

Estimation of slab-derived fluids using olivine-hosted melt inclusions collected from volcanoes in Kyushu, SW Honshu arc, Japan

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Olivine-hosted melt inclusions from four Quaternary volcanoes from Kyushu, located in the volcanic front of SW Honshu arc, were used to estimate primitive magma compositions and slab-derived fluid compositions. Small scoria samples were collected from Nakadake and Ojodake peaks of Aso volcano, Hijiidake peak of Kuju volcano, Ohachi peak of Kirishima volcano, and Kaimondake tephra of Kaimon volcano.

Major and minor elements of olivine-hosted melt inclusions and of minerals (host olivine, Fe-Ti oxides) were determined using an electron probe micro analyzer. H₂O and CO₂ concentrations in melt inclusions were determined by Fourier transform infrared spectroscopy (FTIR). The compositions of melt inclusions were corrected for post-entrapment modifications including diffusive Fe loss, H₂O loss due to iron oxidation and magnetite formation, and olivine crystallization. All melt inclusions, except those from Aso Nakadake, have high volatile concentrations (2.9–4.8 wt.% H₂O, 450–780 ppm CO₂, 0.09–0.19 wt.% S, 0.06–0.10 wt.% Cl). This indicates that there was little or no degassing prior to melt entrapment.

Primitive magma composition, which is in equilibrium with mantle olivine, was calculated using olivine additions to melt compositions. TiO₂, a fluid immobile element, was used to estimate the degree of partial melting, which was then used to estimate the compositions of slab-derived fluid components. Estimated compositions of slab-derived fluids beneath Kyushu frontal arc have a wide variation, but the range of fluid compositions are similar to those from other volcanic arcs. Positive correlation was found between estimated degree of partial melting and H₂O contents in mantle source. K₂O contents in Aso and Kuju primitive magmas are higher than those from Kirishima and Kaimon and from other volcanic arcs. Dehydration processes controlled by phengite-bearing eclogite is a possible mechanism to create high K₂O primitive magmas, when considering the deeper location of subducted slab beneath these volcanoes.