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# Geochemistry of Volcanic Glasses and Sources of Archaeological Obsidian on the Kamchatka Peninsula (Russian Far East): First Results

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Yaroslav V. Kuzmin, Andrei V. Ptashinsky, and Andrei V.  
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Assigning obsidian artifacts to their geologic sources using analytical chemistry techniques is one of the best methods available for establishing prehistoric patterns of trade, exchange, and interaction. In northeast Asia, significant progress in this field has been achieved in Japan (Hall and Kimura 2002; Suzuki 1970; Yamamoto 1990), and more recently in the Russian Far East (Kuzmin et al. 2002a, 2002b). However, on the Kamchatka Peninsula no systematic collections or geochemical analyses of obsidian have taken place.

The Kamchatka Peninsula, situated in far eastern Russia, spans a region of approximately 400 by 1200 km. Located at the boundary between the Pacific and Eurasian plates, Kamchatka is one of the most active volcanic arcs in the world. Consequently, there are many obsidian sources, and approximately 800 archaeological sites with obsidian tools and debitage are known to exist. Source determination of artifacts will give us a better understanding of the prehistoric movement of people and artifacts in this region, and will contribute to the ongoing dialogue of the role that this area played in the colonization of Beringia and the Americas (Goebel et al. 2003).

In 2003, a joint University of Missouri and Russian Academy of Sciences collaborative research project was initiated to identify sources of archaeological obsidian in Kamchatka. During the 2004 field season, we collected obsidian from geologic contexts near the city of Petropavlovsk-Kamchatsky. Our samples were augmented with artifacts from extant collections and with geologic specimens housed in Russian reference collections. Thus far, 251 artifacts obtained from sites across Kamchatka and 43 source samples have been analyzed by instrumental neutron activation analysis (INAA) at the University of Missouri Research Reactor Center.

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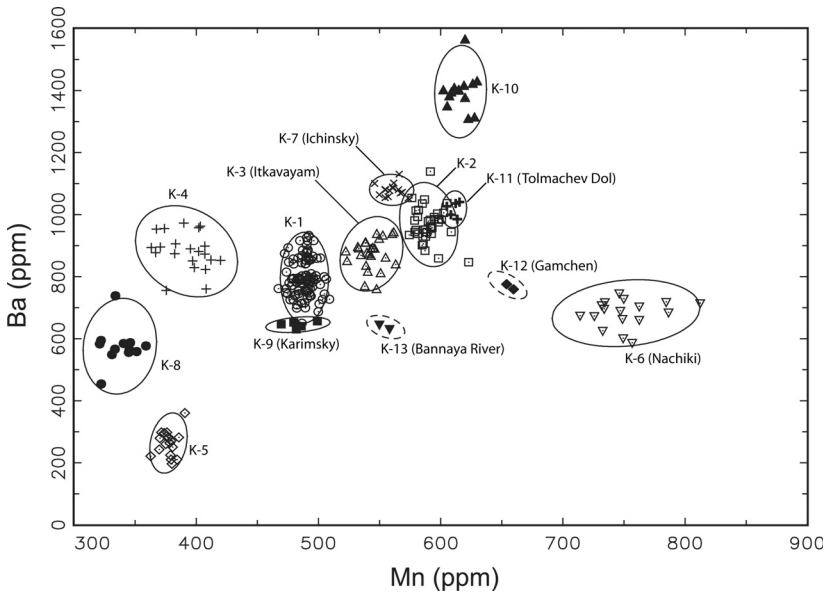
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Thirteen distinct chemical groups, designated K-1 through K-13 (Figure 1), were determined; 11 samples are unassigned. Two groups, K-12 and 13, only contain geological samples. Seven groups (K-2, 3, 5, 6, 7, 9, and 11) comprise obsidian from both sources and archaeological sites. The distances between sources and sites, where obsidians from particular source groups were identified, vary from about 1 to 400 km. Four groups (K-1, 4, 8, and 10) included only artifacts, thereby making source attribution impossible. These groups provide us with an idea of the number of geological sources that must be located, and clues as to where to look. Fieldwork during the 2005 season will focus on the search for sources so far unknown.

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**Figure 1.** Bivariate plot of manganese and barium concentrations for obsidian source samples and artifacts from Kamchatka analyzed by INAA. Ellipses represent the 95 percent confidence interval for group membership. Unassigned specimens are not plotted. Manganese and barium are particularly useful for discriminating elements because as large ions these elements are incompatible with crystallizing solids; as magmas evolve the concentrations of incompatible elements will be different for each source.

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