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Geochemical tomography for melting condition beneath Japan arcs

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Slab-derived fluid (hereafter slab-fluid) plays an important role for generation of arc magmas. If the flux of slab-fluid is enhanced or reduced by variable tectonic settings and the corresponding thermal and flow regimes, it has effects on the mantle melting. The melting condition may contribute to infer the thermal, flow and fluid regimes. We focus on the melting condition in the mantle wedge beneath Central Japan, where the two overlapping slabs, Pacific and Philippine Sea plates, exist and the amount and composition of slab-fluids from the two slabs are well documented, as the regional variation of slab-fluid fluxes that are related to the geometry of the subducting plates.

Based on the chemical composition of major and trace elements, we construct forward and backward models to constrain the melting condition beneath Central Japan. The composition of the primitive rock can be corrected for fractionated phases to estimate backwardly that of primary magma, while the compo-sition of melt generated in the mantle wedge can be forwardly modeledas a function of degree of melting (sensitive to temperature) and mineralogy (proportions of garnet/spinel peridotites, sensitive to pressure) based on the composition of fluid metasomatized mantle.

As a result, the melting condition is characterized by relatively low melting degrees and high proportions of garnet peridotite involved in melting compared to the adjacent arcs with a single subducting slab, e.g., the Izu-arc. This implies that, the melting occurred at deeper depths and lower temperature for Central Japan. This also consistently explains the existence of ada-kites occurred in this area, in spite of the cold setting. The same analysis for the volcanoes in the adjacent areas show transition the thermal and fluid conditions, according to the spatial variation of the tectonic re-gimes, suggesting that geochemical approach is useful to map the physical condition, and could be referred to as geochemical tomography.

Keywords: mantle, melting, slab, slab-fluid, subduction, arc