

Roles of slab-derived melts on the genesis of Eocene-Oligocene andesitic magmas in Izu-Bonin-Mariana arc

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We have evaluated the role of slab-derived melts in the genesis of Eocene to Oligocene andesitic magmas in the Izu-Bonin-Mariana (IBM) arc. This study has dealt with igneous rocks from the following regions: Ogasawara Islands, ODP sites (448, 793, 786, 458, and 459), Guam, Rota, Saipan, the Mariana inner trench, Palau, and Komahashi-daini seamounts. Bulk rock compositions for the rocks from Guam, Rota and Saipan were measured, whereas for the other samples compositions from the literature were used. In order to remove the effects of alteration and fractional crystallization, the bulk rock compositions were filtered. The compiled data is free to download from the GANSEKI database operated by JAMSTEC.

The source materials of arc magmas are considered to be mantle wedge peridotite and slab-derived components. In the case of a boninite from Chichi-jima, the estimated slab-derived component contains relatively large amounts of HFSE, in addition to the fluid-mobile elements. This indicates that slab-derived melts or supercritical liquids are likely source. The former seems to be more likely, because the slab-derived material would be expected to have compositions similar to adakitic rhyolite.

Using this estimated slab-derived melt composition, we examined the role of slab melts on the genesis of other Eocene to Oligocene igneous rocks through forward modeling. The magmas affected by slab melts are distinguished from magmas generated by slab fluid on the basis of Sm/Yb vs La/Sm and Zr/Sm vs Sm/Yb diagrams. Some andesites from the Mariana inner trench, and ODP/DSDP sites of 786, 458 and 459 imply that adakitic slab melts contributed to their genesis, whereas the origin of basaltic rocks is affected by slab fluids. These results suggest that 1) slab melting was common during the early stage of magmatism in the entire IBM arc, and 2) the adakitic slab melt contributed to formation of boninitic magmas.