



# On the provenance of prehistoric obsidian artifacts in South Korea



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## ABSTRACT

Using a series of geochemical data from obsidian samples taken from unmodified rocks and prehistoric sites, we investigated the provenance of some obsidian artifacts found in South Korea. By using LA-ICP-MS and SHRIMP methods, we analyzed rare earth elements (REEs) and lead (Pb) isotopic ratios of obsidian samples from the North Korean side of the Baekdusan Mountain (NK) and artifacts from a Neolithic site in Gadeokdo, southeast coast of South Korea (BG). Published accounts on the elemental correlation of previously analyzed samples were re-examined in consideration of their geological compatibility. It appears that the prehistoric artifacts from the middle to northern part of South Korea have a genetic relationship with obsidians from the Baekdusan area, whereas those of the southern part are related to Kyushu, Japan. REE patterns of the BG and the NK samples demonstrate a prominent contrast between them, suggesting their different provenances. Presumably, the BG obsidians are related to the volcanic rocks of Kyushu. Given that Pb isotopic ratios are indicative of the relative contribution of crust versus mantle component to the volcanic magma, they indicate the addition of a crustal component to the volcanic magma for the Baekdusan volcanic rocks and the NK obsidians. The Kyushu volcanics and the BG obsidians have a relative affinity to the mantle component. The geochemical approach adopted in the current research may be regarded as an accurate and effective means to discriminate and isolate obsidian sources, helpful for provenance and other archaeological study of obsidian artifacts.

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## 1. Introduction

Obsidian is a consolidated material from volcanic magma during the nearly final stage of magmatic differentiation (Bates and Jackson, 1987), and its occurrence is spatially restricted to the volcanic area. Comparative study of prehistoric obsidian artifacts and raw materials provides a clue to understand various aspects of the ancient culture in consideration, such as trade and movement of people. In Korea, obsidian is a rather rare rock to be found. The only known source of fine obsidian materials is Mt. Baekdusan (also known as Paektusan or Changbaishan) volcanic field close to the Sino-Korean border. The amount and quality of obsidian there are regarded very adequate for making stone tools. Although a limited amount of obsidian is known to occur in Meso- to Cenozoic volcanic fields in South Korea, its quality and quantity are not adequate for producing artifacts. On the other hand, the Kyushu volcanic field in southwestern Japan is well known for many obsidian sources. Its proximity to Korea provided ample opportunity to be a potential source of raw materials for prehistoric tool-makers of the southern parts of the peninsula.

In South Korea, obsidian artifacts are known at many prehistoric sites, if limited in quantity (Fig. 1). All of the sites in Fig. 1 are open-air localities dated between c. 25–30 ka and 5–6 ka. Although some of the Pleistocene localities are claimed to have features related to human habitation, such as hearths, they basically represent loose accumulations of artifacts over time in fluvio-colluvial sediments. Association between obsidian artifacts and such features is more pronounced for the Neolithic, although they are not reported in the context of tool-making or use.

Regarding the provenance of the obsidian artifacts, there currently are two contrasting opinions among the researchers. One is that they are mostly from the Baekdusan area (the obsidian artifacts from Hahwagyeri, Hopyeongdong, Jangheungri, Sangmuryongri, Samri, and Suyanggae sites in Fig. 1; Sohn, 1989; Kuzmin, 2004; Kim et al., 2007). The other is that other materials are present, whose sources must be delineated (Gigok, Sangsari, Shinbuk, and Wolsoengdong sites in Fig. 1; Cho et al., 2006; Jang et al., 2007; Cho and Choi, 2010, 2012). Obsidian artifacts from the southern part of South Korea demonstrate genetic similarity to the Kyushu obsidians (Dongsamdong, Tongyeong, and Yeosu sites in Fig. 1; Cho et al., 2006; Jang et al., 2007; Kim et al., 2007).

This study attempts to estimate the provenance of some obsidian artifacts found in South Korea. Based on a series of

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Fig. 1. Major prehistoric obsidian localities in South Korea. Obsidian outcrops in Baekdusan (Ri, 1993) and Kyushu (Togashi and Matsumoto, 1991) are also indicated.

geochemical data obtained from the naturally occurring obsidians and the obsidian artifacts, we examined geochemical correlations between them. After presenting results obtained from the analysis, discussion focuses on the source of the studied artifacts.

## 2. Materials and method

To study the provenance of the obsidian artifacts in South Korea, we chose sets of geochemical data from published reports

which are deemed suitable for the analysis. In doing so, we did not include the data acquired by pXRF because of the poor reliability in the quality of data produced. We also analyzed both newly found natural obsidian samples from the southern flank of the Baekdusan area in North Korea and the artifacts from a Neolithic coastal site of Gadeokdo in Busan in South Korea, using LA-ICP-MS and SHRIMP, at Korea Basic Science Institute (KBSI). Results are presented in Table 1.

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