a time, with a half-twist between each passive element (see Figure 11.12). In alternate-pair (diagonal, twill, split-pair, zigzag) twining, two active elements twist around two passive elements at a time, with alternate pairs of elements selected in alternate rows (Emery 1966:Figs. 309, 310; see also Figure 2.3, this volume). In plain twining with crossed warps (hexagonal twining), pairs of warp elements cross each other between each row of open plain twining, running diagonally through the fabric (Brasser 1975:82). In compact (close) twining, the twining elements are close enough together to completely cover the passive elements. In spaced (open) twining, twining rows are spaced at some distance apart. In weft twining, the active elements are wefts. In warp twining, the active elements are warps. In half-turn twining, each twining element alternates on the two faces of the fabric; in full-turn twining, each element is twisted such that it returns to the same face (Emery 1966:Figs. 313, 314; see Figure 11.12, this volume). Full-turn twining is called wrapped twining if the weft element on the back surface is kept rigid so that it does not appear on the front surface at all (see Figure 11.12). If twining elements of different colors are employed, pattern motifs can be constructed by inserting either a half-turn or a full-turn twist between passive elements, bringing the desired color to the front side of the fabric. See also False embroidery, Weft slant.

Twist. See S twist, Twining, Weft slant, Z twist.

Warp elements. The parallel elements that run longitudinally on a loom, weaving frame, or fabric, which are crossed and interworked by transverse elements (wefts). Supplementary warps are extra (unnecessary to the fabric structure), and usually are added solely for decorative purposes. Discontinuous warps do not span the entire length of fabric, but interwork back and forth within a restricted area. A warp float occurs when a warp element passes over or under more than one weft at a time.

Warp-faced fabric. A fabric in which the warp elements are so close together that they cover the weft elements.

Weaving. The process and the product of interlacing with at least two sets of elements (Emery 1966:68). Some researchers limit this term to textiles produced on a loom with heddles (devices used to lift selected warp elements automatically). Some writers apply this term to any type of fabric construction (e.g., twining).

Weft elements. "The transverse elements in a fabric (generally but not necessarily parallel to each other and to the starting and terminal edges of the fabric), which cross and interwork with the warp elements at more or less right angles" (Drooker 1992:248). Supplementary, or extra, wefts are unnecessary to the fabric structure, almost always being added solely for decorative purposes (Emery 1966:140-141). Discontinuous wefts do not pass across the entire width of fabric, but interwork back and forth within a restricted area. A weft float occurs when a weft element passes over and/or under more than one warp at a time.

Weft-faced fabric. A fabric in which the weft elements are so close together that they cover the warp elements.

Weft slant. The slant direction of twined wefts. When a twining row is oriented vertically, an "S" slant goes diagonally from upper left to lower right, like the center portion of the letter S, and a "Z" slant goes diagonally down from right to left, like the center portion of the letter Z (Adovasio 1977:20, 30). This term is equivalent to weft twining twist (see Twining). When direction is included, the term often is abbreviated as (e.g.) "S-Twist Wefts"; this is not to be confused with twist direction in the yarn itself.

Woolen yarn. Yarn in which wool fibers are fluffed and aligned by carding, then spun so that the fibers are at a significant angle to the length of the yarn; they are generally not dense. Woolen fabrics are woven from woolen yarns.

Worsted yarn. Yarn in which long-staple wool fibers are aligned by combing, then spun; they generally are denser than woolen yarns. Worsted fabrics are woven from worsted yarns.

Wrapped twining. "Full-turn twining in which one twining element (often rigid) remains always on the same side of the fabric" (Drooker

1992:249; see Figure 11.12, this volume). See also Twining.

Yarn. "The general term for any assemblage of fibers or filaments which has been put together in a continuous strand suitable for weaving, knitting, and other fabric construction" (Emery 1966:10).

Z spin. Refers to the direction of twist of fibers in a single, spun yarn. In some chapters of this book, this term is used to designate the initial twist of elements in a double-plied cord (e.g., a "Z-spun, S-twisted" cord), whether or not the single elements are made from short-staple fibers. See Spun yarn, Z twist.

Z twist. One of two possible directions of twist. If a Z-twisted yarn, cord, or rope is held vertical, its elements slant diagonally down from upper right to lower left, like the center portion of the letter Z (Emery 1966:11). The final twist is most visible. Elements that have been plied together usually have their own internal twist, which is usually but not always the reverse of the final twist.

NOTE

1. A number of these definitions are drawn from the glossary of *Beyond Cloth and Cordage: Archaeological Textile Research in the Americas* (Drooker and Webster 2000:267-282). They include those for: bast fiber, cloth, cord, cordage, element, fabric, fabric count, false embroidery, float, interlacing, interlinking, knitting, linking, loom, looping, mordant, octagonal openwork, plain weave, plaiting, plied yarn, pseudomorph, replied yarn, retting, single yarn, S spin, S twist, textile, thread count, twill weave, twining, warps, warp-faced fabric, weaving, wefts, weft-faced fabric, weft slant, yarn, Z spin, Z twist.

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