

IDENTIFICATION OF FEATHERS IN TEXTILES FROM THE CRAIG MOUND AT SPIRO, OKLAHOMA

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We microscopically analyzed 101 textile samples representing 89 cataloged artifacts from the Craig Mound, Spiro, Oklahoma, in order to identify feathers used in their manufacture. Downy feather barbs from three species of birds were identified in textile samples: wild turkey (Meleagris gallopavo; n = 66 samples), Canada goose (Branta canadensis; n = 15), and swan (Cygnus, cf. buccinator; n = 4). These are the first swan remains reported from the Spiro site. Feathers from 84 samples were dyed red or black. Although Spiro iconography depicts falcons, eagles, and woodpeckers, none of the textiles examined in this study contain feathers belonging to species from the avian orders Falconiformes and Piciformes.

The Spiro site, in Le Flore County at the eastern edge of Oklahoma, was the largest of a series of Mississippian period mound centers that spanned the Northern Caddoan Region, an area including the Arkansas River Basin and Ozark Highlands of Oklahoma, Arkansas, and Missouri. Although Spiro clearly played a significant role in the development of regional social complexity, the site is best known for a spectacular collection of well-preserved artifacts discovered there by treasure hunters and professional archaeologists in the 1930s. The recovery from Spiro of so many types of well-preserved objects challenged previous interpretations of Mississippian material culture and still affords new insights on a wide range of issues. In particular, the great diversity of trade items recovered at Spiro defines the site as a significant center with ties throughout much of the Eastern Woodlands, southwestern United States (Bell 1947; Brown 1983, 1996; Rogers 1996), and even central Mexico (Barker et al. 2002). Given the relevance of this site in regional social dynamics, including the rise of Mississippian chiefdoms, refining the documentation of Spiro's complex material remains continues to be an important task. This analysis is part of an ongoing process of assessing connections and describing the artifacts found at Spiro.

The presence of feathers in textiles was apparent as soon as Spiro materials became known in the mid-1930s (Burnett 1945; Gardner 1980; Hoffman 1978; King and Gardner 1981; Kuttruff 1988, 1993; Rachlin 1960;

Willoughby 1952). King and Gardner (1981, 1990) and Kuttruff (1988) defined primary textile categories and offered the greatest set of comparative information. Much of their analysis was based on the Smithsonian collection, which represents the most extensive accumulation of textiles from Spiro (Sievert 2002). However, the small number of previous identifications did not permit a comprehensive understanding of the diversity and relative frequency of bird species represented in Spiro textiles. Here we apply recently developed techniques of feather identification (Dove 1997, 1998, 2000; Reaney et al. 1978; Robertson et al. 1984) to a wide range of Spiro textiles in the Smithsonian collection.

All specimens included in this study are attributed to Craig Mound at the Spiro site and were collected by Harry Trowbridge shortly after the site was looted between 1933 and 1936 (Brown 1996:27). Most, if not all, of the specimens are from the portion of the mound known as the Great Mortuary. The vast majority of perishable items were recovered from this particular context (Brown 1996:84-104). The Great Mortuary dates to the early AD 1400s, although other contexts within the mound that may have produced small textile fragments date as early as AD 1100 (Brown and Rogers 1999).

Methods

We sampled 101 textiles or textile fragments representing 89 cataloged artifacts in the collections of the Smithsonian Institution (Table 1). We purposefully focused on textiles that exhibited macroscopic evidence of plumulaceous (down) feathers or feather-like filaments. Minute samples of fibers and feather barbs were removed from specimens with microforceps and mounted on labeled glass microslides. Loose fragments or fibers in textile boxes were sampled in a few cases. Microslide preparation followed Laybourne and Dove (1994) and Dove (1998), except that HistoSolve[®] was substituted for xylene. We did not wash samples because of their small size and fragility. Microslides were examined with a Reichert Diastar[®] comparison light microscope (100-630×) and photomicrographs were taken with a Polaroid DMC Ie[®] digital camera. Labeled microslides are stored with the Spiro textile collections at the Smithsonian Institution's Museum Support Center. Feather identification methods follow those described by Dove (1998) and incorporate techniques developed by Messinger (1965) and Hargrave (1965).

Table 1. Avian identifications of Spiro artifacts in the Smithsonian Institution, National Museum of Natural History.

Catalog ^a Number	Article Description	Feather/Hair Identification	Color
378240-A	Cloth, tapestry	Wild Turkey	Red
378240-B	Cordage	Wild Turkey	Dark Brown
386187-A	Cloth, tapestry	Wild Turkey & Canada Goose	Red, Light Brown
386188	Cloth, wrapped warp	Wild Turkey	Red
386188	Cloth, wrapped warp	Wild Turkey & Canada Goose	Red, Black
386188	Cloth, wrapped warp	Wild Turkey	Black
386188	Cloth, wrapped warp	Wild Turkey	Red
386188	Cloth, wrapped warp	Trumpeter Swan & Wild Turkey	Red, Black, Yellow
423356-B	Cloth, weft twining	Hair	Red, Yellow
423361	Cloth bundle, spaced weft twining	Hair	Red
423362	Cloth bundle, spaced weft twining	Canada Goose	Light Brown
423365-C	Cloth, wrapped warp	Wild Turkey	Black
423365-C	Cloth, wrapped warp	Canada Goose	Light Brown, Black
423366	Cloth bundle, spaced weft twining	Hair	Red, Brown
423366-E	Cloth bundle, spaced weft twining	Hair	Red, Brown
423366-E	Cloth bundle, spaced weft twining	Hair	Red, Brown
423367-D	Cloth, wrapped warp	Canada Goose	Black
423367-F	Cloth, wrapped warp	Canada Goose	Brown
423367-F	Cloth, wrapped warp	Hair	Yellow, Red
423367-I	Cloth, wrapped warp	Wild Turkey	Brown, Yellow
423368	Loose fibers	Trumpeter Swan	Red
423368-A	Cloth, wrapped warp	Wild Turkey	Brown
423368-C	Cloth, wrapped warp	Wild Turkey	Red
423368-E	Cloth, wrapped warp	Wild Turkey	Brown, Red
423368-F	Cloth, wrapped warp	Canada Goose	Black
423368-H	Cloth, wrapped warp	Trumpeter Swan	Red
423368-H	Cloth, wrapped warp	Trumpeter Swan	Red
423368-I	Cloth, wrapped warp	Canada Goose & Wild Turkey	Black
423368-L	Cloth, wrapped warp	Wild Turkey	Red, Black
423369	Cloth, wrapped warp	Wild Turkey	Red
423369-A	Cloth, wrapped warp	Wild Turkey	Red, Yellow
423369-C	Cloth, wrapped warp	Wild Turkey	Black, Brown
423369-E	Cloth, wrapped warp	Wild Turkey	Red
423369-F	Cloth, wrapped warp	Wild Turkey	Red, Black
423369-I	Cloth, wrapped warp	Wild Turkey	Brown, Yellow
423369-K	Cloth, wrapped warp	Wild Turkey	Red, Black
423369-L	Cloth, wrapped warp	Wild Turkey	Black
423369-M	Cloth, wrapped warp	Canada Goose	Black
423369-Q	Cloth, wrapped warp	Wild Turkey	Red
423369-T	Cloth, wrapped warp	Wild Turkey	Black
423369-U	Cloth, wrapped warp	Wild Turkey	Red
423369-V	Cloth, wrapped warp	Wild Turkey	Red, Black
423369-W	Cloth, wrapped warp	Wild Turkey	Dark Brown
423369-Y	Cloth, wrapped warp	Hair	Brown
423369-AA	Cloth, wrapped warp	Wild Turkey	Black
423369-CC	Cloth, spaced weft twining	Hair	Black
423370-A, B	Cloth, wrapped warp	Wild Turkey	Red, Light Brown
423370-A, B	Cloth, wrapped warp	Wild Turkey	Red, Black
423370-C, D, E	Cloth, wrapped warp	Wild Turkey	Red, Light Brown
423370-C, D, E	Cloth, wrapped warp	Wild Turkey	Red, Light Brown
423371-C	Cloth, wrapped warp	Wild Turkey	Red, Black
423371-D	Cloth, wrapped warp	Canada Goose	Black
423371-E	Cloth, wrapped warp	Wild Turkey	Red, Black
423371-F	Cloth, wrapped warp	Wild Turkey	Black
423371-G	Cloth, wrapped warp	Wild Turkey	Red, Black
423371-H	Cloth, wrapped warp	Wild Turkey	Red, Black
423371-I	Cloth, wrapped warp	Wild Turkey	Red
423371-K	Cloth, wrapped warp	Wild Turkey	Red, Black
423371-N	Cloth, wrapped warp	Canada Goose	Black
423371-P	Cloth, wrapped warp	Wild Turkey	Dark, Light Brown
423371-S	Cloth, wrapped warp	Hair	Black
423371-T	Cloth, wrapped warp	Wild Turkey	Black
423371-X	Cloth, wrapped warp	Wild Turkey	Red
423372-A	Cloth, wrapped warp	Wild Turkey	Red
423372-B	Cloth, tapestry	Wild Turkey	Red, Light Brown
423372-C	Cloth, tapestry	Hair	Light Brown

423372-E	Cloth, wrapped warp	Wild Turkey & Canada Goose	Black
423372-E	Cloth, wrapped warp	Wild Turkey	Light Brown
423372-H	Cloth, wrapped warp	Canada Goose	Black
423372-I	Cloth, wrapped warp	Indeterminate Feather (Pennaceous)	Light Brown
423372-J, K	Cloth, tapestry	Wild Turkey	Red, Black, Light Brown
423372-L	Cloth, wrapped warp	Wild Turkey	Black
423372-M	Cloth, wrapped warp	Wild Turkey	Red
423372-O	Cloth, wrapped warp	Wild Turkey	Black, Light Brown
423372-P	Cloth, wrapped warp	Wild Turkey	Light Brown
423373-B	Cloth	Wild Turkey	Red, Black
423373-C, F	Cloth, tapestry	Hair & Wild Turkey	Red, Black, & Light Brown
423373-D	Cloth	Wild Turkey	Red, Black
423373-F, H, L	Cloth, tapestry	Hair	Light Brown
423373-F, H, L	Cloth, tapestry	Wild Turkey	Black
423373-F, L	Cloth, tapestry	Hair	Red
423373-I	Cloth	Wild Turkey	Red, Black
423373-K	Cloth, tapestry	Indeterminate Feather (Pennaceous)	Light Brown
423373-L	Cloth, wrapped warp	Indeterminate Feather	Black
423373-M	Cloth, tapestry	Hair & Wild Turkey	Brown Red
423373-AA	Cloth, tapestry	Hair	Brown
423374	Cloth	Canada Goose	Black, Light Brown
423375-2838	Cloth	Wild Turkey	Red
423377-1	Cordage	Wild Turkey	Red
423377-2	Cordage	Wild Turkey	Dark Brown
423377-3	Cordage	Hair	Black
423377-4	Cordage	Wild Turkey	Red
423377-8	Cordage	Wild Turkey	Light Brown
423377-10	Cordage	Canada Goose & Wild Turkey	Black, Dark Brown
423378-O	Cloth, wrapped warp	Hair	Red, Black
423380	Cloth, spaced weft twining	Unidentified	Black
448915	Cloth, tapestry	Indeterminate Feather	Light Brown
448916	Cloth, wrapped warp	Wild Turkey	Red
448917	Cloth, wrapped warp	Hair	Red
448919	Cloth	Wild Turkey	Light Brown

^aThe first six numbers are the official Smithsonian catalog number. Letters or numbers following the hyphen refer to specific textile fragments. In some cases, these sub-designations derive from original collector cataloging while others are associated with conservation treatments.

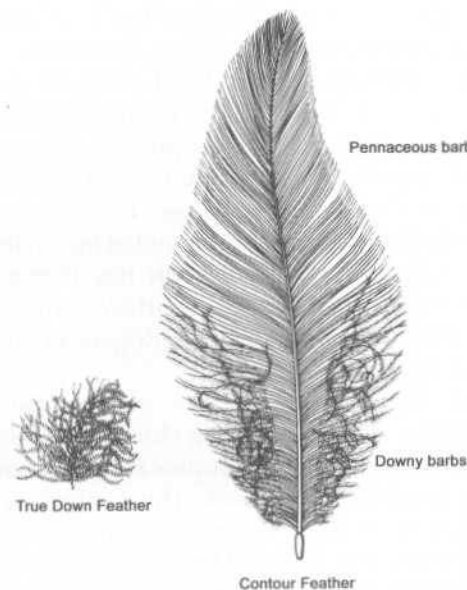


Figure 1. Illustration of a contour feather showing the two types of barbs found on a typical feather. Plumulaceous (downy) barbs have the most diagnostic characters for feather identification and are found on true down and contour feathers.

A typical contour feather consists of two types of barbs: (1) fluffy plumulaceous (downy) barbs located at the base of most contour feathers, and (2) pennaceous barbs with stiff interlocking hooklets that help the feather maintain its form (Figure 1). True down feathers are a different type of feather that grows between feather tracks, helps provide insulation, and has similar microscopic structures to contour feather down. Node shape, node distribution, pigment patterns, and length of downy barbules are diagnostic characters that may be used to distinguish feathers to the family level, and occasionally permit species-specific identification (Dove 2000). We compared the Spiro samples to feathers from species of birds that occur in the Arkansas River valley in a large reference collection of microslides housed at the National Museum of Natural History.

Results

We identified three species of birds from downy feather fragments in cloth, tapestries, and cordage from Spiro (Table 1): wild turkey (*Meleagris gallopavo*; $n = 66$ samples), Canada goose (*Branta canadensis*; $n = 15$), and swan (*Cygnus*, cf. *buccinator*; $n = 4$). Downy feather characters unique to Galliform birds (e.g., quails, pheasants, turkeys) include long barbules, pigmented or unpigmented nodes, transparent projections at the basal nodes, and ringed structures at the distal nodes. Species closely related to the wild turkey in the Spiro area, such as ruffed grouse (*Bonasa umbellus*), greater prairie chicken (*Tympanuchus cupido*), and northern bobwhite (*Colinus virginianus*), were eliminated from further consideration because all have concentrations of

pigment at barbule nodes. In contrast, barbules of wild turkey are typically stippled more heavily in the internodal area (Figure 2).

Downy feathers of Anseriform birds (ducks, geese, swans) exhibit short to medium-long barbules with distinctive distal nodes (Brom 1991). Geese can be distinguished from ducks and swans by the location of nodes, the length of the barbules, internodal length, shape of the expanded nodes, and the distribution and intensity of pigment. In turn, downy feathers of Canada geese can be distinguished from those of the snow goose (*Chen caerulescens*), a common migrant in eastern Oklahoma, by the pattern and intensity of pigmentation in the barbules. Canada goose barbules may have pigmented nodes and typically have moderately stippled internodes (Figure 3), whereas snow geese (including the dark phase) have unpigmented nodes and lightly stippled internodes. Swans can be distinguished from other Anseriforms by the lower initial position of expanded nodes on barbules, the shape of the node, number of nodes, internodal length and the lack of pigmentation on downy barbules (Figure 4). Down feathers of the trumpeter swan (*Cygnus buccinator*), however, cannot be distinguished from those of the tundra swan (*Cygnus columbianus*) using current microscopic techniques. It is likely that swan down in the Spiro textiles represents the trumpeter swan, which wintered commonly in the Arkansas and lower Mississippi river drainages. Swan down was found in three independent samples from the same museum number (423368), and is mixed with wild turkey in another sample (386188).

Four textile samples contain unidentified feathers (448915 and 423373-L, possibly from songbird or wood-

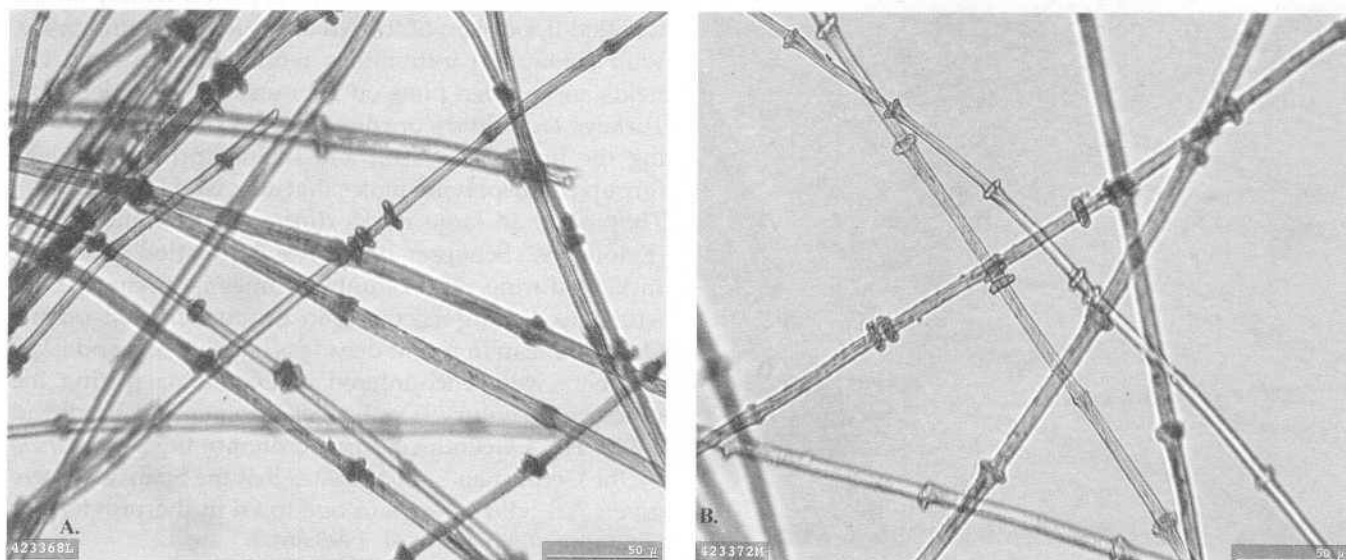


Figure 2. Photomicrographs of Spiro sample 423368L (left), wild turkey (*Meleagris gallopavo*) that was dyed black; and Spiro sample 423372M (right) that was dyed red, showing ringed-structures at the nodes of barbules typical of wild turkey. Sometimes these rings break loose and slide along the barbule.

pecker) and 18 samples contain hair. Down was apparently preferred for textile manufacture. Only 21 samples contain pennaceous feather fragments and no object contains a largely whole or complete pennaceous feather. Most textiles and the constituent down feathers were dyed red or black (often in contrasting color patterns), although light brown, yellow, and dark brown dyes were also noted. Dyed samples of Canada goose down are black, whereas swan down was dyed red. Wild turkey down was dyed black and red (Figure 2) in roughly equal proportions.

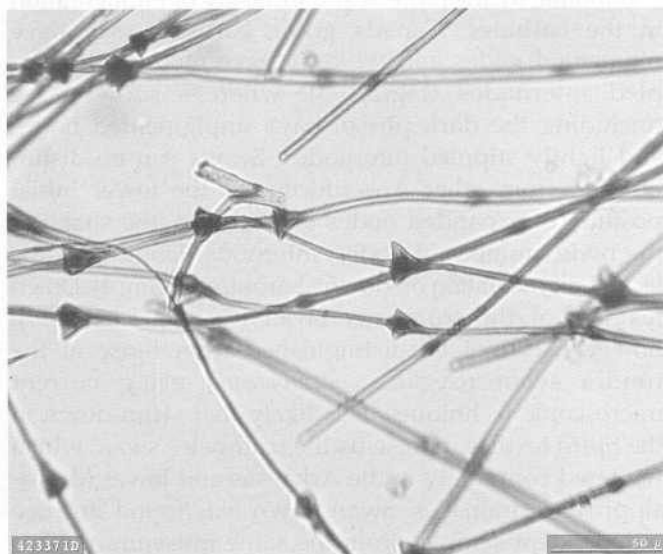


Figure 3. Photomicrograph showing the typical triangular-shaped, expanded and pigmented nodes of Canada goose (*Branta canadensis*). Spiro sample 423371D was dyed black.

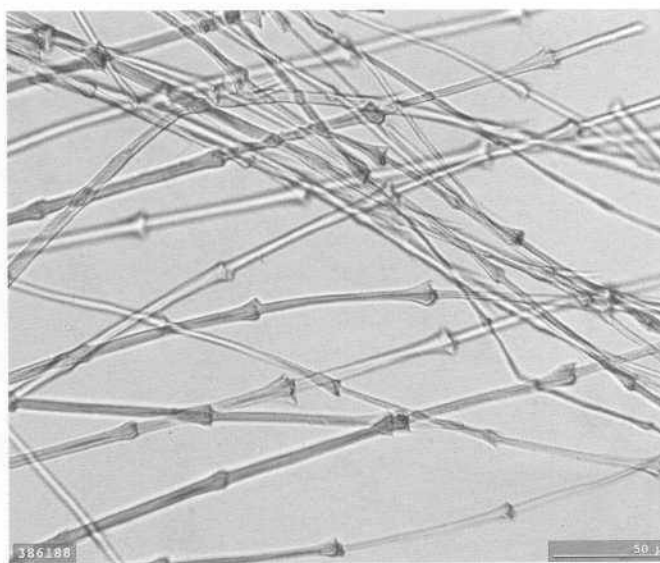


Figure 4. Trumpeter swan (*Cygnus buccinator*) typically has narrow nodes, long internode length and no pigmentation, most like this Spiro sample, 368188.

Discussion

Feather identification was complicated by the fragile nature of the artifacts and by the absence of whole feathers in the sampled textiles. Identifications of feathers in black-dyed textiles were difficult in some cases because dye seemed to concentrate at the nodes and ringed structures of downy barbules, intensifying the pigmentation points. It was also difficult to determine how much cross contamination of fibers occurred between samples when the textiles were removed from the mound. However, the large number of samples analyzed in this study confirmed that plumage from particular species of birds was preferred for the production of textiles and cordage.

Given the relatively large number and diversity of textiles recovered from Spiro, feathers, and especially downy feathers, were extremely important in the manufacture of elite and ceremonial garments and paraphernalia. The textiles represented by the samples studied here appear to be either mantles or blankets, although the fragmentary nature of the specimens makes identification of garment types difficult. The manufacturing technique thoroughly described by Willoughby (1952:111), Kuttruff (1988), and Brown essentially consists of attaching feather or fur to the "warp of a spaced weft twined fabric" (Brown 1996:622).

As noted earlier, feathers of the wild turkey (*Meleagris gallopavo*) were those used most frequently in Spiro textiles. Turkeys have always been an important game species in eastern and southwestern North America. The possibility of turkey domestication is an unresolved issue in the Southeast, although it is well documented in the Southwest and Mesoamerica (Breitburg 1988). Adult turkeys weigh in the range of 3.2-13.4 kg (Aldrich 1967) and would have occurred widely on the wooded floodplain of the Arkansas River around Spiro. Wild (untamed) individuals would have entered old fields and garden plots on the outskirts of settlements. Turkeys are solitary or congregate in small groups during the breeding season and in the spring form leks (groups of displaying males that are visited by females). They occur in large flocks during the fall and winter (Eaton 1992; Schorger 1966). The population density of turkeys during pre-Columbian times is unknown, but ~10 turkeys/km² occurred in optimal habitat on the Ozark Plateau in recent decades (Lewis 1967), and large numbers were encountered in Oklahoma during the nineteenth century (Doolin 1913; Tomer and Brodhead 1992). The sixteenth-century account of the Soto *entrada* by the Gentleman of Elvas notes that the Spaniards were given 700 wild turkeys in one town in the province of Chalaque (Clayton et al. 1993:86).

Although Canada goose feathers were far less common in the Spiro textiles, populations of this species are believed to have bred as far south as central Kansas and

northeastern Arkansas in the nineteenth century (Hanson 1965), and very well could have nested in the Arkansas River valley in eastern Oklahoma prior to the arrival of Europeans. Small quantities of Canada goose bones have been identified at Spiro and other sites in the region (Brown 1996:289; Wyckoff 1980:453). Like the turkey, the Canada goose is large with adults ranging from 3.5 to 7.4 kg. They are mainly vegetarian, feeding on aquatic plants as well as freshly sprouting grass on burned prairies. The practice of clearing agricultural fields through burning would have produced an attractive feeding ground for geese during spring and fall migrations.

Of the three species of birds identified in the Spiro samples, feathers of swans were least common. The trumpeter swan was most likely the species commonly encountered during migration and during the winter in the Arkansas and Mississippi river valleys (Banko 1960). Adult trumpeter swans are about the same size as a large turkey, ranging from 9.1 to 13.6 kg. Swans feed primarily on aquatic vegetation and could have been killed in the sloughs and oxbow lakes along the Arkansas River from November through March. The trumpeter swan has not been identified previously in the faunal remains from archaeological sites in eastern Oklahoma, but Parmalee (1958) reported many bones from this species at the Cahokia site in Illinois.

Beyond the use of feathers in textile manufacture, birds were clearly significant in Spiro iconography with numerous examples of birds or bird-like features represented in shell engravings, copper plates, and other carved materials. Bird representations range from humans dressed in bird costumes (falcon dancers) to anthropomorphized birds, to composite creatures depicting some combination of human, bird, snake, feline, or fish attributes (Phillips and Brown 1978, 1984). Distinctive bird images well represented at Spiro include falcons, eagles, and woodpeckers. Images that can be identified as swan or goose are absent and there is only one representation with distinctive turkey attributes (on the McAdams gorget, University of Arkansas Museum, 47-6-979; Brown 1996:601). Considering the likelihood that these fabrics were used by high-status individuals and for ritual purposes (Kuttruff 1988:151), we might anticipate that iconographic representations of birds would correlate with the actual bird species used in textile manufacture. This, however, is not the case. Birds used in the construction of garments are large species with significant quantities of downy feathers. From a labor investment point of view, this seems logical. Two to three dozen peregrine falcons, each of which would have been extremely difficult to obtain, would be needed to produce the number of down feathers found on a single male turkey.

Conclusions

Textiles from Spiro provide a significant window through which to view distinctions of status, ritual practice, and technology. While Spiro is blessed with the uniqueness of a well-preserved elite context—the Great Mortuary in Craig Mound—comparatively little is known about textile use in less specialized settings at Spiro, or for that matter anywhere else in the Southeast (see Drooker 1992 for an important exception). Clearly some textiles made as elite garments included feathers in the finished product; although we do not know whether other textile items manufactured and used in ordinary households contained feathers. Incorporation of down feathers in a textile represents a significant additional investment of labor, and we simply do not know just how widespread this type of manufacture may have been.

The importance of feathers and their use in the manufacture of elite garments has been addressed by Kuttruff (1993:137-139). Through analysis of textile attributes in relation to status categories she noted that feathers alone were not a good predictor of status. However, the combination of feathers with dye was a good indicator. The samples examined in this study often revealed the presence of several dye colors, providing further support for their association with elites.

In addition to documenting the importance of feathers in textile manufacture, this analysis developed evidence for aboriginal uses of wild turkey, Canada goose, and trumpeter swan. Turkeys, for instance, are identified in faunal assemblages from archaeological sites in eastern Oklahoma, although the number of bones present is very small (Wyckoff 1980, 1989). The bones of geese are even more rare and swan bones have not yet been identified, although they have been found, often in abundance, in archaeological sites in the Midwest such as Cahokia (Parmalee 1958). We question whether we yet have a good understanding of how these and other potentially significant species were utilized.

Notes

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Collections. The textiles described in this study are part of the collections of the Department of Anthropology, National Museum of Natural History, Smithsonian Institution and are housed at the Smithsonian's Museum Support Center in Suitland, Maryland. The catalog numbers of all specimens examined fall between 423362 and 423372 (see Table 1).

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