A Use-Wear Analysis of Obsidian Tools from an *Ana Kionga*

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Introduction

Numerous caves on Easter Island were occupied by the island's early inhabitants. Cave sites have been interpreted as residences, secret storage places, burial places, and refuge caves (Smith 1961:257). Some of these sites have extensive modifications to the natural cave. O-Hae cave, located south of Ahu O-hae on the north coast of Easter Island, is an example of a residence cave which has been modified with the addition of stone walls and enclosures. Refuge caves or *ana kionga* were also frequently modified by human agents: ". . . their mouths are partially closed with masonry, leaving narrow openings through which to enter. Such caves often contain thin layers of refuse" (Smith 1961:257). It is largely on this basis and that of oral tradition (Métraux 1971) that such caves have been interpreted as refuges for displaced former ranking members of the chiefly hierarchy during times of pandemic warfare.

The purpose of the current research is to explore the nature of the occupation of the *ana kionga* in greater detail, using data from a recently excavated refuge cave, Site 6-356 (Stevenson 1988). How does the range of activities performed at these sites compare to normal habitation sites, and what does this tell us about warfare on the island during the Late Period? It is hypothesized that the artifact assemblage from the *ana kionga* should reflect the normal range of domestic activities represented at other habitation sites, if extended periods of hostilities were common. A more limited range of activities should be apparent if periods of conflict were limited in scope and duration.

Site 6-356 is located within Quadrangle 6 on the southern coastal plain (Stevenson 1987:1). The *ana kionga* consists of a natural cavity under a surface basalt outcrop with a natural entrance approximately 50 cm^2; it has been modified with the addition of a tunnel which was constructed of parallel alignments of stones capped by large stone slabs (Figure 1). This tunnel and the outcrop under which it was located were then partially capped with earth removed from the cave interior, effectively disguising the cave entrance. The interior is 4 m wide by 8 m long by 2 m high near the center. The roof slopes to the edges of this space and small, unexplored passages lead from the ends of the cave. Interior alterations include a short wall, constructed of rounded stones and *paenga*, serving to lengthen the outer tunnel entrance, and also a thick interior wall which forms a small side chamber to the right of the opening which is roughly 1.5 m diameter (Stevenson 1988). Six *paenga* were scattered on the floor of the cave and to the east end of the cave was a concentration of small stones and *poro* that may have formed a platform.

Twelve 1 m^2 units were excavated in front of the cave entrance in the central portion of the cave. Most of the resulting artifact assemblage was recovered from the upper 3-4 cm, below this was scoria with no artifacts. This sterile sub-layer was confirmed to a depth of 70 cm b.s. The soil was too moist to screen, but excavation of the interior cave test units yielded bone, including four chicken bone needles, obsidian flakes and tools, one historic glass trade bead, and an extremely corroded dinner knife. In addition, three test units were excavated outside the cave entrance. Portions of this area were capped by 30 cm of soil and basalt fragments which Stevenson (1988) interprets as debris from enlargement of the interior.

Methodology: The High Power Approach

Obsidian artifacts from the cave were subjected to a high power microwear analysis in order to determine the kinds of activities which occurred in the *ana kionga*. High power microwear refers to a technique of lithic analysis pioneered by Semenov (1964) and refined by Keeley (1980), among others, to identify the traces of use-wear on stone tool edges. An incident-light microscope with magnification powers between 40-1000x was used to observe modifications to tool edges in the form of polishes, pitting, and striations. Specific patterns of these wear traces result from different natural and cultural actions to the artifacts. Controlled experimental production of tools allows the identification of these patterns to document the nature of the activity performed and the material worked. The high power approach is contrasted with a low power or macrowear analysis, which utilizes magnification 40x or smaller to identify the presence or absence of use traces and to define the relative nature of the material worked, i.e., hard or soft. The nature of the research design, as well as time, money, and the availability of equipment all determine which or whether both approaches are applied.

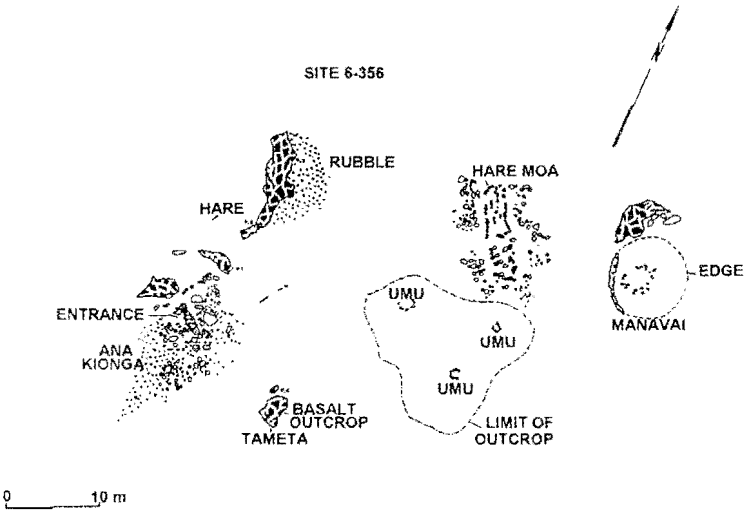

Figure 1. A map of Site 6-356 showing the location of the *ana kionga* and cave entrance (from Stevenson 1988).

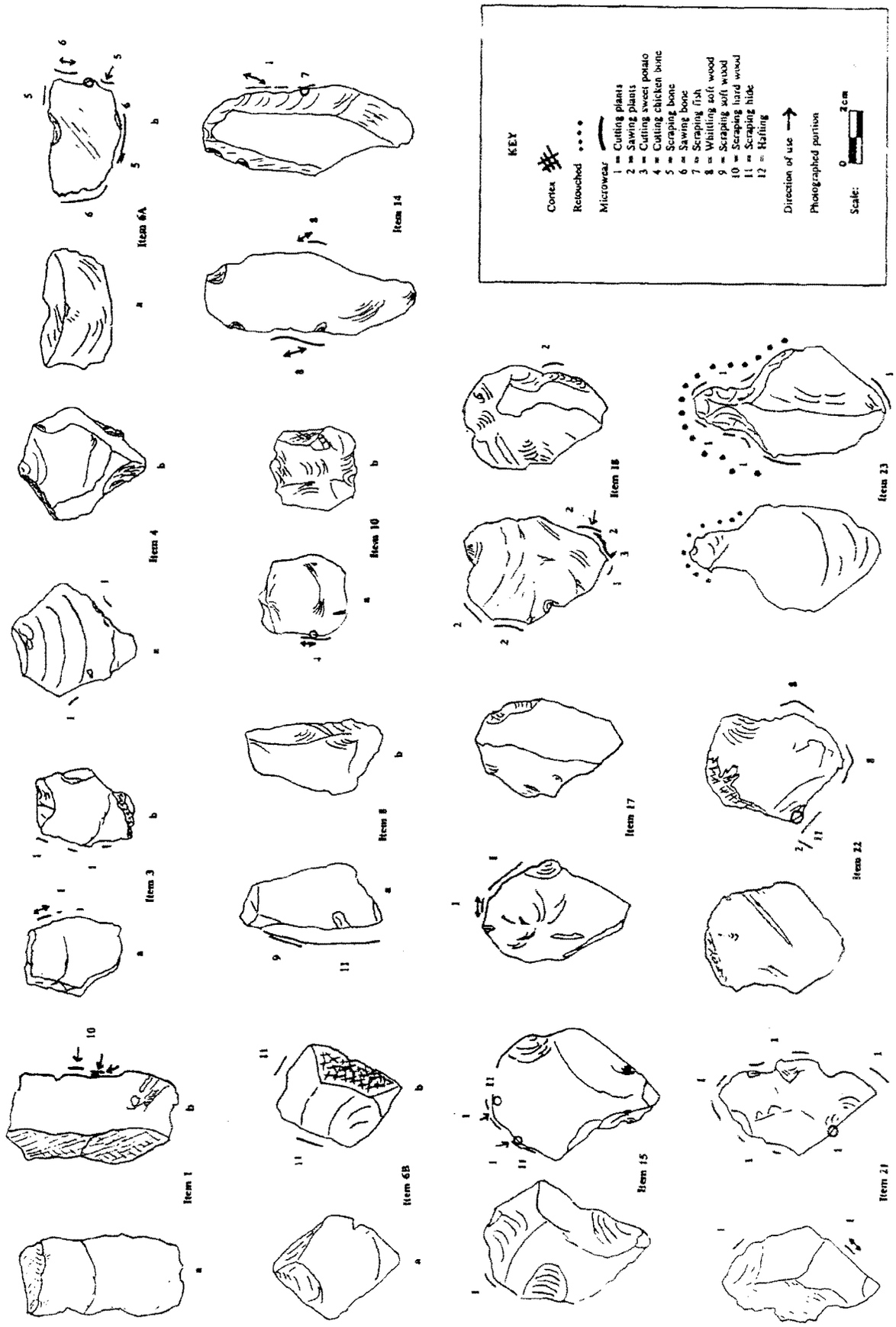

Figure 2. Use-wear traces on tools from Site 6-356, *ana kionga*.

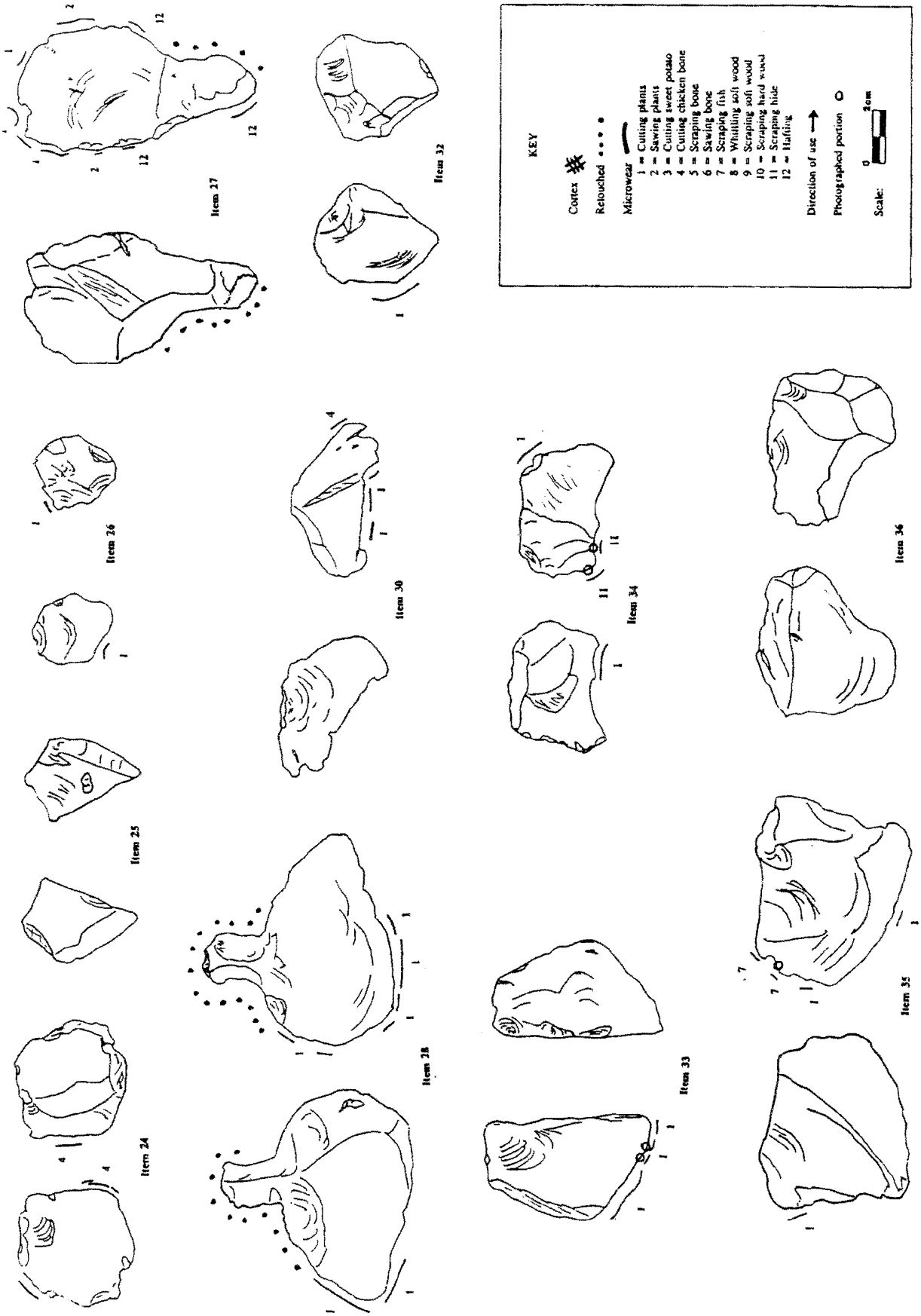

Figure 2 (continued). Use-wear traces on tools from Site 6-356, *ana kionga*.

Table 1. Summary of Use-wear Traces Identified at Site 6-356					
Item #	Description	Length (mm)	Width (mm)	Thickness (mm)	Activity/Material Worked
6-356-1	Flake	59.5	32.1	14.0	Whittling soft wood, sawing plants or scraping fresh 'hide'
6-356-2	Flake	24.5	45.2	7.0	Not utilized
6-356-3	Flake	35.8	28.6	13.4	Cutting green plants
6-356-4	Flake	45.0	41.2	13.2	Cutting green plants
6-356-5	Flake	41.7	25.2	9.1	Not utilized
6-356-6A	Flake	25.0	41.6	6.7	Sawing soaked bone, scraping bone
6-356-6B	Flake	45.9	38.1	10.9	Scraping 'hide'/bone
6-356-7	Flake	28.9	37.1	9.1	Not utilized
6-356-8	Flake	49.4	24.9	11.0	Scraping dry 'hide', scraping soft wood
6-356-9	Flake	23.2	41.7	12.0	Not utilized
6-356-10	Flake	30.9	29.0	8.5	Cutting chicken bone
6-356-14	Flake	75.4	30.5	12.1	Whittling soft wood, scraping fish (residue), cutting grassy plants
6-356-15	Flake	59.7	45.6	15.8	Cutting plants, scraping dry 'hide'
6-356-16	Flake	45.5	35.1	4.2	Not utilized
6-356-17	Flake	43.9	36.1	8.8	Cutting plants
6-356-18	Flake	52.4	37.6	11.0	Cutting sweet potato, sawing fresh, green plants
6-356-19	Flake	45.5	20.6	4.0	Not utilized
6-356-21	Flake	56.6	28.6	9.4	Cutting plants
6-356-22	Flake frag.	49.4	39.8	14.2	Whittling soft wood, sawing plants or scraping fresh 'hide'
6-356-23	Flake	68.9	39.2	12.9	Cutting plants
6-356-24	Flake	40.1	45.3	9.8	Cutting chicken bone
6-356-25	Flake	39.7	29.9	6.2	Not utilized
6-356-26	Flake	27.4	25.5	8.1	Light cutting plants
6-356-27	*Mata'a*	82.9	44.6	13.4	Sawing fresh green plants, cutting fresh green plants, hafting
6-356-28	*Mata'a*	68.6	74.6	11.8	Cutting green plants
6-356-29	Flake	78.2	55.1	19.4	Not utilized
6-356-30	Flake	27.4	55.0	6.4	Cutting chicken bone, cutting plants
6-356-32	Flake	45.5	30.9	12.3	Plant?
6-356-33	Flake	61.1	34.6	10.8	Cutting fresh plants
6-356-34	Flake	33.5	44.5	11.0	Cutting plants, scraping 'hide'
6-356-35	Flake	53.0	65.5	15.7	Cutting fish, cutting plants
6-356-36	Flake	49.5	53.1	14.3	Not utilized

Previous Studies of Obsidian

While most use-wear studies have dealt with flint or chert tools, a few brave souls have applied the technique to obsidian. Obsidian presents special problems for the analyst for several reasons: 1) because of its glass-like nature, obsidian is readily scratched, abraded, and otherwise damaged (Hay 1979). This can obscure or mimic use-wear traces. 2) In an incident light microscope, the light source is reflected through the microscope directly onto the surface of the material being observed. Successful observation requires that the surface being viewed be as flat as possible. Obsidian surfaces can be so highly reflective that it is difficult to see the surface, or, in some cases, the material may resemble a lunar landscape, making it extremely difficult to manipulate an edge to find a flat perspective.

In spite of these problems, use-wear analysis has been

done on obsidian assemblages, e.g., from the Maya Lowlands (Aldendorfer et al. 1989), from Sicily (Hurcombe 1992), from the North Island of New Zealand (Bellwood 1969), from Hawai'i (Schousboe et al. 1983), and on Easter Island (McCoy 1973, Spear 1986). In all of these cases, however, except for Hurcombe's (1992) work in Sicily, the low-power approach was used to illustrate activities performed and the relative nature of the material worked. Hurcombe's (1992) work has shown that it is possible to identify specific use-wear traces on obsidian at high-power levels comparable to those routinely used on flint tools.

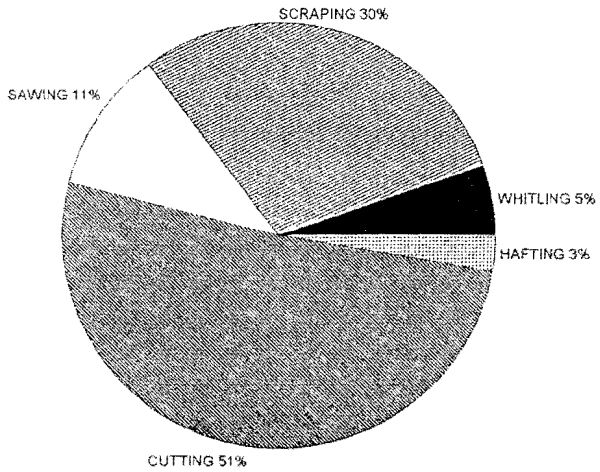

Figure 3. Actions performed: use-wear results from Site 6-356 *ana kionga.*

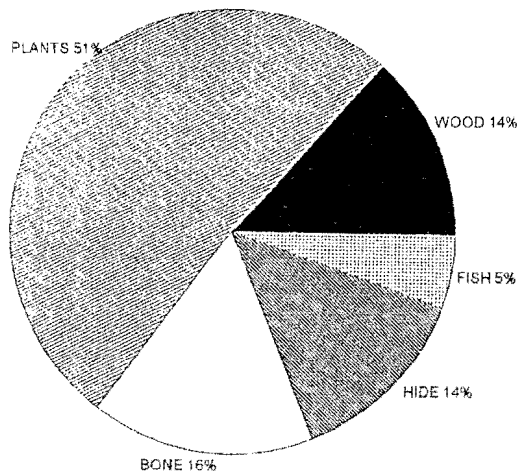

Figure 4. Materials worked: use-wear results from Site 6-356, *ana kionga.*

Sample Description

In the present study 36 obsidian artifacts from Site 6-356 were available for analysis. A sample of 32 items was selected which included 2 *mataa* and 30 flakes. The remaining four items were either too large to be mounted under the scope or were small pieces of shatter. All items in the sample were processed through three baths: 1) undiluted TopJob detergent, 2) a 10% HCl solution, and 3) a weak base solution, followed by thorough rinsing and air-drying after each bath. Items were then wrapped in smooth paper towels and kept free of finger-grease and lint.

Tool edges observed under the microscope were compared to a series of experimentally produced tools, including photographs of Hurcombe's (1992) results and, more specifically, a set of 65 experimental tools produced on Easter Island obsidian during the 1992 field season under the direction of Stevenson et al. (Stevenson 1992, personal communication). Experimental tools included cutting and scraping cooked and green chicken bone, fish, and raw chicken, and various hard and soft plant materials such as *pua,'* taro leaf and tubers, sugar cane, sweet potato, banana leaf, stem, and trunk, *totora* reeds, and hard and soft woods. These experimental tools were processed as above, then identifiable use-wear patterns were photographed. Use-wear characteristics were documented on individual sheets which recorded attributes of polish, striations, attrition, and residues, the locations of each on an edge, and the location on an edge where photographs were taken.

Results of Analysis

The analysis documented 37 examples of use-wear on 23 artifacts (Table 1; Figure 2). Twelve items (38%) had single uses, 11 (34%) had multiple uses, and 9 (28%) were not utilized. These tool edges were produced by a set of actions which consisted of cutting, scraping, sawing, whittling, and hafting (Figure 3). Cutting and scraping account for 81 % of this activity. Hafting was evident on a single *mata'a.* Materials worked during these actions included plants, bone, hard and soft woods, hide, and fish (Figure 4). Plants dominated at 51 % with bone at 16% and wood and hide at 14% each.

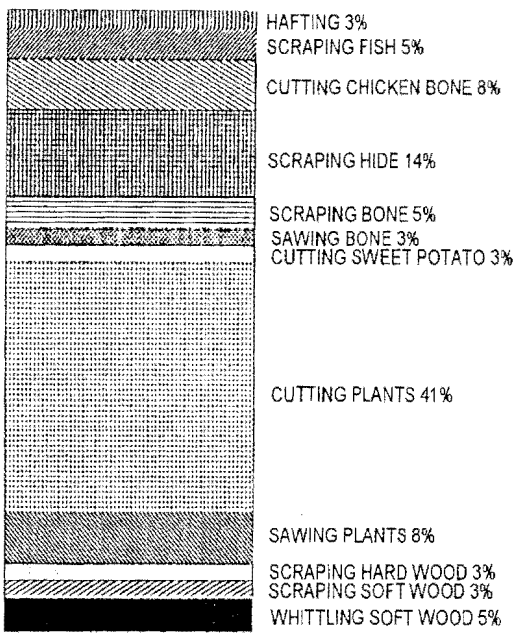

Figure 4. Use-wear results from high-power analysis,Site 6-356, ana kionga.

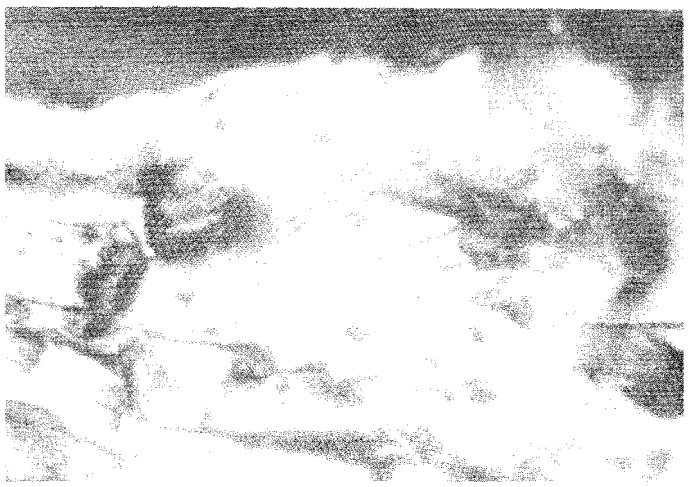

Plate 1. Item 6-356-14: whittling soft wood (OM 250X, photograph 1).

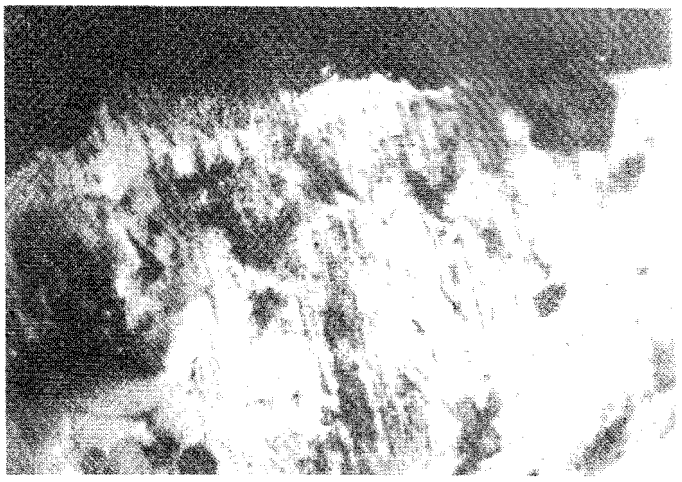

Plate 2. Item 6-356-35: plant striae and polish (OM 250X)

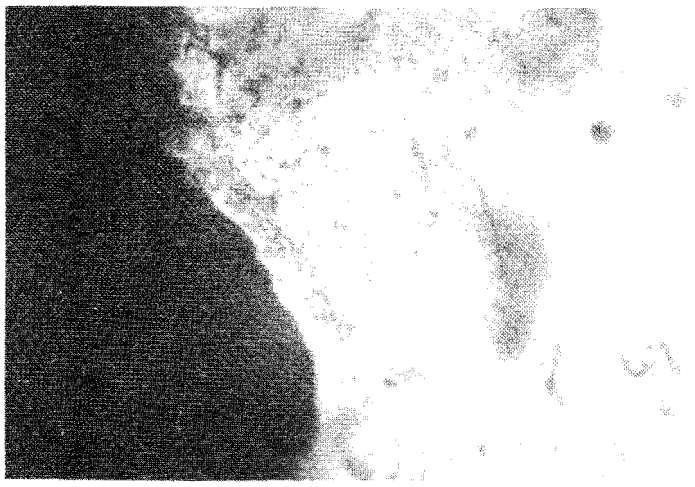

Plate 3. Item 6-356-34: cutting fresh green plant (OM 250X).

Plate 4. Item 6-356A: ventral side, sawing bone (OM 250X).

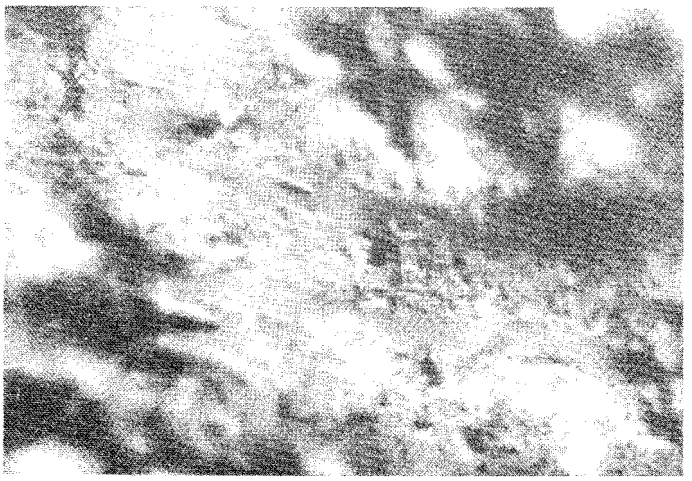

Plate 5. Item 6-356-10: dorsal side, possible fish filleting, intense utilization (OM250X, photograph 2).

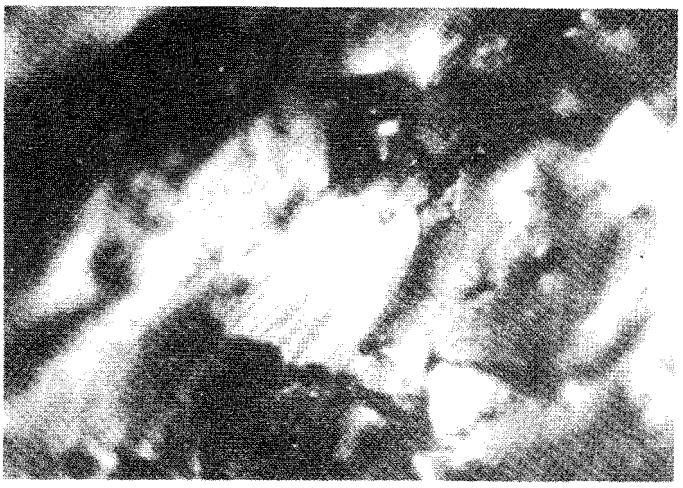

Plate 6. Item 6-356-14: ventral side, left edge; possible fish scale residue (OM 350X, photograph 1).

The hide-working category probably represents some other material as mammals were largely limited to rats and no evidence supports an intensive rat-hide industry! On the other hand, *mahoute*, or rough fibrous plants, were pounded and scraped to create cloth, and it is highly likely that the 'hide' traces could be the result of this process. When materials worked are correlated with actions performed, a set of 12 distinct activities were documented (Figure 5). These include whittling (Plate 1) and scraping a soft wood, scraping hard wood; sawing and cutting plants—particularly fresh green plants (Plates 2 and 3) and including sweet potato; sawing (Plate 4) and scraping bone; cutting chicken bone; scraping a hide-like material; scraping fish (Plates 5 and 6); and hafting.

Summary and Conclusions

The set of use-wear traces are consistent with those expected in a domestic functional context, concerned with food preparation, gear fabrication, and/or gear maintenance. Limited comparative data are available due to the lack of other high-power analyses. However, Spear (1986) performed a low-power macrowear functional analysis on tools from two *ana kionga*—Sites 3-72 and 7-571. Site 3-72 (see map in Spear 1986) is 16 m^2 with an elevation of 5 m. It has a walled in front and an elaborate entryway. The tool assemblage consists of 6 drills, 3 *mataa*, 85 edge altered flakes, obsidian debitage, a core, a basalt adze, and one basalt pounding stone. The 85 edge-altered flakes exhibited 21 % hard material worked and 51 % soft material. Spear (1986) noted that this site had a higher percentage of utilized debitage than other cave sites, but a lower percentage of altered edges per flake.

Site 7-571 (see map Spear 1986) is a larger coastal cave 52 m^2 with a walled off cave mouth and a stone wall entryway (see plan view of site, Spear 1986). The artifact assemblage included 244 bone artifacts with many needles, 3 fishhooks, 19 coral files and an abrader, a number of basalt tools, hammerstones, and *poro* flakes, with an obsidian assemblage of 30 *mata'a*, 15 files, 7 drills, and several thousand flakes. A sample of 54 edge-altered flakes subjected to macrowear analysis were utilized on hard materials (29%) and softer ones (40%).

The problem with comparing these results to those from microwear is that the low-power approach does not specify materials worked beyond hard or soft, nor does it describe the range of actions which produced the altered edges. Thus, comparison of these approaches is limited. However, when the activities at Site 6-356 are reduced to similar 'hard' and 'soft' categories, we have 40% hard and 60% soft materials, which is comparable to Spear's results from Site 372, the smaller of the two *ana kionga* which he described, with 21 % hard and 51 % soft materials.

How do the *ana kionga* compare with sites interpreted as residence caves? Smith (1961) described two residence caves, Puapau and O-hae Cave, situated along La Pérouse bay. Puapau is located on the north coast between Hanga-o-hae and Hanga-ko-uri. The cave is situated in the cliff face above the sea; the mouth is open at 3.5 m wide by 1.3 m high (see Smith 1961, Figure 69). The interior is 5.5 m wide with a 1.7 m high roof. The artifact assemblage includes European items in the upper stratum along with many *mata'a* (n = 48), chipped obsidian perforators, a prismatic blade, numerous scrapers (n = 83), basalt adzes, bone fishhooks and needles, worked human bone, worked wood, shell beads, and faunal material consisting of fish, bird, and marine shells. The contact period items suggest a late date for this material (early 1700s).

The second site, O-hae Cave, is a natural rock shelter with added stone enclosures (see Smith 1961, Figure 72). Located south of Ahu O-hae on the north coast, the site overlooks Hanga-o-hae. This cave is elongate, originally open at the north along its entire length. It was completely enclosed with a stone wall, and two circular enclosures of stone core masonry were added along the western two-thirds of this wall. Unlike Puapau and more like the *ana kionga*, O-Hae Cave has a tunnel-like entrance passage and another passage between the cave and the western enclosure. The natural shelter measures 9 m long east-west by 2-3 m wide north-south with a height of about 1.2 m. The artifact assemblage produced a limited number of European items along with a considerable inventory of chipped obsidian, basalt, and bone tools, including 34 *mata'a*, 34 perforators, 72 scrapers, picks, abraders, adzes, bone fishhooks and needles, worked human bone, and a quantity of faunal remains also consisting of fish, bird, and marine shells. A late date is suggested for the upper stratum of this site also.

Site 3-72 (Spear 1986) exhibits a total artifact assemblage which is comparable in quantity and kinds of items to Site 6-356, while Sites 7-571, Puapau, and O-hae Cave all produced much larger and more diverse tool inventories. This would suggest that the larger caves were residences (some, like Site 7-571 and perhaps O-hae Cave also used as refuges) where a variety of domestic tasks were carried out; by contrast, the more limited tool inventory recovered from Sites 6-356 and 3-72 would tend to suggest that a more limited range of activities occurred at the *ana kionga*. However, as documented through the microwear analysis, Site 6-356, while lacking the numerous formal tools of the larger sites, nevertheless produced evidence of a wide range of domestic activities, most utilizing expedient flake tools.

This observation highlights another contrast between the sites, e.g., that the larger cave sites served as ordinary residences while the smaller caves served as temporary refuges during periods of active conflict. The generally thin lenses of occupational debris in these refuge caves have been interpreted as evidence of short-term occupation during skirmishes between rival groups. However, several factors support the possibility of longer term usage of the refuge shelters: 1) the elaborate preparation of the caves as hidden refuges, 2) the intensive use of expedient flakes (64% of all flakes at Site 6-356), and 3) the range of domestic activities documented by microwear analysis. Taken together, this information suggests that the occupants of such sites were confined to their refuges during periods of extended hostilities. Given that there are no comparable analyses from other *ana kionga*, this interpretation is subject to further testing.

In conclusion, the present analysis supports the interpretation of Site 6-356 as an *ana kionga* and has documented the domestic nature of activities performed at the site. It also supports an interpretation of repeated occupations over a

period of several weeks or more. This in turn suggests that warfare may have consisted of long-term periods of hostilities, marked by frequent skirmishes, during which time groups would be forced to seek shelter in refuges carefully constructed within their territories for this purpose.

This study illustrates the potential of microwear analysis to add to our knowledge of Easter Island prehistory. In the future we hope to conduct similar analyses on artifacts from a variety of site types, as well as additional *ana kionga*.

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