

クリアル列島南部エトロフ島出土石器の使用痕分析

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Use-wear Analysis of Stone Tools from Etorofu Island, the Southern Kuril Islands

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Abstract: The aim of this paper is to clarify the uses of stone tools gathered from Etorofu Island, the southern Kuril Islands. "The high-power approach" of lithic use-wear analysis using a metallurgical microscope with incident light was employed in this study. Specimens examined are 19 flaked stone scrapers and 39 ground stone axes/adzes collected from the 1920s to the 1930s. It seems highly possible that they are dated to a period from the Epi-Jomon culture to the Okhotsk culture. These tools are made from shale, mudstone, sandstone, basalt, andesite, black schist, and welded tuff. As a result of analysis, distinct use-wear polish could be seen on 6 scrapers and 7 axes/adzes. The morphological features of use-wear polish suggested that stone scrapers were used for processing bones and/or antlers and grass plants. Axes/adzes were estimated to be used not only for wood-working, but also for hide-working. Hafting traces were also detected on two stone adzes.

Key words: Etorofu Island, stone scraper, stone adze, stone axe, lithic use-wear analysis

Introduction

This study aims to identify the uses and functions of stone tools gathered from Etorofu Island, the southern Kuril Islands. According to result of lithic use-wear analysis, it has been previously demonstrated that stone tools unearthed on this island, known as "the Etorofu-type stone adzes" (Sugiura 1993), were used for felling or processing wood (Takase 2010). This paper examines the utilization of other kinds of stone artifacts, e. g., flaked scrapers, bifacially beveled axes and unifacially beveled adzes based on microscopic observation.

1. Specimens analyzed

Specimens analyzed in this study include 19 stone scrapers and 39 stone axes/adzes gathered from Etorofu Island. These artifacts are part of two collections owned by the education boards of Shibetsu Town and Rumoi City.

The stone tools shown in Figures 2, 4 and 5 were collected by Kayoji Yoshida from either the Rausu seashore sites [Tankovoe 1-3 sites, Takiguchi 1953, Golubev 1970, Prokofiev 1993, Samalin 2009, Vasilevskij 2009] or the Naibo site⁽¹⁾ from 1929 to 1933. In 1988, his wife Chie Yoshida donated these artifacts to the education board of Shibetsu Town, eastern Hokkaido. The Rausu seashore sites are located on a dune formed beside Rausu Lake (Kujbyshevskoe

Lake) which is situated four kilometers west of Rubetsu (Kujbyshev) and around its marsh.

Sugita (1993) prepared a detailed report on this collection and discussed its significance regarding the distributional remarks of ornaments, particularly, tube beads made from jasper and a labret. It is difficult to specify the date of each stone tool due to a lack of detailed data of the sites. However, pottery included in this collection indicates that these stone tools are likely to be assigned to a period from the first half of the Epi-Jomon culture to the Okhotsk culture (ca. third century B. C. E to ninth century C. E.). This estimation is supported by other artifacts collected from the same sites (Igarashi 1989, Sugiura and Yamamiya 1992) and results of excavations at the Tankovoe 1 and 2 sites where grave pits with circular stone arrangements of the Epi-Jomon period were found (Kondratenko and Prokofev 1989)⁽²⁾.

Figure 2 shows chipped stone scrapers on various shaped flakes obtained from the Rausu seashore and the Naibo sites. Distinct notches can be seen on several artifacts (Figure 2: 1-3, 5 and 6). All tools shown in this figure are made from shale. Stone axes and adzes gathered from these sites are shown in Figures 4-6. A naked-eye stone classification by Morio Akamatsu showed that green mudstone is used for tools shown in Figure 4: 1, 2, 8, 9, 11-13; basalt for tools shown in Figure 4: 7 and 10; andesite for a tool shown in Figure 6: 2; and mudstone is used for other artifacts (Sugita 1993).

Other specimens were obtained from collection owned by the education board of Rumoi City, northern Hokkaido, and it is currently at the Rumoi Municipal Museum. These materials were collected by Yoshio Kishida from 1934 to 1935 from either the Shana (Kurilsk) sites or a different site which located approximately three kilometers north of Shana. Fukushi (1991) gave a temporary name "Niumoi" to the latter site in his report on this collection⁽³⁾. It is difficult to specify precise location from where these archaeological remains were collected, even though the Shana sites occur across several localities (e. g., Fukushi 1991, Samalin 2009, Vasilevskij 2009).

It is also difficult to order these archaeological remains chronologically due to an absence of pottery. However, according to the previous reports on pottery collected at the same sites (e. g., Schnell 1932, Takiguchi 1953, Kiyono 1969, Ushiro 1996) and the techno-morphological features of these artifacts, almost all of the materials in this collection should be assigned to a period spanning from the Epi-Jomon culture to the Okhotsk culture. In particular, a large number of long isosceles-triangle-shaped arrowhead and carefully retouched tongued knives undoubtedly form a part of the lithic assemblage of the Epi-Jomon period. On the other hand, the large bifacially beveled stone axe is confidently assigned to a period of the Okhotsk culture in this region. It is not to be denied that one of the stone adzes from the "Niumoi" site date back to the Jomon period (Figure 6: 3) as Nomura and Sugiura (1995) pointed out, there is still no

additional evidence to reinforce this estimation.

Figure 2 illustrates stone scrapers or retouched flakes from the Shana sites. Basalt is used for artifacts shown in Figure 2: 1, 4, 6-8 and 10. Other artifacts are made from shale. Stone axes and adzes are shown in Figures 6-8. Only two fragments of the stone axe/adze were collected from the Shana sites (Figure 7: 4 and 5), and the other materials are from the "Niumoi" site. According to Akamatsu's stone identification, the kind of stone used for making each artifact is as follows (Fukushi1991):

Figure 6: 3, black schist; Figure 6: 4 and Figure 8: 1, basalt; Figure 6: 5 and Figure 7: 2, green mudstone; Figure 6: 6 and Figure 7: 3 and 4, mudstone; Figure 7: 1 welded tuff; Figure 7: 5, sandstone, Figure 6: 2 and Figure 7: 4, basalt.

2. Method of analysis

"The high-power approach" pioneered by Keeley (1977, 1980) was used for analysis. A metallurgical microscope with incident light (OLYMPUS BX-30M) and a magnifier ranging

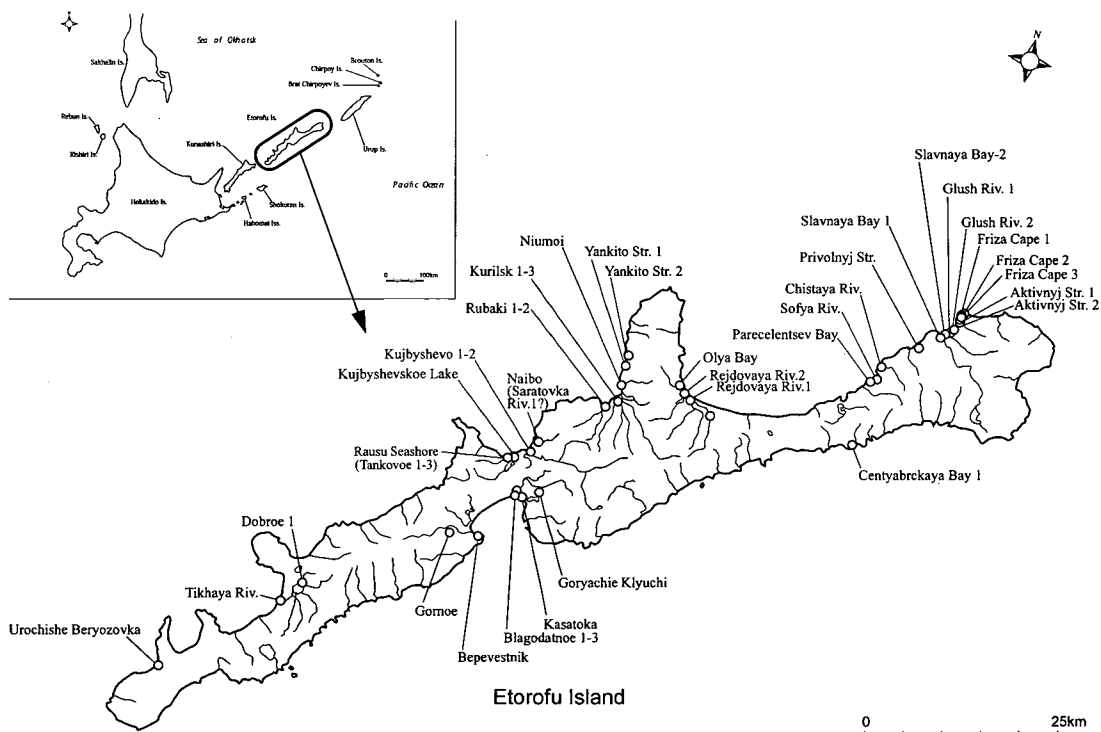


Figure 1 Map showing location of sites in Etorofu Island (after Schnell 1932, Saito 1933, Chubarova 1960, Kiyono 1969, Golubev 1970, Sugita 1993, Ushiro 1996, Kondratenko and Prokofev 1989, Samalin 2009 and Vasilevskij 2009)

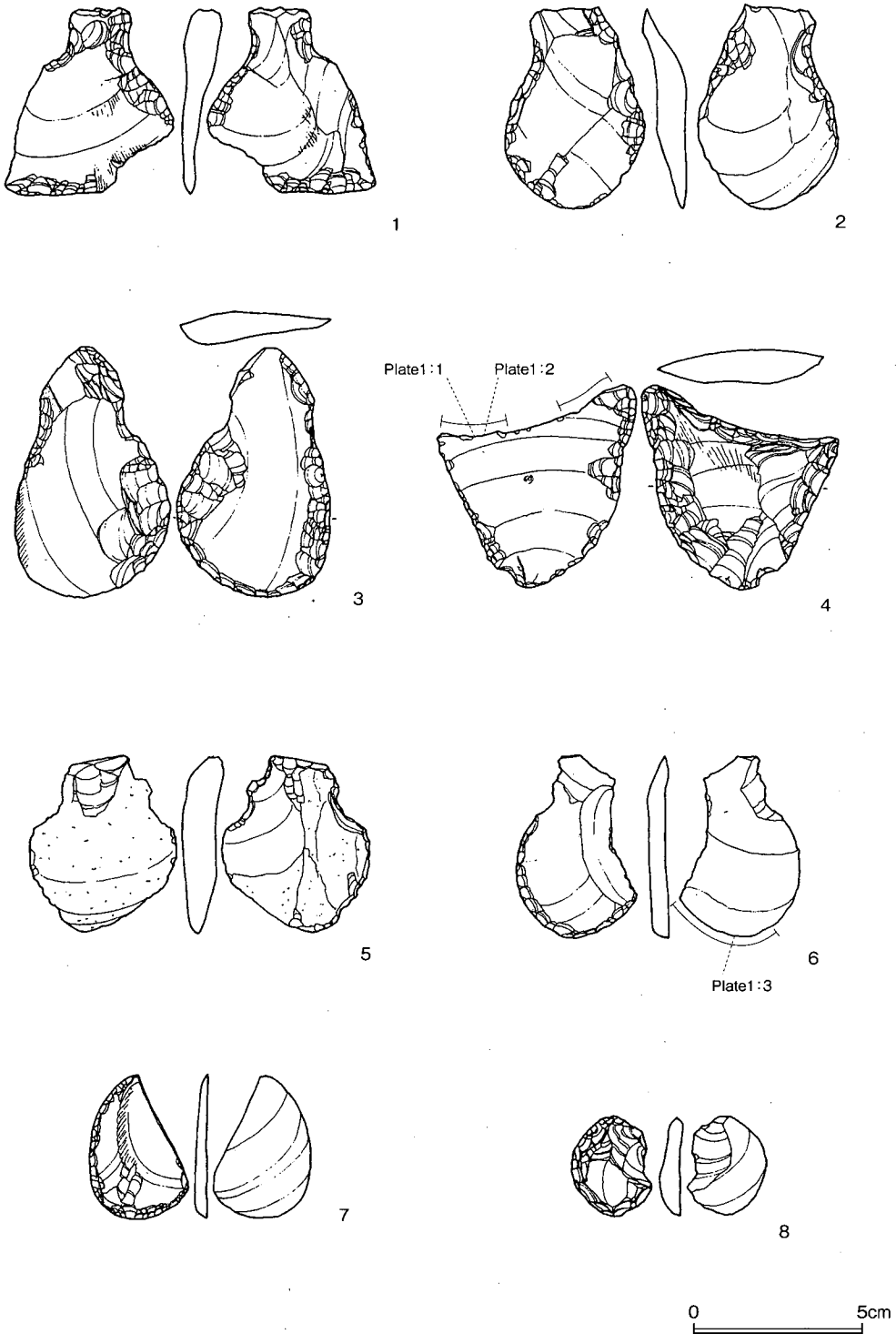


Figure 2 Result of use-wear analysis (1) [1-8: after Sugita (1993)]

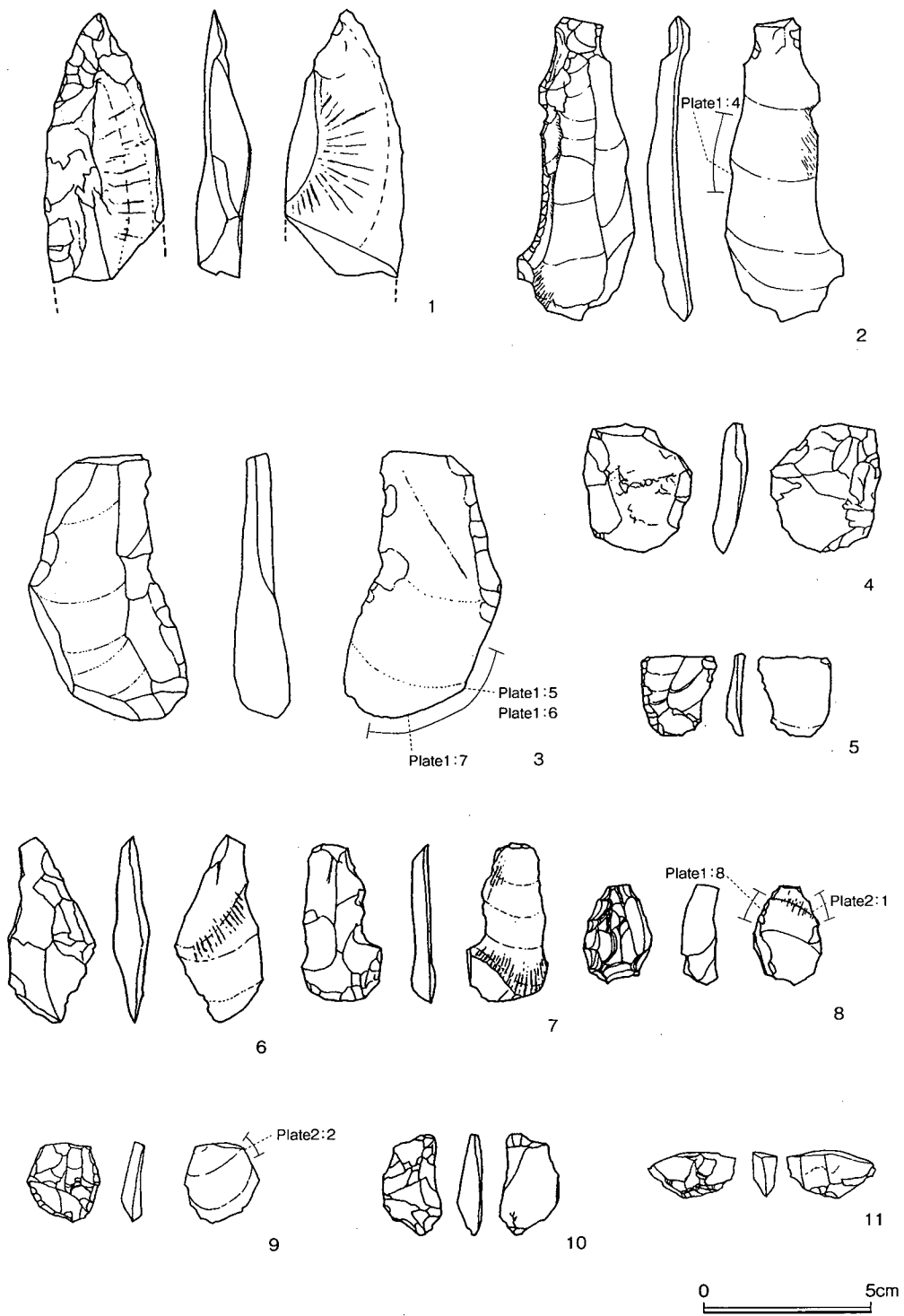


Figure 3 Result of use-wear analysis (2) [1-11: after Fukushi (1991)]

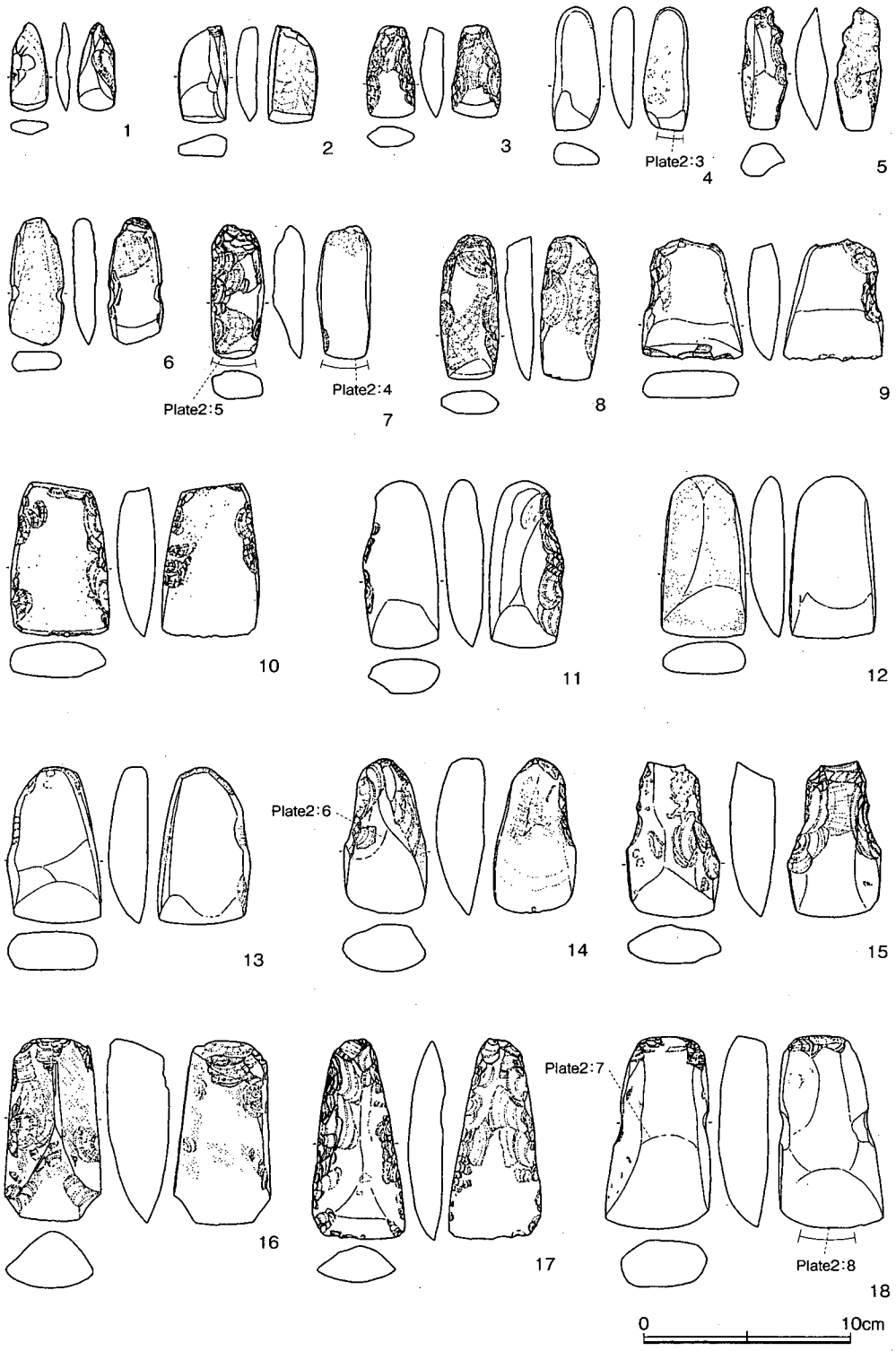


Figure 4 Result of use-wear analysis (3) [after Sugita (1993)]

from 100x to 500x was employed for microscopic observation. Micrographs were taken using a digital camera (OLYMPUS DP-12) attached to the microscope. Before making the microscopic observation, fat on the surface of the artifacts was removed using laboratory paper wipe laced with ethanol.

Classification of use-wear based on polish morphology followed the pattern recognition system set up by Keeley (1977, 1980), Kajiwara and Akoshima (1981), Vaughn (1985) and Akoshima (1989). This is based on results of a use experiment of stone tools made from sedimentary rocks such as flint and shale. However, use-wear polish observed on ground axes and adzes made from volcanic and metamorphic rocks was compared mainly to the results of experiments using axes and adzes attached to wooden hafts (Saino 1998, Takase 2007), since it is occasionally difficult to classify use-wear polish by referring to a framework based upon a use experiment of stone tools made from sedimentary rocks held and moved by grasping hands.

3. Results

(1) Flaked stone scrapers

For the convenience of describing the results of analysis, the left drawing of plan-view of each stone tool shown in Figures 2-8 is denoted as "A face" and the opposite side as "B face".

In Figure 2: 4, a smooth, bright and flat use-wear polish distributes around the in-curved edge on the "A face" of the tool (Plate 1: 1 and 2). The size of patch of use-wear polish is less than 100 μ m and their distribution is restricted to the higher microtopographical area of the stone surface. The dominant orientation of striation is clearly perpendicular to the edge.

Edge rounding and rough use-wear polish covered with minute pits could be seen on tools shown in Figure 2: 6 (Plate 1: 3). The breadth of the striation is wide, and its edge is vague. Striations perpendicular to the edge run across the rounded surface. Tools shown in Figure 3: 2 seems to have use-wear polish with rough and pitted surface distributed on the top part of the original uneven rock surface, although the degree of development is not high (Plate 1: 4). Striation could not be seen clearly.

A smooth use-wear polish is distributed along the edge of the "B face" of Figure 3: 3 (Plate 1: 6 and 7). The small patch of use-wear polish is round in shape, while the well-developed part is relatively flat (Plate 1: 5). The dominant direction of striation is perpendicular to the edge. Similar small patches could be seen on the tip of the "B face" edge of Figure 3: 8 and 9 (Plates 1: 8; 2: 1 and 2). However, the orientation of striation could not be observed distinctly. No hafting trace was detected on these flaked stone scrapers.

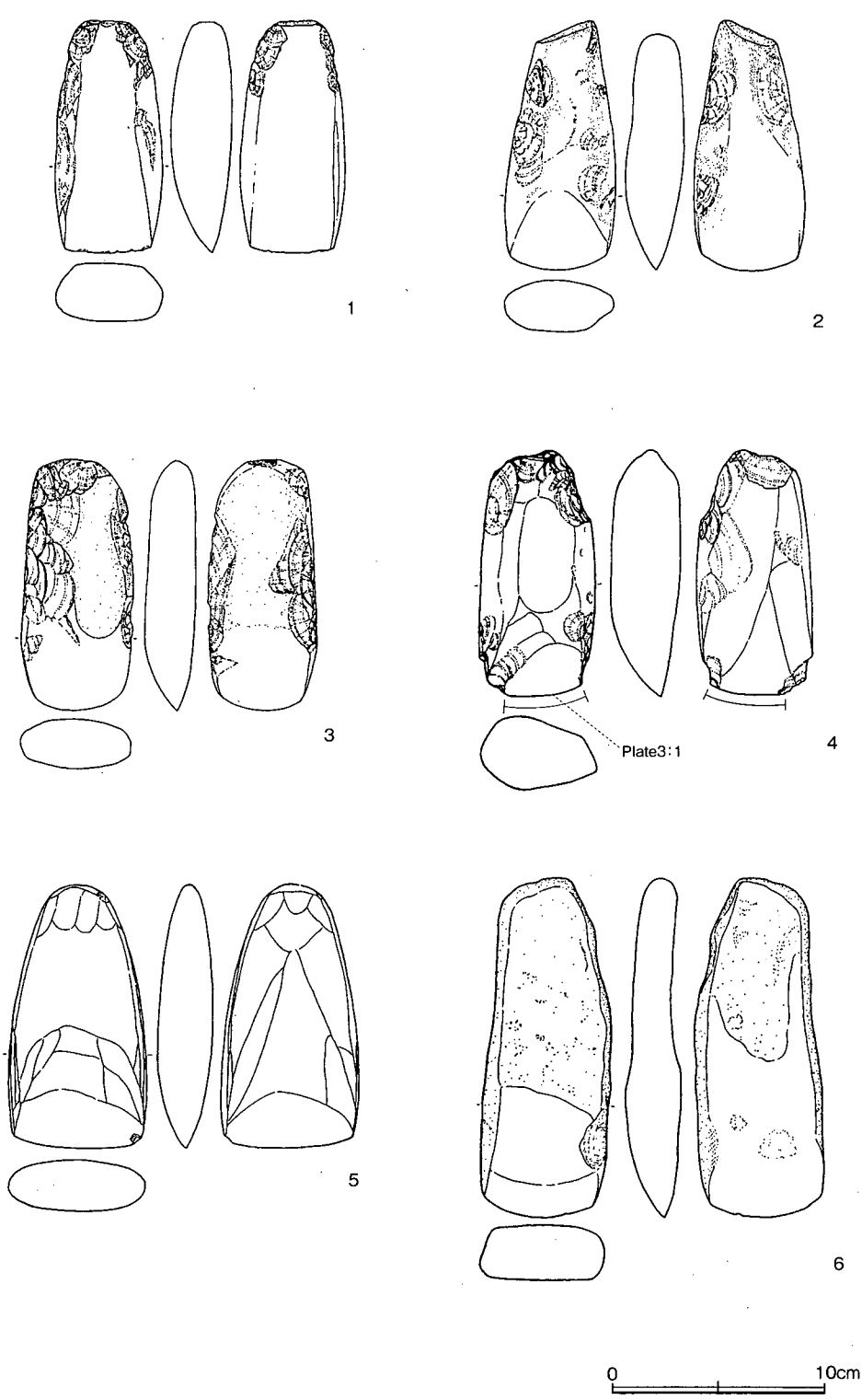


Figure 5 Result of use-wear analysis (4) [1-6: after Sugita (1993)]

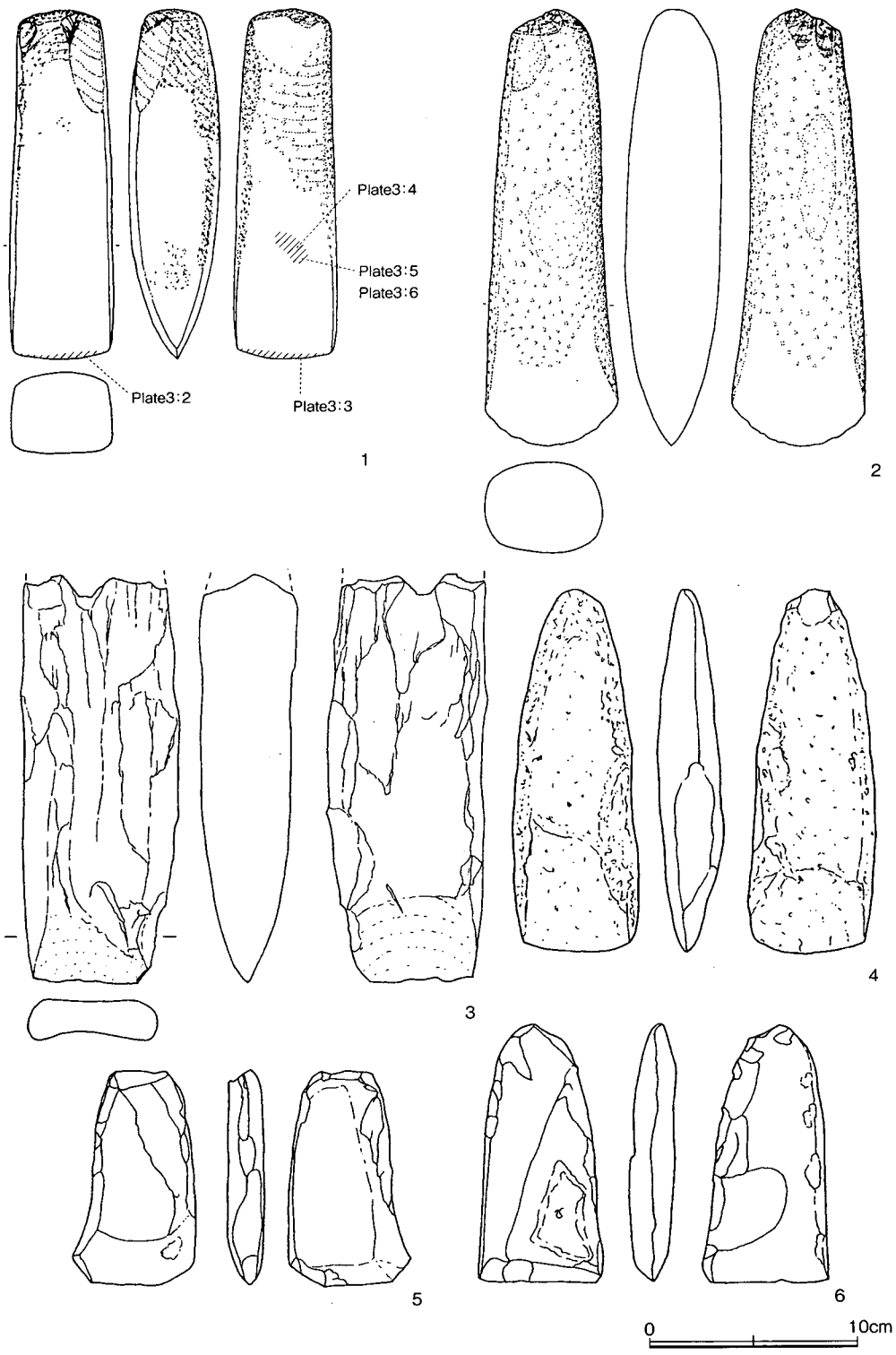
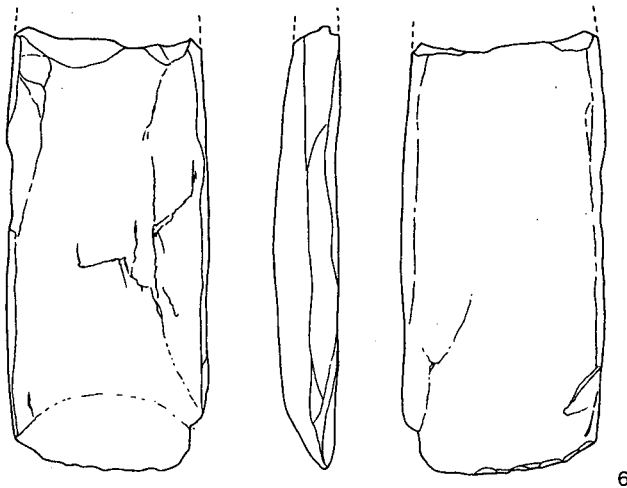
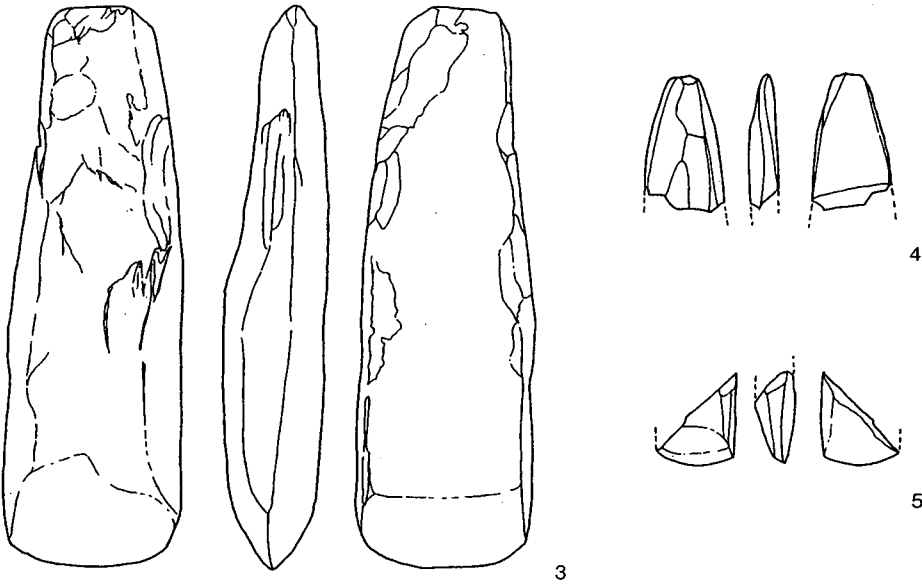
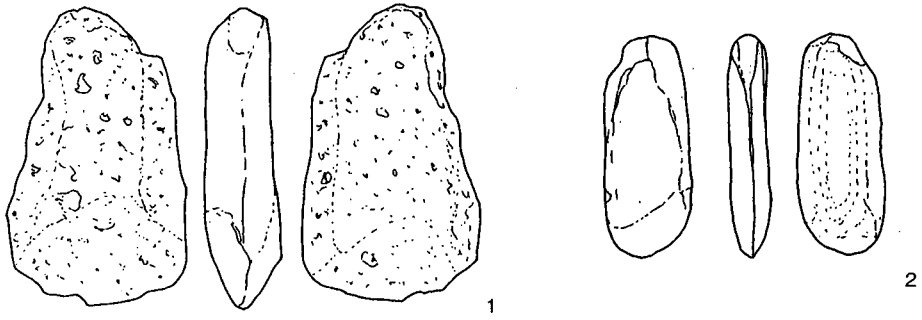


Figure 6 Result of use-wear analysis (5) [1-2: after Sugita (1993), 3-6: after Fukushi (1991)]



0 10cm

Figure 7 Result of use-wear analysis (6) [1-6: after Fukushi (1991)]

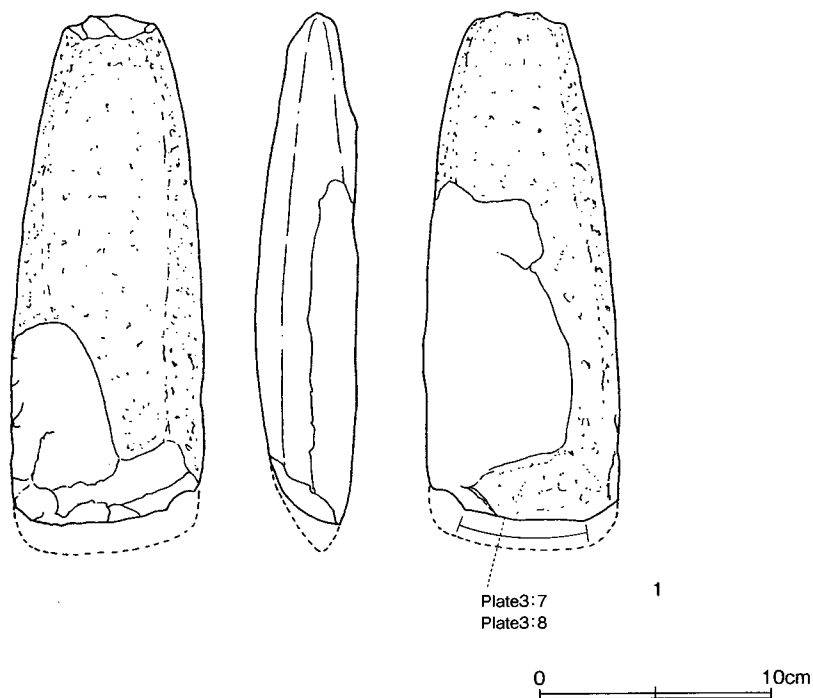


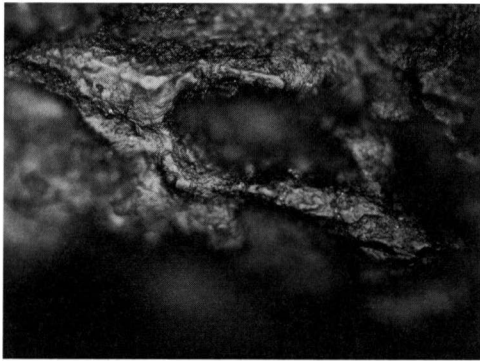
Figure 8 Result of use-wear analysis (7) [1: after Fukushi (1991)]

(2) Ground stone axes and adzes

Rounding and a number of micro-flakings are observable by the naked-eye on two specimens. On the very tip of the working edge of Figure 6: 2, micro-flakings distribute with high density. The number of micro-flakings on the "B face" is certainly larger than those of on the "A face". This indicates that the destructive force that formed the micro-flakings was exerted from the direction of the "A face" to the "B face." On another specimen (Figure 4: 12), striation with a "generic weak polish" (Vaughn1985) was observable on the edge of the "B face." The direction of striation suggests that the specimen was solely used in a transverse motion.

Use-wear polish could be clearly observed on 7 specimens (Figures 4: 4, 7, 14, 18; 5: 4, 6: 1; 8: 1). Abrasive surface is covered by rough and pitted use-wear polish of the edge of the tool shown in Figure 4: 4 (Plate 2: 3). Almost all of striation show perpendicular orientation to the edge. Use-wear polish and striation with the same characteristics were also distributed on the working edge of Figure 5: 4 (Plate 3: 1).

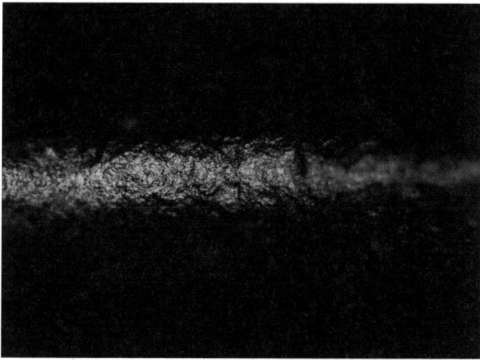
Use-wear polish with a smooth surface, domed or relatively round in cross-section was detected on the tip of the working edge on both surfaces of the tool shown in Figure 4: 7. The degree of development of use-wear polish is not high; it can only be recognized as a tiny scattered patch with a diameter smaller than 30 μ m (Plate 2: 4 and 5). The orientation of the striation could not be distinguished, while a "filled-in striation" (Keeley1980) perpendicular to



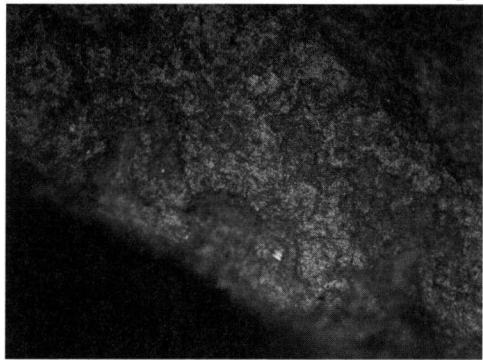
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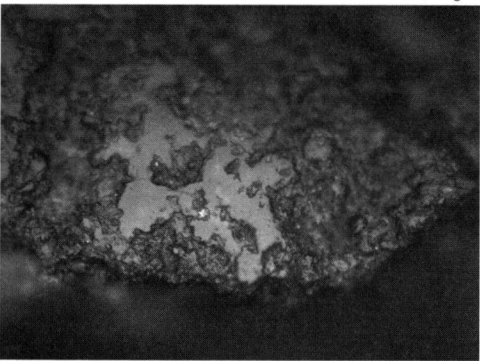
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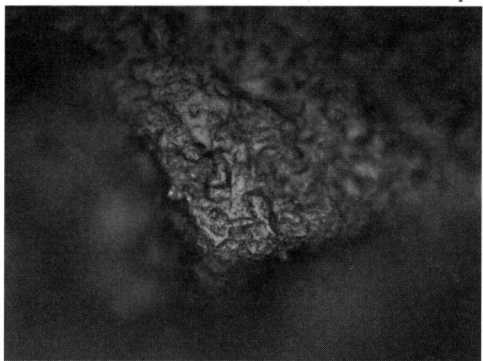
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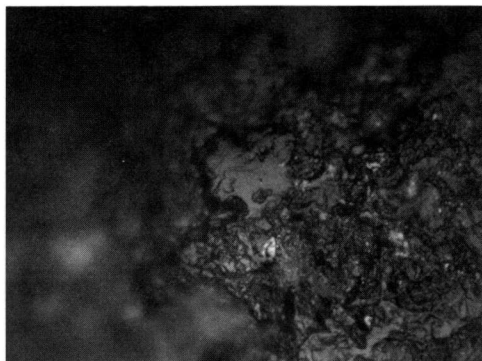
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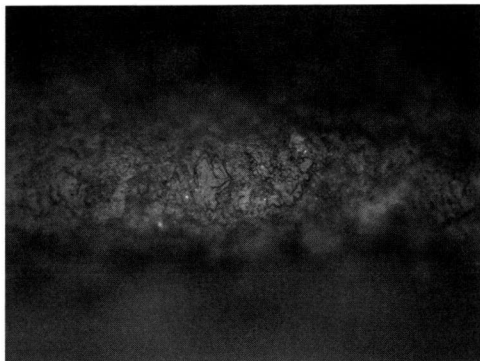
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Plate 1 Micrographs of use-wear polish (1)

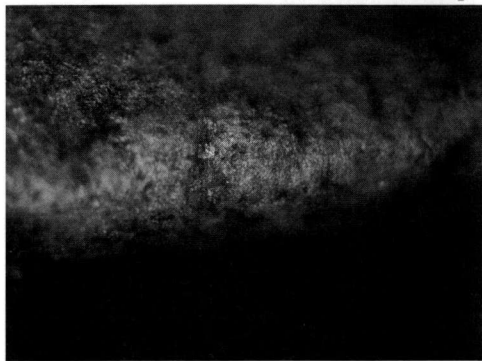
[3, 4: 100x, 1, 5-7: 200x, 2, 8: 500x. Breadth of micrograph taken at the magnifier of 200x is about 600 μm .]



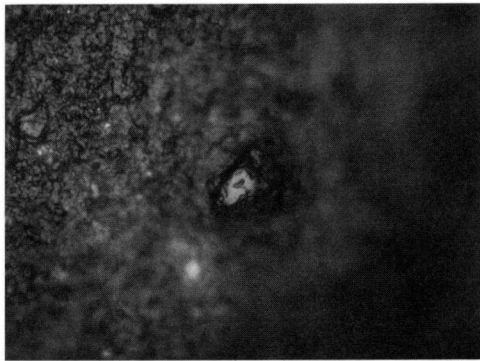
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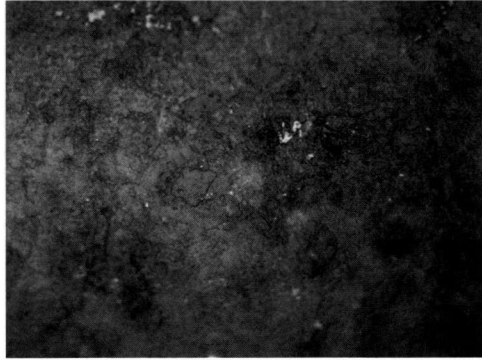
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Plate 2 Micrographs of use-wear polish (2)

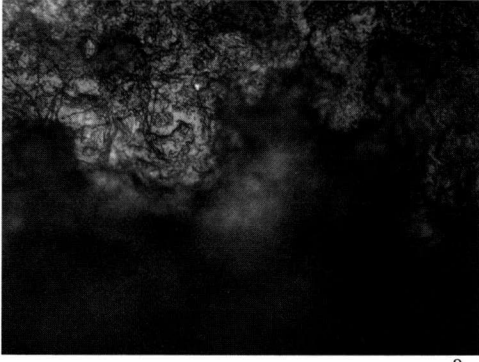
[3: 100x, 2, 6, 7: 200x, 1, 4, 5, 8: 500x. Breadth of micrograph taken at the magnifier of 200x is about 600 μm .]



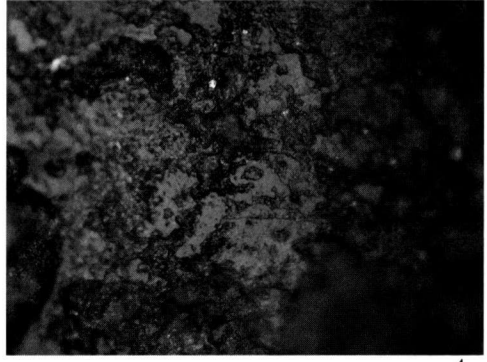
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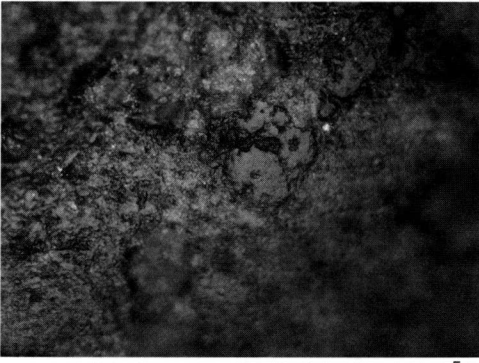
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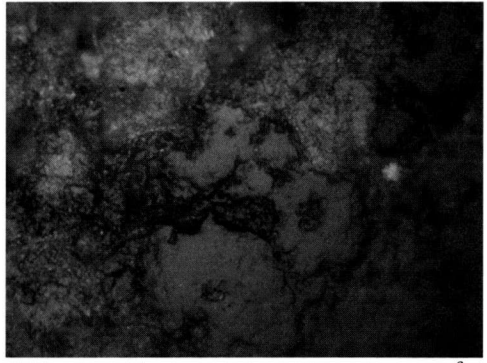
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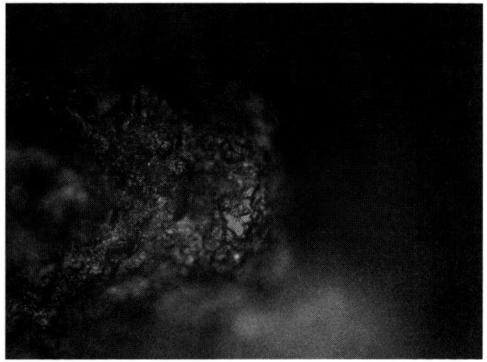
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Plate 3 Micrographs of use-wear polish (3)

[1: 100x, 2-5, 8: 200x, 6, 7: 500x. Breadth of micrograph taken at the magnifier of 200x is about 600 μm .]

the edge run on the microwear polish area. Similar polish distributes on the edge of Figure 4: 18 (Plate 2: 8).

It is remarkable that resemble polish could be also seen on the central part of the "A face" of Figure 4: 14 (Plate 2: 6). However, it partially combines different features characterized by relatively flat surface compared to the typical polish produced by wood-working. It is distributed only in the higher topographical area of the "A face," and it is not observable in the corresponding part on the "B face." Such a use-wear polish is also distributed on the top of midportion of the "A face" of Figure 4: 18 (Plate 2: 7), while microwear polish can not be seen on the edge of this specimen.

In Figure 6: 1, a smooth use-wear polish could be observed on both surfaces of the working edge. Polish domes are frequently raised, and they form more developed patches by linkage (Plate 3: 2 and 3). The size of a use-wear patch is, however, relatively small; the maximum length of each microwear is between 10 μ m to 80 μ m. The distribution of use-wear polish is restricted to the summit of minute asperity on the stone tool surface. In addition, use-wear polish could be detected on the central part of the "B face" of this specimen. From a macro view, the morphological characteristics of use-wear polish were similar to those observed at the edge. However, the use-wear polish is well-developed, and the maximum length of the patch reaches 200 μ m. A cross section of use-wear polish presents relatively flat shape (Plate 3: 4-6).

The original working edge of the tool shown in Figure 8: 1 was broken. However, the tip of the tool and the ridges formed by micro- and macro-flakings around the edge are slightly worn down. Therefore, this tool is estimated to be used after large-scale fracture of the edge. A relatively well-developed, smooth polish with a round-shaped rim can be seen on the "B face" of Figure 8: 1 (Plate 3: 7 and 8).

4. Discussion

(1) Uses of flaked stone scrapers

The condition of the surface of all the specimens examined in this study was well preserved. At least under optical microscopy, serious influences of the cortex on analysis need not be taken into consideration.

The analysis enabled to categorize use-wear polish detected on flaked stone scrapers into three groups. The first is smooth and flat use-wear polish distributed in a restricted area along the edge of Figure 2: 4 (Plate 1: 1, 2). This polish has a common feature with "bone polish" or "D1-type polish" which is correlated closely with hard animal resources, such as bone and antler. The orientation of the striation indicates that it was used in a scraping or whittling motion. These traceological data suggest that this tool was used for processing bone and/or

antler.

Second, a rough use-wear polish covered with minute pits, as seen in Figures 2: 6 and 3: 2, can be regarded as a variation of polishes classified as “dry-hide polish,” “tanned or dry-hide polish” and “E2-type polish.” Figure 2: 6, with perpendicular striations, is considered to have been used for scraping hide (Plate 1: 3). Figure 3: 2 (Plate 1: 4) is estimated to have been used for hide-working, although the direction of motion could not be specified.

Third, the smooth and domed polishes observed in Figure 3: 3, 8 and 9 are essentially the same as “wood polish” or “B-type polish” (Plates 1: 5-8; 2: 1, 2). The orientation of striation on a specimen shown in Figure 3: 2 clearly indicates that it was used in a scraping and whittling motion. These traces suggest that they were used mainly for processing plant material and that at least one specimen was used for scraping or whittling it. In addition, restricted area of polish distribution shows that the worked material was a relatively hard substance. Thus, there is a strong possibility that these tools were used for wood-working. Nevertheless, within an area of well-developed microwear, smooth but relatively flat shaped polish is dominant. In particular, the large patch seen on an artifact shown in Figure 3: 3 (Plate 1: 5) resembles “reed polish” and “plant polish.” Hence, there still also remains a possibility that this tool was used for processing grass plants.

(2) Uses of ground stone axes and adzes

It is safe to say that three specimens of stone axes/adzes (Figures 4: 12, 6: 2 and 3) with edge rounding and striation were used for some practical purposes, though worked material cannot be predicted since distinct use-wear polish was not found. At the same time, it is important that there is a lot of small edge breakage along the working edge on the “B face” of Figure 6: 2. The results of a systematic experiment of felling wood using stone axes shows that the number of micro-flakings produced on the edge of the lower side tends to be larger than that on the upper side (e. g., Takase 2007). This is because the upper face makes contact with wood for the first time, and the impact reaches opposite side forming the micro-flakings. Suppose the axe shown in Figure 6: 2 was attached to a haft and used as an axe, the “A face” must be the upper face during use.

Distinct use-wear could be seen on 7 specimens. The use-wear polish observed on the ground axe/adze is classified into two groups. The first is identified as “dry-hide polish”, “tanned or dry-hide polish” and “E2-type polish” generated at a high rate by hide-working. These polishes are observed on materials shown in Figures 4: 4 and 5: 4, and they may have been used for scraping hide (Plates 2: 3; 3: 1), although a hafting trace could not be seen by the microscopic observation in this study.

The second group of microwear polish is roughly equivalent to “wood polish” and “B-type polish” as observed on the edge of the tools shown in Figures 4: 7, 18, 6: 1 and 8: 1 (Plates 2: 4, 5, 8; 3: 2, 3, 7, 8). However, working on fresh wood with ground axes/adzes frequently produces use-wear polish with some characteristic morphological features that are different when compared with that of typical “wood polish” as has been reported (e. g., Saino 1998, Takase 2007). The points of differences are: (a) a slightly rough and pitted surface, and (b) a relatively flat shape in the cross-section. Particularly, if they are hafted so as to be subject to enormous force at the edge, a similar use-wear polish is often generated on both face of the edge and on the contact zone with the haft. Such a polish has been distinguished from typical “wood polish” and classified as “type Ia” (Saino 1998) or “types 2 and 3” (Takase 2007).

On the artifacts shown in Figures 4: 7, 18; 6: 1 and 8: 1, such a use-wear polish as well as typical “wood polish” and “B-type polish” distributed along the edge area. In addition, they can be also seen on the higher portion or along ridge formed by plural ground surfaces on the “A face” of Figure 4: 14 and 18 (Plate 2: 6 and 7). This distribution of use-wear polish is suggestive of contact area with the wooden haft where is subjected to stress during use. If this inference is appropriate, the “A face” of Figure 4: 14 and 18 must have been fixed to a knee-shaped inflectional wooden haft to be used as adzes. Unifacially beveled edge produced by grinding the “A face” as shown in side-view drawings of the figure supports this estimation. In short, it seems highly possible that there were some adzes attached to wooden haft that are involved in the specimens examined in this paper.

Just like the results of case study in the Epi-Jomon period of Hokkaido Island (Saino 1998, Takase 2007), stone adzes from Etorofu Island was used not only for wood-working, but also for hide-working. This conclusion might raise a problem related to producing hide and their trading across wide area. However, further consideration is needed to explain the social background of the existence of stone adzes for hide-working in this period.

Results derived from this paper also lead to an understanding of the meanings of similar tools made from different kinds of raw materials. As is well known, a number of bone axes and adzes were used in the Okhotsk culture. Almost all of them have been inferred to be used as hoe for digging or moving ground and snow (e. g., Yamaura 1982). However, lithic use-wear analysis demonstrated that worked materials of stone axes and adzes of the period were evidently different from those bone tools. This fact will provide important assumption to explain intra- and inter-site differences of tool composition of this period.

Conclusion

The lithic use-wear analysis based on the high-power approach enabled to see distinct use-

wear polish on 6 scrapers and 7 axes/adzes. The morphological features of polish suggested that stone scrapers were used for processing bone and/or antler and grass plants. In the cases of axes/adzes, five of the seven specimens were used for felling or processing wood attached to wooden haft. The remaining two specimens may have been used for hide-working.

The uses of stone tool in the Northern Pacific Rim region have not yet been studied, even though it was one of the most important tools for utilizing various resources until the latter half of the 2nd millennium C. E. Lithic use-wear analysis will provide indispensable information to clarify how stone tools were used to harness resources in this region.

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Notes

- 1) Detailed information on this site is limited. However, it is possible that the Saratovka river 1 site might be the same site or is located at least in a neighboring area.
- 2) Radiocarbon dates of charcoal collected from these sites cover a wide range of period (Zaitseva *et al.* 1993, Nomura 1996). Calendar year calibrated by a program (Calib Rev 6.0.1) based on IntCal09 (Reimer *et al.* 2009) is between 1952 calBC to 424 calAD; it seems to have a tendency to be older the expected age. However, results of radiocarbon dating do not have a substantial impact on the date estimation in this paper, as archaeological contexts of each specimen for radiocarbon dating have not yet been necessarily clarified.
- 3) It is still difficult to match the name and location of this site even by referring to the latest achievement of a general survey by Russian archaeologists (e. g., Samalin2009, Vasilevskij 2009).

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【要旨】

クリアル列島南部エトロフ島出土石器の使用痕分析

高瀬克範

本稿では、クリアル列島南部のエトロフ島から出土した続縄文期～オホーツク文化期に位置づけられる可能性が高い石器の機能・用途を明らかにすることを目的として、高倍率法による使用痕分析を行った。

分析対象は、吉田嘉代治氏のコレクション（標津町教育委員会保管）、岸田喜男氏のコレクション（留萌市教育委員会保管）に含まれるスクレイパー 19 点と「エトロフ型石斧」以外の石斧 39 点である。これらは、1929～1935 年のあいだにエトロフ島のラウス海岸（タンコヴォエ、詳細地点不明）もしくは内保、紗那（詳細地点不明）、仮称ニウモイ遺跡で採集されたものである。岩石は、スクレイパーには頁岩・玄武岩が用いられている。また、石斧には、泥岩・砂岩・玄武岩・安山岩・黒色片岩・緑色泥岩・溶結凝灰岩が用いられている。

分析の結果、刃部に微細剝離痕・線状痕・ラウンディングのみが認められる資料も存在したが、明確な使用痕光沢面（ポリッシュ）が 6 点のスクレイパー、7 点の石斧に確認された。使用痕光沢面の形態学的特徴から、スクレイパーは皮革、角・骨やイネ科植物の加工に用いられたと推定された。石斧には、皮革加工に用いられたものと、木に対して用いられた可能性が高いものが含まれていることが明らかになった。また、片刃石斧のなかには主面に木製柄への着柄痕跡と考えられる使用痕光沢面が認められる資料もあり、刃面が作出されている面を前主面として膝柄に着柄し、横斧として用いられた可能性が高いことを指摘した。

キーワード：エトロフ島，石製スクレイパー，石斧，石器使用痕分析