10.1.3 Microscopic Use-wear and Residue Analysis of Stone Tools from 7K-F-11 (Gray Farm Site), Kent County Delaware by Bruce L. Hardy
Microscopic Use-wear and Residue Analysis of Stone Tools from 7K-F-11 (Gray Farm Site), Kent County Delaware

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Introduction

Microscopic use-wear and residue analyses were performed on a sample of 33 stone artifacts from the Gray Farm Site (7K-F-11), Kent County, Delaware. Typologically, the sample included projectile points (n=9), scrapers (n=3), microtools (n=14), drills (n=3), and shaft abraders (n=4). All artifacts were minimally handled and unlabeled prior to analysis.

Methods

The methods used here are a combination of microscopic residue and use-wear analysis that follow the protocol of Hardy et al.:

All artifacts were examined with an Olympus BH microscope under bright-field incident light at magnifications ranging from 100 to 500 diameters. All wear patterns and residues were photographed using a Nikon Coolpix 995 digital camera, and their location on the surface was recorded on a line drawing of the artifact. Identifications of residues were made by comparison with published materials and a comparative collection of experimental stone-tool replicas (Brunner and Coman, 1974; Catling and Grayson, 1982; Beyries, 1988; Anderson-Gerfaud, 1990; Hoadley, 1990; Fullagar, 1991; Teerink, 1991; Hather, 1993; Hardy, 1994; Brom, 1986; Kardulias and Yerkes, 1996; Williamson, 1996; Hardy and Garufi, 1998; Pearsall, 2000; Haslam, 2004; Dove et al., 2005; Fullagar et al., 2006). Residue recognition was the primary goal of the analysis; therefore, no special procedures were conducted to clean the tools for the sake of rendering use-wear patterns more visible. While this procedure may limit the use-wear information obtained, it serves to maximize the residues observed (Hardy and Garufi, 1998; Hardy et al., 2001; Hardy, 2004). Potentially identifiable residues include plant (plant tissue, plant fibers, starchy residue, epidermal cell tissue, wood, raphides, phytoliths, resin) and animal tissues (muscle tissue, collagen, fat, bone/antler, blood, hair, and feathers) (Hardy et al., 2001; Lombard, 2004; Wadley et al., 2004). Distribution of residues and use-wear on the artifact surface were used to help demonstrate use-relatedness and to identify use-action (Hardy and Garufi, 1998; Hardy et al., 2001; Lombard, 2004).

Use-wear patterns recorded included edge damage (microflake scars, edge rounding), striations, and polishes. These were used to help identify use-action (Odell and Odell-Vereecken, 1980; Mansur-Franchomme, 1986). Due to the potential overlap of polishes produced by different materials, use-wear polishes were categorized as either ‘‘soft’’ or ‘‘hard/high silica’’ (e.g., Newcomer et al., 1986, 1988; Moss, 1987; Bamforth, 1988; Hurcombe, 1988; Bamforth et al., 1990; Grace, 1990; Fullagar, 1991; Shea, 1992). Soft polish often results from processing animal tissue such as skin and meat. Hard/high-silica polish is produced when processing soft plants with high silica content, such as reeds and grasses, and wood, bone/antler, and tilling soil. The amount of time a tool was used, silica content of the processed material, and presence of water are all factors that can influence polish formation (Fullagar, 1991; Hardy, 2004). A combination of residue and use-wear analysis can provide complementary and corroborative information, potentially producing more accurate results than either technique.
used alone (Hardy, 1998; Hardy and Kay, 1998; Hardy et al., 2001; Rots and Williamson, 2004). (Hardy et al., 2008:651-2)

One deviation from these methods is that all residues were photographed with a Dino-Lite DinoEyepiece Digital USB Camera and DinoCapture 2.0 software. One further modification involves the identification of starch grains. Since small starch grains 5 µm or less in size, can be confused with other small particles (Haslam, 2006; Loy, 2006), the identification of grains at this site through reflected light alone is viewed as probable or possible. Extraction and analysis with other techniques is advised.

Results

Projectile Points

For a visual summary of results, see Figures 1-6.

Seventy-eight percent (7/9) of the projectile points show evidence of hafting in the form of hard/high silica polish, abraded ridges and striae on the proximal portion of the tool only. This wear pattern is caused by movement of the tool within the haft (Hardy et al., 2001). All of these points show exhibit signs of hafting on both faces, suggesting that they were hafted with a male or socket arrangement (Stordeur, 1987). Six of the points were used as projectiles. The seventh has striae and hard/high silica polish on the tip and may have also been used as a drill.

The remaining two points show minimal evidence of hafting. One has an impact fracture on the tip and may have been used. The other has hard/high silica polish on the distal end and may have been used to cut a hard material.

One further level of detail is provided on artifact 867.3 (Figure 7). A fragment of wood fiber is preserved on the proximal portion on one side in the area of the haft. This wood fiber displays paired bordered pits. Paired bordered pits are relatively rare in wood anatomy and are most commonly found in sitka spruce (Picea sitchensis) and larch (Larix laricina) (Hoadley, 1990). Sitka spruce occurs only in western North America. Larch (also known as tamarack) distribution today in North America extends from Alaska to Labrador and south to northern New Jersey. It is also found locally in Virginia and western Maryland (Little 1980).

Scrapers

All three scrapers shows signs of use. Two were handheld while one was hafted. All three scrapers exhibit soft polish with two having hair fragments indicative of scraping hide (Figure 8). It is likely that the third was also used to scrape hide but no residues were found to confirm this.

Microtools

Two of the 14 microtools exhibited no functional evidence. The remainder showed a range of uses including perforating hide, scraping and piercing soft material, scraping and piercing hard or high silica material, scraping starchy plant, and scraping resinous plant. Five microtools had no residues and their function is based solely on wear patterns. One microtool has hard/high silica polish associated with a resinous material. Further plant tissues are absent
on this tool. The final microtool has soft polish associated with starch grains and raphides (calcium oxalate crystals) (Figure 9). The starch grains are small (~ 5-6 microns) with a centric hylem and are not very numerous. No other diagnostic plant tissue is present.

**Drills**

All three drills appear to have been associated with animal processing. Two have hairs and soft polish suggesting they were used to perforate hides. Both appear to have been handheld. The final drill was hafted, probably with a juxtaposition arrangement (Stordeur 1987) as hafting traces are present on only one side of the tool. Near the tip are numerous possible blood residues. Blood residues vary greatly in morphology so this identification should be considered preliminary.

**Shaft Abraders**

All shaft abraders exhibited occasional striations in line with the movement of the tool (Figure 10). They also occasionally showed undiagnostic plant fragments.

**Discussion**

The evidence from the projectile points is unsurprising. However, the identification of a larch (tamarack) tracheid deserves discussion. The tracheid is located in the region of the haft and could derive from the arrow shaft itself. Larch is tough, waterproof wood that comes relatively knot-free and produces a good, durable arrow (Fadala, 1999). Today, the range of larch is near to but does not include Delaware. If the identification of larch is correct, it may represent trade from or travel to places further north or west.

The scrapers were likely all associated with hide scraping. Two showed soft polish and hair fragments indicative of hide processing while the third had the same wear pattern but no residues. While it is possible to identify hair to species by the shape and arrangement of scales on the cuticle (Teerink, 1991), it is usually not possible with an isolated hair fragment. Scale patterns vary on different parts of the body and as you move from root to tip on an individual hair. In this case, scale patterns were not preserved, but other diagnostic features of the hair (medulla) were visible. Analysis of the nearby and closely related site of Hickory Bluff also showed evidence of hide processing with scrapers (Petraglia et al., 2005). As with the scrapers, all three drills are associated with animal processing. Together, this evidence suggests that hideworking was a relatively common activity at the site.

The microtools showed a variety of different uses. Despite their small size, they show no evidence of hafting. Most of these are similar in morphology to microlithic drills (also called Jaketown perforators) from Poverty Point, Louisiana (Ford et al., 1955; Yerkes, 1983). In experiments scraping antler with the lateral edges, Ford and Webb (1956) produced tools of similar morphology. Several of the microtools from Gray Farm appear to have been used as scrapers in a similar fashion, albeit on different materials. However, others appear to have been used as perforators despite their relatively blunt nature.

The shaft abraders present evidence that is consistent with their assumed function. Striae parallel to the direction of movement and occasional fragments of plant tissue are consistent with
abrading arrow shafts. The evidence, however, is relatively scarce given the depth of the grooves in the sandstone. Due to the soft nature of the sandstone, other traces of use must be removed as the sandstone itself breaks away.

Based on this analysis, the overall pattern suggests a somewhat flexible and opportunistic tool use. Although the sample size is small, there is variation in use of some tool types. Microtools served a variety of different uses and even projectile points show multiple types of use.
<table>
<thead>
<tr>
<th>Artifact #</th>
<th>Tool Type</th>
<th>Function</th>
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<tbody>
<tr>
<td>185.11</td>
<td>Projectile point</td>
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<td>Projectile point</td>
<td>Hafted projectile point</td>
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<td>Projectile point</td>
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<td>1868</td>
<td>Projectile point</td>
<td>Minimal hafting evidence, distal end used on hard material</td>
</tr>
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<td>1869</td>
<td>Projectile point</td>
<td>Impact fracture only, no hafting evidence</td>
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<tr>
<td>195.31</td>
<td>Scraper</td>
<td>Scraper scraping hide</td>
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<td>Scraper</td>
<td>Scraper scraping soft material</td>
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<td>1423.6</td>
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<td>1508.39</td>
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<td>1509.36</td>
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Figure 1: Projectile points. AR= abraded ridges; HHS= hard/high silica polish; short lines indicate striations; arrows indicate impact fractures
Figure 2: Scrapers. HHS= hard/high silica polish; Hr=hair; Sf= soft polish
Figure 3: Microtools. HHS = hard/high silica polish; Lt = light polish; Rp = raphides; Sf = soft polish; Sk = skin fragments; SG = starch grains; short lines indicate striations; arrows indicate damage to tip.
Figure 4: Microtools. HHS = hard/high silica polish; Pt = plant tissue; Rs = resin
Figure 5: Drills. HHS = hard/high silica polish; Hr = hair; PBR = possible blood residue; Sf = soft polish; short lines indicate striations.
Figure 6: Shaft abraders. Pf= plant fibers; Pt= plant tissues; lines indicate striations.
Figure 7: 867.3 A) Hard/high silica polish and abrasion on ridge; B) tracheid, arrows indicate one of the pairs of bordered pits
Figure 8: 1423.6 A and B) soft polish; C) hair fragment
Figure 9: 1354.6 A) soft polish; B) raphides; C) starch grain (cross-polarized light)
Figure 10: 1580 A) plant tissue; B) striations
References Cited


Hardy, B.L., 2004. Neanderthal behaviour and stone tool function at the Middle Paleolithic site of La Quina, France. Antiquity 78, 547-565.


