The Dynamics of Obsidian Use by the Microblade Industries of the Terminal Late Palaeolithic

Takashi Tsutsumi*

This paper discusses the procurement and utilization of obsidian by the microblade industries of the terminal Late Palaeolithic in the Chubu and Kanto districts of central Japan at the end of the last glaciation, 18,000–16,000 cal BP. The core of the discussion is based on the source determinations for 4,000 obsidian artifacts from sites in these two regions.

The sourcing results identified obsidians from five groups of sources in the Chubu and Kanto districts—Wada Suwa, Tateshina, Kozushima, Hakone and Amagi—and procurement and utilization of all five sources in the microblade industries in the same districts. Among these sources, both Wada–Suwa and Kozushima obsidians were identified in sites over 200 km from the sources, indicating development of wide zones of utilization. Possible strategies for using these sources include direct procurement, trade, and embedding (in seasonal rounds). Which strategy, or strategies, was actually used is not known at this moment.

There was a distinct increase in the use of obsidian from the Kozushima source, on an island in the Pacific Ocean, by the microblade industries, compared to earlier phases of the Late Palaeolithic. The microblade-technology revolution for the efficient use of lithic resources and the aggressive development of obsidian sources on distant islands reflect a strategy of the peoples in the Japanese Islands for adapting to the rapid changes in the environment at the end of the Pleistocene.

Keywords: obsidian source, microblade industry, source determination procurement strategy, procurement zone

I. Introduction

Human is a tool-using animal. Consequently, they face the problem of finding and developing sources of raw materials for the tools their livelihood depends on. This has been a basic problem since the beginning, the Palaeolithic Period, right up to modern times, and it will be a continuing problem into the future. The theme of this symposium is “Abrupt Environmental Changes and Human Activities from the Last Glacial to the Holocene.” This paper deals with how humans handled the use of resources in this transitional period. Specifically, this paper discusses the procurement and utilization of obsidian by the microblade industries during the terminal Pleistocene (18,000–16,000 cal BP) in the Chubu and Kanto districts of central Japan. Japan is a part of the Pacific volcanic arcs, and there are many obsidian sources in the islands, from Hokkaido in the north to Kyushu in the south. In the Chubu and Kanto districts, the main obsidian sources are Takaharayama (Tochigi Prefecture), Wada–Suwa (Nagano Prefecture), Tateshina (Nagano Prefecture), Kozushima (Tokyo Prefecture), Hakone (Kanagawa Prefecture), and Amagi (Shizuoka Prefecture). Based on the differences in the elemental composition of these sources, a large number of palaeolithic obsidian artifacts have been identified to source in...
recent years. Masao Suzuki, a pioneer in obsidian analysis, and Tetsuo Warashina, Shuji Ninomiya, Iwao Inoue and Shigeo Sugihara have studied the elemental composition of these sources and of obsidian artifacts from the sites where obsidian was used in order to determine patterns of obsidian use. They have produced extremely useful results.

This author, an archaeologist, and a chemical analyst Akihiko Mochizuki have used non-destructive X-ray fluorescence analysis to study the use of obsidian in the microblade industries of the Chubu and Kanto districts (Mochizuki and Tsutsumi, 1997). Combined with the source analysis by Mochizuki (e.g. Mochizuki, 1998), this study has now identified the sources of over 4,000 obsidian artifacts. The following discussion deals with the dynamics of obsidian use by the microblade industries of the terminal Late Palaeolithic.

II. The microblade industries of Chubu and Kanto, and the use of obsidian

1. The microblade industries of the Chubu and Kanto districts

Presently, there are 81 sites belonging to the earliest phase of the Late Palaeolithic (Hashimoto, 2006), dated about 30,000 to 35,000 years BP (Fig. 1). In contrast, 1,792 sites belonging to the terminal Late Palaeolithic Microblade industries have been identified (Tsutsumi, 2004). This is an increase significantly greater than by ten times from the earliest part of the Late Palaeolithic to the end of that period, and this increase in sites most likely reflects a similar increase in population.

Out of these 1,792 known microblade sites, this paper deals with the roughly 530 micro-

![Fig. 1 Distribution of Late Palaeolithic sites](image)
blade sites in the Chubu and Kanto districts, or about 30% of all the microblade sites known in Japan. These 530 or so sites cluster into several areas: Lake Nojiri, Kaida Highland, Nobeyama Highland, Mt. Akagi flanks, Musashino Upland, Sagamino Upland, and Mt. Ashitaka and Mt. Hakone flanks. In these areas, the Yadegawa method for microblade production, using small 3–4 cm cylindrical cores, is widely seen (Fig. 2). This paper analyzes the obsidian commonly used by the Yadegawa method in these microblade sites.

The Tsukimino Kamino site on the Sagamino Upland has a good set of stratified occupations from the later half of the Late Palaeolithic. The length of cutting edge obtained from the same 100 g of stone used for the main tools increased ten times from the oldest occupations to the youngest: 46 cm in the knife-shaped-tool phase, 66 cm in the pointed-tool phase, and 578 cm in the microblade phase. The change of flaking technique from hammer to pressure flaking made this efficient use of stone material possible through accurate and consecutive blade removal. The introduction of microblade technique is the revolutionary change allowing efficient use of obsidian, the material available only in limited regions and costly to procure.

2. Use of obsidian in microblade industries

The microblade industries in the various areas of Chubu and Kanto used different sources for their obsidian (Table 1). Different researchers often give different names for these sources. So here, to avoid confusion, I will use the following names for the major groups of sources (Fig. 3): Wada–Suwa (Wada Pass, Kirigamine, Hoshigato, Omegura and others), Tateshina (Tateshina, Futagoike, Tsumetayama, Mugikusa Pass, and others), Hakone (Hataju and others), Amagi (Kashiwa Pass), Kozushima (Onbase Island), and Takaharayama (Nanahirozawa and Amayuzawa). Further, the Wada–Suwa and Tateshina groups are close neighbors and are commonly referred to as the Shinshu group of sources.

**Sagamino Upland**: The obsidian sources for 13 microblade sites on the Sagamino Upland have been identified (Mochizuki and Tsutsumi, 1997; Mochizuki, 1998). Obsidian from the Wada–Suwa, Tateshina, Hakone, Amagi and Kozushima sources were identified, showing sites on this upland using various sources for procuring obsidian. Looked at by individual occupations, five patterns, A–E, can be seen. A is the Shinshu group only; B is Amagi and Hakone; C is Kozushima; D is Shinshu, Amagi and Hakone; and E is Kozushima, Amagi and Hakone. Notably, Kozushima and Shinshu obsidian are not found together in the same occupation.

**Musashino Upland**: Mochizuki (1998, 2000) has sourced 295 obsidian artifacts from two sites on this upland. Wada–Suwa obsidian was dominant in both sites; the source and the sites are separated by 100 km across mountains ranges.

**Hakone and Ashitaka flanks**: Mochizuki (1998) has identified the obsidian sources for 856 artifacts from three sites in this area. Obsidian from the Kozushima source was common, and there was also obsidian from the Wada–Suwa sources, but obsidian from the nearby Amagi and Hakone sources was not very common.

**Nobeyama Highland**: Mochizuki and Tsutsu-
Table 1 The microblade industries of Chubu and Kanto, and their obsidian sources

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<tr>
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<th>Hokone sources</th>
<th>Amagi sources</th>
<th>Kozushima sources</th>
<th>NK source</th>
<th>XO source</th>
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(mi jointly analyzed 441 obsidian microblade cores from the Yadegawa site on the Nobeyama High-land (Tsutsumi, 2006). Of these, 112 were from the Wada–Suwa sources 40 km away, and 133 were from the Tateshina sources 20 km away. But 157 of these cores were of obsidian from the Kozushima source 200 km away and separated by a wide span of the ocean. The other 49 cores are identified with two sources of the NK and the XO. These two sources are recognized as the different groups of chemical composition, but their exact geographical locations are not known yet.

Kaida Highland: Mochizuki (1998) identified 80 obsidian artifacts from the Wada–Suwa sources in the Koshi site here, and one microblade of obsidian came from the Oga source in Akita Prefecture more than 500 km away to the north.

3. Obsidian procurement zones

The results of obsidian sourcing of artifacts from a number of sites in the Chubu and Kanto districts can be mapped to show the relationships among sources and sites of utilization (Fig. 3). This map then shows sources and procurement zones.

Wada–Suwa procurement zone: Obsidian from the Wada–Suwa sources is 50—100% of the obsidian found in all microblade sites in all areas: Nobeyama Highland, Kaida Highland, Mt. Akagi flanks, Musashino Upland, Sagamino Upland, Shimousa Upland (Chiba Prefecture), and Ashitaka-Hakone flanks. This procurement zone spans an area of 150—200 km. Some artifacts of Wada–Suwa obsidian have also been identified in the Tarukuchi site in Niigata Prefecture almost 300 km from the source, in the heart of the region dominated by artifacts of hard shale (Warashina and Higashimura, 1996). In sites in Kanto, the somewhat poorer quality Tateshina obsidian is not as common as the Wada–Suwa obsidian.)
Fig. 3 Obsidian sources and obsidian-use sites of the microblade industries
Large circle: major obsidian source, Circle: obsidian source, No circle: obsidian-use site.

obsidian.

Kozushima procurement zone: The Kozushima obsidian source is on an island in the Pacific Ocean, but it is common in sites near the coast on the mainland, on the Sagamino Upland and the Ashitaka–Hakone flanks, 100 km or more from the source. Significantly, 35% of the obsidian artifacts from the Yadegawa site on the Nobeyama Highland were made of Kozushima obsidian.

Hakone–Amagi procurement zone: Compared to the wide transportation of Wada–Suwa and Kozushima obsidian over distances greater than 100 km, obsidian from the Hakone and Amagi sources was used almost exclusively in sites less than 100 km from the source, on the Sagamino and Musashino Uplands and the flanks of Mt. Ashitaka. Hakone–Amagi obsidian is poorer in quantity and quality compared to the Wada–Suwa and Kozushima obsidians, thus its utilization zone is smaller and its relative quantity in sites is less. It can be seen as a back-up resource for the better obsidians.

III. Development of obsidian sources and acquisition

The obsidian sources and their procurement zones have been discussed above. The remain-
The most important question on these strategies is probably the type of economic system the peoples had, whether it involved each group directly obtaining raw materials or whether various groups were involved in a single socio-economic network. At the present moment, there is no clear answer to this question. Further, the question is complicated by the fact that it is not known whether the peoples used one strategy only, or whether they adapted the strategy depending on the material to be obtained. However, the Wada-Suwa obsidian found 300 km away in the Tarukuchi site, and the Oga obsidian found over 500 km away in the Kaida High-land at Koshi site, are probably transported too great distances to be within the range for direct procurement by a single human group. These examples suggest there was a widespread social network functioning among a number of groups.

The method of obsidian procurement was also influenced by the environment of the resource. For example, the region around the Wada-Suwa source is a cold highland at 1,500 – 2,000 m above sea-level, and in winter the whole region is closed off by deep snow. This would make procurement of obsidian at this source very difficult in winter, so most likely collection here was carried out in other, more favorable seasons.

The Kozushima source is another example of obsidian procurement from a source in a severe environment. The sea surrounding the source is presently about 200 m deep. And even with the 130 m drop in sea level during the Glacial period, this source was not connected to the main islands by land; getting there would have required some sort of sea craft. However, no such craft is known from the Late Palaeolithic, and no tool for their manufacturing has been identified in the assemblages, leaving considerable doubts about how Palaeolithic humans exploited this source. Notably, the utilization of Kozushima obsidian tends to become more significant over time, especially in the microblade industries. However, the Palaeolithic humans got to this source, their strategy for obsidian procurement seems to have advanced rapidly toward the end of the Palaeolithic.

The microblade-technology revolution for the efficient use of lithic resources, and the aggressive development of obsidian sources on distant islands, reflect a strategy of the peoples in the Japanese islands for adapting to the rapid changes in the environment at the end of the Pleistocene.

IV. Conclusion

Source identification has elucidated that the obsidian from Wada–Suwa, Tateshina, Kozu-
shima, Hakone and Amagi had been collected and supplied to the Microblade industries of Chubu and Kanto districts. The supply zones of obsidian from Wada–Suwa and Kozushima performed wide range more or less 200 km distance. The obsidian supply from the Kozushima, in particular, had steeply increased during the stage of Microblade industries. The active exploitation of obsidian resource seems to have developed far back in the later half of OIS2, across over the Pacific seawater.

The basic archaeological method for studying territories and economic spheres of Late Palaeolithic social groups uses the distribution of stone tool types and technologies. But this method has limited refinement. The chemical analysis of lithic sources thus provides natural scientific support for interpretations of economic spheres. Particularly, we have a good grasp of the relationship among obsidian sources and the archaeological sites where obsidian was consumed. Although this detailed knowledge is local for the Japanese Islands with their great many obsidian sources, this knowledge provides high-quality information for the topic “Abrupt Environmental Changes and Human Activities from the Last Glacial to the Holocene.”

References


後期旧石器時代末の細石刃石器群における黒曜石資源利用の動態

堤隆

【要旨】
本稿では、日本列島の中部・関東地方において、最終氷期末の18,000～16,000 cal BPにみられる後期旧石器時代末の細石刃石器群の黒曜石資源の獲得と供給について述べた。論説の骨子は、遺跡から出土した4,000点を超す黒曜石製石器の産地同定結果である。
産地同定によると、中部・関東地方に存在する和田・藤芳、蓼科、神津島、箱根、天城の黒曜石産地群の黒曜石は、いずれも産地のもの細石刃石器群の段階において獲得・供給されていたことが明らかとなった。このうち和田産地群や神津島産の黒曜石は、200 kmにおよぶ広範囲な供給ゾーンを形成する。この供給ゾーンをとのような状況で黒曜石が動いていくかについて、直接採取・交換・埋込みの獲得戦略がモデル化されている。しかし、当時の社会システムを投影するこのモデルのどれが該当するかについては、今日大きな議論となっている。
これらの黒曜石利用のなかで、神津島産黒曜石の供給は、細石刃石器群の段階にあって以前より格段に多くなる傾向がある。細石刃技術という石材有効利用の頂点に立った石器製作の技術革新と、航海を伴う海洋域の黒曜石資源の積極的開発が、最終氷期末の環境変動に向き合った日本列島の人類の適応戦略のひとつものの姿を示している。

キーワード：黒曜石産地、細石刃石器群、産地同定、石材獲得戦略、供給ゾーン

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