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Endscrapers of the Old Koryak Culture: A Case Study in the Kamchatka and Taigonos Peninsulas

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Abstract: This study purposes to clarify the functions and uses of stone endscrapers of the Old Koryak Culture (ca. the 5th to 17th centuries C.E.) from the northern Kamchatka and Taigonos peninsulas. Through an examination of the "high-power approach (HPA)" of lithic use-wear analysis, it has been found that all of the endscrapers with heavily abraded edges had been used for hide-working, and that there were also traces of hafting, probably into handles made of bone or antler. Furthermore, an interpretative model for estimating the direction of tool movement indicates that scrapers with relatively sharp edge-angle were used in a whittling motion, while scrapers with blunt edge-angle were used in a scraping motion. This study also revealed that working edges of almost half of the endscrapers we examined were worn rounded to an extent that measurement of use-angles was difficult, implying that many of these tools were used for a variety of tasks in the hide-working process, tilted at varying angles against the hides. These results show that although the *Paleo-asiatic-type* of scraper may have existed in this region prior to the 17th century, it constituted only a part of the hide-working toolkit. The assemblage of hide-working tools in the Old Koryak Culture was relatively varied and multipurpose. It is believed that at some point between the period of the Old Koryak Culture and the beginning of the period of ethnographic documentation of the region, a transition occurred whereby the toolkit was pared down to a single tool—the *Paleo-asiatic* scraper.

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Introduction

It is known that cultures using animal hides in northeast Asian societies can be roughly divided into two groups: those based on the use of fish skins, and those based on the use of the hides of mammals (Sasaki 1992: 146). In general, the latter had a more complex technological system, and is thought to have developed later (Sasaki 1992, Saito 1998, 2006)(1). Based on this premise, it is thought that the former cultures, originally situated in the lower reaches of the Amur river and Sakhalin island and spreading as far (south) as the Songhua (Sungari) river area and Hokkaido island, later received an influx from ethnic groups (further inland) along the Amur and upper Songhua river regions (Sasaki 1992: 148). This phenomenon is believed to have been

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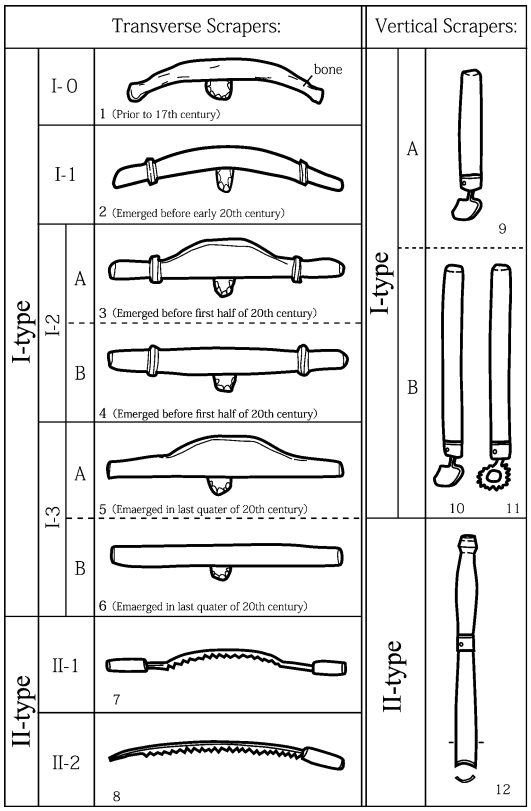


Figure 1 Classification of Scrapers of the Kamchatka Peninsula
[Modified from a presentation poster which was a part of Takase (2006). Chronology is different for the Chukchi Peninsula]

closely linked to the movement of the Tungusic peoples, and possibly even to the Japanese hide-working technologies subsequent to the Kofun period (Matsui 1987, 2005, Sasaki 1992).

In hide-working, the Tungusic peoples have used as their main tool the *Tungusic-type* scraper, an iron blade attached to a long haft (Fig. 1: 9–11, Fig. 2), as well as a tool with a wide denticulate blade and handles on both sides that was used to remove hair and apply tanning agents (Fig. 1: 7, 8; Fig. 2)[(2)]. However, near the northeast coast of the Eurasian continent, a type of scraper known as the *Paleo-asiatic* (or *East Siberia-type*) has been predominantly used (Fig. 1: 1–6; Fig. 2).

From the view point of material culture studies, the author has divided scrapers into two types: *vertical* and *transverse* (Fig. 1). The working edge of the *vertical-type* is perpendicular to the long axis of the handle. For the *transverse-type*, the working edge is parallel to the handle. Although this division is applicable for all regions around the globe, in Siberia the *vertical-type* corresponds to the *Tungusic-type* scraper. The *transverse-types* consist of the *Paleo-asiatic-type*, which has a stone or iron blade fitted into a slot in the center of the haft (*transvers-I-type*), and a notched scraper with a wide transverse haft to be used with both hands in conjunction with the *Tungusic-type* scrapers (*transverse-II-type*).

The approach of material culture studies intends to eliminate any bias that may occur through linguistic and ethnographic preconceptions that can interfere with objective treatment of

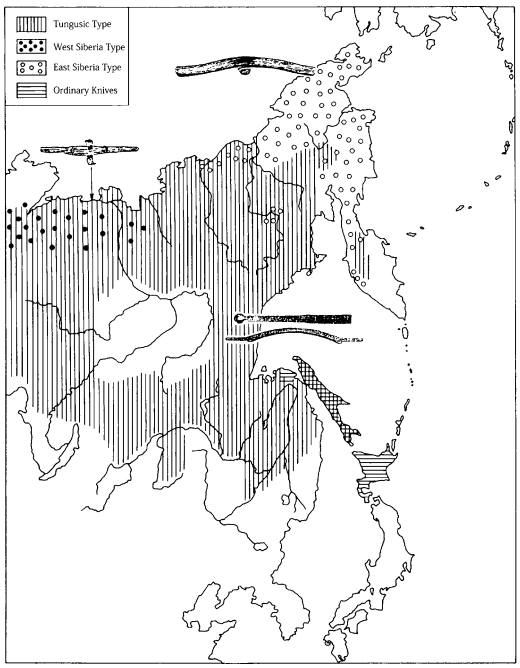


Figure 2 Distribution of Scrapers in Northeast Asia and Siberia (after Sasaki 1992)
[The distribution of the Tungusic-type scrapers in the central Kamchatka Peninsula is thought to have been the result of the migration of the Even people to this region in the 19th century]

the archaeological material. Nevertheless, it is notable that there is a consistent relationship between scrapers and hide-working techniques that cannot be ignored[3]; the *vertical-* and the *transverse-II-types* are closely linked to Tungusic ethnic culture, which includes the use of fish eggs and oil, animal brains, guts and plants as tanning agents. In contrast, the *transverse-I-type* was used mainly by non-Tungusic peoples who used urine and feces in their tanning process. In this context, and on the premise that hide-working techniques using excreta had been distributed widely in northeast Asia and Siberia by the 14th to 15th century C.E. (Sasaki 1992: 143), it is possible that the *transverse-I-type* scrapers can be traced back to this period.

However, there are as yet many unknown factors concerning the origin and development of these scrapers (Sasaki 1992: 148). Even if the "urine and feces" method of tanning had developed out of earlier cultural traditions utilizing fish skins (Sasaki 1992: 148), it is not yet unclear how tools such as the *transverse-I-type* scrapers might fit in the picture. In light of current research results, this study will identify specific functions of endscrapers found on the Kamchatka and Taigonos peninsulas, dated prior to the 17th century, from an archaeological perspective. In addition, related issues requiring future discussion, on the history of hide-working by the peoples in this region will be examined.

1. Materials and Methods

(1) Sites and Artifacts

The *transverse-I-type* scraper has been an important hide-working tool in the region corre-

sponding to the former Koryak Autonomous Okrug of the Russian Federation (presently a part of Kamchatka Krai after its integration with Kamchatka Oblast' in 2007). A *transverse-I-type* haft believed to predate the 17th century C.E. (Fig. 1: 1) has been found in this region, along with numerous lithic artifacts from a site of the same period. This region undoubtedly holds important clues to the origins and development of the *transverse-I-type* scraper. However, historical records for this area prior to the 19th century are very scarce, therefore, the role of archaeology is extremely important.

There are already some organized reports of archaeological studies of this area (e.g., Semenov 1964, Dikov 1977, 1979, Ptashinskij 1989, 2005). The specimens examined in this study were collected by Prof. Andrej V. Ptashinskij at Kamchatka State University in the course of several field surveys in the northern Kamchatka and Taigonos peninsulas after 1989 when an initial report was published (Ptashinskij 1989) until 2006. Artifacts are currently in care of Kamchatka State University. Some of the material have already been released (Ptashinskij 2004, 2005), although an academic report on his field surveys is being compiled.

The sites that yielded lithic artifacts for this study belong to three groups: those located on the Elistotratova peninsula in the east Taigonos peninsula, sites on the north shore of Penzhinskaja bay, and sites on the coastal area of Korfa bay in northeast Kamchatka peninsula (Fig. 3). We have also included material unearthed from the central Kamchatka peninsula for comparison. An overview of the material from each site is as follows (Figs. 4–5):

[**Elistotratova peninsula**] At the Itkana-V site, four endscrapers have been found, as well as points, flakes, and retouched flakes, made from basalt. Pottery fragments with decoration executed by cord rolling and waffle-like stamp ornaments, and left plain were collected. Some tree bark remains have also been unearthed from the permafrost.

[**Northern shore of Penzhinskaja bay**] The Khaimikino site has yielded two basalt endscrapers, potsherd fragments plain or with clay rolling ornamentation, stone points made of basalt and obsidian, and ground mudstone axes. At the Kamennaja-I site, two basalt endscrapers, pottery fragments left plain or with ornamentation of cord rolling and square stamp, basalt points and slate fragments, and a wooden implement grooved with square patterns that may have been used for modeling or decorating clay vessels were found. At the Kamennaja-III site, three basalt endscrapers, three pottery fragments with rectangular pattern stamp and cord rolling, slate fragments and basalt flakes and retouched flakes were unearthed. The Mys Zelyonuj site yielded six endscrapers made from basalt; clay vessels with square checked stamp, cord rolling, application of clay-rope and plain surface in great numbers; basalt, obsidian and agate flakes and retouched flakes; and pieces of tree bark. At the Mys Kontrol' nuj site, two basalt endscrapers, one bone fragment and flakes made from basalt and chert were collected. Some of these sites had initially been identified as the Neolithic (Dikov 1964, 1977, Ptashinskij 1989), however, the attributes of the pottery fragments found in subsequent investigations have identified the presence of the Old Koryak Culture elements.

[**Korfa bay area**] The Zelyonuj Kholm site had four basalt endscrapers, two chert endscrapers, basalt points, flakes, retouched flakes, a lamp believed to be made of sandstone, a lot of pottery fragments both embellished with cord rolling decoration and plain surface, bone points and decorated bone artifacts.

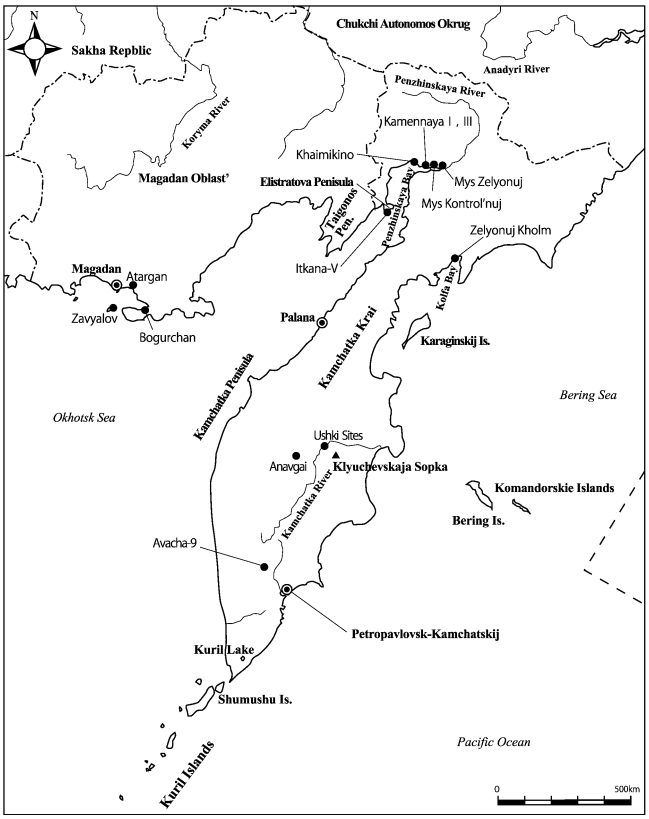


Figure 3 Map showing location of sites

[**Central Kamchatka**] Although this region falls outside of the Old Koryak Culture sphere, a material from this region was involved in the specimens examine in this study for comparative purposes. At the Anavgai-I site, one basalt endscraper was found, along with many basalt and obsidian flakes. Present-day Anavgai villagers are prolific users of the *transverse-I-type* scrapers, so it is difficult to rule out the possibility of commingling of ethnographic material. However, the find of obsidian flakes and their use as described below makes it reasonable to assume that the artifacts are of prehistoric origin.

The history of archaeological research in the region from the north coast of the Okhotsk Sea to northern Kamchatka peninsula has been discussed in detail by Dikov (1977), Lebedintsev (1990), Kikuchi (1974a, 1995, 2004) and others. The Old Koryak Culture, which plays an important role here, is an archaeological culture for which R. S. Vasilevskij (1961, 1971) established a framework for research. It is designated as having continued from the end of the 5th to 17th century C.E., and is subdivided into five phases, the Zavjarov (the 5th to 8th century), Bogurchan (ca. the 10th century), Atargan (the 10th to 13th century), Lengel'var' (the 13th to 15th century), and the period from the 16th to 17th century(4). This chronological system is basically adhered to today even after recent research revealed the presence of the Tokarev culture (Lebedintsev 1990), believed to predate the Old Koryak Culture on the northern coast of the Okhotsk Sea.

Nevertheless, these chronologies and divisions of periods are still open to reconsideration,

because it is undeniable that the present chronological scheme is still rough. In addition, there are still unresolved issues concerning the expanding process of the Old Koryak Culture from the north coast of the Okhotsk Sea into the northern Kamchatka peninsula (e.g., Ptashinskij 2005), as well as its relationship with the Neolithic of this area (Ptashinskij 1989, 2003). Despite such problems, the endscrapers examined here are almost certainly dated to the first and second millennium C.E., especially a period of the Old Koryak Culture before the 17th century. This is based on the following reasons:

First, all of the items of pottery found at the sites have flat rims and rounded bottoms with ornamentation characteristic of the Old Koryak Culture such as square stamp, cord rolling and clay-rope ornaments (e.g., Ptashinskij 2005: 90)[5]. Second, AMS radiocarbon dates of nine specimens of wooden artifacts and charcoal collected from the same cultural layer as the end-scrapers show between 1200±30 BP to 475±20 BP. Third, the *transverse-I-type* scraper haft is believed to have been made from the bone of a sea mammal (Fig. 1: 1)[6], a feature that is typologically of an earlier stage than the oldest ethnographic example of a wooden haft (Fig. 1: 2) (Takase 2004, 2005, 2006). Fourth, the locations of many sites do not overlap with the Koryak settlements of the 19th to 20th centuries (Ptashinskij 1989). Fifth, each site had an abundance of basalt and obsidian points and other artifacts associated with the endscrapers, and were definitely earlier in age than the period for which ethnographic records exist. Lastly, there is no positive evidence to indicate that the above mentioned stone artifacts may go back as far as the Neolithic, because there is no point made on blade and with characteristics such as with fine retouch, barbs, and triangular cross-sections[7]. Therefore, it is reasonable to assume that the majority of the endscrapers examined in this study belong to the Old Koryak Culture.

(2) Methods of Analyses

Three methods are combined in this study. One is a method of lithic use-wear analysis known as "high-power approach (HPA)" pioneered by Lawrence H. Keeley (1977, 1980). The objective of this analysis is to make sure that endscrapers were used for processing hide by detecting micro-wear polish which is closely related to hide-working such as "dry hide polish" (Keeley 1980) or "E2-type polish" (Kajiwara and Akoshima 1981, Akoshima 1989). Endscrapers from the above sites that show signs of heavy use through naked eye observation are selected, and examined for use-wear polish using a metallographic microscope with an incident light (DSM-IIIS, Daiko Science Co., Ltd.) at magnifications of 50x to 200x after the removal of oils and fats on the surface of specimens by ethanol. Micrographs are taken using a digital camera (Ricoh Caplio GX) mounted on the microscope.

Secondly, replication method is applied to examine cross-sections of the edges. The cross-section of a negative replica of an endscraper enables observation of minute details of wear on the edges, and makes it easier to measure the use-angle[8]. The replicas are made with polymerization-type silicone impression material (Tokuyama Fit Tester, Tokuyama Dental Co., Ltd.)[9]. A carbon 9B graphite pencil is used to mark each scraper on locations (often near the edge on the ventral face) where most developed surface abrasion can be seen, after which the impression material are applied to the surface of stone tools, then removed carefully after hardening. The carbon markings originated from graphite pencil, transferred to the inside surface of the replica,

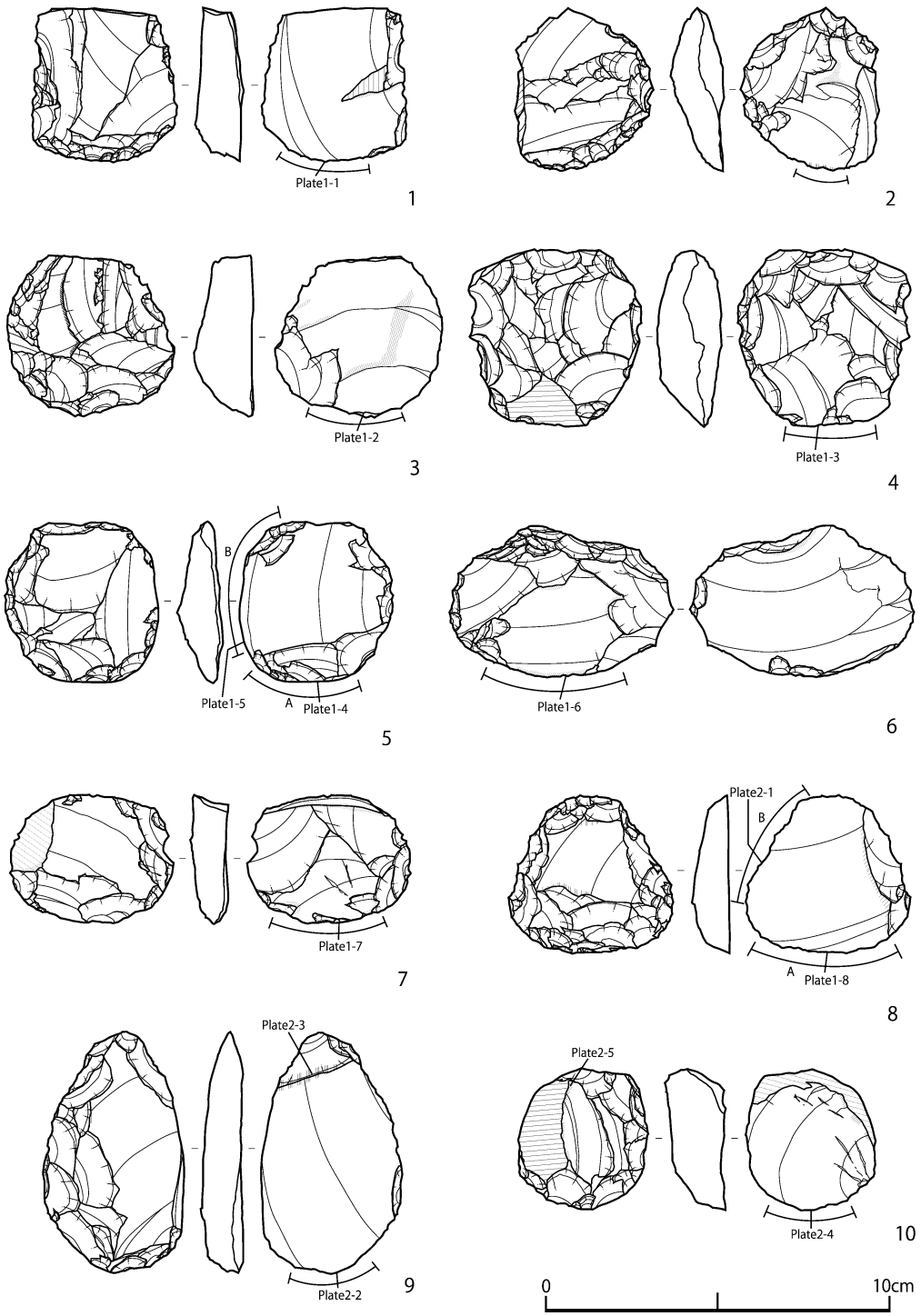


Figure 4 Endscrapers from the Kamchatka and Taigonos Peninsulas (1)

[1•2: Itkana-V; 3: Khaimikino; 4: Kamennaja-I; 5–7: Kamennaja-III; 8–10: Mys Zelyonuj. Shaded areas are macroscopically identified abrasions]

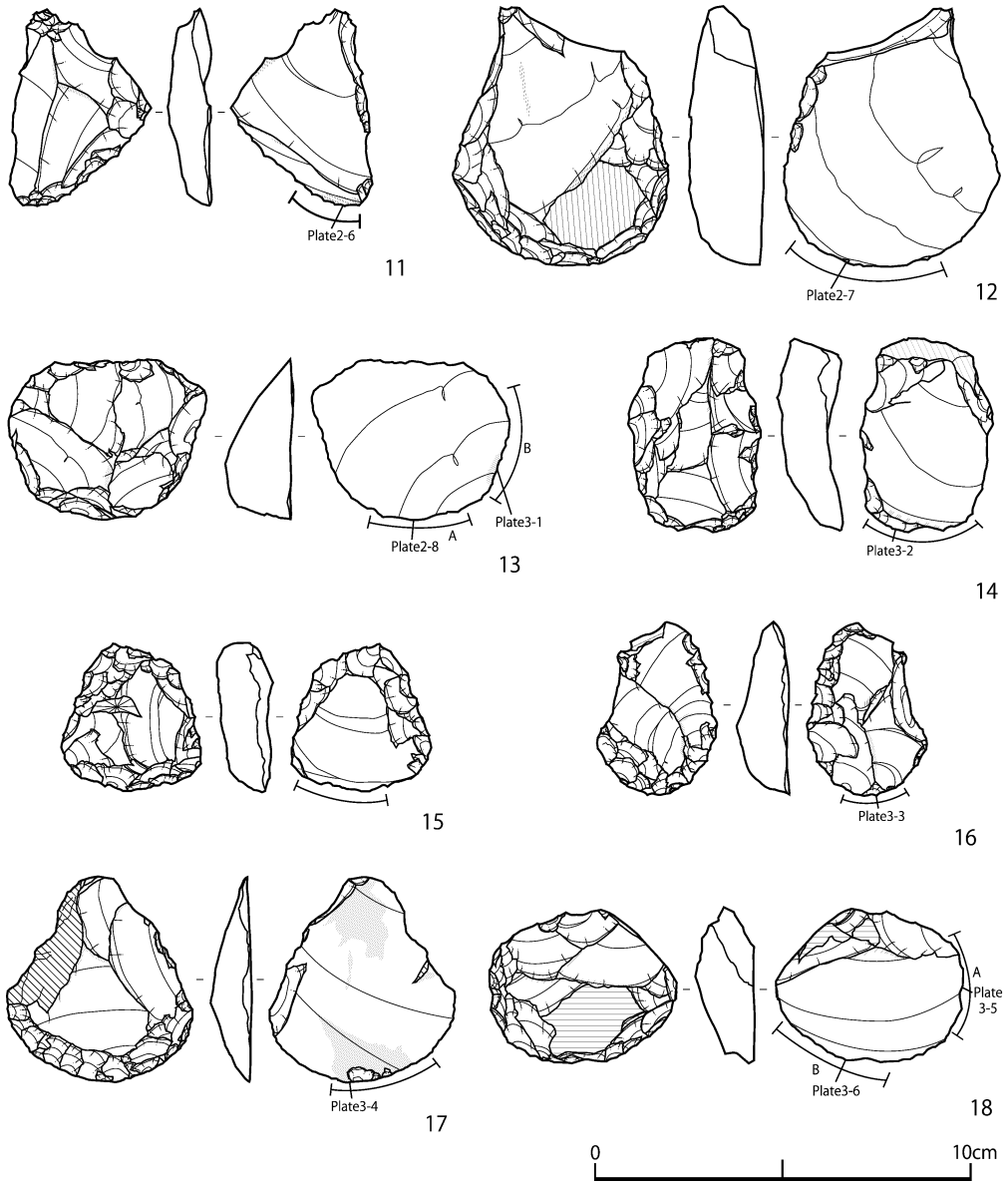
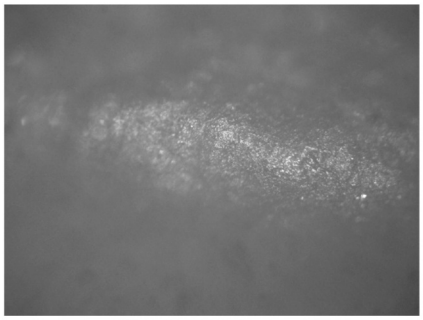


Figure 5 Endscrapers from the Kamchatka and Taigonos Peninsulas (2)

[11–13: Mys Zelyonuj; 14–16: Zelyonuj Kholm; 17: Mys Kontrol' nuj; 18: Anavgai. Shaded areas are macroscopically identified abrasions]



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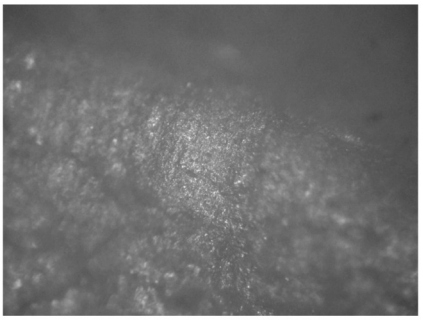

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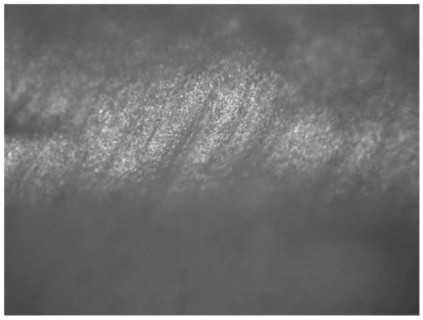

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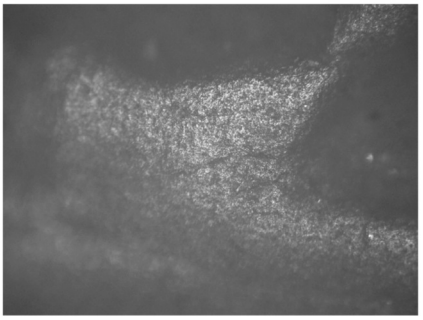

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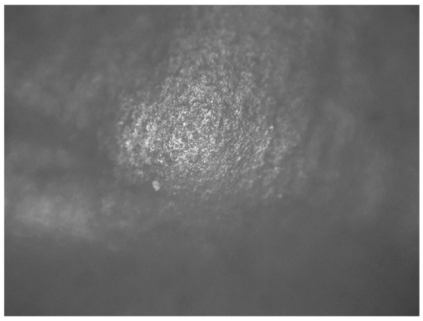

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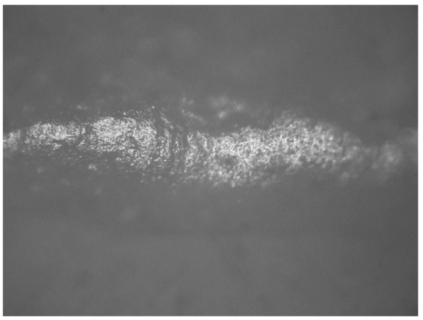

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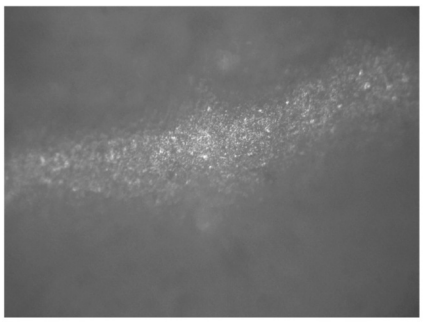

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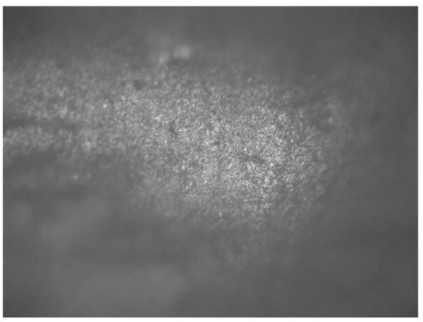
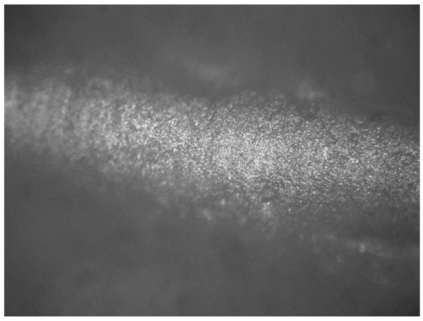


8 No. 8 (A, 100×)

Plate 1 Migrographs of use-wear polish

[1–8: Metallographic microscope; width of photograph: 1.00 mm. Number and location of artifacts correspond to Figure 4]



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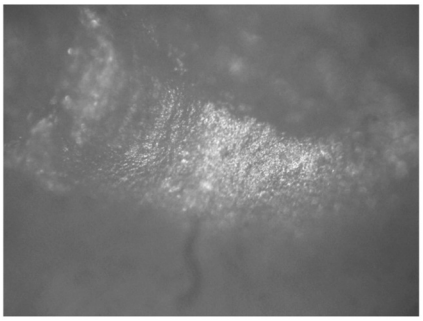

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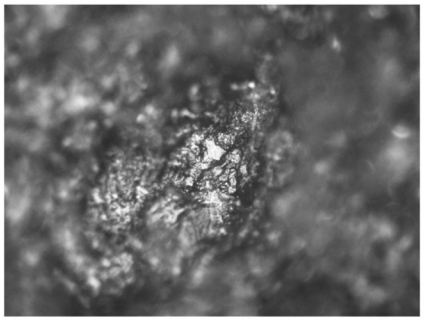

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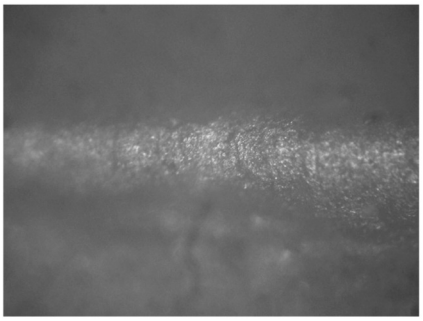

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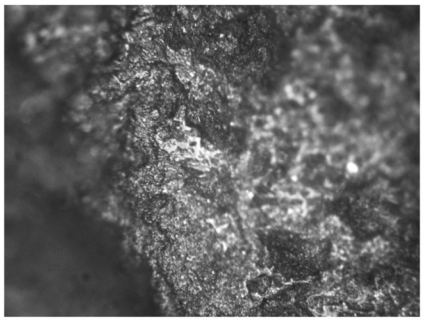

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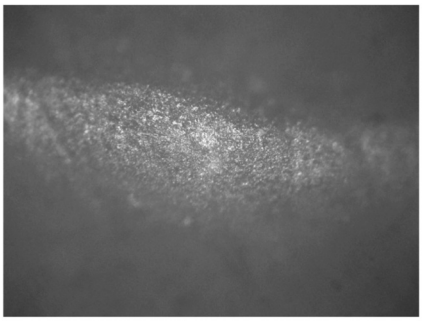

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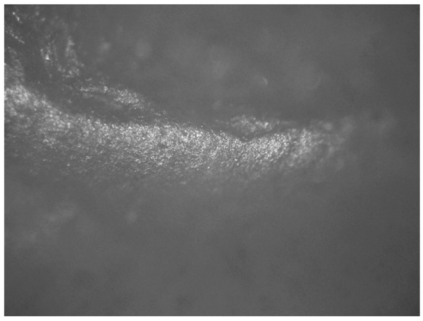

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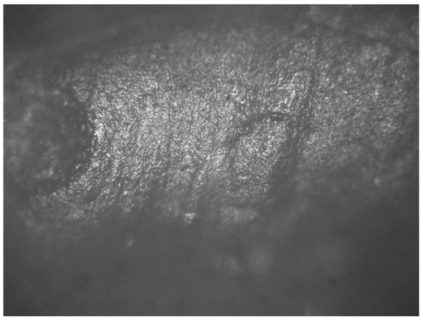
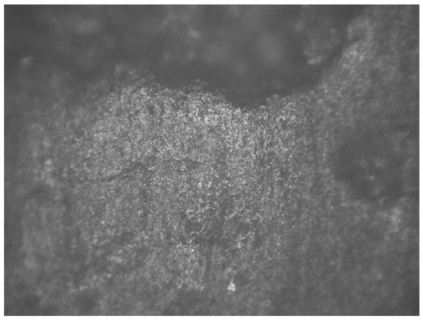


8 No.13 (A, 100×)

Plate 2 Micrographs of use-wear polish

[1–8: Metallographic microscope; width of photograph: 1.00 mm Number and location of artifacts correspond to Figures 4 and 5]



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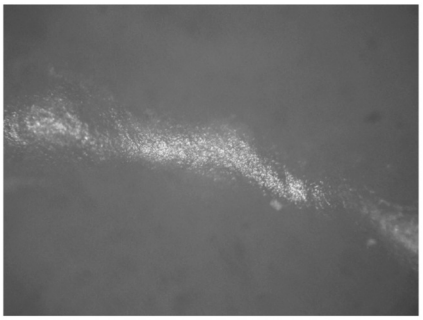

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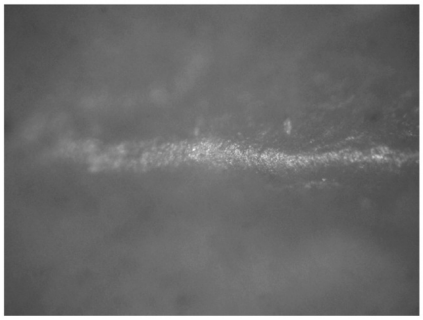

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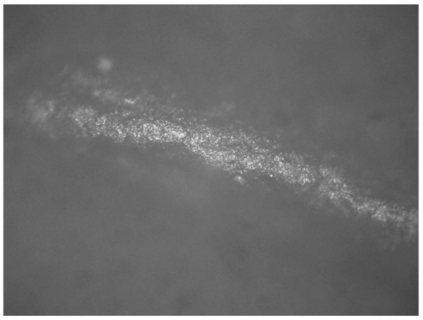

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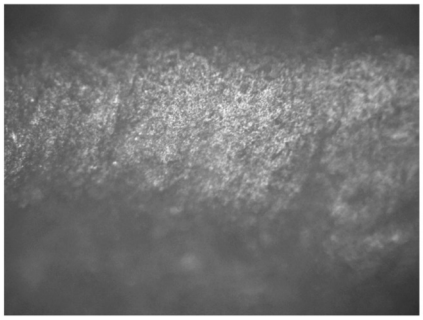

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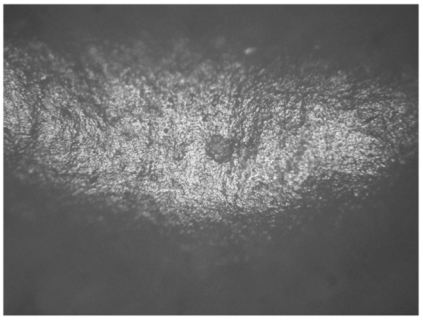

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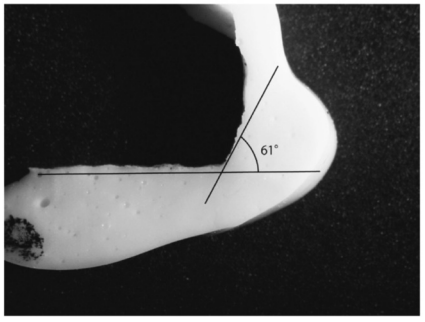

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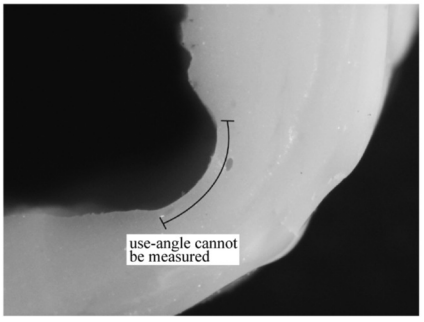
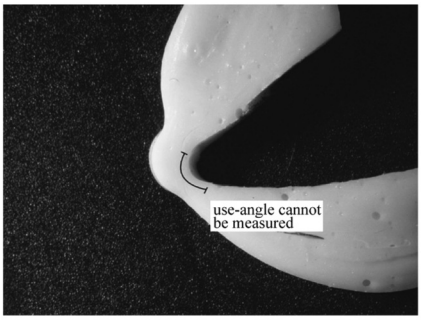


8 No.4 (20×)

Plate 3 Migrographs of use-wear polish (1–6) and cross-section of replicas on the tool edge (7, 8)

[1–6: Metallographic microscope; width of micrograph of 1–6: 1.00 mm. 7, 8: Stereomicroscope; width of photograph: 10.00 mm at magnification of 6.3, 3.15 mm at magnification of 20. Number and location of artifacts correspond to Figure 5]



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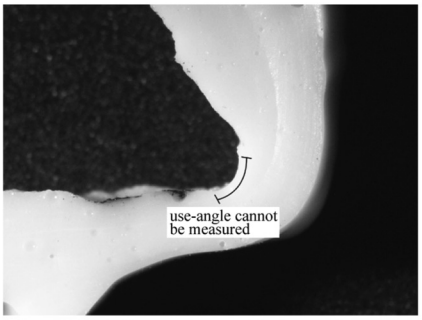

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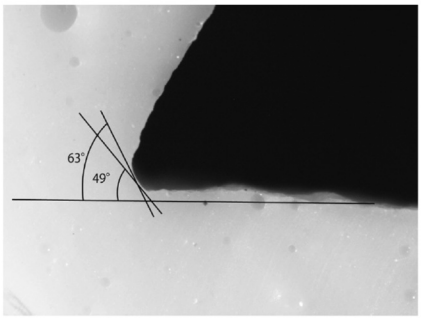

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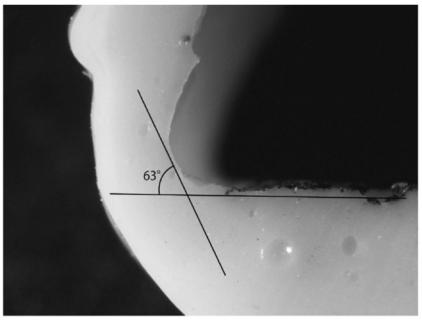

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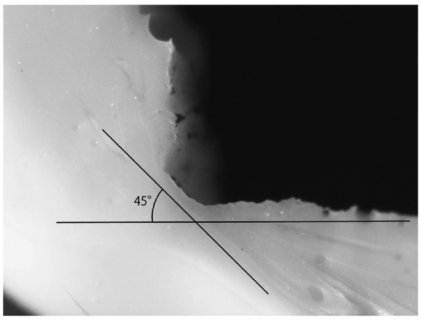

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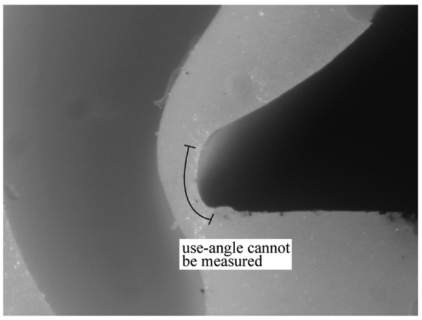

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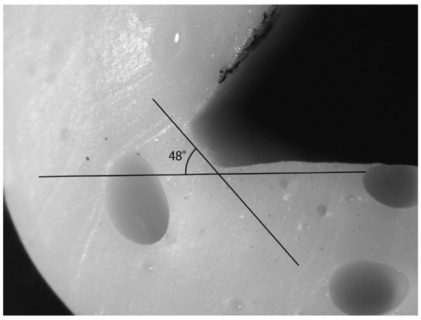

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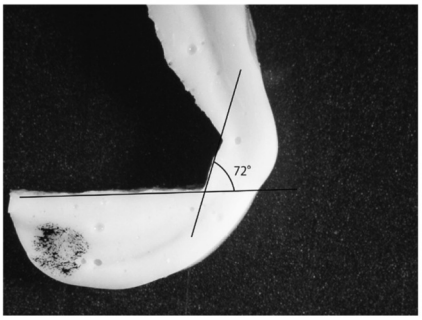

8 No.18 (6.3×)

Plate 4 Micrographs (4) of cross-section of replicas on the tool edge

[1–8: Stereomicroscope; width of photograph: 10.00 mm at 6.3 times magnification, 3.15 mm at 20 times magnification. Numbers and location correspond to Figures 4 and 5]

are used as guides for cutting vertically the replicas using razor blades. The carbon marks that remained on the stone tool were later removed with a kneaded eraser.

A stereomicroscope (Olympus SZX-9, 6.3x to 57x magnification) is used to examine the cross-sections, and micrographs were taken with a digital camera (Olympus DP-12). In many cases, the use-angle of the tool is the angle between the ventral face and the line extended from the abraded surface on the edge. Bifacial stone tools are presumed to have been used with the flat side facing down. Since all of the endscrapers have "plano-convex" cross-sections, there are no difficulties in determining which side faced up during the use, and there is no discrepancy in the distribution trends of use-wear polish.

Lastly, the direction of tool movement during the use of endscrapers is estimated by an interpretation model based on ethnographic data (Takase 2005). The edge-angle (taking the mean of five locations where attrition is observed, measured with a protractor) and the use-angle measurements as observed from the silicone replicas are used in the following formula, which calculates the "tilt index" (x) to estimate the direction of tool use:

$x = \text{use-angle} / \{(180^\circ - \text{edge-angle}) \times 1/2\}$

When the index (x) is larger than 1.0, the direction of tool movement is interpreted as scraping (pulling motion), and when less than 1.0, the motion is determined to be whittling (pushing motion).

These three methods of analysis have been carried out, and the results have been compiled for a discussion of the specific function of endscrapers of the Old Koryak Culture.

2. Results

A macroscopic examination of the extent of edge abrasion was conducted on 24 endscrapers from the above sites (22 made from basalt, 2 from chert). Of these, 18 examples, or 75 percent of the total, showed visible signs of heavy abrasion, and four exhibited extensive edge abrasion in two different parts (Table 1). Under high-power magnification, all 18 examples exhibited use-wear polish identified as the "dry hide / leather polish" (Keeley 1980) or "E2-type polish" (Kajiwara and Akoshima 1981, Akoshima 1989); furthermore, striations were also observed in a direction perpendicular to the edge (Fig. 4 and 5; Plate 1–3).

Next, replicas were made of the edges of the 18 endscrapers where use-wear polish was most strongly developed. For examples with more than one surface with use-wear, separate replicas labeled "A" and "B" were made of each, as shown in Figures 4 and 5. The cross-sections of the replicas indicated that nine of the specimens, despite abrasive surface was formed, had rounded cross-sections that made measurement of their use-angles difficult (Table 1; Plate 3: 8; 4: 1, 2, 6).

The nine other endscrapers had relatively flat abrasive wear surfaces (Table 1; Plate 3: 7; 4: 3, 4, 5, 7, 8) and the tilt indexes of the tools were calculated based on the edge-angles and the use-angles. The results are shown in Figure 6, in which the vertical axis is the edge-angle, to aid in examining relationship between production and use of tools. This is because ethnographic records have shown that edge-angles may vary depending on the type of haft, even when the direction of tool movement is the same and the degree of tilt differs at different stages of hide-working (Takase 2004).

Table 1 Results of analyses

Specimen No.	Site	Length (cm)	Breadth (cm)	Thickness (cm)	Stone	Mean Edge-Angle (°)	Use-Angle (°)	Tilt Index	Abrasion Wear on Tool	Hafting Traces
1	Itkana-V	4.5	4.3	1.4	Basalt	78	50-62	1.00-1.22	Y	D type?
2	Itkana-V	4.8	4.1	1.5	Basalt	63	N/A	—	Y	
3	Khaimikino	4.7	4.9	1.2	Basalt	73	61	1.15	Y	
4	Kamennaja-I	5.3	5.1	1.9	Basalt	65	N/A	—	Y	D type?
5	Kamennaja-III	4.7	4.5	1.3	Basalt	A: 55 B: 51	A: N/A B: N/A	— —	Y	
6	Kamennaja-III	4.5	6.7	1.3	Basalt	60	41	0.68	Y	
7	Kamennaja-III	3.8	4.8	1.1	Basalt	72	N/A	—	Y	
8	Mys Zelyonuj	4.1	4.3	1.1	Basalt	A: 74 B: 73	A: 42 B: 49-63	A: 0.79 B: 0.91-1.17	Y	
9	Mys Zelyonuj	7.2	4.2	1.2	Basalt	75	63	1.19	Y	D type
10	Mys Zelyonuj	4.3	3.9	1.8	Basalt	67	N/A	—	Y	D type
11	Mys Zelyonuj	5.4	3.8	1.2	Basalt	79	N/A	—	Y	
12	Mys Zelyonuj	6.9	5.2	2.0	Basalt	99	N/A	—	Y	
13	Mys Zelyonuj	4.4	5.4	1.8	Basalt	A: 77 B: 67	A: 26 B: 45	A: 0.50 B: 0.79	Y	
14	Zelyonuj Kholm	4.8	3.3	1.4	Basalt	74	38	0.72	Y	
15	Zelyonuj Kholm	5.3	3.6	1.8	Basalt	64	N/A	—	N/A	
16	Zelyonuj Kholm	4.0	3.8	1.0	Basalt	74	48	0.90	Y	
17	Mys Kontrol'nuj	5.1	5.1	1.1	Basalt	64	N/A	—	Y	
18	Anavgai	4.2	5.1	1.1	Basalt	A: 82 B: 74	A: 61-71 B: 72	A: 1.03-1.20 B: 1.36	Y	

Figure 6 also includes the material in which only the edge-angles could be measured (the dots on the vertical axis, the horizontal coordinate being 0). It can be seen that overall, many of the endscrapers have edge-angles between 50 and 70 degrees. For the examples in which the direction of motion could be inferred, those with edge-angles of about 60 degrees (Nos.6 and 13B) had horizontal coordinates of less than 1.0, and were presumed to be used in a whittling motion. In contrast, those with edge-angles of 70 degrees or more seem to include both the scrapers used for whittling (Nos.8A, 13A, 14, 16) and those used for scraping (Nos.1, 3, 9); there is also one example in which the direction of tool movement could not be determined (No.8B).

Incidentally, in No.18, which comes from the central Kamchatka peninsula (and was provided as comparative material), both A and B have relatively large edge-angles, and tilt index also suggests that both edge were used in a scraping motion. Therefore, the tool would not have been of the *transverse-I-type* that are used only in a whittling motion, and indicates that even though the *transverse-I-type* scrapers are predominant in this region today, the toolkit seems to have been more diverse in prehistory.

As seen in Table 1 and Figures 4 and 5, clear traces of abrasion, discernable to the naked eye, could be identified on ridges and ripples of almost all of the artifacts. It is believed that at least some of these are traces of attachment to handles or hafts. In fact, "high-power approach" of lithic use-wear analysis has revealed relatively with micro-wear polish with smooth and flat surfaces in Nos. 1, 4, 9 and 10 (Plate 2: 3, 5) within the abraded areas except edge. Although the striations are less clear, detected micro-wear polish are most similar to "bone polish" (Keeley 1980) and the "D-type polish" (Kajiwara and Akoshima 1981, Akoshima 1989); the distribution of polish is limited to the convex areas so that contact with a hard substance is inferred. In

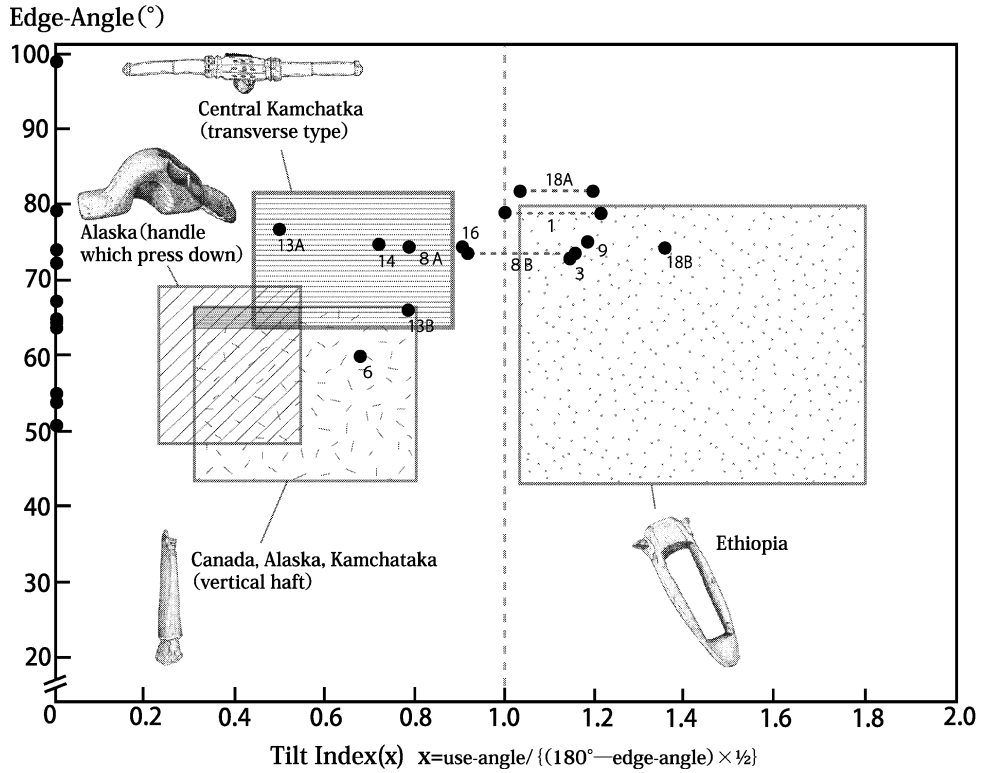

Figure 6 Edge-angles and degree of tilting of endscrapers during use

[after Takase (2005). Ethnographic information based on Nissen and Dittemore (1974), Gallagher (1977), Clark and Kurashina (1981) and Takase (2004). The sources of the figures of tool are Murdoch (1892) for Canada and Alaska, Clark and Kurashina (1981) for Ethiopia, Takase (2004) for Kamchatka. The examples with horizontal coordinate 0 are those for which use-angle measurements were difficult. For the stone tools with difference of use-angle less than 15°, tilt indexes using both the maximum and minimum use angle measurements are shown.]

conjunction with results of use experiment of flaked stone tools, it is most probable that they have been created by contact with hafts or handles made from bone or antler.

3. Discussion

(1) Functions and Uses of Endscrapers

From the morphological examination of use-wear polish and the striations running perpendicular to the edges, it is surmised that the endscrapers with heavy edge abrasion were used for hide-working. The polish of the type seen here correlates closely to the use-wear of stone tools worked on dried and tanned hides so that these stone tools were probably used not only on raw hides, but in multiple stages in the hide-working procedure, from the removal of fat, tissue and membranes to the final softening stage.

With respect to the nine endscrapers for which edge angle measurements were possible, it is thought that they were used at consistently about the same angle against hides. Endscrapers with relatively acute edge-angle (about 60 degrees) were estimated to be used in a whittling motion. On the other hand, those with more obtuse edge-angle (more than 70 degrees) were likely to be

used both in a whittling and a scraping motion, and a few of them might have been used for both tasks. Although we must keep in mind that the number of specimen in the present study is not necessarily sufficient for a definite conclusion, there does not seem to be a consistent relationship between direction of tool movement and the size and shape of endscrapers. Nor have we been able to determine whether there is a distinct tendency for either the right or left part of edge to be abraded to a greater degree.

Almost all of the specimens had traces on higher topographical area of having been fitted into a handle, and microscopic examinations have revealed the possibility of contact with bone or antler. The ethnographic descriptions and materials in the northeast Eurasia available today cite only the existence of wood handles. However, in this study there were no traces of contact with wood. The results of the study seem to indicate that *transverse-I-type* scrapers fitted into bone/antler handles were used in the Old Koryak Culture, as indicated by characteristics of a whittling motion and hafting, and the lack of difference in the degree of wear between the left and right sides of the tools.

However, we do not believe that the *transverse-I-type* scraper was the only type to be used for hide-working. Actually, one scraper was used in a scraping motion but was fitted into a bone handle (No.9). Therefore, it is natural to suppose that the tool assemblage included stone edges other than the *transverse-I-type* scrapers, which were also used for a variety of tasks in the hide-working process. In the ethnographic records, the only hide-working tool of the Chukchi-Kamchatkan language-speaking peoples was the *transverse-I-type* scraper used in a whittling motion, which is a major point of divergence from the archaeological evidence.

Another important fact is that about half of all the tools we examined had edges that were heavily abraded, making measurement of edge angles impossible. It is thought that these tools were used for a variety of tasks (i.e. removal of hair, fat and membranes, and softening hides) in the hide-working process. It is natural to assume that for these different tasks there were also a variety of hafting handles and methods.

However, since in archaeology we deal with material on a scale of several centuries, the paucity of archaeological material in this region restricts research. In light of the simplicity of the hide-working toolkit in the ethnographic records, the endscrapers that had consistent edge-wear traces, enabling measurement of edge-angles in this study, may have been relatively younger developments of the Old Koryak Culture[10]. Unfortunately the archaeological record is too poor to permit a discussion of subdivided chronological differences; but it can be inferred that the early endscrapers were used for various hide-working tasks, and that sometime between a period of Old Koryak Culture and the period of ethnographic documentation, there was a shift to an exclusive use of *transverse-I-type* scrapers. As we have seen, there is ample evidence of the presence of *transverse-I-type* scrapers during the Old Koryak Culture period, and these artifacts may have originated at an even earlier stage as discussed below. However, this does not necessarily mean that their detailed tool use strategies seen in the modern ethnographic records are the same as that of earlier period.

(2) The Occurrence and Development of *Transverse-I-type* Scraper

The *transverse-I-type* scrapers seen in the ethnographic records have the following attributes:

1) they are made on irregular-shaped flakes that do not have a pronounced bulb of percussion; 2) almost all of them are unifacial, and bifacial retouch and grinding being very rare; 3) their edges can be seen to have been retouched in an arc shape in a plan view; 4) their edge-angles concentrate between 60 and 70 degrees; 5) the retouch used to produce the tools is coarse; 6) they have three basic shapes: round, oval or semi-circular; quadrangular with parallel edges; or triangular with a base narrower than the edge; 7) The base and both sides of the tool often exhibit evidence of retouching and truncation for the purpose of fitting into a haft; 8) their maximum length and breadth range between 3.0 and 8.0 centimeters, relatively large for a tool of this type; and 9) their thickness measures between 0.9 and 2.8 centimeters, and they are relatively thick.

The endscrapers examined in this study have characteristics similar to those of the ethnographic examples, yet as stated above, their uses are not as straightforward. Of course, not all of the endscrapers with the abovementioned attributes are necessarily directly related to the *transverse-I-type* scraper and, conversely, it is also possible for stone tools of other shapes to be used in the same way. However, attributes 6) to 9) in particular are believed to signify that the part of the tool that fitted into the handle was consistently about the same size. Furthermore, other characteristics, such as their function's having been limited to whittling, the tools' being made to fit and be removed easily from the haft, and the edges' having been frequently reproduced, also indicate a possible connection with the *transverse-I-type* scraper. The endscrapers examined in this study have lengths and breadths that fall within the normal range of the edges of the *transverse-I-type* scrapers from ethnographic records (Fig. 7), as well as their thicknesses (0.9 to 2.8 centimeters). Therefore, in the discussion of the occurrence and development of the *transverse-I-type* scraper, it will be difficult to ignore the fact that many endscrapers with similar characteristics have been found in large numbers at sites in the same period and region.

Looking at Northeast Asia as a whole in the period from the first millennium B.C.E. to the second millennium C.E., stone tool assemblages containing many endscrapers with characteristics 1) to 9) as listed above are those of the Tar'ya Culture in the southern Kamchatka peninsula [or subtypes of "Old Itel' men" culture in the middle and southern Kamchatka peninsula (Dikov 1979: 260, 270)]. Specimens No.18, the comparative example introduced above, is possibly of this period[11]. On the other hand, in the northern Kamchatka peninsula, the *transverse-I-type* scraper seems to have already been present in the Old Koryak Culture assemblages, as discussed above. It has been known for a long time that many endscrapers found in the area have attributes similar to stone edges used for the *transverse-I-type*; stone tools from the Mys Zelyonuj site are a typical example (Semenov 1964, Dikov 1964).

In the north coast of the Okhotsk Sea, archaeological artifacts assigned to the Zavjarov phase of the Old Koryak Culture have yielded endscrapers that definitely exhibit the characteristics listed above, and similar tools have turned up in assemblages of even earlier periods (e.g., Orekhov 1987, Lebedintsev 1990, Slobodin 2001). Although the scarcity of archaeological records of the northeast coast of the Bering Sea makes evaluation of this area difficult (Orekhov 2005), in the middle and southern Chukchi peninsula, many similar endscrapers have been found from the Ust'-Bel' skaya Culture period (ca. first millennium B.C.E. to first millennium C.E) (Kuzmin 2000) to the Old Bering Sea Culture and Kanchalan Culture periods (first millennium C.E. to second millennium C.E.) (Dikova 1964, Dikov 1979).

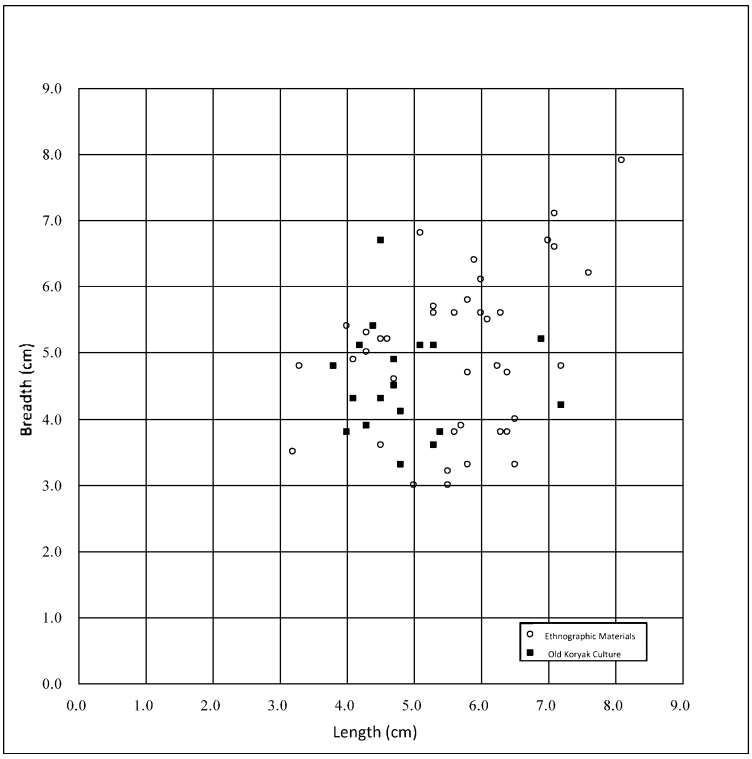

Figure 7 Length and breadth of endscrapers in the Old Koryak Culture and ethnographic materials

However, there is a drastic decline in this type of endscraper in the region from the north coast of the Chukchi peninsula to Wrangel island in the High Arctic. Even though the scarceness of archaeological records may be a factor, there have been very few finds of endscrapers with the above characteristics. In the Kolyma river basin, small and thin scrapers with fine retouching along edges are dominant. And in the Primor'e, Sakhalin and Kuril islands, stone scrapers that have a possibility to have been used as edges of the *transverse-I-type* are very scarce.

On the northwest Alaskan peninsula, especially after the Punuk and Thule Culture periods (latter half of the first millennium C.E. to the second millennium C.E.), there is evidence of interaction with the Chukchi peninsula. However, in the Norton and later periods, archaeological evidence of the possible presence of stone scrapers related to the *transverse-I-type* scrapers is not as clear as in the Chukchi peninsula. In the region from the Aleutian islands to the northwestern Alaskan peninsula, a ground-edge scraper seems to have developed around two thousand years ago, and is believed to have been part of a different tradition than that of the Eurasian technologies with which this study is concerned. The tools in the assemblages that may have been used for hide-working were ground on both surface of edges, unlike the *transverse-I-type* scrapers, and the flaked endscrapers have notches near their bases that serve as stems and are relatively small and thin overall.

Thus it can be determined that the endscrapers with edges retouched in the same manner as the *transverse-I-type* scrapers of the ethnographic record were widely distributed along the north shore of the Okhotsk Sea, the Kamchatka peninsula and the southern half of the Chukchi

peninsula from the first millennium B.C.E. and later. Even though the morpho-technological similarities suggest that the *transverse-I-type* scrapers originated in this region, it is still possible that the endscrapers had a polyphyletic origin. In this sense the region is of some importance for the study of the occurrence and development of the *transverse-I-type s*craper.

On the basis of the present study, however, it is important to realize that the *transverse-I-type* scraper may have been only one of various tools for hide-working. During the Old Koryak Culture period, the lithic assemblage for hide processing was more complex, and there were also variety in direction of tool movement. Sometime during the Old Koryak Culture and before the period of ethnographic documentation, there seems to have been a transition whereby the *transverse-I-type* scrapers became the only tool to be consistently made and used.

Conclusion

Based on the analysis of bone artifacts and stone tools, it can be stated with certainty that the *transverse-I-type* scrapers of the Old Koryak Culture in the Kamchatka and Taigonos peninsulas were hafted onto bone handles to be used for hide-working. However, this type of endscraper, used in a whittling motion, was not the only type to be used in the hide processing; there were also other types of scrapers used in a scraping motion as well. In addition, the consistent presence of endscrapers with indeterminate edge-angles indicates that some endscrapers were used for a variety of tasks at different stages of hide-working. Although there is not yet enough evidence at hand for a detailed discussion of diachronic changes, it is believed that early assemblages contained a variety of stone tools used for diverse purposes, but that at a certain point in time, reliance on the *transverse-I-type* scraper grew, along with an increasing restriction of its function, which was eventually limited to only tool for processing hide.

In modern Kamchatka, women of the indigenous peoples prepare many *transverse-I-type* scrapers and handles; they are used for specific purposes to produce high-quality leather products (Takase 2004, 2005, 2006). It is likely that they have applied their traditional skills for tanning hides to adapt to the rooting of the market economy. In contrast, there are also women who use fewer tools to make hide products for their own use, and individual tools were used for different tasks in various processing stages. Such a practice of using different leather-working techniques is thought to have emerged in the 20th century; the context of use in the Old Koryak Culture is different from either extreme seen today. In the future, it will become possible to trace the temporal development of these tools in the Old Koryak Culture in more detail, and it is also necessary to follow diachronic changes that have occurred from the 18th to the 21st century.

Acknowledgement

I would like to express my gratitude to Dr. A. V. Ptashinski (Kamchatka State University) and Dr. V. V. Petrasheva (Russian Academy of Sciences, Far East Branch, Pacific Institute of Geography) for their guidance and assistance in gaining access to the materials. It goes without saying that I assume full responsibility for the content of this study.

End Notes

1) This does not necessarily mean that use of fish skin and animal hide is mutually exclusive cultural element, and the occurrence of use of fish skin is older than that of animal hide.
2) In this paper, hide-working is defined as the process by which the dermis layer of an animal skin is exposed, and scrapers as tools used in physical, not chemical, removal of the epidermis and hairs from an animal skin (Takase 2004). It should be mentioned that in Eurasia, the *transverse* scrapers also include the *Samoyed* or *West Siberia* type (Sasaki 1992), distributed from west Siberia to the Scandinavian peninsula, but their relationship to the *Paleo-asiatic* type is as yet unclear. The few ethnographic descriptions of the Khanty, Mansi and Sami peoples make evident that the *Samoyed* type alone has many variations in terms of the shapes of handles and edges (e.g., Luk'janchanko 2003, Sokolova 2007), so that regional and temporal differences are issues that must be explored further. Moreover, endscraper means a stone tool without pointed part and retouched on one or more sides on flake to create edge with linear or arc-shaped plan view.
3) It goes without saying that technology and material culture do not necessarily coincide exactly with linguistic and ethnic groups; there are many known instances of peoples of different linguistic groups with mutual cultural influence (Sasaki 1992, Takase 2004, Andreeva and Sem 2004).
4) The Kamennaja site cluster may also contain sites of the Atargan phase.
5) There are few finds with slipped clay rope decoration (Kikuchi 1974b, 1995, 2004) on the north Okhotsk Sea coast, but a great deal has been found in Kamchatka, from the northern part of the peninsula to the central west coast area (Jochelson 1928, Nakayama 1934, Ptashinskij 1989, Semenov 1964, Krenke 2002). The chronological relationships need to be studied in more detail. However, at present it is almost certain that they predate the Old Koryak Culture.
6) According to A. V. Ptashinskij, the material which is exhibited in the Kamchatka State Incorporated Museum comes from the Kamennaja-I site (personal communication).
7) However, I do not believe that the Neolithic chronology is complete and that total dependence on past research is risky. For instance, there is a discrepancy between the Avacha-9 site (Ponomarenko *et al.* 2002) and the third cultural layer of the Ushki sites (Dikov 1979) concerning the age of a distinctive type of assemblage characterized by points with a triangular cross-section using the blade technique. It will become necessary to clear up these problems one by one (Takase 2006, Ptashinskij and Takase 2007).
8) This method is considered a type of low-power analysis (Semenov 1964), and our approach here is a combination of low-power and high-power analyses. Although there are as yet few cases in which replicas have been made to examine use-wear traces, the effectiveness of typological observations of lithic surfaces by SEM has been verified, except at extremely high magnifications of more than 1000x (d'Errico 1988). A more rigorous discussion of this topic will be provided at another time.
9) As with pottery, attention should be given to prevent damage to stone tools through contact with oil and residual silicon (d'Errico 1988: 163). Some specimens may require the use of mold release agents depending on the type of stone and the preservation condition, but I have not had any problems in this respect so far.
10) In my experience, the edge-angles of the heavily abraded Paleolithic endscrapers are relatively stable (Takase 2005, 2007). Thus, it is not possible to find out a tendency that endscrapers of newer age have stable edge abrasion surface.
11) Georg Wilhelm Stellar (1774: 241) recorded that the Itel'men method of tanning was to place a piece of wood like a saddler's stand on their knees, and to scrape the hide back and forth using a crystal implement fastened to the center between two sticks. Although this record diverges somewhat from the ethnographic description of the Koryak and Chukchi methods of hide-working, the act of placing a wooden board on the lap corresponds to ethnographic descriptions and if we take note of the fact that the scraper is used in a back-and-forth motion, and that the stone tool has been attached to the "middle of the haft," there is a strong possibility of the use of the *transverse-I-type* scraper. Stepan. P. Krasheninnikov (1754: 188–189) also wrote that the processing and sewing of hides was women's work among the Itel'men and that they used "a stone secured into a piece of wood" for the task. Although rigorous examination will become necessary to validate continuity from the Tar'ya period, it can be seen that in the mid-18th century, people on the southern Kamchatka peninsula probably used the *transverse-I-type* scraper.

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