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The Ulaanbaatar 2014 papers

Panel: Starting Over Again: the Early Palaeolithic Research in Japan Today (Fumiko IKAWA-SMITH and SATŌ Hiroyuki)

SEDIMENTOLOGICAL APPROACH TO THE SUNABARA EARLY PALAEOLITHIC SITE IN JAPAN

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INTRODUCTION

As recent studies and the papers in this volume indicate, the existence of the Early Palaeolithic in Japan is not a primary concern for the majority of archaeologists, while a minority seriously doubts the artefactual nature of the materials from such sites. The aftereffects of Fujimura's 藤村 scandal remaining strong among Japanese archaeologists, some archaeologists are turning their back on the Early Palaeolithic research. In 2009, we made a joint survey in close collaboration with specialists in geology, geomorphology, sedimentology and tephrochronology at the Sunabara 砂原 site (MATSUFUJI and UEMINE 2013).

Among such scientific approaches, sedimentological approach contributed to elucidate the embedding process of the artefacts at the Sunabara site. Observing artefacts themselves is a fundamental work in archaeology. However, in the Early Palaeolithic studies in the Japanese archipelago, we believe over-reliance on a single method leads to serious errors. Because of the nature of the raw material and minimal archaeological information, a single method directed to the elucidation of material culture has methodological limitation. Since a stone tool itself is a component of sediments, archaeologists have to examine all the materials in the total context of sedimentation (KIKUCHI 2001:160). In our investigation and evaluation of the Sunabara site, we relied not only on the examination of recovered lithics themselves to distinguish artefacts from geofacts, but also on uncovering and recognition of the old ground surface to ascertain the occurrence of the stone materials in the sediment.

FROM DISCOVERY TO EXCAVATION

The Sunabara site is located on the middle marine terrace in Izumo City 出雲[市], Shimane Prefecture 島根[県] near the northern coast of the Sea of Japan (Fig. 1), with GPS coordinates of 35.17.22.003 N and 132.37.55.003 E. On August 8, 2009, NARUSE Toshirō 成瀬敏郎 found a flake made of chalcedony at the outcrop in Sunabara, Izumo City. This triggered the discovery of the Sunabara Palaeolithic site as well as the beginning of our investigation in this area.

Fig. 1: Locations of the early Palaeolithic sites in Shimane Prefecture (illustrated by Kashimir 3D).

The chalcedony flake was found from a palaeosol just below a thick volcanic ash layer. Our preliminary field survey during August 22–24, 2009 revealed that iron oxide and clay mineral on the surface originated from the palaeosol layer. Furthermore additional five stone artefacts were recovered in the upper layer of muddy silt on the outcrop. This discovery prompted our excavation of September 15–30, 2009. We organized the interdisciplinary excavation team consisting of archaeologists, geomorphologists and a sedimentologist. The excavation pit is 4 m wide, 7 m long and 2.5 m deep in maximum depth, situated on the middle marine terrace near the outcrop where the first chalcedony flake was discovered.

Our excavation was carefully done with well-established three dimensional recording as well as some new digging methods. We used a power shovel during the removal of the upper sterile sediments. Reaching the cultural layer, we switched to a manual excavation method of slicing the soil by 1–2 mm deep. Not only the locations of the unearthed artefacts and natural pebbles were carefully recorded, but also their orientations were fully recorded in order to evaluate their sedimentological context. In addition, we recorded the process from the appearance to taking up of every material through photographs and videos, so as to ensure transparency of our excavation and to obtain extensive archaeological information. The detailed recordings system must contribute to scientific evidence in future.

Cultural layers and their ages

Stone artefacts were unearthed from two layers, layers VIb and VIa. The sediment of Layer VIb consists of palaeosol with bright reddish brown colour formed during the final interglacial period with high rainfall. This layer yielded six stone artefacts; therefore, we identify it as Cultural Layer I. Layer VIa is dull or bright yellowish brown muddy silt covering Layer VIb. Thirty stone artefacts were unearthed from Layer VIa, named Cultural Layer II.

At least three terraces are known in this area. The Sunabara site is on the middle marine terrace, formed during the last interglacial. The fluvial deposits and marine terrace gravel occur under the Layers I through Vb, made of aeolian sediment. The Daisen-Matsue 大山松江 pumice (DMP; c.130ka, MACHIDA and ARAI 1979: 319) is not present in the fluvial deposits, but volcanic glass and rock fragments of Sanbe-Kisuki 三瓶木次 tephra (SK; c.110ka, TSUKUI and SAKUYAMA 1981) from the Sanbe volcano 三瓶[山], about 18 km from the Sunabara site, are present in the

Fig. 2: Stratigraphy of Sunabara site (North section).

Layer VIa. Hence the formation age of the layer VIb as paleosol is estimated to be the marine isotope stage (MIS) 5e; c. 120 ka.

In the excavation pit at the Sunabara site (Fig. 2), several key tephra were detected. From the bottom to top, DANHARA Tōru identified Sanbe-Unnan tephra (SUn; c. 70 ca, MIURA and HAYASHI 1971) from Layer Va, Sanbe-Sunabara tephra (SS; FT age 53 ka, NARUSE 2010) from Layer III, and Aira-Tanzawa 姶良丹沢 tephra (AT; c. 30 ka, MACHIDA and ARAI 1976) from Layer I. After the excavation, sedimentation of high dense volcanic glasses, the rock fragments and biotites originated from Sanbe-Kisuki tephra were found in Layer VIa, Cultural Layer II. Accordingly, estimated ages of Cultural Layers I and II are c. 120 ka and c. 110 ka, respectively. The geological age from this site offers the most reliable among the Early Palaeolithic sites in Japan.

Recovery of old ground surface

We were successful in recovering the old ground surface through the micro-stratigraphic excavation method. The old ground surface consisted of the sun-cracks or mud-cracks (Fig. 3) that resulted from ex-

Fig. 3: Sun-crack surface 1 (from S-E).

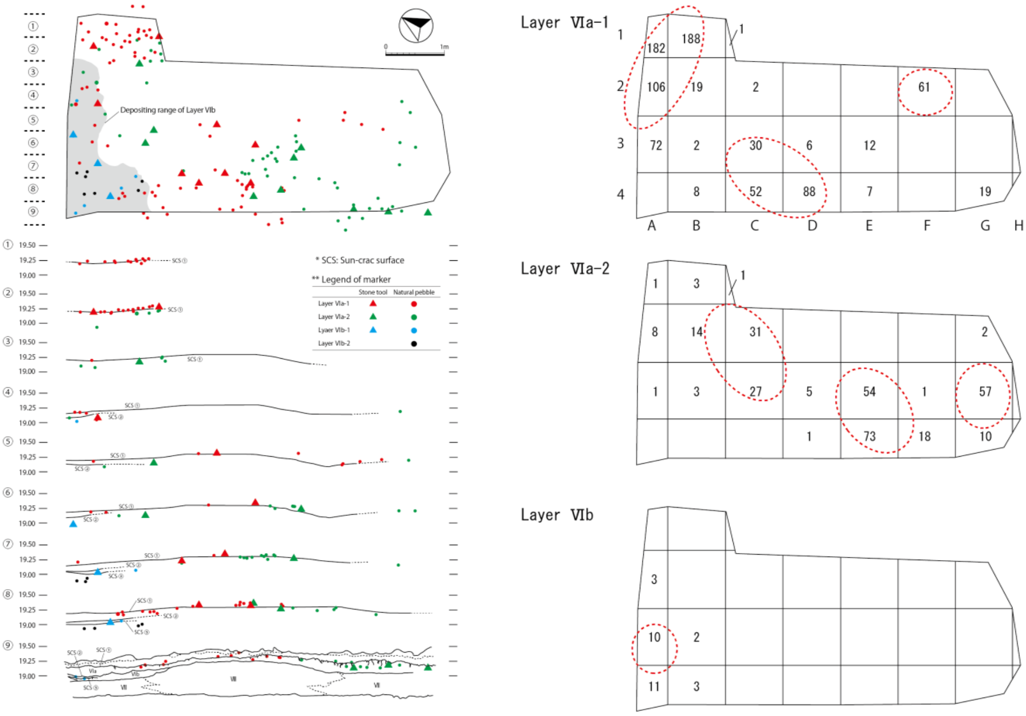

Fig. 4: Distribution of lithic artefacts and natural pebbles (numbers of right figure include minute materials recovered with mesh).

posed and dry unconsolidated mud sediment. The sun-cracks are the evidence of diastem (BARELL 1917), a very short interruption in the succession of deposit, and serve as a strong index of the old ground surface. In our excavation pit, we discovered a total of three sun-crack horizons in the Layers VIa and VIb. Remarkably, a carbonized large leaf and many trace fossils were found on the uppermost sun-crack surface in Layer VIa, which does prove that these surfaces were not under water but were potential-living surfaces for humans.

On comparing the vertical distribution recorded with three-dimensional coordinates to the sun-crack surfaces, some stone tools and natural pebbles remained just as on the sun-crack surface 1 of Layer VIa (Fig. 4, left). Although on the sun-crack surface 2, the bedding plane between Layers VIa and VIb do not present a clear relationship, the sun-crack surface 3 of Layer VIb exhibits the same tendency as the sun-cracked surface 1. These vertical distributions of lithic artefacts and natural pebbles show that they were left on each surface just after dried up.

Horizontal distributions of every stone material on each of the three sun-crack surfaces interestingly revealed that they were not evenly distributed but they were concentrated in different areas of each surface (Fig. 4, right). These distributions may be considered as the proof that these stone materials were left by early humans, provided that they remained in the original positions.

Whether or not the artefacts remained in their original positions can be examined by sedimentological analyses. The limonites in the subdivided Layer VIa-2 (deposited beneath the sun-crack surface 1) maintained their original form (tubular or arborescent) and stood upright. In contrast, those in the subdivided Layer VIa-1 (mudflow deposited on top of the sun-crack surface-1), consisting of clay balls, were broken and were not upright. These findings indicate that the deposits in the Layers VIa were undisturbed. The mottles adhere to almost all lithic artefacts and natural pebbles; and the observed imprint fossils prove that the mottles correspond with the artefacts and pebbles.

Furthermore, analysis of the orientation of these materials indicates that their positions did not change or move by the fluvial flow that formed the sediment of the Layers VIa and VIb. For example, at the river bed, we find cobbles overlapping like roof tiles. This configuration, called imbrication, is the response of sediment particles to a strong sustained water current. Similar to the archaeological excavation pit, if artefacts

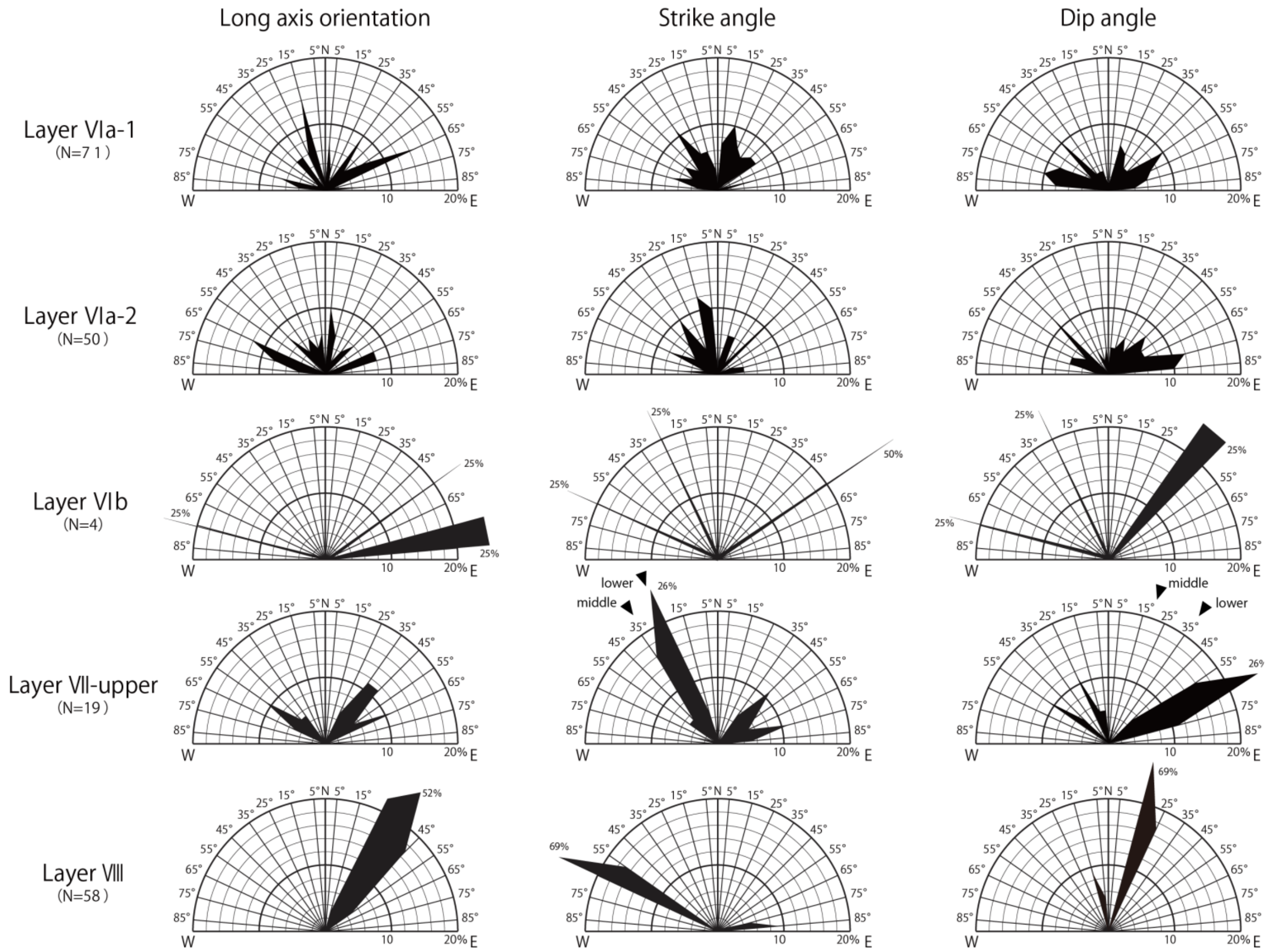

Fig. 5: Orientation of lithic artefacts and natural pebbles (measurements owe to magnetic north).

and natural pebbles moved in response to a strong, sustained water current, they must have experienced imbrication. Imbrication is a useful index to determine whether the recovered objects maintained their original position or not. Materials from the layers beneath Layer VII are terrace gravel, which are natural deposits and show clear imbrication (Fig. 5). In contrast, the lithic artefacts and natural pebbles from the Layers VIa and VIb are cultural layers and do not show an obvious imbricated structure, suggesting that they were not carried by water flow. The abovementioned sedimentological data could not be explained by the conjecture that these materials are naturally broken pebbles, not artefacts.

LITHIC ARTEFACTS

Thirty-six artefacts were unearthed from the Layers VIb and VIb, the Cultural Layer I and II (Fig. 6). In addition, a quartzite hammer stone was collected on the slope surface near the outcrop where the first chalcedony flake was found. Most of these stone artefacts found in Layers VIb and VIa were composed of coarse rhyolite, and the

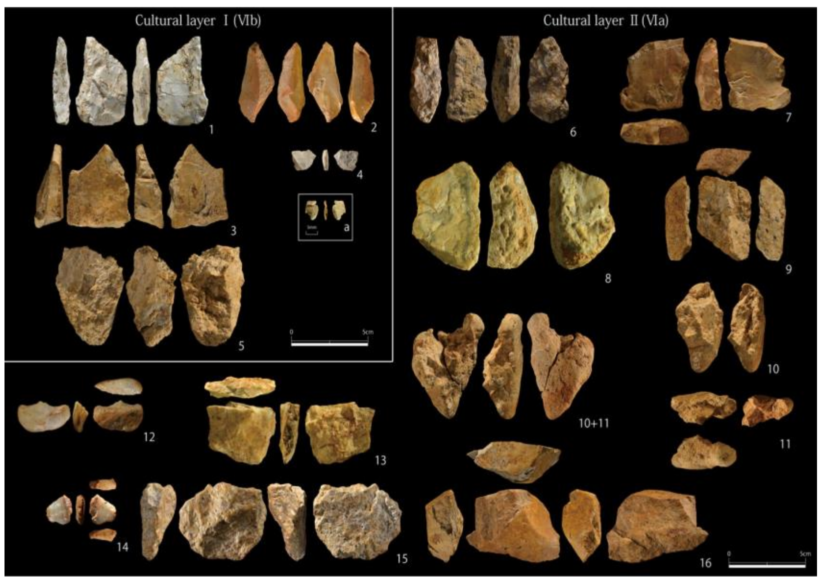

Fig. 6: Lithic artefacts from Sunabara site.

remainder made of chalcedony and quartz. Coarse rhyolite and quartz make up less than 1% of the tertiary and quaternary gravel around the site. However, the nearest source of the fine chalcedony such as the first flake discovered by NARUSE is the southern coast of Lake Shinji 宍道[湖] located about 20 km from the site.

Stone artefacts from the Sunabara site could be classified as scrapers, chopping tools, becs, flakes, chips, hammer-stones, cores, and chunks. The tool composition is quite similar to that of the Early Palaeolithic assemblages of the Korean peninsula and the mainland China. However, these artefacts, especially those composed of coarse rhyolite including many phenocryst, are difficult to recognize. The surface roughness also makes it difficult to see how the artefacts were manufactured. These are the main causes for the artefact/geofact dispute among Japanese Palaeolithic archaeologists. In our report of the Sunabara site investigation (MATSUFUJI and UEMINE 2013) we presented the observation results of each artefact as explanatory texts and line drawings, based on our experience gained while observing the quartzite palaeoliths in Korea and China. In addition, a new method that would allow every archaeologist to reproduce observational results from each type of stone material is being proposed (UEMINE 2014). Detailed information will be presented in another paper.

CONCLUSION AND PROSPECT

The Sunabara site is a very rare site that provides a reliable estimate of its geological age and elucidates the sedimentological formation process of the site. Although evaluation of the artefacts is currently controversial, all the lithic specimens from the site cannot be considered naturally cracked geofacts because of the careful and precise observation along with comprehensive analyses of their sedimentological environment. Our investigation of the site opened a new horizon to the provocative study of the Early Palaeolithic period throughout the Japanese archipelago, and this scientific study will serve as an important guide for the future field studies.

After the excavation of the Sunabara site, we continued our field research on the Early Palaeolithic. Therefore, some interesting information is still being collected on human migration into the Japanese archipelago before the settlement of the Sunabara site. In July 2012, KIKUCHI Kyōichi picked up a pebble tool from the surface of housing land at Itazu 板津, approximately 5.5 km from the Sunabara site (Fig. 7 left, MATSUFUJI 2013). The tool, made of a tabular cobble of rhyolite, has a few crude scars similar to an early palaeolith from the Korean peninsula. To elucidate the original layer, we compared the adhered sand and clay on the scars with the sediment samples from the Itazu housing land. NARUSE collected and reserved the samples from the various 14 levels of the Itazu profile. Judging from the mineral characteristics of sand grain and grey white clay, he concluded that this cleaver-like pebble tool had been originally contained in the loess layer of the MIS 6 glacial age from 0.18 to 0.13 Ma. The Itazu palaeoliths would certainly have been older than those recovered from the Sunabara site.

Moreover, in March 2011, two potential hammer stones made of hard sandstone were collected from the Kakeya 掛合 outcrop, Unnan City 雲南[市] in Shimane Prefecture (Fig. 7, right, MATSUFUJI 2014). They were picked up from the fine paleosol and loess deposited between the high river terrace gravel and the sediment including DMP volcanic ash under SK tephra 2 m thick. Although the case is still under investigation, they may date to MIS 7 or 8.

So long as we find it unlikely that hominin migration to the Japanese archipelago took place over the open sea during the Last Interglacial stage, the hypothesis that they used the land bridge during the earlier glacial stage must be considered. These new discoveries in Shimane Prefecture would suggest that further exploration for archaeological sites dating to MIS 6 or even earlier is warranted.

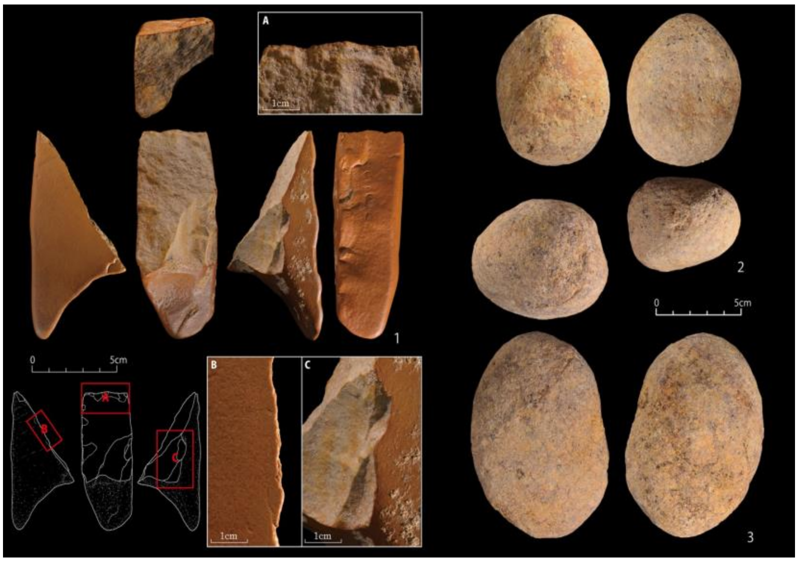

Fig. 7: Lithic artefacts from Itazu site and Kakeya outcrop.

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