A PREHISTORIC TWINED BAG FROM BIG BONE CAVE, TENNESSEE: MANUFACTURE, REPAIR, AND USE

Jenna Tedrick Kuttruff

Introduction.

Textiles are rarely preserved at the majority of prehistoric sites in the southeastern United States. Much of what we know about prehistoric textiles from this region has been revealed by fabric and cordage impressions on pottery or clay hearths and a few textiles or textile pseudomorphs preserved in the presence of copper. Many of the textiles which have been preserved in the Southeast have been recovered from dry rock shelters and caves. Twined bags or bag fragments are sometimes found among the perishable remains left by prehistoric peoples in caves and rock shelters (Harrington 1924 and 1960, Holmes 1896, Scholtz 1975, Watson 1969 and 1974). An example of such a bag was recovered from Big Bone Cave and this paper presents the results of an examination of the materials used, yarn and fabric construction, repairs, and use patterns of that bag.

The term “bag”, as used in this paper, refers to a flexible container which may be closed and is used for the purpose of holding, storing, or carrying something (see also Hough 1912). Bags have the potential to be two-dimensional when empty but three-dimensional when filled. The bags used by prehistoric Indians in North America have taken various forms and were constructed using a variety of techniques and materials from plant and animal sources; both decorated and undecorated bags were used. These differences may have been due to the function of the bags within the society as well as cultural differences.

Big Bone Cave.

Big Bone Cave (Site Number 40VB103) is located in Van Buren County, Tennessee, and is the major feature of the Bone Cave Mountain State Natural Area. According to Crothers (1986:11) the cave has a mapped horizontal length of approximately 15.5 kilometers and a

ARS TEXTRINA 8 (1987), pp. 125-153
total vertical extent of 65 meters. The cave is noted as an important source of saltpetre during the nineteenth century, for the discovery of the remains of a ground sloth (*Megalonyx jeffersonii*), and for the cultural remains of prehistoric Indians. Prehistoric textile items reported from Big Bone Cave in early reports include nets, mats, moccasins, and mummies wrapped in coarse cloth and a feather cloak (Crothers 1986:16).

The twined bag, which is the subject of this report, was recovered from the cave in 1982 and is presently in the collection of the Division of Archaeology, Tennessee Department of Conservation. The discovery of the bag and other aboriginal remains brought renewed attention to the cave and resulted in a systematic archaeological survey which was conducted in 1984 and 1985 (Crothers 1986).

The bag was discovered against the right wall about twenty-one meters into the first side passage to the right in the Bone Cave Branch from the Junction Vat Room. Crothers (1986:48 and 50) reported uncorrected radiocarbon dates for the cave system which ranged from 1050 B.C. to A.D. 1510. Thus, prehistoric use of the cave appears to have taken place over a period of at least twenty-five hundred years. Direct association of the bag with either of two radiocarbon samples collected near its findspot is not known. These dates are reported as A.D. 355 and 1510. If the earlier date is correct for the bag then it could be assigned to the Middle Woodland Period, but if the later date is correct then it would be Late Mississippian. The use of twined textiles has been documented for both cultural periods. Direct dating of the bag using accelerator mass spectrometry is needed in order to assign the appropriate cultural period.

**Description and manufacture.**

This author is in agreement with Emery (1966:xv) when she states that structure inheres in fabric and its elements but evidence of process is seldom retained. Thus, fabric structure is generally ascertainable while the processes used to produce a fabric may not be known. This is particularly true of prehistoric textiles where there are no written records and no possibility of observation of the processes involved in textile manufacture. There have been few, if any, positive identifica-
tions of textile tools in the archaeological literature relating to the southeastern United States. Therefore, the descriptive terminology and classification used in the analysis of the bag follows Emery's (1966) system of classification which is based upon the actual structural makeup of the fabric. This classification system was selected over other systems including the Basel system (Seiler-Baldinger 1979) which is based upon the process of textile manufacture. The descriptions of possible processes used in the manufacture of the bag are speculative in nature and are not known with certainty.

The twined bag recovered from Big Bone Cave was preserved due to the dry conditions of the crawlway, the lack of light, and the relatively constant temperature in the cave. The bag had been damaged during use, repaired in several areas, and abandoned prior to the completion of the repair of a large hole. When recovered from the cave, the bag was crumpled, dirty, and very brittle. After the bag was photographed and an initial analysis was made, it was carefully wet cleaned to remove the dirt, add flexibility to the fibers, and to neutralize the acids formed by the aging of the cellulosic fibers. Figure 1 shows both sides of the bag after wet cleaning.

The bag is rectangular in shape and is 24 cm wide by 18 cm deep. The body of the bag is made by spaced 2-strand weft twining (Emery 1966) in which a pair of wefts encircle a single warp (Figure 2). The wefts make a half turn between each warp so that alternate weft yarns surface with each twining movement. The twining twist slants down to the left when the warps are in a vertical position but down to the right when the wefts are in a vertical position and is, therefore, described as being S-twined with a forty degree angle of twining twist. There are five twining twists and five warp yarns per centimeter. The spacing of the rows of twining on the body of the bag varies from 1.31 to 1.59 cm; however, on side one of the bag the spacing between the last two rows of twining is only 0.61 to 0.65 cm.

Several different kinds of fibrous vegetal materials were used in the construction and subsequent repairs of the bag. They appear to be locally available materials rather than exotic plant species, but positive identifications have not been made because of the lack of comparative collections of known fibers from Tennessee (C.E. Smith, personal
communications 1982). Scanning electron photomicrographs (Figure 3) were taken of fibers from the weft, the warp, and the large twined patch in repair number 5. Both the warp and the patch appear to have been made from some type of leaf tissue, possibly a grass. The spun fibers have been described below following Scholtz (1975:10) as either hard fibers which are composed of comparatively stiff fibers from the leaves and stems of plants, or as bast fibers which are composed of more flexible fibers from the inner bark of dicotyledonous plants. Unspun fibrous materials have simply been designated as unprocessed plant materials. Further research dealing with the identification of fibers is planned.

Whitford's (1941) study of the vegetal fibers used in ethnological and archaeological textile artifacts from Indian tribes of the Mississippi drainage and eastward, which are in various museum collections, provides a partial list of the variety of fiber possibilities for the construction and repair of the bag under investigation. Of the eleven monocotyledonous species identified by Whitford the grass family was the most commonly and widely used. He identified *Andropogon furcatus*, Muhl. (big blue stem grass), *Hierochloe odorata*, L. (sweet grass) and *Arundinaria tecta*, Muhl. (canebrake). The list of twenty-one dicotyledonous species which were identified included two species of *Apocynum* (dog-bane and Indian Hemp), four species of *Asclepias* (milkweed), *Dirca palustris*, L. (moose or leatherwood), *Tilia americana*, L. (basswood), *Eryngium yuccaefolium*, Michx. (which provided both leaf and bast fibers), and three species of *Urticaceae*, Reichemb. (nettle).

The structures of all of the spun yarns incorporated into the bag are the same even though the types of fibers used varied. They are all 2-ply yarns made up of Z-spun singles which have been plied together in the S direction (Figure 4). The diameters of the yarns vary from 1.5 to 4.3 mm. Table 1 summarizes attribute information from the analysis of the various yarns found in the bag.

The warp or untwined elements are composed of 2-ply yarns made from fibers similar to those described by Scholtz (1975) as medium shred hard fibers. The angle of ply-twist averages approximately forty degrees but ranges from thirty to fifty degrees. There are ap-
proximately three to four twists per cm, and the yarns average 2.0 mm in diameter. The weft or active twining elements appear to be made from bast fibers. The ply-twist on these yarns ranges from thirty-five to forty degrees with approximately six twists per cm. These yarns average 1.5 mm in diameter.

Differences in the flexibility of the fibers used, the diameters of the warp and weft yarns, and the amount of twining twist influence the characteristics of the resulting textile fabric. The smaller more flexible active wefts allow the larger, stiffer passive warp elements to be positioned in close proximity when only a half turn of the twining wefts is made between each warp. Thus, even when the wefts are spaced nearly 1.5 cm apart the fabric still has a closed appearance and would be able to hold relatively small items. This would not be true if there were wide spaces between both the warp and the weft.

The warp of the bag is continuous and could have been warped flat, starting with a corner on one edge and ending with a corner on the opposite edge. This method would form the warp loops which are found in the rim structure. The twining of wefts upon a warp foundation requires no special devices other than a means of suspension of the warps and, thus, would not require the use of a “true-loom” which generally is considered to include a means of tensioning the warp as well as forming a shed. Early accounts and ethnographic studies of Indians of the eastern woodlands describe the use of a cord stretched between two posts as a means of supporting warps for twining (see Amsden 1932; Whiteford 1977:55) and this may have been the method used for the construction of the bag.

Figure 5 illustrates the locations of the structural features and repairs of the bag. The first row of twining was done in the center of the warp, and the warp was folded along this twining row. Thus, the first row of twining goes from corner to corner along the bottom of the bag. The remaining fourteen rows form individual rings which go all the way around the folded warp in a circular fashion. These rows of twining are not connected to one another, but the beginning and end of each row are joined in a manner that is not visible from the outside of the bag. The join appears to have been made along edge B which has been partially destroyed.
Edge A of the bag is no different from the body of the bag, whereas, edge B contains two larger spun bast fiber yarns which are 3.0 mm in diameter. These yarns are knotted at the lower corner of the bag, and a small mass of unspun fibers are attached at that corner. These two bast yarns act together as a unit in the fabric structure as warps or passive elements, that is, the pair is encircled by a single twining stitch.

The open edge or rim of the bag (Figure 6) is finished by twisting the warp ends together in the S direction. The two loops from each set of four warps are caught in a single element interlooped band (comparable to a very tight crochet chain) which connects the numerous groups of warp yarns. This leaves approximately a 2 cm space between the top (fifteenth) row of twining and the interlooped band. A coarsely shredded, hard fiber, 2-ply cord which is 4.3 mm in diameter was knotted to one edge of the bag and irregularly interlaced through some of the spaces in the rim (see Figure 8). A portion of this was broken and separated from the bag. This cord could have been used as a draw-string to close the bag, as a means of carrying the bag, or both.

**Repair.**

The bag had been damaged and appears to have been repaired on several different occasions, since each of the damaged areas was repaired in a different manner using different materials. These repairs could indicate that the bag was used over an extended period of time or that it received very hard use in a relatively short period of time. The fact that the bag was repaired also indicates that it was valued. This value placed upon the bag may have been the result of the time, energy, and skill necessary to replace it, as well as its usefulness in conducting daily activities.

There is a blackened area near the rim on side 1 of the bag which looks as though it is the result of scorching (Figure 6). This scorched area was 4.5 cm in length and 3.0 cm wide along the last row of twining. It did not break any of the yarns of the fabric but merely discolored them.

Repair number 1 (Figure 7) was made near the bottom of the bag on the same side as the scorched area (side 1). This was the only damaged
area which was near the bottom of the bag, and there was no evidence of scorching or charring on the broken yarns. There are four broken warp yarns between the second and third rows of twining. The resulting hole has been mended with a piece of unprocessed hard fibrous material which appears to still have some cortex present. At its widest part, the strand used measures 2.8 mm. The two ends of the strand are on top with the stitches being made first around the top row of twining, then around the bottom row, and again around the top row of twining.

Repair number 2 (Figure 8) had been made on a hole in one corner of the rim. Portions of several warp yarns were broken and missing but the interlooped band along the rim and the twining wefts were not broken. The ends of the fibers in the broken warp yarns show no evidence of charring. The rim band and weft yarns were fastened together with a piece of unprocessed plant material which is 3.1 mm wide and 0.9 mm thick.

Repair number 3 (Figure 9) is located along the rim on side 2 of the bag. Part of the interlooped band is broken and the top loops of four warps are missing. A bast yarn was used to join the two twisted groups of warps on either side of the missing group and then knotted. This repair would serve to strengthen the rim where the band was broken and to help protect the top row of twining from stress.

Repair number 4 (Figure 10) is located along the lower portion of the large hole on edge B. This portion of the hole had been stitched using large running stitches. The yarn used for the stitching is structurally identical to the warp yarns but is cleaner. No dirt particles are visible between the fibers of the repair yarns but are very obvious between the fibers of the warp yarns. The running stitches begin between the sixth and seventh rows of twining but have come unstitched by the tenth twining row.

Repair number 5 (Figure 10) is the most extensive repair and a twined fabric structure similar to that of the original bag was used to fill in a portion of a hole which had left about one-fourth of the rim missing. The ends of the fibers in the broken warp yarns appear to have been charred and the original hole may have been caused by burning. The patch was begun on side 2 by looping the new warp yarns between the
eleventh and twelfth rows of twining. Some of the original warp from along edge B of the bag are incorporated into the patch, and the twining of the first row of the patch was done with a yarn similar to the stitching yarn in patch number 4. The upper two twining rows of the patch was done with the new patching yarns. These yarns are lighter in color and slightly larger in diameter than the original warp yarns. They are 2-ply, hard fiber yarns which are 2.25 mm in diameter. Loops of the patching yarns are joined in groups along the rim with loose interlooping (chain stitches) but the groups were not twisted together as in the original rim.

A heavy yarn or cord (3.6 mm in diameter) joins the corner of the patch with the edge of the unpatched hole on the other side of the bag. This cord has two ply-twists per cm and a twenty to twenty-five degree angle of twist. It appears to be made of coarsely shredded hard fibers. The patch looks crude and irregular when compared with the fabric structure of the original bag. The yarns and fibers of the patch are very clean in comparison with similar portions of the original bag.

Use patterns.

Evidence leading to the probable use of this bag can be obtained from close examination and structural analysis as well as from archaeological context. It seems unlikely that the bag would have been carried 21 meters into a crawlway, which is well into the interior of the cave, just for the purpose of disposal. Therefore, shortly before its abandonment the bag was probably being used in a manner consistent with the definition of a bag, and that is, to hold, store, or carry something. No evidence has been found for pockets in the clothing of prehistoric Indians of the Southeast, and it would be difficult to carry many items when crawling on hands-and-knees through a dark tunnel without the aid of some type of container. Therefore, the bag would have been used for carrying items into and/or out of the cave. Sunflower seeds were found near the bag when it was removed from the cave. It is not known if these seeds were directly associated with the bag, but certainly carrying foodstuffs into the cave would have been a likely use.

A small piece of gypsum was found in the bottom of the bag. Although Watson (1982) saw no evidence of gypsum mining in the areas of Big
Bone Cave that she visited, she states that removal of cave minerals was clearly one of the main aboriginal activities that went on in the Kentucky caves (Watson 1969 and 1974). The piece of gypsum found in the bag gives direct evidence for the collecting of gypsum and one of the uses of this particular bag.

The bag has been charred or burned in at least two areas. There were a great number of torch materials and remains observed within the cave. The use of torches to see what was being taken from or placed into the bag would have provided ample opportunity for the bag to have been burned.

As previously stated, twined bags are common items among the prehistoric textile assemblages recovered from dry rock shelter and cave sites. Scholtz (1975) reports on fourteen twined bags from Ozark bluff shelters in Arkansas and Harrington (1924 and 1960) mentions at least forty-seven twined bags (he sometimes refers to them as woven bags but his photographs and drawings indicate that they were actually twined) from his work in the Ozark bluff shelters of both Arkansas and Missouri. Twined bags have also been recovered from caves and shelters in Tennessee and Kentucky (Holmes 1986, Orchard 1920, Schwartz 1965, Watson 1969 and 1974, King 1974) and from the Spiro Site in Oklahoma (Brown 1976).

The majority of these bags are spaced plain or alternate pair weft twining, but sometimes compact twining was combined with spaced twining. Various uses for these bags have also been given. Primarily they were used as containers, but secondary uses have also been reported. Prehistoric bags have been found which contained small items such as pipes, shells, awls, cordage, balls of cedar bark, and small wrapped packages. So called “medicine” bags have also been described such as one recovered by Harrington (1960:35) which contained beaver teeth, a bird beak, bird bones, and worked crystal, limonite, hematite, and calcite. The most commonly reported use is as a container for nuts and seeds. Corn, corn cobs and shelled corn have all been recovered in bags. Squash, pumpkin, sunflower, and chenopodium seeds as well as unidentified seeds, beans, and acorns have also been found in bags. Because of the openness of the fabric construction in spaced twining these bags were frequently lined with.
leaves or grasses to minimize the loss of small seeds. Leaves and grasses were also stuffed on top to prevent loss through this opening. Inner linings or wrappers of deerskin were occasionally used for this purpose. Bags have been found in burial contexts and have contained infant burials as well as adult bundle burials (Harrington 1960). Non-container uses (re-uses or secondary uses) for bags include their use as torch materials in caves and as linings for storage pits.

Summary and conclusions.

One of the goals of the analyst of archaeological textile remains is to be able to infer past human behavior relating to those textiles. The technical analysis of this twined bag from the archaeological context of Big Bone Cave, Tennessee, yields information about the systemic context or the behavioral system which produced it, used it, and discarded it.

The variety of vegetal materials utilized in the bag and its repairs appear to have been of local origin rather than of exotic materials which could only have been obtained through trade. The amount of fiber processing varied from little or no processing found in repair materials to comparatively extensive processing needed to extract and shred the bast fibers used in the weft. All of the spun yarns were of the same structure (2-ply with Z-spin and S-twist) but varied in the type of fibers used, the degree of shredding, the angle of twist, and the diameter. The fibers and yarns utilized in the original manufacture of the bag were selected for their inherent properties, finely processed, and relatively uniform. The fabric of the bag was carefully and expertly constructed, so that even the joinings of the ends of the twining elements are not readily visible. The repairs, however, appear to be rather crude and haphazard in comparison. This may indicate that they were made quickly with materials at hand, or they may have been made by a person whose textile skills were not as highly developed as the original manufacturer.

The fact that the bag had been damaged during use and repaired on several occasions may indicate that the bag was used over a period of time and that it was valued because of its usefulness and perhaps because of the costs involved in its replacement. The bag was obviously used as a container to hold and carry items in the cave. The proximity
of sunflower seeds to the bag in its archaeological context and the nu-
merous reports of similar bags holding a variety of nuts and seeds
points to one possible use of the bag. The fact that gypsum was found
in the bottom of the bag indicates the use of this bag prior to its discard
or loss. The charring of different areas of the bag indicates that it was
used in close proximity to fire. The bag may have been abandoned or
discarded because the large hole which had not been completely
repaired limited its usefulness or it may have simply been dropped and
lost in the dark crawlway of the cave rather than purposefully
abandoned.

It is the intent of this author to demonstrate that the careful analysis of
textile artifacts can increase our knowledge of the prehistoric people
and cultures which produced and used those textiles. Analysis of
materials used yields information about the relationships of people to
the environment; fabric analysis reveals information about the techni-
cal skills and artistic values of the persons involved in manufacture;
and from analysis of use, wear, maintenance, and discard patterns, in-
formation is gained about the daily activities and values of the society.

Acknowledgements.

The author would like to express her sincere appreciation to those
persons who contributed to the writing of this paper. Carl Kuttruff
made the bag available for study and provided much encouragement
and support. Lucy R. Sibley and Richard Yerkes read and offered
helpful suggestions on earlier forms of this paper. Randall R. Bresee
provided the SEM photomicrographs of the fibers and Michael Barton
identified the gypsum.
References

Amsden, Charles

Brown, James A.

Crothers, George M.
1986 Final Report on the Survey and Assessment of the Prehistoric and Historic Archaeological Remains in Big Bone Cave, Van Buren County, Tennessee. Department of Anthropology, University of Tennessee, Knoxville.

Emery, Irene

Harrington, Mark R.

Holmes, William Henry

Hough, W.

King, Mary Elizabeth

Orchard, W.C.
1920 Sandals and Other Fabrics from Kentucky Caves. Indian Notes and Monographs, Museum of the American Indian, Heye Foundation, New York.
Scholtz, Sandra Clements
1975 *Prehistoric Plies*. Arkansas Archaeological Survey Research Series No. 9, Fayetteville.

Schwartz, D.W.

Seiler-Baldinger, Annemarie
1979 *Classification of Textile Techniques*. Calico Museum of Textiles, Ahmedabad, India.

Watson, Patty Jo


1982 Notes on a Visit to Big Bone Cave, Van Buren County, Tennessee. Ms. on file, Tennessee Division of Archaeology, Nashville.

Whiteford, Andrew Hunter

Whitford, A.C.

The Ohio State University
Department of Textiles and Clothing
Columbus, Ohio, U.S.A.
<table>
<thead>
<tr>
<th>Element</th>
<th>Fiber</th>
<th>Number of ply</th>
<th>Ply-twist direction</th>
<th>Spin direction</th>
<th>Ply-twist angle</th>
<th>Diameter (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warp</td>
<td>hard</td>
<td>2</td>
<td>S</td>
<td>Z</td>
<td>40</td>
<td>2.0</td>
</tr>
<tr>
<td>Weft</td>
<td>bast</td>
<td>2</td>
<td>S</td>
<td>Z</td>
<td>35 - 40</td>
<td>1.5</td>
</tr>
<tr>
<td>Edge B yarns</td>
<td>bast</td>
<td>2</td>
<td>S</td>
<td>Z</td>
<td>30 - 35</td>
<td>3.0</td>
</tr>
<tr>
<td>Interlooped band</td>
<td>bast</td>
<td>2</td>
<td>S</td>
<td>Z</td>
<td>35</td>
<td>1.5</td>
</tr>
<tr>
<td>Draw string</td>
<td>hard</td>
<td>2</td>
<td>S</td>
<td>Z</td>
<td>30</td>
<td>4.3</td>
</tr>
<tr>
<td>Rim cord, repair 5</td>
<td>hard</td>
<td>2</td>
<td>S</td>
<td>Z</td>
<td>20 - 25</td>
<td>3.6</td>
</tr>
<tr>
<td>Repair 5</td>
<td>hard</td>
<td>2</td>
<td>S</td>
<td>Z</td>
<td>40</td>
<td>2.2</td>
</tr>
<tr>
<td>Repair 4</td>
<td>hard</td>
<td>2</td>
<td>S</td>
<td>Z</td>
<td>30</td>
<td>2.4</td>
</tr>
<tr>
<td>Repair 3</td>
<td>bast</td>
<td>2</td>
<td>S</td>
<td>Z</td>
<td>30</td>
<td>2.0</td>
</tr>
<tr>
<td>Repair 2</td>
<td>hard</td>
<td>- unprocessed -</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repair 1</td>
<td>hard</td>
<td>- unprocessed -</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 1 Bag after wet cleaning, (b) side 2.
TWINED BAG
FABRIC STRUCTURE

Expanded view of
spaced 2-strand S-twist weft twining

Figure 2
Expanded view of fabric structure, spaced 2-strand weft twining.
Figure 3
Scanning electron photomicrographs of fibers,
(a) weft

142
Figure 3
Scanning electron photomicrographs of fibers,
(b) warp
Figure 3
Scanning electron photomicrographs of fibers,
(c) patch in repair number 5
Figure 3
Scanning electron photomicrographs of fibers, (d) cross section of patch in repair number 5.

145
YARN TYPE

Single S-spun  Single Z-spun

2-ply yarn
Z-spun S-plied

Figure 4
Yarn structure, 2-ply, Z-spun, S-twist.
Figure 5
Location of structural features and repairs,
(a) side 1,
Figure 5
Location of structural features and repairs,
(b) side 2.
Edge finish on rim of bag and scorched area on side 1.
Figure 7
Repair number 1.
Hole has been filled with a strip of unprocessed plant material which is worked to connect two rows of weft twining.
Figure 8

Repair number 2, with bag opened.
A strip of unprocessed plant material ties together the rim band and the twining wefts from the top two rows of twining. Also shown is a portion of the heavy cord which may have functioned as a draw string for the bag.
Figure 9

Repair number 3.
A bast yarn connects two groups of warps on either side of the missing warp group along the rim on side 2 of the bag.
Figure 10

Repair numbers 4 and 5, side 2.

Stitch holes from repair number 4 are visible near edge B.

In repair number 5, a twined patch of lighter colored yarns fills in a portion of the large hole along the rim and edge B of the bag.