Microwear analysis of experimental flint and obsidian tools

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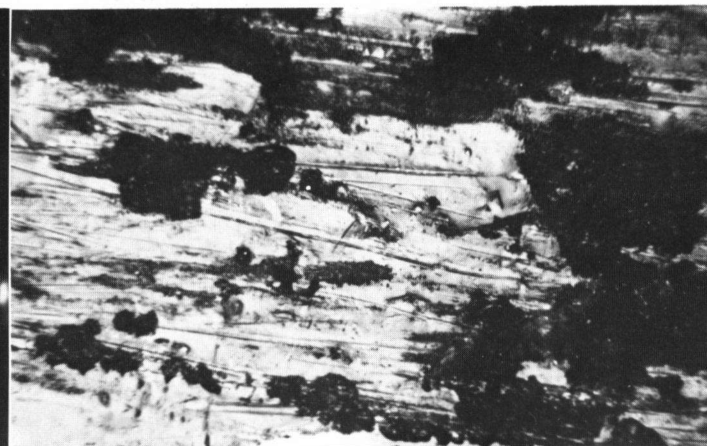
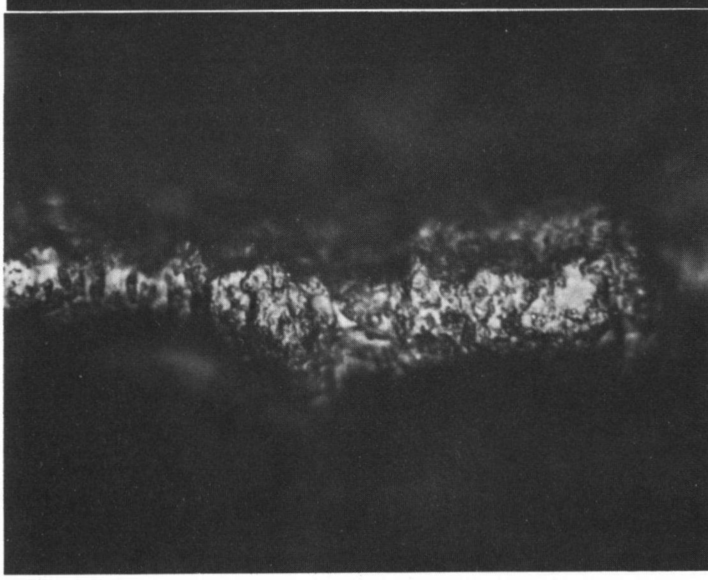
Interest has grown during the past several years in the functional analysis of chipped stone tools by microscopic inspection of damage traces which result from intentional use and other agencies (KEELEY 1976; ODELL 1975; TRINGHAM et al 1974). The researches of KEELEY and of TRINGHAM and associates have been instrumental in establishing the prerequisite experimental criteria for interpreting the 'functions' of prehistoric stone implements. The observation of microwear polishes on flint tools has been shown to be particularly promising (KEELEY and NEWCOMER 1977). This presentation summarizes the principal results of an on-going experimental project designed to widen the application of interpretive microwear polishes from one type of flint (British chalk flint, used by KEELEY) to several types of flint, as well as to obsidian.
The materials in question were obtained from the Argolid region of southern Greece (the flints) and from the Aegean island of Melos (the obsidian). The results of the experimental studies will be applied to the microwear analysis of flint and obsidian tools from a major prehistoric site in the southern Argolid, Franchthi Cave (JACOBSEN 1976, 1973). The three grades of flint collected from the general region of the cave, distinguished by grain size (fine, medium-fine, and medium-coarse), provide a realistic sample of the great diversity of flint types present in the prehistoric collection. This diversity, however, is greatly reduced when considering only the factor of grain size. The categories are easily established by visual inspection of fresh breaks (from 'shiny and smooth' to 'dull and coarse') and by viewing such surfaces at high magnification (ca 300x, Wild M50 metallurgical scope) and noting the prevalence of natural bright spots as opposed to darker background areas. Indeed, it is imperative to know what microscopic bright spots occur naturally on a given type of flint, to avoid confusing them with microwear polishes.
The results of over 120 experimental tests conducted thus far (3/79) with flakes of the three flint types on a wide variety of materials (stone, bone, antler, wood, hide, vegetal matter, meat) indicate a striking regularity in the developmental processes and resultant patterns of microwear polishes across all flint types. As noted by KEELEY, under high magnification one can distinguish, on tools of the same flint, the various distinctive polishes produced by such materials (provided the tool is used for at least a minute or so). Previously unreported, however, is the consistent observation that tools of different grades of flint subjected to the same task develop microwear polishes that differ not in quality (i.e., diagnostic characteristics) but only in quantity (i.e., amount of development, size of polish areas). Specifically, tools of the fine-grained flint develop a given polish more quickly and eventually to a more extensive degree than do tools of the medium-fine grain. In turn, the medium-coarse pieces are much slower in forming polishes and exhibit overall weaker polish development than do the medium-fine tools. But the diagnostic features of the polishes remain substantially constant throughout. The concept is illustrated in Figs. 1, 2. Thus a sliding scale or continuum of patterns of distinctive microwear polishes can be established for a wide variety of flint types by testing only certain grain-size groups. Moreover, the results will undoubtedly be applicable to flint from any area, as long as the grain-size factor is properly observed. This represents a great economy of research effort.

Obsidian, on the other hand, presents problems of a different order. Given the extreme paucity of published information on obsidian microwear (eg, SCHÔUSBOE 1977), it was not known at the onset of the present research what constitutes the equivalent of 'polish' on obsidian. This vitreous, completely homogeneous material is smooth and highly reflective in a fresh break. Two classes of microwear traces seem to fit the bill (Table I). A very quick-forming and destrucitve 'matt surface' (Fig. 3) is caused by lithic particles (grit, mud, obsidian microchips, etc.). While this phenomenon is seemingly the obverse of a 'polish', its equivalent on flint is an equally distinctive type of rough-textured polish caused by the same agents. The second category consists of smoothing or rounding of the surface, elevated features, and edges of an obsidian tool (Fig. 4). The same fine-scale mechanical abrasion which smoothes grain particles on flint to create polish (DAUVOIS 1976: Fig. 31-36) acts to soften and dull





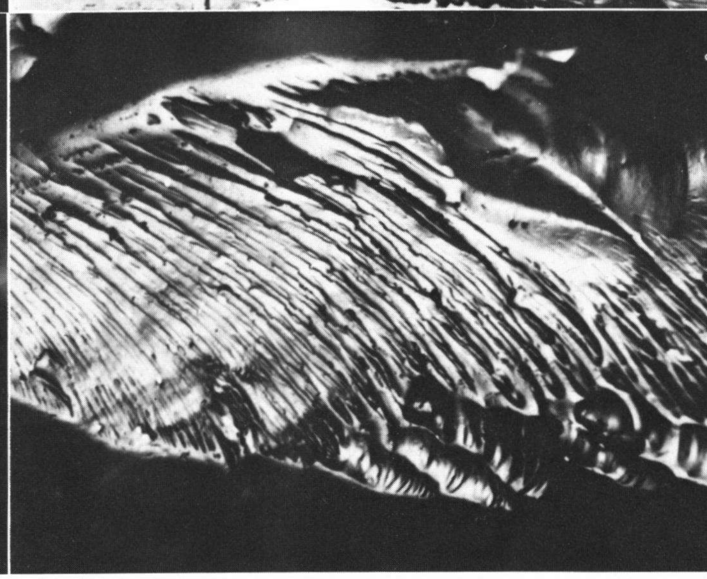


Figure 1 *Fine-grained flint used to scrape fresh cow bone (1200 strokes, 9 min), resulting in a diagnostic edge bevel. Note the solid coverage of the polish (smoother, brighter areas) and the short, wedge-shaped troughs that indicate the direction of motion (original magnification: 280x).*

Figure 2 *Medium-coarse flint used to scrape fresh cow bone (1200 strokes, 9 min). The edge bevel is less developed, the polish is less covering, and the perpendicular troughs are less numerous than in Fig. 1 (original magnification: 280x).*

Figure 3 *Matt surface (rough, darker areas) and striations, as caused by lightly rubbing mud for a few strokes on the surface of a fresh obsidian flake (original magnification: 84x).*

Figure 4 *Large edge facet on an obsidian flake used to cut cane-like reeds (1200 strokes; 12 min), resulting in strong rounding/smoothing of the edges, microscar ridges, and fissure crests (original magnification: 400x).*

the otherwise sharp surface features and edges of obsidian implements. Experiments with obsidian flakes on the same wide range of materials, mentioned above, thus far indicate that abrasion patterns on obsidian are not as specific as are polishes on flint. Only general categories of abrasion patterns may be safely established - soft, medium, or hard materials - with a few distinctive exeptions that can be identified more specifically (bone, stone, and hide). Once again, the interpretive criteria established by experimentation should be applicable to obsidian tools from any area, if the raw material does not contain enough impurities to affect structural homogeneity.

ACKNOWLEDGEMENTS
Travel funds were generously provided by the Department of Anthro pology, University of Pennsylvania.

TABLE I

Flint	**Obsidian**
Grit Polish	Matt Surface
Polish	Rounding/Smoothing
(Microflaking, Striations, Residues)	

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