

Mantle evolution beneath back-arc basin inferred from peridotite xenoliths from the Japan Sea

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Peridotite xenoliths are found in basaltic to andesitic lavas from the Shiribeshi Seamount in the Sea of Japan, a Miocene back-arc basin of the Western Pacific Region. These peridotites are divided into two-pyroxene peridotites, dunite and wehrlite. Two-pyroxene peridotites have retained their original mantle geochemical signatures, although partly suffered from chemical modifications from the host magma. The dunites and wehrlite were, on the other hand, formed from the two-pyroxene peridotites by extensive interaction with magma active before the host one. Clinopyroxenes in the two-pyroxene peridotites display various REE patterns. Some peridotites are similar in LREE-fractionated (LREE-depleted) character of clinopyroxene to abyssal peridotites directly recovered from mid-ocean ridges and back-arc basins, which are usually interpreted as simple residue after partial melting. Other samples with LREE-enriched patterns of clinopyroxenes are residues after flux melting due to infiltration of slab-derived fluids. Orthopyroxene veins cutting olivine in the two-pyroxene peridotites were a product of reaction with aqueous fluid released from subducted slab. The geochemical variations of the peridotite xenoliths from the Sea of Japan (the Seifu Seamount, the Oshima-shima Island and the studied samples) are likely to be related to evolution of the mantle beneath the Sea of Japan from hydrous to near-dry with a progress of the back-arc rifting. The mantle evolution beneath the Sea of Japan inferred from the peridotite xenoliths is well consistent with the geochemical and isotopic results from the Miocene basaltic rocks formed during opening of the Sea of Japan. Our mantle process model beneath the Sea of Japan also reconciles with recent models for the melting regime and evolution of the mantle beneath global back-arc basins, and gives constraints on formation and evolution of the back-arc basins.

Keywords: Back-arc basin, Sea of Japan, Mantle, Peridotite xenolith