# Geochemical study on basaltic xenoliths and rhyolites from Kozushima,Izu ac

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Kozushima is a Quaternary volcanic island belonging to the Izu arc. It is located on the rear arc side of the volcanic front, of which the slab depth is ~200 km. Kozushima is a gourd-shaped island approximately 6.5 km north-south and 4.0 km east-west, and several lava cones are connected with each other by pyroclastic deposits. Although most of the volcanic islands in the Izu arc are basaltic to andesitic in composition (e.g., Oshima, Miyakejima, and Hachijojima), the three islands located on the rear arc side (i.e., Kozushima, Niijima, and Shikinejima) are mostly composed of rhyolites. The rhyolites in Kozushima are categorized into three types based on the mineralogical compositions: hypersthene rhyolite, cummingtonite rhyolite, and biotite rhyolite. On the basis of the eruption age, the activity of biotite rhyolite is classified into the first to third stages. A small volume of basaltic xenoliths can be exceptionally found in the rhyolite from the Menbo area, southwest of Kozushima. The origin of the basaltic xenolith is unclear, while a connection to the high-alumina basalt found in Niijima has been proposed.

The objective of this study is to geochemically clarify the origin of the basaltic xenoliths and their relationship with the eruption of rhyolites in Kozushima. To this end, we measured the concentrations of major and trace elements in 4 basaltic xenoliths and 24 rhyolites collected from Kozushima. The major element abundances were determined by X-ray fluorescence analysis (Rigaku RIX2100). The trace element abundances in 4 basaltic xenoliths and 14 rhyolites were measured using ICP-MS (Thermo X series II). The $SiO_2$ in the basaltic xenoliths and rhyolites ranged from 51 to 54% and 73 to 77%, respectively. The analyzed basaltic xenoliths are classified as high-alumina basalts based on the abundances of alkali elements and $SiO_2$. The abundances of MgO, $tFe_2O_3$, $Al_2O_3$, and CaO increase along with the increase of $SiO_2$, whereas $K_2O$ decreases as $SiO_2$ increases. The N-MORB normalized trace element patterns of the basaltic xenoliths shows enrichments in incompatible elements and depletions in HFSEs, the characteristics which is typical for island arc basalts. The rhyolites have trace element abundances higher than the basaltic xenoliths, and the trace element patterns are similar to those of the basaltic xenoliths. In contrast to the basaltic xenoliths, negative anomalies in Sr and Eu are found for the rhyolites. Additionally, the abundances of Sr and Eu in the rhyolites decrease with the increase of $SiO_2$. Furthermore, the cummingtonite rhyolite has higher abundances of Y and HREEs when compared to the other rhyolites. These characteristics most likely reflect the involvement of plagioclase and amphibole in the formation of rhyolites (Taniguchi et al., 1990). Overall, the major and trace element characteristics in the Kozushima rocks suggests that the rhyolites were originated from a less differentiated magma represented by the basaltic xenoliths via a fractionation process involving plagioclase and amphibolite.

Among the basaltic rocks from the Izu arc volcanoes, the basaltic xenoliths from Kozushima possess highest trace element abundances. This is consistent with the conclusion of a previous study (Kimura et al., 2010) that the trace element abundances in basalts in the Izu arc volcanoes increase with increasing subduction depth of the Pacific plate.

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