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Editorial

Human behavioral variability in prehistoric Eurasia

This volume is a result of the Symposium "Human Behavioral Variability in Prehistoric Eurasia: Views from the Lithic and Raw Material Perspectives". It took place on 29 July 2015 as part of the Scientific Program of the XIX-th INQUA Congress held in Nagoya, Japan. The conveners of the Symposium were Akira Ono, Jun Takakura, Yuichi Nakazawa, and Yaroslav V. Kuzmin (see Science Council of Japan, 2015. P. 59, 63). In total, 16 oral and six poster presentations were delivered. Here we give an overview of the content of ten papers by the Symposium's participants, which constitute this Special Issue "Human Behavioral Variability in Prehistoric Eurasia" of *Quaternary International*. These studies cover a vast area—from Mongolia to Alaska—but concentrate mainly on Northeast Asia (Japan, China, the Russian Far East, and Korea).

Kuzmin (2017) reviewed the current state-of-the-art on obsidian provenance studies in Northeast Asia, and their impact on some important issues in prehistoric archaeology and geoarchaeology including the origin of seafaring in the northern Pacific. It was demonstrated once again that the identification of the primary sources for archaeological obsidian serves as solid evidence of human migrations. According to the available data, the range of early movements/contacts in Northeast Asia often exceeds 600–700 km in a straight line. In later prehistory (since the Early Iron Age), the distances between obsidian sources and consumption sites of up to 1000–1500 km were quite common.

The striking feature of obsidian provenancing in Northeast Asia as presented by Kuzmin is the use of multiple sources by inhabitants of the same site(s), regardless of the fact that the quality of the raw material (i.e., obsidian) is identical (see also Kuzmin et al., 2008). The cause of this phenomenon is not yet well understood; perhaps, some unknown patterns of human behavior were responsible for the creation of a sophisticated system for the acquisition and use of valuable raw material such as obsidian. Another important implication that became possible with the help of obsidian sourcing is that the earliest evidence of seafaring in the northern Pacific is now dated to at least ca. 34,000 BP (ca. 38,500 cal BP) (e.g., Ikeya, 2015). This is in accord with the latest data on early crossings of the high seas in the region (Fujita et al., 2016).

Because of its volcanic origin, the Japanese Archipelago is rich in igneous rocks suitable for making stone tools. Among these rocks, obsidian is the best-studied toolstone because of both frequent occurrences at Upper Paleolithic sites and its homogenous geochemical composition. By taking advantage of obsidian provenance data from 43 Upper Paleolithic sites (517 assemblages with ca. 85,000 specimens) in the central part of Honshu Island (Japan), consisting of the Chubu, Kanto, and Ashitaka–Hakone regions, Shimada et al. (2017) describe the dynamics of hunter-gatherers in term of regional obsidian circulation. The frequencies of obsidian artifacts for five major source groups (Takahara, Central Highlands, Kozu-Onbase Island, Hakone, and Amagi) fluctuated in the assemblages of six core regions in central Honshu. The paper also presents the diachronic change in the use of obsidian sources through the five continuous cultural periods—from the Early Upper Paleolithic to the final Late Upper Paleolithic—generally dated to ca. 38,000–16,000 cal BP. Moreover, incorporating the regional environmental data based on pollen records recovered from the highly elevated peat bog of Hiroppara, Central Highlands (1400 m a.s.l.), the decreased use of obsidian in this region just prior to the onset of the Last Glacial Maximum (LGM) is interpreted as the result of ephemeral occupations of the obsidian outcrops. A non-linear relationship between human presence in the Central Highlands and climatic fluctuations as shown by Shimada et al. is therefore evident.

This paper is an excellent example of the meticulous analysis achieved for the vast primary evidence on the spatiotemporal patterns of the human use of raw material sources as a proxy to Upper Paleolithic mobility and contacts. This is partly due to the very high degree of obsidian provenance studies in Japan, perhaps the best in the world. It is noteworthy that in the final Late Upper Paleolithic the amount of obsidian from the remote Kozu-Onbase source, located in the open ocean off Honshu Island and accessible only by boat, reached the highest value, ca. 44%. This testifies in favor of well-developed maritime transport at this time (see also Kuzmin, 2017).

Ikeya (2017) examines the impact of volcanic eruption and tephra on prehistoric populations of the Tokai region, central Honshu Island (Japan). The case study involves analysis of the Initial–Early Jomon sites which existed before and after the Kikai-Akahoya (K–Ah) tephra dated to ca. 7300 year ago. As a result, the Tokai region was covered by volcanic ash and was also greatly affected by this event, especially the local vegetation and marine invertebrates; the latter were one of the staple foods o Jomon hunter-gatherers. A change in pottery type in the eastern part of the region immediately after the Akahoya ashfall is interpreted as evidence of human migration. In addition, an analysis of clay raw materials from both western and eastern Tokai was conducted, using the Energy-Dispersive X-ray Fluorescence method and microscopic examination of mineral grains from pottery. For comparison, the mineralogical composition of sand from the main rivers in eastern Tokai was employed, assuming that people used sand for tempering the clay paste. Based on these two independent datasets, Ikeya demonstrates that humans transported pottery from the

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western to the eastern part of the region. This is a good example of a geoarchaeological study in a volcanic region rich in archaeological materials.

Similar to the late Upper Paleolithic in China (see Kato, 2017), the Upper Paleolithic in Hokkaido, a large island in the north of the Japanese Archipelago, is characterized by the prominence of microblade technology. A critical question among Paleolithic archaeologists in Hokkaido is how to explain the highly diversified microblade core reduction technologies (e.g., Nakazawa et al., 2005). Because microblades in Hokkaido were extant for 10,000 years, from the LGM to probably the end of the Younger Dryas (ca. 24,000–13,000 cal BP), it is likely that the observed diversity in some microblade technologies was created as a response to climatic changes. Considering this prospect, Otsuka (2017) builds his study of the human-environmental relationship on the basis of the variation in microblade technocomplexes in Hokkaido and global climatic changes from the LGM to the Late Glacial when pottery technology appeared at the Taisho 3 site in southeastern Hokkaido, dated to ca. 15,000–14,000 cal BP (Obihiro Board of Education, 2006; Yamahara, 2014). Incorporating the datasets from microblade core size, burin maintenance technique, and stone tool components, "miniaturizations" of stone tools became remarkable in the early Late Glacial when climatic conditions were relatively mild. Otsuka proposes a hypothesis that changes in stone weapon systems (including use and maintenance) are related to fluctuations in the available faunal resources. This conjunctive argument further raises the question: why and how did the early Late Glacial hunter-gatherers maintain two specialized weapon systems (i.e., stone spear technology and microblade technique)?

Nakazawa and Akai (2017) selected two microblade technological schemes from Hokkaido Island of Japan, *Sakkotsu* and *Oshorokko*, to demonstrate the possible impact of environmental conditions on the subsistence of the Late Glacial hunter-gatherers in the northern Pacific Rim region. Both complexes existed at ca. 14,000–18,000 cal BP (and possibly to ca. 22,000 cal BP); perhaps, they were in use simultaneously, but this is a subject for future studies. Using the Ishikari Lowland of central Hokkaido as a key region, Nakazawa and Akai analyzed microblade lithic technologies from the view of a cost-benefit model in behavioral ecology. They found that the Sakkotsu microblade cores are more than twice as large compared to the Oshorokko ones. Also, the utility to cost ratios for these complexes are quite different: low values are found for the Sakkotsu technology while the Oshorokko one has the higher values. The conclusion of Nakazawa and Akai is that it reflects different goals for each group: the bearers of Sakkotsu technology tried to maximize the production of microblades; people who used the Oshorokko technique pursued efforts to minimize the cost of raw material transportation. These results may be used when one projects the behavioral patterns of microblade-making populations to the process of human movement from the temperate latitudes (40–50° N) to the more northerly terrains of Northeastern Siberia and Beringia, and ultimately the New World (Alaska and the Northwest Coast of North America), with latitudes higher than 50° N.

The weaponry system is a critical part of Paleolithic hunter-gatherers' subsistence and technology. Lithic analysts interested in this topic have conducted experiments to interpret the observed tool breakage patterns (e.g., Barton and Bergman, 1982; Rots and Plisson, 2014; Sano et al., 2012). Yamaoka (2017) focuses on the possible projectile function of trapezoids, a unique and diagnostic stone tool class in the Japanese initial Early Upper Paleolithic (EUP) assemblages, while their function has not been fully accounted for. Given the assumption that trapezoids were used as a hunting weapon, Yamaoka provides an inference on behavioral parameters that created macro-fracture patterns through a comparison of his experimental tools used for throwing, shooting, and stabbing. The observed bending fractures on the EUP trapezoids from Layer BB V of the Doteue site (Shizuoka Prefecture, Japan), dated to ca. 35,000–36,000 BP (see Ikeya, 2015), are similar to the fracturing patterns on the replicated trapezoids used in shooting with a bow and throwing with a spear-thrower. By taking into account the size difference in the basal portion of Paleolithic trapezoids where shafts are attached, the paper concludes that the spear-thrower was most likely a weapon in which trapezoids served as projectile tips, while there is still the possibility that its function was part of the bow-and-arrow technology (e.g., Sano, 2016).

Territoriality is a critical concept in hunter-gatherer socio-economic studies. During the late Upper Paleolithic, China sustained one of the largest portions of the mobile hunter-gatherers' oecumene across the Eurasian continent in the middle latitudes (30–50 °N). Kato (2017) discusses the late Upper Paleolithic territories by comparing the lithic material compositions (local vs. non-local) among the selected sites from three densely occupied regions in northern China (North China Plain), and two regions in Northeast China. A gross sub-division of lithic materials into local and non-local provides a general picture of regional variations. That is, foragers in northern China obtained local lithic materials (i.e., flint), while those in Northeast China used non-local obsidian, probably from sources such as the Changbaishan Mountains and Inner Mongolia (but see below), suggesting that the territorial range in the northeast (300–450 km) was larger than in the north (100–230 km). It is of interest that the estimated territorialities are comparable to the ranges of obsidian circulation by Paleoarchaic hunter-gatherers who inhabited the arid Great Basin of North America (Jones et al., 2003). To portrait a better picture of Upper Paleolithic territorial ranges, it will be necessary to provide a whole set of the compositional data of lithic raw materials, especially by incorporating geochemical analyses of obsidian.

It is, however, unlikely that an obsidian source exists in Inner Mongolia as Kato (2017) has suggested, because all previous research in Northeast China and neighboring regions has not revealed an unknown source which was widely used in prehistory, besides the well-known Paektusan (Changbaishan) one (e.g., Jia et al., 2013; Kuzmin, 2010, 2012; Kuzmin and Glascock, 2014; Kuzmin et al., 2002). Also, the absence of direct information (i.e., geochemical or petrographic composition) of the primary sources of other raw materials in both regions under study makes the conclusions by Kato (2017) not fully substantiated according to modern standards in provenance studies (e.g., Rapp, 2009).

The transition from the Middle to the Upper Paleolithic and the origin of modern behavior in Asia are among the most important topics in prehistoric archaeology of this continent (e.g., Kaifu et al., 2015). In their paper, Khatsenovich et al. (2017) introduce new data from northern Mongolia, a region still not adequately studied. At the Kharganyan Gol 5 site, several cultural layers were distinguished. The most important for Paleolithic research is the bottom part of the sequence. The lowermost components, layers 7 and 6, are dated to ca. 43,300–46,200 BP. The earliest lithic assemblages are most probably of the terminal Middle Paleolithic (Levallois) type. In Layer 5 above layers 6–7, the first evidence of the Upper Paleolithic occurred in the form of volumetric blade cores, end and side scrapers, backed bladelets, burins, and borers. This assemblage is dated to ca. 38,700 BP. In Layer 5, a rare kind of artifact—a rectangular piece of muscovite mica with a hole in the middle—was discovered. Based on the general geological