Title:

Lithic refitting and its implication for the integrity and duration of site occupation: The case of the Late Upper Paleolithic site of Kiusu-5 in Hokkaido, northern Japan

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Abstract:

This paper presents several production sequence refits from the Late Upper Paleolithic site of Kiusu-5 in Hokkaido, northern Japan, and discusses these refits as potentially important sources of information about the transportation as well as discarding of stone tools and blanks. A few refits show that reduction sequences were involved in the production of flakes, elongated flakes, and blades, and their modification as well as discarding, allow us to infer their stage in the production-use-discard cycle. Furthermore, many refits illustrate that the sets of formal tools (particularly in endscrapers) not accompanied by manufacturing debris were imported into the site and discarded at that spot. Both patterns of the refits from the Kiusu-5 site may indicate the occurrence of the task-specific activity and the relatively short duration of the occupation of the site.

Keywords:

Refitting; Integrity; Occupation; Upper Paleolithic; Endscraper

1. Introduction

It has often been stated that the refitting of chipped stone artifacts can objectively unite isolated artifacts into larger units which make sense in terms of the formation process of an archaeological record. This has provided valuable data for the reconstruction of human behaviors as well as for understanding the taphonomy (e.g., an assessment of integrity of the context, the degree of post-depositional movement, and an approximate order of time that the assemblage represents) of an archaeological record in a site (e.g., Leroi-Gourhan and Brézillon, 1966; Cahen et al., 1979; Villa, 1982; Volkman, 1983; Skar and Coulson, 1986; Pigeot, 1987; Olive, 1988; Roebroeks, 1988; Bergman et al., 1990; Bodu et al., 1990; Cziesla, 1990; Morrow, 1996; Bamforth and Becker, 2000; Vaquero et al., 2007; Sumner and Kuman, 2014). Although the study of refitting in archaeology has a history of more than 100 years, its analytical importance has only been widely recognized in the last four decades (De Loecker et al., 2003). Since the late 1960s, multiple researchers have worked extensively to identify lithic refitting from the study of prehistoric sites in the Old and New Worlds, including Japan (e.g. Anbiru and Tozawa, 1975; Kimura, 1992; Takakura, 2010; 2013). In the study of the Paleolithic sites in Japan, lithic refitting has become a standard practice and is deployed wherever suitable prehistoric sites are encountered.

It is generally accepted that lithic refits can be classified into at least three types (Schurmans, 2007). The first type is a break refit which consists of simply fitting broken artifacts back together. The second type is a production sequence refit, representing the dorsal－ventral refitting in stone artifacts, usually related to the results of the reduction of blanks from lithic raw materials. This type consists of different blanks and/or a blank and a core together. The last type comprises modification or re-sharpening refits, including different retouching flakes (including spalls) and/or a retouching flake and a tool together. Such refits allow us to study how tools (e.g., burins or bifaces) were maintained and recycled (e.g., Jacquier and Naudinot, 2015). Although these different categories of lithic refits may sometimes be blurred, as in technologies where the core becomes the tool (e.g., in the reduction of arrowheads or bifaces) (Schurmans, 2007:8), the distinction retains a heuristic value for understanding a variety of lithic refits among lithic assemblages.

Until recently, the production sequence refits, more specifically those addressing blank production technology and intra-site human behaviors related to the lithic reduction, were a priority on the agenda of lithic refitters (e.g., Anbiru and Tozawa, 1975; Cahen et al., 1979; Volman, 1983; Roebroeks, 1988; Kimura, 1992; Slavinsky et al., 2016). Some of their studies have implicitly regarded production sequence refits as an indicator of knapping activities carried out at a specific time in the past at the place of discovery. This is of course a highly simplified interpretation that cannot fully account for the origin of tool blanks and tools (i.e., their place of production). It should be stressed that the places of production and the processes of transporting tools and blanks by site occupants can be distinguished using systematic analyses of the results of dorsal－ventral refitting (De Bie, 2007).

Although it is usually difficult to specify the duration of an occupation and the number of occupational events at a particular site, in the analysis of production sequence refits an important clue can be found for understanding the relative duration of a site's occupation. Morrow (1996) insists that the span of occupation at a site should not be assessed only through the elucidation of aspects of discarding behavior, distinguishing between and correlating primary and secondary refuse deposits, but also by identifying the frequency of ghosts and orphans stemming from lithic refitting. According to Morrow's definitions, ghosts designates tools and blanks that are missing from a refitted set, while orphans mean tools and blanks that cannot be fitted to any other flakes. His assumption is that when the frequency of ghosts and orphans is high in given a site assemblage, the duration of its occupation is shorter than the use life of the artifacts, indicating a highly mobile group.

In this paper, I would like to show several production sequence refits obtained from a Late Upper Paleolithic component at the Kiusu-5 site in Hokkaido, Northern Japan, and argue that these refits are potential important sources of information for the transportation as well as the discarding of stone tools and blanks at the site. In addition, I drew out the integrity and duration of the occupational event(s) at the Kiusu-5 site through reconstruction of the transportation and discarding of the refits.

2. The Kiusu-5 site

This paper deals with archaeological materials from Kiusu-5, an Upper Paleolithic site located in the central part of the Ishikari lowland, central Hokkaido (Fig. 1). An extensive rescue excavation of the Kiusu-5 site was carried out by the Hokkaido Archaeological Operation Center from 2003 to 2009 (Suemistsu, 2013), which opened an area of 13,655 m^2 (Fig. 2). The excavation revealed the presence of a single Late Upper Paleolithic component, occurring above the primary Eniwa-a (En-a) pumice fall deposit that dates to approximately 17,000 radiocarbon years BP (Umetsu, 1986). No archaeological features associated with the Late Upper Paleolithic assemblage, such as dwelling structures and hearths, have been confirmed at this site. The acidity of the deposits in the region is unfortunately not conducive to the preservation of organic artifacts. The reconstruction of human behaviors performed at the site is thus based solely on the analyses of the lithic artifacts recovered and their distribution.

This component consists of 27,106 artifacts including microblades, microblade cores, burins, burin spalls, endscrapers, sidescrapers, drills, points, bifaces, retouched flakes, blades, elongated flakes, cores, flakes, chips, adzes, stone hammers, stone grinders, anvil stones, pebbles, and pieces of ochre (Table. 1). These artifacts are made of obsidian (N = 25,932), hard shale (N = 930), chert (N = 17), mudstone (N = 151), sandstone (N = 20), andesite (N = 10), tuff (N = 6), basalt (N = 1), and limonite (N = 39). From the spatial distribution of the lithic artifacts, three lithic concentrations (SB-1, SB-2, and SB-3) have been identified within the Kiusu-5 site as distinct (Fig. 2) (Suemitsu, 2013). Although two concentrations, SB-1 and SB-3, have not been completely excavated and documented, each of them is expected to have originally been around 10 m in diameter. There is a distance of more than 40 m between the lithic concentrations.

The lithic artifacts from those concentrations are particularly characterized by prismatic blade core technology leading to the production of formal stone tools such as endscrapers, sidescrapers, and burins, and wedge-shaped bifacial microblade core technology termed the Oshorokko type from the Late Upper Paleolithic. Many researchers agree that the lithic assemblage, with its Oshorokko type microblade cores, belongs to the Terminal Pleistocene, from a techno-typological point of view (roughly from 13,000 to 11,000 radiocarbon years BP) (e.g., Kimura, 1995; Nakazawa et al., 2005; Yamada, 2006; Takakura, 2012; Akai, 2016).

It appears that there is little difference between the lithic assemblages from SB-1, SB-2, and SB-3 in their overall technological and typological characteristics. For this reason, the assemblages from concentrations SB-1, SB-2, and SB-3, consisting of co-occurring sets of identical typological and technological traits, give little reason to suspect that they have mixed with other assemblages.

Obsidian is the main exploited raw material in the Late Upper Paleolithic assemblage at the Kiusu-5 site, followed by hard shale, mudstone and sandstone. There are 25,932 obsidian artifacts in the lithic assemblage, representing 96% of the entirety of the assemblage. Suemitsu (2013) presents the results of analyses of the source provenance of the obsidian artifacts, using energy dispersive X-ray fluorescence (EDXRF). There are 41 samples that have been treated by these analyses. The samples include microblade cores (N = 9), endscrapers (N = 26), sidescraper (N = 1), drills (N = 2), burin (N = 1), biface (N = 1), and retouched flake (N = 1). The results of EDXRF analysis show that all samples from the Late Upper Paleolithic assemblage originated in Akaigawa, a major source of obsidian in Hokkaido and at least 80 km from the Kiusu-5 site (Fig. 1). We can thus conclude that the obsidian artifacts were transported some distance from the Kiusu-5 site.

By contrast, the sources of hard shale, mudstone and sandstone used in this assemblage have yet to be systematically studied. Nevertheless, high-quality cobbles of hard shale can only with difficulty be acquired near the site, because of the geological distribution of sedimentary rocks in the central part of the Ishikari lowland (Nakazawa, 2016). Therefore, materials made of hard shale might also be transported from some distance from the Kiusu-5 site.

The Upper Paleolithic assemblages of most sites near the major sources of obsidian in

Hokkaido (Fig. 1) (e.g. the Shirataki site group located in eastern Hokkaido) are generally dominated by a primary reduction of blanks into blades, bifaces, and boat-shaped tools; in turn, they yield large quantities of obsidian artifacts, mostly debitage (e.g., Kimura, 1992; Takakura, 2013). By contrast, various lithic reduction processes and traces of the transportation of tools and blanks are observable in sites a considerable distance from the sources of obsidian. Indeed, analyses of the manufacturing processes and the consumption of lithic raw materials among many Late Upper Paleolithic assemblages in the Ishikari lowlands, as demonstrated by Akai (2016), show that multiple blanks, such as prefabricated percussion cores, blades, bifaces, and retouched tools, were imported into the sites from various sources, and various reduction sequences, such as the flaking of blades (and microblades), the retouching and re-sharpening of tools, and bifacial thinning, were done at these sites.

Taking into consideration the distance between the Kiusu-5 site and the nearest source of obsidian, we can predict that obsidian tools and blanks (e.g., blades and bifaces) were imported into the site from the sources of lithic raw materials where there probably were workshops, and therefore various lithic reduction processes were employed at the Kiusu-5 site. The analyses of the abundant lithic refits obtained from this site will help deepen understanding of human behaviors of transportation as well as of discarding tools and blanks.

3. Refits from the Kiusu-5 site

The Hokkaido Archaeological Operation Center has intensively engaged in the physical refitting of chipped stone artifacts from the Kiusu-5 site. Through its systematic approach to lithic refitting, 266 break refits and 130 production sequence refits (or modification or re-sharpening refits) have been recognized from the Late Upper Paleolithic component (Suemitsu, 2013). The raw materials used in the production sequence refits (or modification or re-sharpening refits) include obsidian (N = 108), mudstone (N = 13), hard shale (N = 8), and sandstone (N = 1). To isolate different minimal analytical nodules (Larson and Ingbar, 1992; Nielsen, 2017) from obsidian pieces is difficult, because these do not exhibit remarkable macroscopic variation (i.e., type of cortex, texture, presence of fissures and joints, color, and interior inclusions) from one piece to another. Nevertheless, 1,040 artifacts have been refitted to date. The total number of larger artifacts, not including the small chips in the assemblage, is 6,252. Thus, the degree of refitting success (i.e., percentage of artifacts consisting of refits among the total number of larger artifacts in the assemblage) is nearly 16%. This is roughly similar to the average refitting success of flint artifacts found in European Upper Paleolithic studies (e.g., Pigeot, 1987; Almeida, 2007).

Although the distribution of artifacts composing of each production sequence refit is mainly limited to each lithic concentration within the site (SB-1: 11 refitted sets, SB-2: 59 refitted sets, SB-3: 52 refitted sets, and outside of the concentrations: 4 refitted sets), the distribution of a few production sequence refits (only four examples) extends over two or more lithic concentrations (Fig. 2 and Table. 2). The distinctive distribution of lithic concentrations and the distances between them leads away from the conclusion that this distribution of refits was affected by post-depositional movement. Therefore, we put forward that knapping scatters were not significantly modified by post-depositional disturbances.

The production sequence refits (or modification or re-sharpening refits) obtained from the site indicate the reduction of flakes (N = 78), elongated flakes (N = 12), blades (N = 32), burin spalls (N = 7), blank of microblade core (N = 1), and biface (N = 1). The refits indicating the reduction of blades, microblade core blanks, and bifaces are exclusively made of obsidian (Table. 3). This demonstrates that a particular kind of raw material was expected to be used in the production of these artifacts. However, the refits related to the reduction of flakes are made of various raw materials, such as obsidian, hard shale, mudstone, and sandstone.

Examples showing the reduction of burin spalls, microblade core blanks, and bifaces should be evaluated as modification or re-sharpening refits (Fig. 3). Refits showing the reduction of burin spalls include not only burins refitted with spalls (N = 4) but also different spalls together (N = 3). In the refits from the Kiusu-5 site related to the modification or re-sharpening processes, one or few flakes (spalls) were simply refitted with burins, microblade core blanks, and bifaces (see Table. 2). Thus, it appears that the modification or re-sharpening of burins, microblade core blanks, and bifaces did not intensively occur at the site.

The majority of production sequence refits (73%) are made up of only two or three conjoinments (i.e., refitted broken artifacts), but there are 14 sets composed of more than 5 conjoinments, up to a maximum of 64 (refitted set No. 45) (see Table. 4). Under such cases, the refitted sets Nos. 55, 57, 66, 78, 75, and 73 demonstrate that many flakes and elongated flakes with natural cortexes are conjoined and that the reduction of flakes and elongated flakes from obsidian angular cobbles took place within SB-2 (Figs. 4 and 5). These examples have exclusively been recovered from SB-2. The reduction sequences in the refitted sets Nos. 55 and No. 57 were especially characterized by the removal of irregular flakes. While the cores in the refitted sets Nos. 57 and No. 78 were discarded at the same spot where the cores were exhausted by flaking, the cores in the refitted sets Nos. 55, 66, 75, and 73 are missing from the refits, implying that those cores were probably exported for other occupations. Thus, these refits (Nos. 55, 57, 66, 78, 75, and 73) suggest that obsidian core blanks roughly prepared at the previous occupation were imported into the site, and immediately knapped at a certain spot for the production of flakes and elongated flakes (SB-2).

Refitted set No. 45, which uses sub-angular obsidian cobbles, shows that core blanks were transported to the site and that the reduction of blades, the modification or re-sharpening of tools (e.g., endscrapers, sidescrapers, and burins), and the discarding of tools and cores mainly took place at SB-2 (Fig. 6). Refitted set No. 45 is only example of the extensive production of blades that apparently characterize the assemblage. Repeated rejuvenations of platforms and flaking faces resulted in the exhaustion and abandonment of the core in this refitted set. It is important to note that retouched tools included in the refitted set No. 45 were abandoned in the area where they were manufactured, after utilization and re-sharpening near the same spot. Interestingly, the refitted products of different technological stages of blade reduction are spatially clustered at SB-2. Therefore, this refit illustrates that the roughly prepared core blank was imported into the site and knapped for the production and the immediate use of blades and tools within the limited area of activity. This refit can be interpreted as reflecting task-specific activities from the transportation of raw materials to the use and discarding of blanks and tools at the site.

On the other hand, many examples demonstrate that tools (e.g., endscrapers, sidescrapers, burins, and retouched flakes) manufactured principally on formal blades, without natural cortex, are conjoined in a dorsal-ventral refit but are lacking debitage waste and cores (Fig. 7). De Bie (2007: 41) insisted that the place of the production of examples that were only refitted with other tools cannot be determined from refitting alone. However, the numerous cases only refitted with other tools observed in the Kiusu-5 site allow us to infer that they were made outside of that site and were transported from a previous location. These refits can be regarded as orphans (Morrow, 1996). The examples sharply contrast with refits representing the conducts of intensive reduction of blade blanks in terms of their transportation between sites. Most modified or re-sharpened tools in these refits are not related to the blade core reduction processes developed at the Kiusu-5 site, as seen in the refitted set No. 45, and were therefore introduced into the site as either tools or unmodified blade blanks from previous occupation. Recognition of this undoubtedly emphasizes the mobile character of blade blanks and tools (particularly in endscrapers), which were associated with movement between sites.

Moreover, it is necessary to stress that most artifacts including these refits tend to be restrictively recovered from the same spot within the site (Table. 2). The refitted sets Nos. 62, 63, 67, 90, and 97 belong to SB-2. The refitted sets Nos. 11, 15, 16, 21, 70, and 65 were obtained from SB-3. The artifacts composing the refitted set No. 61 were exceptionally recovered from SB-1, SB-2, and SB-3. Additionally, the artifacts composing the refitted set No. 49 were recovered from SB-2 and SB-3. Nevertheless, it is apparent that most remains consisting of these refits are spatially clustered within a single activity area (i.e., SB-2 and SB-3). These patterns may be used to support the explanation of the distinctiveness and internal integrity of human behaviors within each activity area, with regard to the transportation, use, and discarding of blade blanks as well as tools.

4. Discussion and conclusion

Our understanding of the mobility strategies of the prehistoric hunter－gatherers during the Late Upper Paleolithic in Hokkaido has long relied on inferences drawn from the raw material economy and the variability of tool kits (e.g., Kimura, 1992; 1995; Nakazawa et al., 2005; Yamada, 2006). Nevertheless, we should consider that both of them do not directly represent the specificity of mobility (e.g., the duration in a given location, the frequency and distance of their movement, the extent of the region they occupied, and the time between repeated occupations of the same location) (Sellet, 2006). It is here proposed that various production sequence refits (or modification or re-sharpening refits) can be confirmed from the Late Upper Paleolithic assemblage at the Kiusu-5 site through a systematic refitting procedure. Interestingly, these demonstrate a variety of processes of transportation and discarding with regard to tools and blanks employed by the occupants during the Late Upper Paleolithic, providing us with an important suggestion of the integrity and relative duration of the occupation within each activity area at the site.

In the case of the Kiusu-5 site, the reduction sequences reflected in the refitted sets Nos. 55, 57, 66, 78, 75, and 73 were involved in the production of flakes and elongated flakes, and their modification as well as their discarding. In these refitted sets, roughly prepared core blanks were imported into the site, and removal of various flakes and elongated flakes were subsequently employed at SB-2. Furthermore, the refitted set No. 45, the only example that shows any reduction of blades, illustrates that the importation of core blanks, and the production, use, and discarding of blades and tools occurred at a certain spot (SB-2). In this refit, non-local raw material was utilized, which may have originated in the Akaigawa obsidian source, but manufacturing was for immediate use. This case can be interpreted as representing the occurrence of task-specific activities and its relative immediate episode of production－use－discard cycle at SB-2.

On the other hand, many formal tools (particularly in endscrapers) and blades were transported to the site from a previous occupied location and discarded at a certain spot, which was not obviously associated with the production of blanks. It is evident that the transportation of the tools and/or blanks occurred between occupations, partially maintaining the state of sets produced outside of the site. These are orphans (Morrow, 1996), in the sense that they are not accompanied by manufacturing debris.

In addition, it appears that most numerous un-refitted tools made on blades, such as endscrapers, sidescrapers, and burins, obtained from the Kiusu-5 site, were also imported into the site either as tools or unmodified blades. Therefore, the frequency of orphans is relatively high among the lithic assemblage from this site. These transported tool kit may demonstrate that the relative duration of the occupation(s) at the Kiusu-5 site did not exceed the average use-life of the formal tools that characterize the assemblage. The transportation of many specific tools, while sometimes maintaining the state of sets produced in the lithic workshop sites, may be associated with tasks conducted during special-purpose, long-distance logistical forays (see Thacker 2006).

On the basis of the above refitting data, the distribution of artifacts composing each production sequence refit at the Kiusu-5 site tends to be limited to a certain area of activity within the site. In fact, there are very few refits at the site that extend over two or more lithic concentrations. Notably, this exhibits that lithic remains were rarely moved over long distances within the site. The poor evidence for inter-locus refits at the Kiusu-5 site contrasts sharply with spatial patterning of numerous inter-locus refits in many other sites, having been interpreted as the camps of mobile hunter-gatherers during the Upper Paleolithic (Leroi-Gourhan and Brézillon, 1966; Pigeot, 1987; Olive, 1988; Bodu et al., 1990; Eickhoff, 1990; Floss and Terberger, 1990; De Bie, 2007; Rensink, 2012; Beyries et al., 2015; Brenet et al., 2017).

In general, the connection through refits of different lithic concentrations provides us with evidence for the temporal relationships and human activities among the accumulations of remains to be evaluated (e.g., Roebroeks and Hennekens, 1990; Hofman, 1992; Casper and De Bie, 1996). Refits from the Kiusu-5 site are, however, not enough to prove that the three activity areas were contemporaneous. Rather, it is necessary to consider that artifacts discarded by the primary occupants can sometimes be recycled during later occupational events and transported to other areas, as has been demonstrated by several studies (Larson and Ingbar, 1992; Vaquero et al., 2007, 2015, 2017; Brenet et al., 2017).

Although the three lithic concentrations apparently share identical lithic technological characteristics and provenances of raw materials, it is necessary for us to emphasize the distinctiveness and internal integrity of human behaviors within each activity area at the Kiusu-5 site, with regard to the transportation, use, and discarding of blade blanks as well as tools. Indeed, the refits allow us to discern that the occupational activities in each area were undertaken separately, regardless of whether the three lithic concentrations were contemporaneous or not.

It should be noted that refits of formal tools (e.g., endscrapers, sidescrapers, and burins) and blanks (e.g., blades) lacking debitage are frequently observed in other lithic assemblages of Hokkaido during the Late Upper Paleolithic (Takakura, 2000; Akai, 2016; Yamada, 2016). The Late Upper Paleolithic assemblage from the Yoshiizawa site, associated with the Oshorokko type microblade cores, is one of those instances. Formal stone tools made on blades, such as endscrapers, also dominate the composition of the stone tools in this lithic assemblage (Takakura, 2000; Yamada, 2016). Use-wear analysis in the assemblage from the Yoshiizawa site reveals that most endscrapers were used for a small number of specific tasks, such as hide working, rather than being employed in multi-functional purposes (Iwase et al., 2016). Therefore, these results prompt us to interpret that the endscrapers associated with the Oshorokko type microblade cores during the Late Upper Paleolithic were frequently made outside of the site and transported into the site for task-specific occupation(s) in certain areas of activity.

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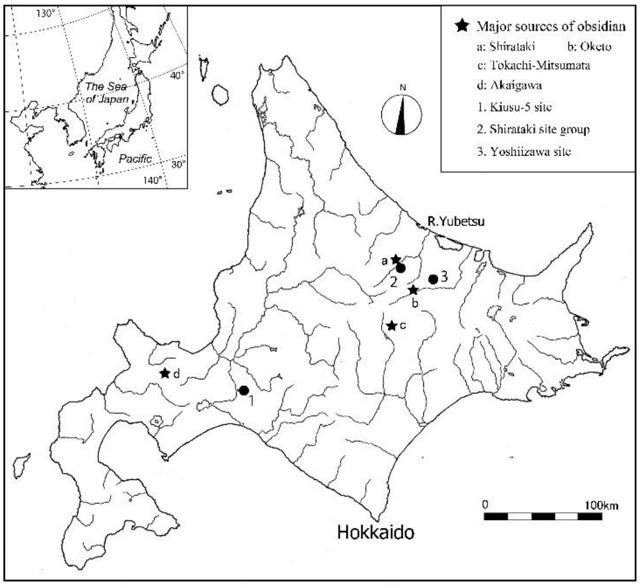

Figure 1: Locations of archaeological sites and obsidian sources mentioned in this paper.

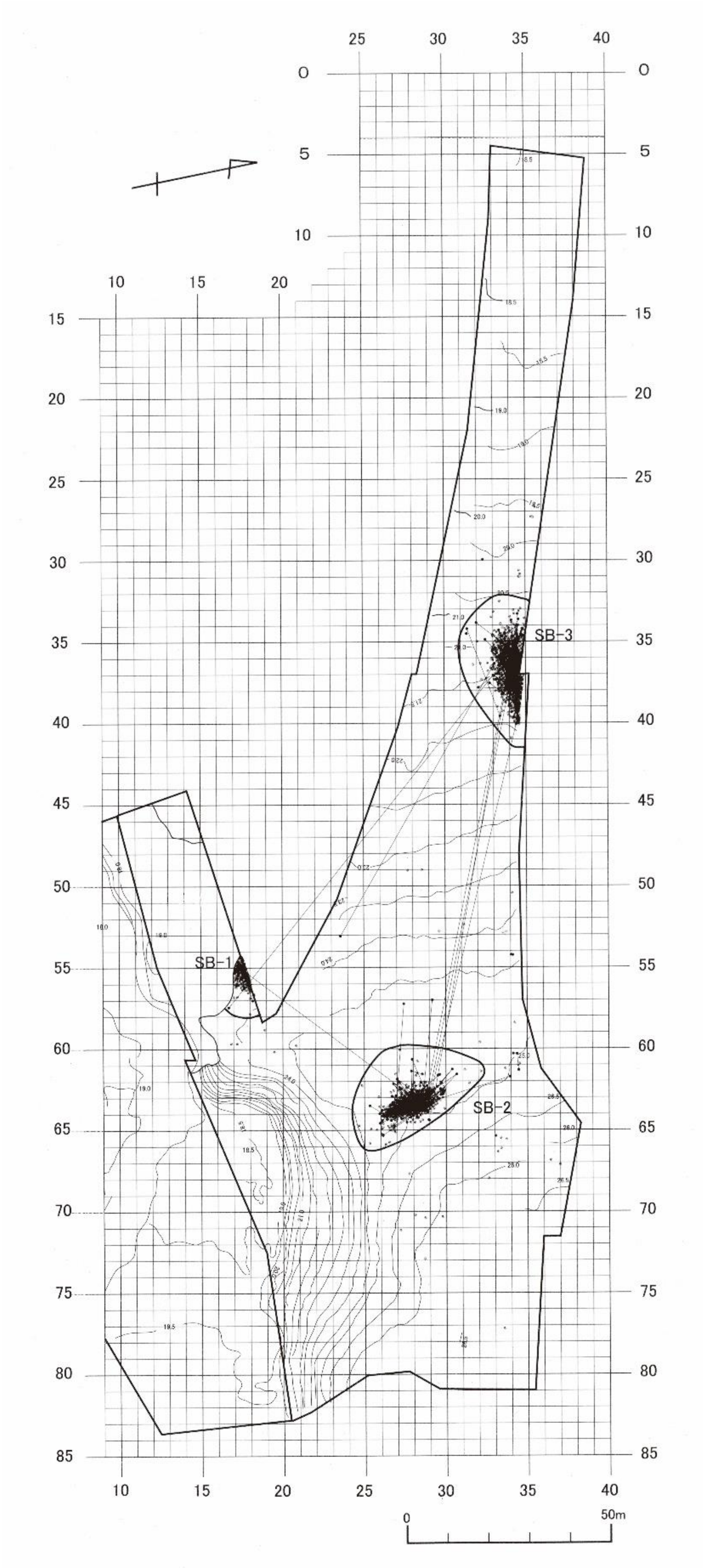

Figure 2: Distributions of stone artifacts within the Kiusu-5 site (Suemitsu, 2013). The connection lines among the small dots show refitted artifacts.

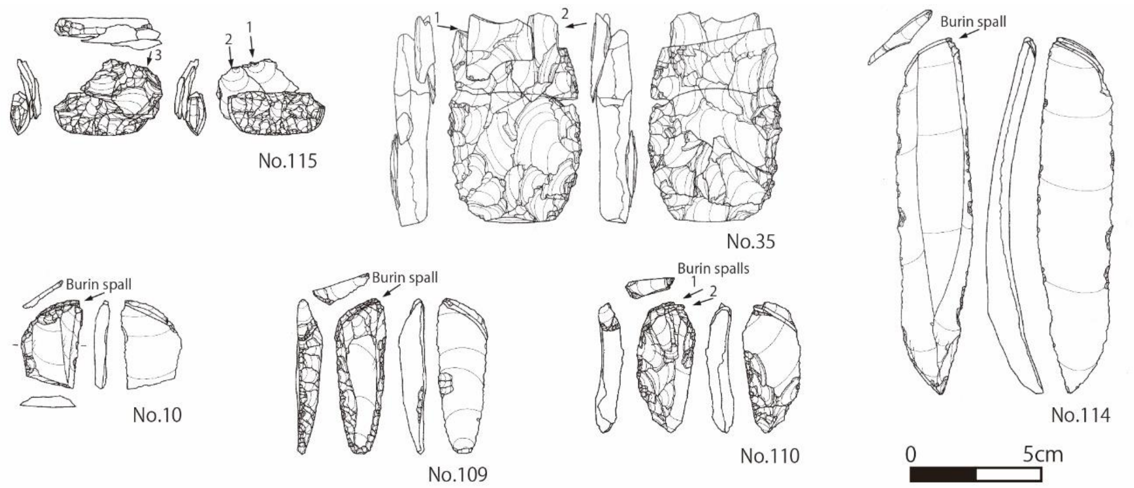

Figure 3: Refitted sets from the Kiusu-5 site (1) (modified after Suemitsu, 2013): Nos. 115 (reduction of blank of microblade core using obsidian), 35 (reduction of biface using obsidian), 114, 10, 109, and 110 (reduction of burin spalls using hard shale). Note: the arrows indicate direction of removals. The Arabic numerals correspond to the sequential order of removals.

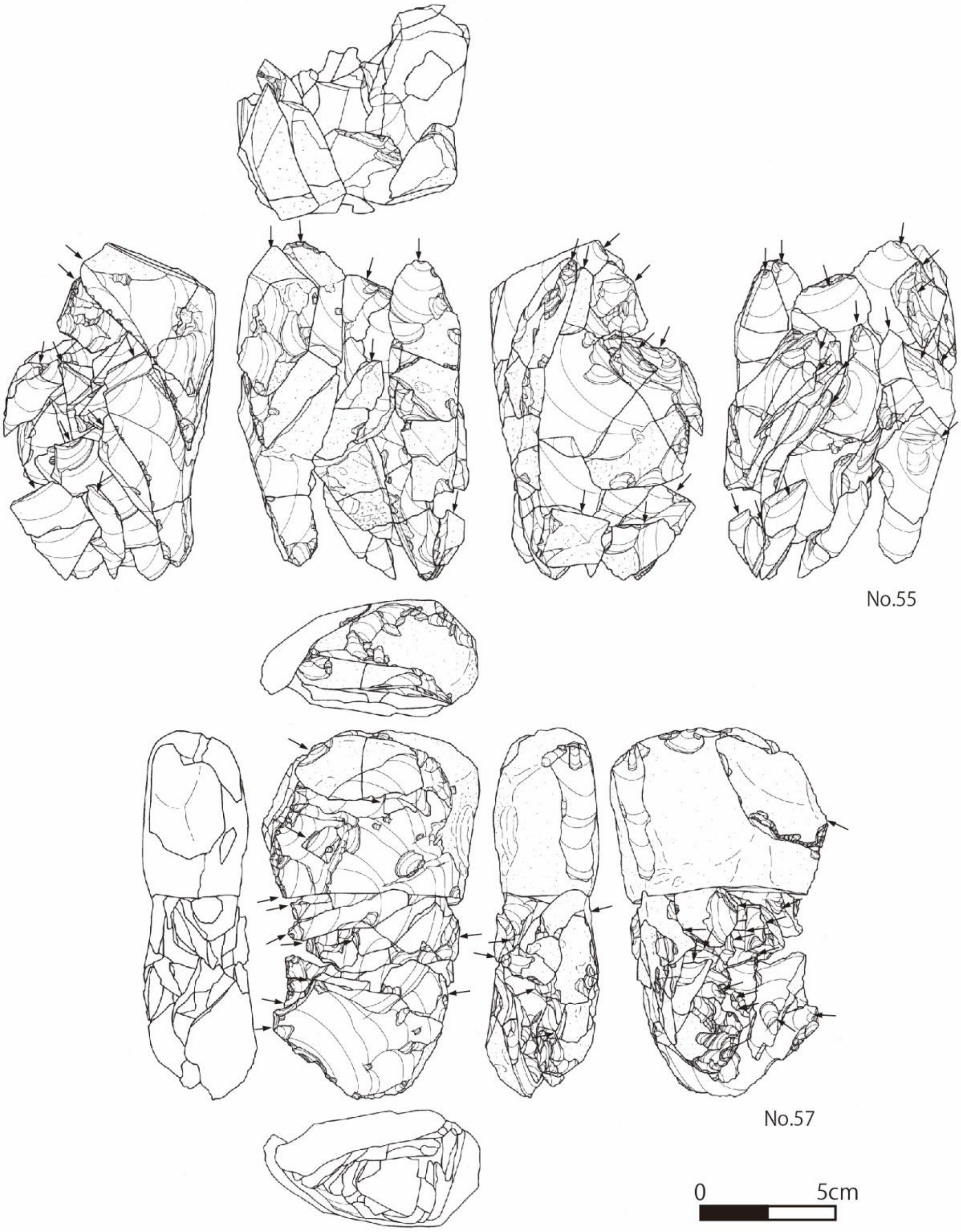

Figure 4: Refitted sets from the Kiusu-5 site (2) (modified after Suemitsu, 2013): Nos. 55 and 57 (reduction of flakes using obsidian). Note: the arrows indicate direction of removals.

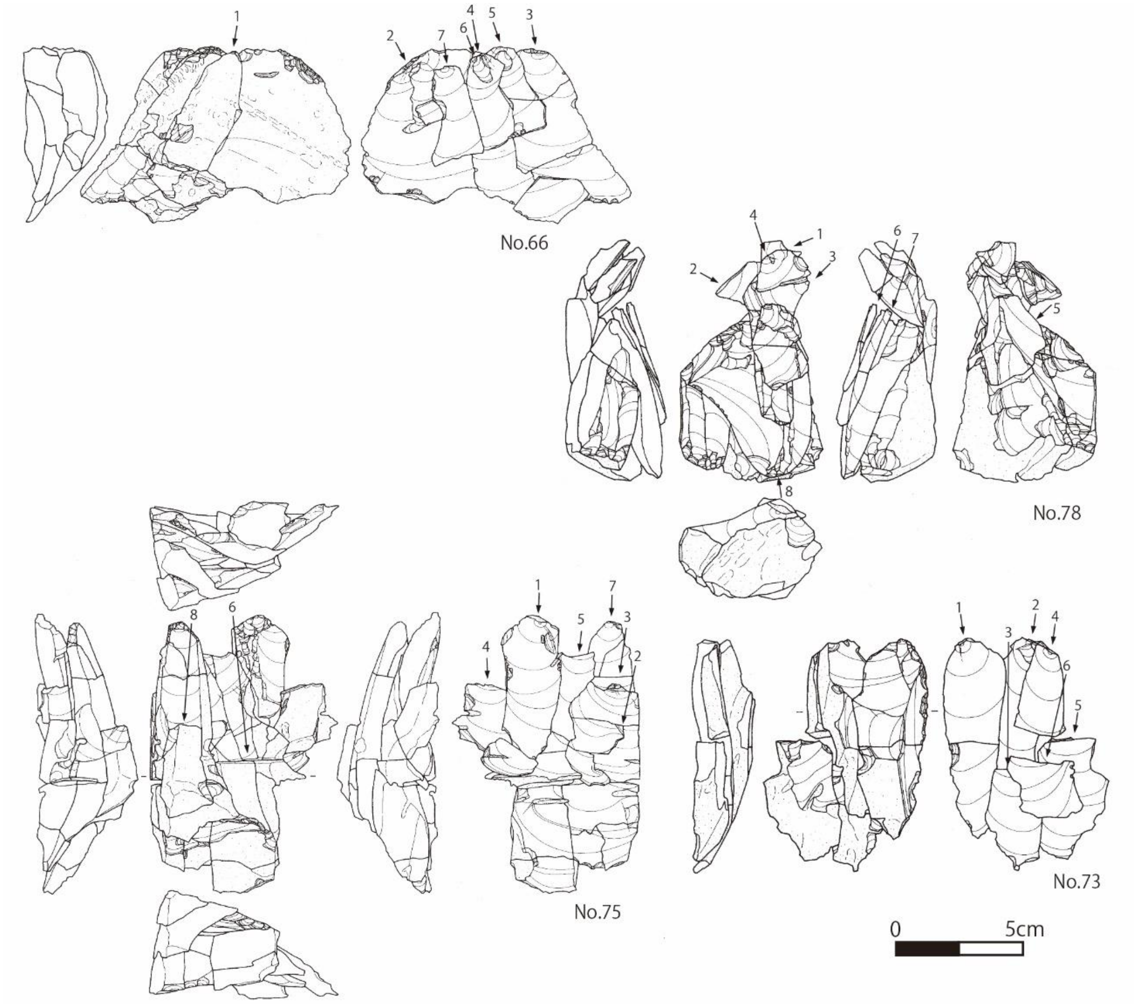

Figure 5: Refitted sets from the Kiusu-5 site (3) (modified after Suemitsu, 2013): Nos. 66, 78 (reduction of flakes using obsidian), 75, and 73 (reduction of elongated flakes using obsidian). Note: the arrows indicate direction of removals. The Arabic numerals correspond to the sequential order of removals.

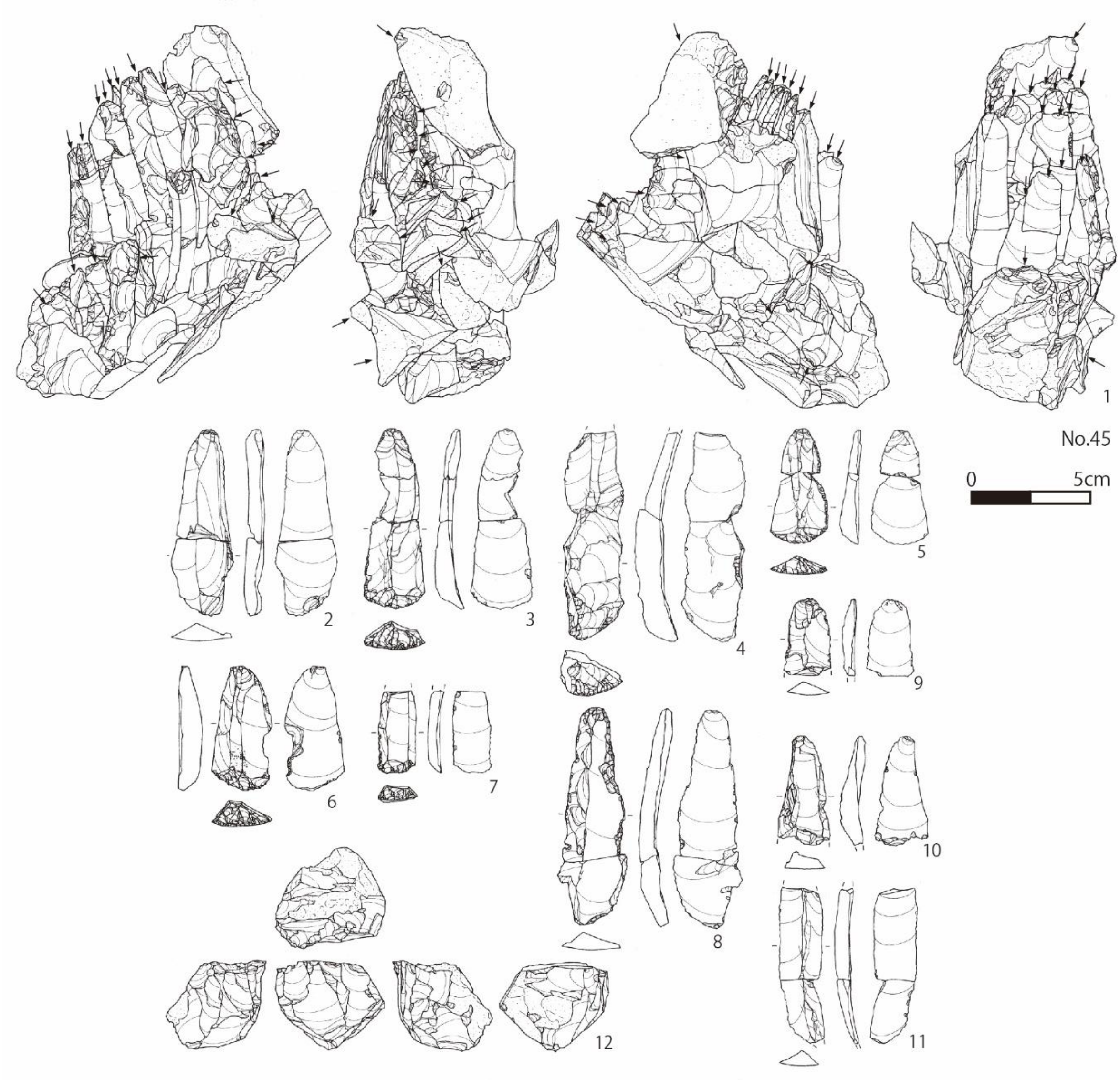

Figure 6: Refitted sets from the Kiusu-5 site (4) (modified after Suemitsu, 2013). 1: refitted set No.45 (reduction of blades using obsidian), 2-12: artifacts included in refitted set No.45 (2: burins, 3-7: endscrapers, 8: sidescraper, 9-11: blades, 12: core). Note: the arrows indicate direction of removals.

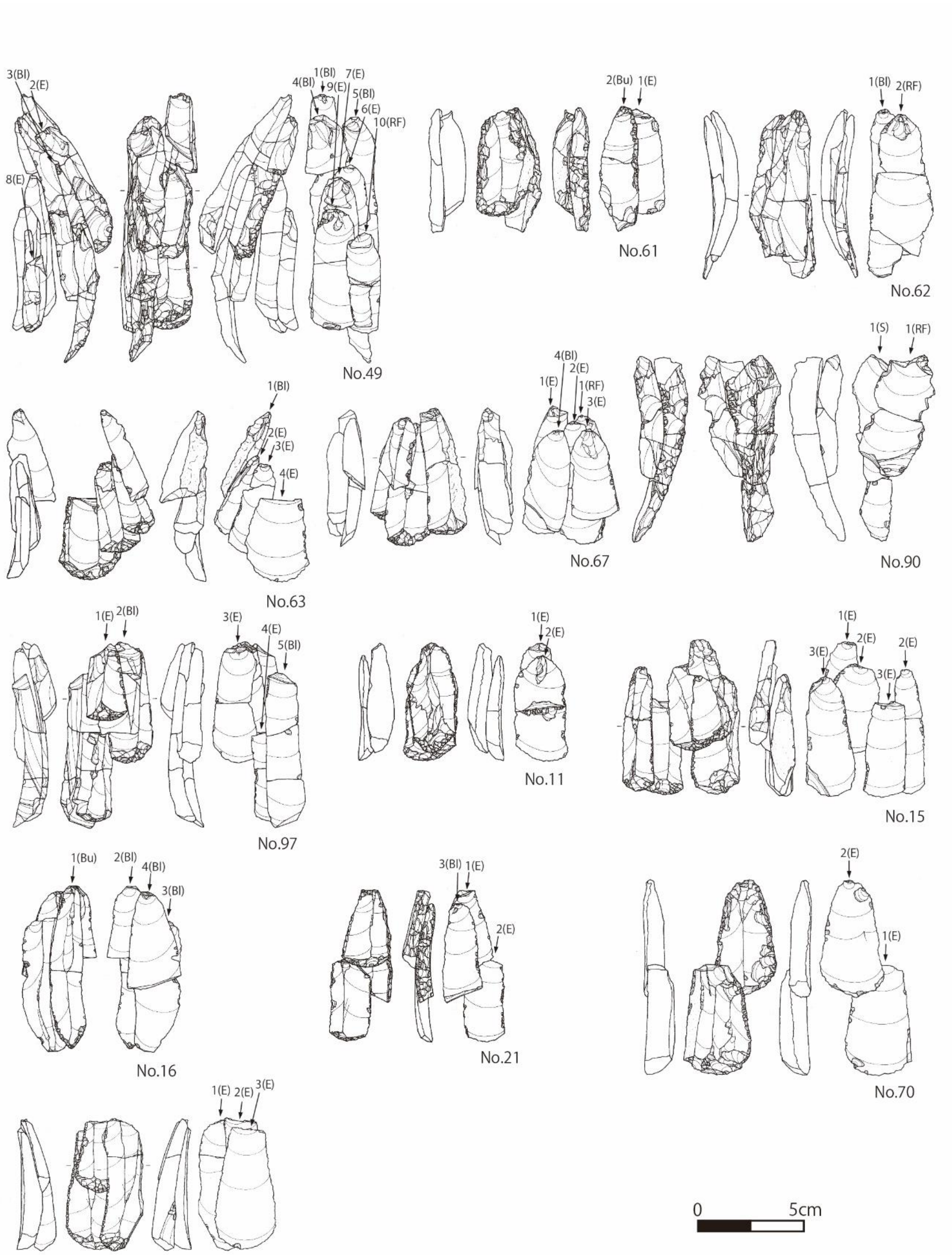

Figure 7: Refitted sets from the Kiusu-5 site (5) (modified after Suemitsu, 2013): Nos. 49, 61, 62, 63, 67, 90, 97, 11, 15, 16, 21, 70, and 65. Note: the arrows indicate direction of removals. The Arabic numerals correspond to the sequential order of removals (E: endscraper, Bl: blade, Bu: Burin, S: sidescraper, RF: retouched flake).

Table 1: Composition of the lithic assemblage from the Kiusu-5 site.

	Microblade	Micoblade core	Burin	Burin spall	Endscraper	Sidescraper	Drill	Point	Biface	Retouched flake	Blade	Elongated flake	Core	Flake	Chip	Adze	Stone hammer	Stone grinder	Anvil stone	Pebble	Ochre
SB-1	19	1	6	20	39	10	1	0	3	31	14	25	0	233	1532	1	0	0	0	2	5
SB-2	104	2	30	203	176	36	4	3	2	217	179	138	32	1997	13587	1	2	1	0	18	30
SB-3	71	18	23	127	152	32	6	0	14	116	102	84	5	1774	5731	5	1	0	1	2	4
Other	1	0	3	4	12	9	0	6	2	12	20	3	0	57	4	1	0	0	0	0	0
Total	195	21	62	354	379	87	11	9	21	376	315	250	37	4061	20854	8	3	1	1	22	39

Table 2: Composition of stone artifacts consisting of the refitted sets referred in the text. Note that the number in the parenthesis denotes the number of stone artifacts.

Refitted sets	Raw materials	SB-1	SB-2	SB-3	Other
No.115	Obsidian			Microblade core(1), Flakes(3)	
No.35	Obsidain			Bifaces(2), Flakes(4), Chip(1)	
No.114	Hard shale	Burin(1)	Spall(1)		
No.10	Hard shale	Burin(1), Spalls(7)			
No.109	Hard shale		Burin(1), Spall(1)		
No.110	Hard shale		Burin(1), Spalls(2)		
No.55	Obsidian		Retouched flakes(15), Elongated flakes(4), Flakes(31)		
No.57	Obsidian		Sidescrapers(1), Flakes(40), Chips(5), Cores(2)		
No.66	Obsidian		Sidescraper(1), Retouched flakes(6), Flakes(7)		
No.78	Obsidian		Elogated flakes(2), Flakes(8), Cores(2)		
No.75	Obsidian		Elogated flakes(5), Flakes(17)		
No.73	Obsidian		Sidescrapers(2), Elogated flakes(4), Flake(1)		
No.45	Obsidian		Endscrapers(8), Burins(2), Sidescrapers(2), Retouched flakes(6), Blades(19), Flakes(56), Core(1)		Flake(1)
No.49	Obsidian		Endscrapers(10), Blades(6), Retouched flake(1),	Blade(1)	
No.62	Obsidian		Retouched flakes(3), Blades(2)		
No.63	Obsidian		Endscrapers(4), Blade(1)		
No.67	Obsidian		Endscrapers(5), Retouched flake(1), Blade(1)		
No.90	Obsidian		Sidescrapers(1), Retouched flakes(3)		Blade(1)
No.97	Obsidian		Endscrapers(5), Blades(5)		
No.11	Obsidian			Endscrapers(3)	
No.15	Obsidian			Endscrapers(6), Blade(1)	
No.16	Obsidian			Burins(2), Blades(3)	
No.21	Obsidian			Endscrapers(2), Blade(1)	
No.70	Obsidian			Endscraper(1)	Endscraper(1)
No.65	Obsidian			Endscrapers(4)	
No.61	Obsidian	Endscraper(1)	Burin(1)	Burin(1)	

Table 3: Types of reduction sequences and lithic raw materials used in refitted sets from the Kiusu-5 site.

Reduction type	Raw materials				Total
	Obsidian	Hard shale	Mudstone	Sandstone	
Flakes	62	2	13	1	78
Elongated flakes	11	1	0	0	12
Blades	31	0	0	0	31
Burin spalls	2	5	0	0	7
Blanks of microblade core	1	0	0	0	1
Bifaces	1	0	0	0	1
Total	**108**	**8**	**13**	**1**	**130**

Table 4: Types of reduction sequences and distribution of refitting sets according to the number of conjoinments (i.e., refitted broken artifacts).

Reduction type	The number of conjoinments										Total
	2	3	4	5	6	7	8	9	10	10<	
Flakes	51	8	9	3	2	1	0	2	0	2	78
Elongated flakes	7	2	0	0	2	0	1	0	0	0	12
Blades	17	4	3	3	2	0	0	0	1	1	31
Burin spalls	4	2	1	0	0	0	0	0	0	0	7
Blanks of microblade core	0	0	1	0	0	0	0	0	0	0	1
Bifaces	0	0	0	1	0	0	0	0	0	0	1
Total	**79**	**16**	**14**	**7**	**6**	**1**	**1**	**2**	**1**	**3**	**130**