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MIDDLE PALEOLITHIC HAFTED STONE TOOLS FROM STAROSELE, WESTERN CRIMEA

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Abstract: Microscopic use-wear and complementary residue examination of chipped stone tools document a hafting technology of wood handles or detachable foreshafts in excess of 40,000 years old. Microwear used to identify the hafted portion of these tools is based upon experimental and archaeological analogs--most notably of North American Paleoindian Folsom and experimental replicate projectile points. Haft residues include plant cells and starch grains. The former appears to be the actual handle or foreshaft material; the latter the remains of a mastic used to glue tools to a handle or foreshaft.

One way to evaluate the potential for hafting chipped stone tools is through microscopic examination of use-wear for experimental replicates and for archaeologially-obtained artifacts that assuredly were attached to a handle or foreshaft and others that assuredly were not. This approach, augmented and complemented by the addition of organic residue analysis, is the one we follow in our examination of Middle Paleolithic tools from the western Crimea site of Starosele. Starosele, a deeply stratified multilayered alluvial site in excess of 40,000 years old (Marks *et al.* 1997), has produced Middle Paleolithic stone tools found elsewhere in the Crimea (Chabai *et al.* 1995) and more generally in eastern Europe. For the most part, these tools have been described in formal, typological terms. The role of optional maintenance to the progressive reduction in size and transformations of shape over a tool's use-life (cf., Dibble 1987) is also increasingly recognized in the typological assessments. These typologies are especially useful for describing tool industries (Chabai 1996). But they are not as well-suited to determine tool function and the manner in which a tool was either held or hafted--even for unifacial and bifacial points one might assume to have been hafted (but see Chase 1989:332).

Our purpose in this paper is to describe analyses explicitly designed to understand tool function and hafting potential, and that came about as an intended result of the 1995 excavation program at Starosele in which the senior author participated. Stone artifacts excavated in 1995 were handled as little as possible and, without further effort to clean adhering matrix, were deliberately packaged in individual clean, polyethelene plastic, ziploc bags. Matrix that formed an artifact mold was also saved and similarly packaged with its artifact. These samples were then shipped to the junior author, who microscopically examined the matrix adhering to an artifact as well as that that formed its mold for organic residues. He in turn sent these specimens on to the senior author, but did so without further comment about his results; the senior author then cleaned the specimens of adhering matrix and conducted further microwear examinations. The methodologies used in these two independent evaluations are described elsewhere (Fullagar *et al.* 1996; Hardy 1994; Kay 1996). In doing our individual studies, we employed similar recording approaches and at intermediate magnifications (100-

400X) completely scanned an artifact surface and its edges to visually identify and photograph residues and use-wear. So it was possible to systematically compare our results for 50 Middle Paleolithic artifacts from Starosele and a second site, Buran Kaya III, which is also in the Crimea.

To be perfectly frank, we were surprised and pleased our results were almost completely complementary for all 50 tools. Where organic residues were noted, so too was use-wear. The organic residues adhering to the tools' surfaces thus appear to be functionally related rather than some spurious association. Use-wear, however, did occur in the absence of organic residues. Invariably this circumstance was the case for tool use-wear interpreted to be the result of contact with hard to extremely hard materials such as bone, antler, or stone, but it also was true (although less commonly) for other tools whose use-wear was interpreted to be due to softer contact materials. So one interpretation of this result is that preservation of organic residues depends on specific micro-chemical environments during and after tool use. Suitable preservation environments are less likely, or even unlikely, to occur during stone tool usage against hard to extremely hard contact materials; and seemingly also for other geo-chemical conditions that are not understood.

An important relation between the two studies was that the spatial distribution of organic residues could be readily explained in light of use-wear and vice versa. The organic residues and use-wear did not occur uniformly or randomly but were restricted in extent to specific portions of tool edges and surfaces. The comparison of the two types of evidence allows these tools to be subdivided into discrete, functional areas and edges, and their associated contact materials. The most significant and basic division is between a tool edge, or edges, and the area of prehension or hafting.

Viewed logically, hafting allows a greater application of force directed against a tool edge or working surface and thus, a mechanical advantage over the hand-held employment of a similar tool form. But it does not necessarily assure the absolute *stability* of the hafted portion, or a lack of movement within the haft during tool use. Microscopic effects of friction due to haft binding and use-related movement are readily observable (Kay 1996). These afford unambiguous use-wear criteria to differentiate hand-held from hafted tools; among the more important, the nonrandom placement, orientation, extent, and organization of striae typical of haft wear.

For reasons of space and scope, we mention only in passing one example of a hafted tool and more fully describe another. Both are fashioned from flint and are representative of the functional variability we see among hafted tools at Starosele and other Middle Paleolithic sites in the Crimea. Hafting microwear on the second tool is remarkably similar to that observed by the senior author (unpublished data) on the hafting surfaces of Folsom points from two widely separated late Pleistocene sites in the North American Plains (Cooper [see Bement 1997], and Stewart's Cattle Guard [see Jodry and Standford 1992]), although neither tool form nor function is necessarily the same.

Regardless of time or space, microwear signifies general processes of use, prehension, and hafting that can be readily interpreted from experimentral and archaeological controls.

Microwear analysis is not just *a* way to evaluate tool hafting, but indeed is *the* preferred way to systematically make these evaluations (Beyries 1987; Chase 1989:332; Mellars 1989:351). Before moving on to these examples and their implications, we wish to emphasize the heuristic potential of similar field sampling approaches in archaeology. Simply put, our advice is to follow the procedures just outlined to ensure organic residues may be detected and then correlated with use-wear evidence.

USE-WEAR AND ORGANIC RESIDUE EXAMPLES

Hafted stone tools appear to be relatively common throughout the Starosele record. For purposes of illustration only, two examples are of unifacial flake tools from Level 3. In contrast to the overlying Level 1 that is radiocarbon dated to about 41,000 B.P., Level 3 has only preliminary Uranium and ESR dates but is likely to be in the mid-40,000 year old range (Jack Rink, personal communication to Kay, May 1997).

The first example is that of a flake thickest at its faceted striking platform, and formally classed as a semi-crescent sidescraper. Its dorsal surface is unifacially retouched on both sides about midway from the proximal end, which is not further altered or thinned. The retouch converges to a sharp point at the distal end, but overall the result is an asymmetrical form. Its use-wear is unambiguous. The converging retouched edges at and near its tip exhibit the characteristic striations produced experimentally of projectile point impact followed by knife rather than scraper usage (see Kay 1996); the unretouched proximal end, hafting striations oriented transverse to the longitudinal axis and both oblique and perpendicular to the edges. Feather barbules of two different birds (one a raptor, the other a waterfowl) were found near the tip in the exact same area as the impact/cutting use-wear; the area identifed as the haft element had plant starch grains and raphides, and wood fiber but no animal residues. Among the implications would seem to be that the starch grains and raphides relate to hafting technology and perhaps were part of a mastic; the wood fiber, perhaps a foreshaft; the feathers, birds killed and butchered by this tool.

Further evidence of the connection between starch grains and wood residues being restricted to the haft element of a tool is present in the second example, formally--or typologically--described as an atypical endscraper with a denticulated lateral edge. It snapped near its proximal (or striking platform) end. This tool actually was employed, however, as a gouging burin, or chisel, but lacks the faceting hallmarks of burin preparation. Its snapped, unretouched end is the thickest part of the tool and has a slightly obtuse edge angle. This end is both sharp and resistant to damage, and was the working edge of the burin. Its microwear (Fig. 1c) is restricted to the immediate edge area and, in part, consists of a narrow micropolish zone (<0.02 mm in width) with narrow, u- and v-shaped striae perpendicular to the edge. The use-striae orientation and the narrow contact zone are consistent with usage of the burin edge along its entire front and with force applied parallel to the longitudinal axis of the tool. Tool motion is indicated by both the direction of the use-striae and the crystallization of a soluble inorganic on either side of the polish zone. Crystallization occurs on the trailing side, or side opposite tool employment. The bi-directional crystallization shown in Fig. 1c would occur when a tool is used in a rockered stroke, or back-and-forth motion, that is perpendicular to the tool's longitudinal axis, which is also--of course--the direction of the use-striae. That the working edge is not rounded, the localized nature of the polish zone, and with use-striae only within the polish zone indicate a hard to extremely hard contact material; exactly what this material was remains in doubt.

The retouched edges of this tool have no microwear, although there is edge damage. Its ventral surface from about 0.5 cm back from the burin edge and extending to the opposite end has a nearly continuous microabrasion (Fig. 1b) of large and deep, divot-like striae and adhering abrasive particles. This kind of abrasion is what one would expect from the contact of one relatively flat surface with another, less hard one. The abrasion is highly directional with an overall organization parallel to the longitudinal axis of the tool. It appears to be complementary evidence of the directions of applied force in using the burin. Sets of striae are rockered, and intersect. The two surfaces would have had to have slipped (if only slightly) past one another, while also wobbling from side to side, during tool use. Inasmuch as this microwear appears to be related but is separate from the actual burin use-wear, how can it be best explained and what does it tell us?

The inescapable explanation is, this microwear would be consistent with usage of the burin if and only if the tool were attached to a handle. Only a little of the tool surface and its burin edge would have extended beyond the handle, and is reasonably approximated if not fully measured by the gap between the haft and burin use-wear of about 0.5 cm. (The terminus of the haft element [see Fig. 1] is based on the maximum extent of the haft microwear.) The retouched edges that converge to a rounded base would have served as a long, hafting tang. The most appropriate reconstruction of the handle would be to have had one or more relatively flat residue surfaces that could be tightened about the tool but that proved to be insufficient to fully stabilize it. Seemingly compelling macroscopic evidence of this instablility is in the two negative, step-fractured flake scars on the ventral surface that originates at the rounded base of the haft element (see Fig. 1). This location is the distal terminus of the blade at the instant of its detachment It is also directly opposite from the burin edge and would have been the spot of maximum applied force in using the tool. This scarring would have been caused by bi-polar force, perhaps most likely produced by burin usage operating against the opposite (basal) end of the tool where it rested and was blocked in the handle. Although speculative, a split handle with at least one flat side whose tightness about the tool could be adjusted by lashings and with a supporting, blocking end to anchor the tool is a reasonable interpretation of the microwear evidence.

Organic residues were present on the ventral surface of its haft element. These are plant residues, specifically cells of an unidentified wood (Figs. 1a, 2) and starch grains easily recognized, in Fig. 2, by the "Maltese cross" that appears in their centers under polarized light. Because there is no edge-related microwear in the haft element, the occurrence of these plant residues cannot be explained by cutting or scraping tasks. By a process of elimination, these residues are best explained as relating directly to tool hafting; or simply put, the wood cells to the handle itself, the starch grains again to a possible mastic.

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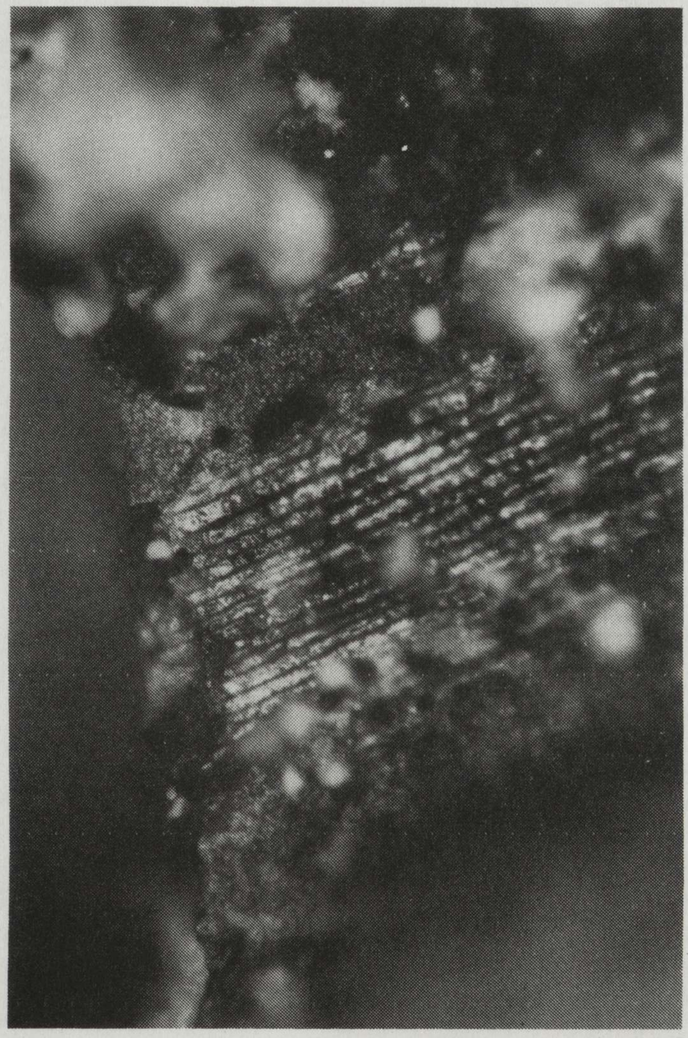

Fig. 1a. Starosele 1995. 147 Level 3. F22 (8).

Fig. 1b. Starosele 1995. 147 Level 3. F22 (8).

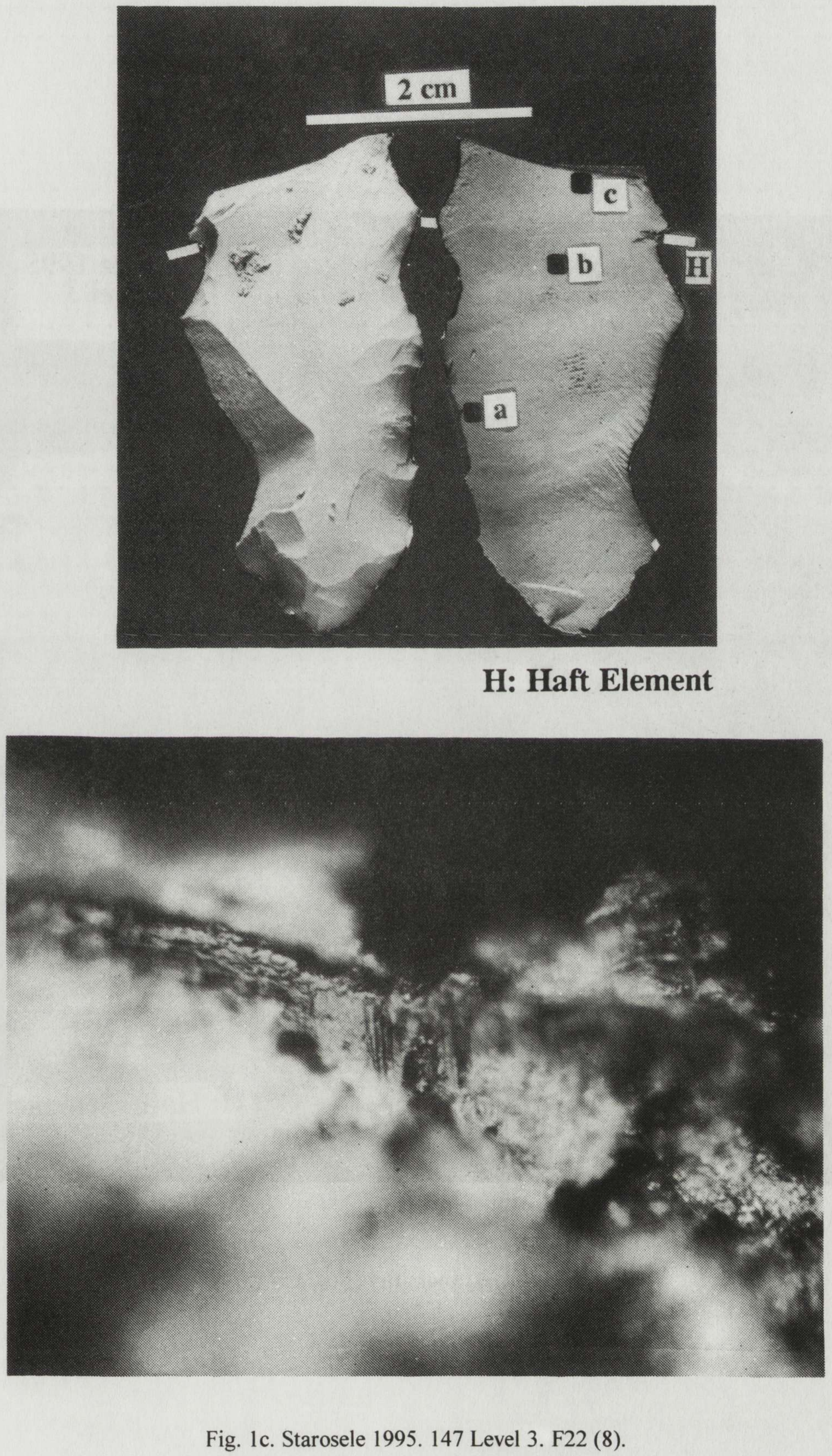

Fig. 1c. Starosele 1995. 147 Level 3. F22 (8).

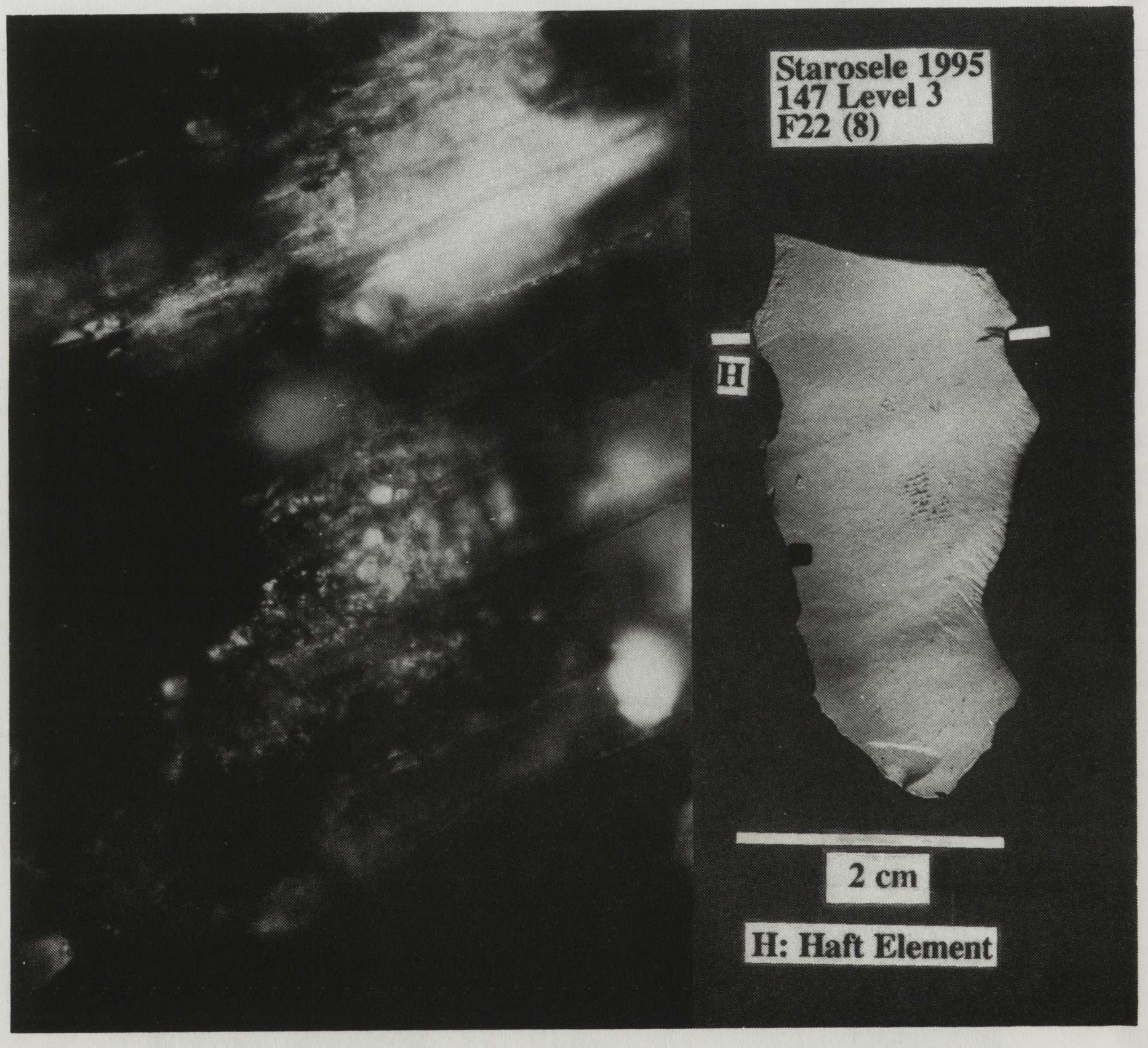

Fig. 2. Starosele 1995. 147 Level 3. F22 (8).