

Diversity in Sr-Nd isotopic composition of Mg-rich basalts in Hahajima Islands, Bonin archipelago

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Based on the detailed geological and petrographical observations of the Paleogene basaltic rocks of the Hahajima Islands, we distinguished three distinct primitive basaltic rocks from Mukoojima and Futagojima. The calculated compositions of olivine which is in equilibrium with their bulk rock compositions are 91.7 (FJ03), 92.8 (MK03), and 93.2 (MK INC). These samples are clearly distinguished from each other in bulk rock SiO₂ vs Mg# plot.

Based on the major, trace and isotopic data, and also petrological data, we will discuss the origin of the three distinct primitive magmas found from Hahajima Islands.

Based on the detailed geological and petrographical observations of the Paleogene volcanic rocks of the Hahajima Islands, we distinguished three distinct primitive basaltic rocks from Mukoojima and Futagojima. These samples include olivine-clinopyroxene basalts (sample: MK03 and FJ03) and glassy inclusion (sample: MK INC) found in olivine-clinopyroxene basalts from the Mukoojima. Their bulk rock compositions are very primitive in terms of MgO and Cr contents and in Mg#. Although no fresh olivine phenocrysts are found from the samples, the calculated compositions of olivine which is in equilibrium with their bulk rock compositions are 91.7 (FJ03), 92.8 (MK03), and 93.2 (MK INC). Compositions of chromian spinel contained in these samples are characteristically high in Cr# (FJ03: 0.60-0.70, and MK03: 0.60-0.75).

These samples are clearly distinguished from each other in bulk rock SiO₂ vs Mg# plot.

Some major and trace element data are as follows:

MK INC: SiO₂ = 52.9%, TiO₂ = 0.51%, MgO = 13.5%, K₂O = 0.2%, Cr = 534 ppm, Ni = 275 ppm

MK03: SiO₂ = 51.7%, TiO₂ = 0.51%, MgO = 11.7%, K₂O = 0.1%, Cr = 695 ppm, Ni = 208 ppm

FJ03: SiO₂ = 48.6%, TiO₂ = 0.70%, MgO = 13.3%, K₂O = 0.2%, Cr = 713 ppm, Ni = 226 ppm

In order to discuss the features of the source mantle and the melting processes, we determined Sr and Nd isotopic compositions of these samples (assuming the age of 40 Ma): MK INC: SrI = 0.70326 (2 sigma 0.00001), NdI = 0.51289 (0.00001); MK03: SrI = 0.70351 (0.00001), NdI = 0.51297 (0.00001); and FJ03: SrI = 0.70364 (0.00001), NdI = 0.51300 (0.00001).

Although these data are not very different from each other, the differences in isotopic compositions are meaningful because of small range in analytical error during the experiments. Based on the major, trace and isotopic data, and also petrological data, we will discuss the origin of the three distinct primitive magmas found from Hahajima Islands.

Paleogene primitive magmas found in the Izu-Bonin arc include the boninites from Chichijima and from Holes 786A/B and 793B (ODP Legs 125 and 126). If we compare these boninites and the primitive magmas from Hahajima at an Mg# > 0.65, they are distinguished in SiO₂ content; that is, 48-53% for the basalts from Hahajima, 50-57% for the boninites from Holes 786A/B and 793B, and 56-58% for boninites from Chichijima. These differences, of course, can be attributed to the difference in compositions of source material and also in melting processes within the mantle. Our talk will include a discussion on the regional diversity in geochemistry of the primitive rocks in the Paleogene Izu-Bonin arc.