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Obsidian resource use from the Jomon to Okhotsk period on Rebun Island: An analysis of archaeological obsidian

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ABSTRACT

Hokkaido obsidian sources have been widely exploited by hunter-gatherer groups in Northeast Asia since the Upper Paleolithic (~30,000 cal. BP). Rebun Island is located 50 km from the northwest tip of Hokkaido in the Sea of Japan. Given that obsidian does not occur naturally on Rebun Island, all obsidian materials found there are the result prehistoric transportation of these resources. Examination of 133 obsidian artifacts collected from excavations on Rebun Island employing portable X-ray fluorescence (pXRF) provides data for assessment of obsidian resource use during the Middle Jomon, Epi-Jomon, and Okhotsk periods on Rebun Island. Previously published data are also consulted for the Late and Final Jomon, and Epi-Jomon period on Rebun Island. The findings of this study suggest that the most prevalent changes in obsidian resource use on Rebun Island occur between the Middle and Late Jomon periods, and the Late Jomon and Okhotsk periods. These results demonstrate that variation in obsidian resource use during these periods is closely associated with patterns of culture change, in Hokkaido, and on Rebun Island.

1. Introduction

Hokkaido, the most northern of the four main Japanese islands, is situated on two volcanic arcs between the Sea of Japan, the Sea of Okhotsk, and the Pacific Ocean (Izuho and Hirose, 2010). The use of Hokkaido obsidian for lithic tool production began by approximately 30,000 cal. BP (Imamura, 1996; Izuho and Sato, 2007; Kikuchi, 1986; Kobayashi, 2004; Mizoguchi, 2002). At this time, obsidian gravels from the Shirataki source located in northeastern Hokkaido were utilized by early hunter-gatherers (Izuho and Hirose, 2010). There are 21 known sources for obsidian in Hokkaido (Fig. 1), with the most widely exploited being Shirataki and Oketo sources (Ferguson et al., 2014; Hall and Kimura, 2002; Izuho and Sato, 2007; Wada et al., 2014). Obsidian from Hokkaido has been recovered from archaeological sites in Amur River Basin, Sakhalin Island, and throughout the Kuril Islands (Gjesfjeld and Phillips, 2013; Ferguson et al., 2014; Phillips, 2010, 2011; Phillips and Speakman, 2009; Kuzmin, 2006, 2010, 2011, 2012; Kuzmin and Glascock, 2007; Kuzmin et al., 2002; Kuzmin et al., 2013). Despite the presence of locally available lithic materials in these regions, the high quality obsidians found in Hokkaido were likely important resources for facilitating and maintaining exchange networks, and for the production of lithic tools (Fitzhugh et al., 2004; Kuzmin et al., 2002; Kuzmin and Glascock, 2007; Phillips, 2011). Therefore, the distribution of Hokkaido obsidian into neighbouring geographic regions indicates the long-standing use and transportation of these resources by prehistoric hunter-gatherers. Obsidian provenance research in Hokkaido has slowly grown since the early 2000′s. However, few provenance studies have been conducted on obsidian artifacts found on Rebun Island (Tomura et al., 2003).

Rebun Island is located approximately 50 km west of the northernmost tip of Hokkaido, and approximately 95 km south-southwest of Sakhalin Island. Despite the peripheral location of Rebun Island to these larger islands, hunter-gatherers are suspected to have occupied Rebun Island since approximately 20,000 BP (Sakaguchi, 2007a, 2007b). Obsidian does not occur naturally on Rebun Island. Therefore, all obsidian found on Rebun Island is the result of the transportation of these resources to Rebun, via direct procurement, or through exchange with local groups in Hokkaido.

In this study, the provenance of 133 obsidian artifacts, including finished tools and debitage, is determined using portable energy dispersive X-ray fluorescence (pXRF). These artifacts are derived from Middle Jomon, Epi-Jomon and Okhotsk period sites found on Rebun Island. Geological reference samples of obsidian collected from primary and secondary deposit in Hokkaido were also analyzed by pXRF to determine artifact provenance. Additionally, the results of this study are compared with the findings from earlier research in order to examine how culture change in Hokkaido may have influenced obsidian resource use on

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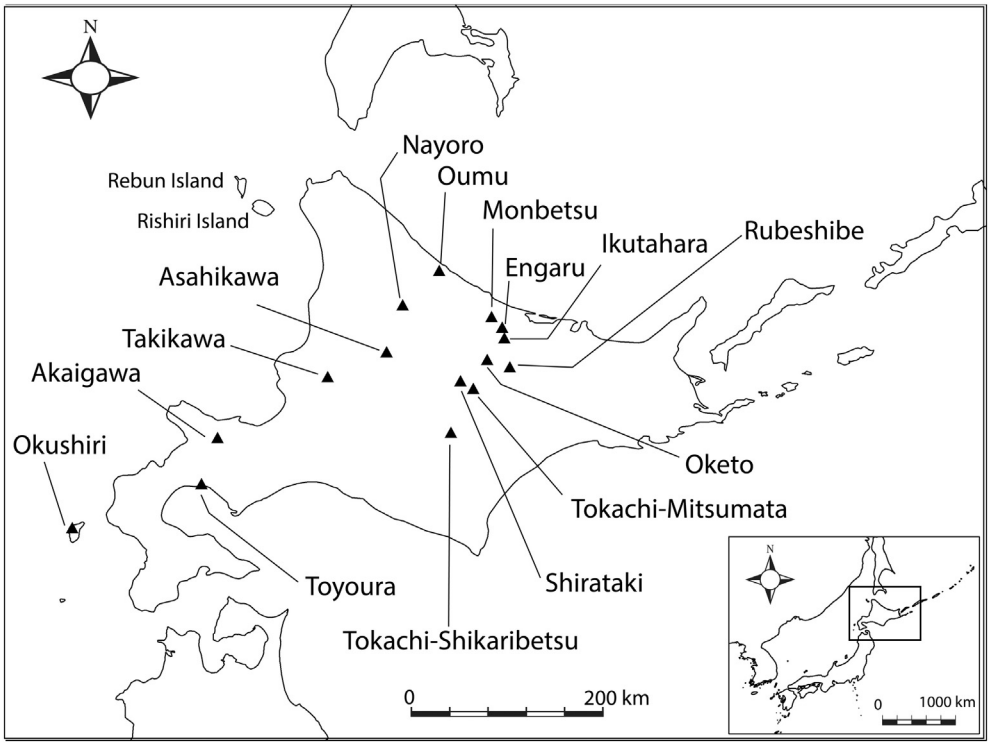

Fig. 1. Map of analyzed obsidian source in Hokkaido. The triangles indicate the approximate location of the obsidian source.

Rebun Island. These results shed new light on the lithic raw material industry of hunter-gatherers on Rebun Island for the Middle Jomon, Epi-Jomon and Okhotsk periods.

1.1. Archaeological context of Hokkaido and Rebun Island

The archaeological record of Hokkaido is unique when compared to the rest of Japanese archipelago. This is uniqueness is attributed to the perpetuation of hunter-gatherer life-ways in Hokkaido after wet-rice agriculture, brought by the immigrating Yayoi culture from the Korean peninsula by approximately 2800 BP, became widespread in western Japan (Aikens and Higuchi, 1982; Crawford, 2008, 2011; Habu, 2004; Hudson, 2004; Matsui and Kanehara, 2006; Okada, 1998a; Okada, 1998b; Yamaura, 1998). Current archaeological, genetic, and osteological evidence have further distinguished the prehistoric inhabitants of Hokkaido from their contemporaries found in western Japan (Akazawa, 1986; Befu and Chard, 1964; Chisholm et al., 1992; Fukase et al., 2012; Ishida, 1996; Minagawa and Akazawa, 1992; Okada, 1998a; Okada, 1998b; Sato et al., 2007; Temple and Matsumura, 2011; Yamaura, 1998). During the Holocene, the hunter-gatherer groups of Hokkaido included the Jomon: Incipient, Early, Middle, Late and Final phases (14,000–2700 cal. BP), Epi-Jomon (2700–1500 cal. BP), Okhotsk (6th–10th cent. CE), Satsumon (7th–13th cent. CE), and Ainu (13th–19th cent. CE) (Weber et al., 2013). During these cultural periods, elaborate exchange networks facilitated the movement of obsidian, jade, bitumen, ceramics, and shells between Hokkaido, western Japan, and Northeast Asia (Hall and Kimura, 2002; Hudson, 2004; Kato et al., 2008; Kuzmin et al., 2013; Oxenham et al., 2006).

The identification of microblades, microcores and tanged points from Rebun Island suggest the earliest occupations of Rebun Island occurred during the Late Paleolithic (20,000 to 11,000 cal. BCE) (Sakaguchi, 2007a). However, the first long-term occupations of Rebun Island are dated to the Middle Jomon period (2950 cal. BCE) (Sakaguchi, 2007a). Well-established occupations of Rebun Island did not occur until the Late Jomon period (2470 cal. BCE) (Sakaguchi, 2007a, 2007b). Archaeological sites Uedomari 3, Kafukai 1, and Hamanaka 2 (Fig. 2) were selected given the availability of archaeological obsidian samples suitable for pXRF analysis (i.e., ≥5 mm thick and ≥10 mm wide, with relatively flat surfaces).

The Middle Jomon site Uedomari 3 was excavated in 1984 by the Hokkaido Archaeological Resources Center (Keally, 1990: 21). The site has been dated to approximately 2950–2470 cal. BCE, and included 5 dwelling pits, 14 small pits, 1 stone-encircled hearth, 57 fireplaces and 2 refuse areas (Keally, 1990:21; Sakaguchi, 2007a). Large flame-rimed pots typical of the Jomon period were recovered from Uedomari 3. The ceramic styles identified at Uedomari 3 are associated with the Ento Upper and Rouletted styles found in Hokkaido (Keally, 1990). The Ento Upper style is typically associated with Middle Jomon of southwestern Hokkaido, and is seldom found further north than Sapporo (Kobayashi et al., 1992). The Rouletted style is generally associated with Middle Jomon groups found in northeastern Hokkaido (Keally, 1990; Kobayashi et al., 1992).

Kafukai 1 contains archaeological remains from the early to late phases of the Okhotsk culture (1500–800 cal. BP). The site was excavated from 1968 to 1971 by members of the Research Institute for the Study of North Eurasian Culture on Rebun, Faculty of Literature, Hokkaido University (Ohyi, 1981: 711). The Okhotsk complex at Kafukai 1 contains semi-subterranean hexagonal and rectangular pit-houses typical of Okhotsk residential sites, as well as human burials, and lithic, ceramic, metal artifacts, and midden deposits containing shellfish, fish, and sea mammal remains (Ohyi, 1981). Juvenile bear crania recovered from four of the six house pits at Kafukai 1 indicate contact between Hokkaido and Rebun Island during this period, given that bears are not native to Rebun Island. Mitochondrial DNA analysis of these bear remains revealed that the lineages of three of these animals were derived from central, and southwestern Hokkaido (Masuda et al., 2001).

Hamanaka 2 is a multi-component shell-midden site spread between various locations in the village of Hamanaka (Sakaguchi, 2007a: 29). Excavations at Hamanaka 2 have been carried out by Japanese archaeologists consistently since the 1990's. The oldest deposits at Hamanaka 2 date to the Late Jomon (2470 to 1250 cal. BCE) and Final Jomon periods (880 to 790 cal. BCE) (Nishimoto, 2000, Sakaguchi,

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