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Late-Glacial bifacial microblade core technologies in Hokkaido: An implication of human adaptation along the northern Pacific Rim

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ABSTRACT

The wedge-shaped microblade core technology found along the northern Pacific Rim has been regarded as a trait of hunter-gatherer adaptation during the Late Glacial and initial Holocene. Having recognized variable microblade core reduction methods among the technocomplexes in Hokkaido, by employing an optimization model in lithic technology, the present paper addresses the question of what role bifacial microblade core technologies played in foraging, through a comparative analysis of utility, cost of transportation, and failure rates between the larger ("*Sakkotsu*") and smaller ("*Oshorokko*") bifacial microblade core technologies in the Late Glacial Hokkaido. Results suggest that as opposed to the larger bifacial microblade core technology, the smaller bifacial microblade core technology was more effective for exploring unpredictable environment across the northern Pacific Rim.

1. Introduction

Owing to its unique and standardized techno-morphological traits, wedge-shaped microblade cores have been regarded as the material signature of human adaptation across the northern latitudes (>40 °N), namely regions of the northern Pacific Rim consisting of northeastern Asia (i.e., Siberia, Mongolia, China, Korea, and Japan) and northern North America (i.e., Alaska and Pacific coast of Canada) during the Late Glacial and initial Holocene (e.g., Nelson, 1937; Müller-Beck, 1967; Smith, 1974; Yi and Clark, 1985; Cheng and Wang, 1989; Ackerman, 1992; West, 1996; Kuzmin and Orlova, 1998; Dixon, 1999; Goebel, 1999; Hamilton and Goebel, 1999; Bever, 2001; Yesner and Pearson, 2002; Hoffecker and Elias, 2007; Doelman, 2008; Goebel et al., 2008; Kajiwara, 2008; Wang et al., 2009; Bae, 2010; Graf, 2010; Buvit and Terry, 2011; Elston et al., 2011; Bae and Bae, 2012; Lee, 2012; Kato, 2014; Nian et al., 2014; Wang and Qu, 2014; Wang et al., 2015; Yi et al., 2014, 2015). A battery of analytical studies on microblade assemblages particularly from the Japanese late Upper Paleolithic sites have revealed that wedge-shaped microblade cores are shaped by a series of standardized reductive processes, suggesting that Late Glacial hunter-gatherers designed complex core technology to produce highly standardized microblades (e.g., Yoshizaki, 1961; Morlan, 1967; Kobayashi, 1970; Tsurumaru, 1979; Fujimoto, 1982; Bleed, 1996, 2002a,b; Kimura and Girya, 2016). Among the regions along the northern Pacific Rim, Hokkaido, the northernmost Japanese island has yielded rich Upper Paleolithic microblade assemblages, characterized by highly variable microblade core technologies and represented by distinctive steps in core reduction sequences, which are known to be unique core reduction methods (Nakazawa et al., 2005, see also; Bleed, 2001). In Hokkaido, bifacial wedge-shaped microblade core technology first appeared in the Last Glacial Maximum (LGM) (Nakazawa et al., 2005; Izuho et al., 2012), followed by the advent of variants in the ways cores and platforms were prepared during the post-LGM, ca. 18,000–11,500 BP (Yamada, 2006; Tsutsumi, 2011; Nakazawa and Yamada, 2015). Among the variants, large and small bifacial microblade cores called *Sakkotsu* and *Oshorokko* are distinctive microblade-core types in Hokkaido (Yoshizaki, 1961; Morlan, 1967; Tsurumaru, 1979; Bleed, 2001; Nakazawa et al., 2005). Although there is an empirically observed size difference between these two microblade core technologies, these morph-metric differences are less emphasized than techno-morphological variation in microblade core reductions. The question of why regional variation in bifacial wedge-shaped microblade core technology emerged is more critical to understand the general question of why and how the Late-Glacial hunter-gatherers successfully adapted to the rigorous climate and ecology, as well as the diverse geographic and geological conditions of the northern Pacific Rim. In order to orient the archaeological record into anthropological significance, by employing a framework of optimization theory in stone tool technology, we address the question of how the variation in bifacial microblade core reduction methods was related to hunter-gatherer foraging, by comparing utility to the cost of transportation

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and failure rates between the large and small bifacial microblade core technologies in the Late-Glacial microblade technocomplexes in central Hokkaido. Based on the results of these analyses, we provide an implication of the important role the wedge-shaped microblade core technology played in the human adaptation in the northern Pacific Rim during the Late Glacial (ca. 18,000–11,500 cal. BP) and the initial Holocene (ca. 11,500–8000 cal. BP).

2. Bifacial wedge-shaped microblade cores in Late-Glacial Hokkaido

2.1. A brief research history

Besides the difference in dates between the Pleistocene/Holocene sites in the Old and New Worlds, it is the morphological affinity in wedge-shaped microblade cores shared among the assemblages from both sides of the regions of the northern Pacific Rim that support the idea of human migrations from East Asia to North America through the Beringia (Nelson, 1937; Yi and Clark, 1985; Andrefsky, 1987; Hoffecker et al., 1993, 2014; Hoffecker and Elias, 2007). The peculiar morphological characteristics of wedge-shaped cores have been particularly scrutinized by Japanese archaeologists to distinguish reductive processes of microblade cores in microblade production (Yoshizaki, 1961; Kobayashi, 1970; Tsurumaru, 1979, see also; Bleed, 2001). Techno-morphological studies conducted between the 1960s and the 1990s almost completely described core reduction sequences and the types of resultant microblade cores (e.g., Yoshizaki, 1961; Hayashi, 1968; Kobayashi, 1970; Anbiru, 1979; Tsurumaru, 1979; Bleed, 1993, 2002a,b; Chiba, 1993). Based on these analytical results, it is now recognized that more than half a dozen of patterned microblade core reduction sequences are present in Hokkaido (Sato and Tsutsumi, 2007), known as the “gihō” (Bleed, 2001: 102, 2002b: 96) or “methods” (Nakazawa et al., 2005: 276). Moreover, meticulous descriptions of microblade cores have allowed us to understand prehistoric human technology by comparing reduction sequences characterized by different sequential steps and processes that reduced the mass by removing flakes, spalls, and microblades among assemblages (Bleed, 2001).

2.2. Large and small bifacial wedge-shaped cores in Late-Glacial technocomplexes in Hokkaido

Fig. 1 illustrates core types and corresponding reduction sequences in bifacial microblade core technology. While archaeologists have made some observations on the techno-morphological differences among the bifacial microblade cores (e.g., *Sakkotsu* and *Shirataki* types) including the presence/absence of core and platform preparations after removing spalls (i.e., first spalls with trihedral sections and secondary ski spalls with trapezoidal sections (Bleed, 1993)), and blank types of bifaces (e.g., flakes, split cobbles, angular debris (Hayashi, 1968; Anbiru, 1979; Tsurumaru, 1979; Chiba, 1993)), they are generally viewed as variation in the reduction of bifacial microblade-cores that follow the processes of preparations of bifacial preforms, removing of multiple spalls along the longest axis of the biface to make the relatively flat surface of the platform, and the detachment of microblades from one end of the elongated platform, which is the specific reductive method most often known as the “Yubetsu gihō” (Yoshizaki, 1961: 15), or “Dyuktai technique” (Flenniken, 1987: 118, about the concept of “Dyuktai culture” see; Yi and Clark, 1985). Similar to the reduction sequence of the *Yubetsu* method but a little different reduction sequences are also recognized in the “*Oshorokko*” method (Yoshizaki, 1961; Tsurumaru, 1979; Bleed, 2001). In *Oshorokko*-type microblade cores, a core platform is set in an oblique direction along the perimeter of a biface near the end. The size differences between these two methods, however, are implicitly incorporated into the classification procedure in determining the reductive methods of microblade cores rather than as techno-morphological traits that serve as criteria to identify distinctive reductive methods.

2.2.1. Sakkotsu and Oshorokko complexes in central Hokkaido

Because all of these methods were found separately among the assemblages, the microblade assemblages in Hokkaido are better analyzed by dividing them into the complexes represented by different microblade core reduction methods (Nakazawa and Yamada, 2015). The *Sakkotsu* and *Oshorokko* complexes are distinctive not only in the size difference of the bifacial wedge-shaped microblade cores, but also in the variation in tool compositions. The typical tool inventory for the *Sakkotsu* complex is characterized by endscrapers, sidescrapers, and burins made on flakes, and “half-oval” small bifaces, sometimes with chopping tools, while that of the *Oshorokko* complex is characterized by blade-based endscrapers, sidescrapers, and burins, often with edge-ground axes (Fig. 2). In the archaeological sites, these two complexes have neither been associated with one another in the same assemblage, nor been stratigraphically separated in the same site. Notable differences make it legitimate to view them as mutually independent complexes, and most Japanese archaeologists currently agree with the interpretation that the *Oshorokko* complex appeared later than the *Sakkotsu* complex (Yamahara, 1998; Nakazawa et al., 2005; Terasaki, 2006; Yamada, 2006; Naoe, 2014; Nakazawa and Yamada, 2015). However, the limited number of chronometric dates

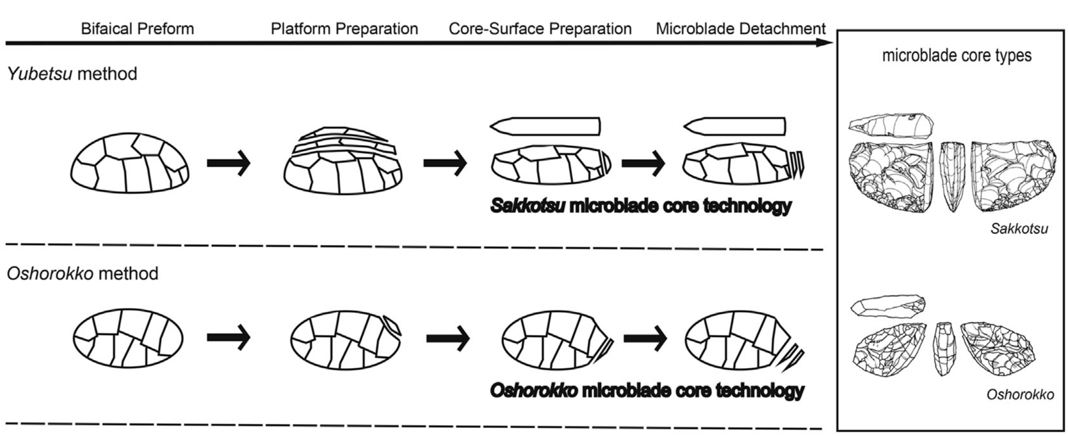

Fig. 1. Reduction sequences of bifacial microblade cores and corresponding types of wedge-shaped microblade cores. *Yubetsu* method has resulted in microblade cores of *Sakkotsu* type. Schematic illustration of reduction sequences is modified from Nakazawa et al. (2005).

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