九州地方の電気伝導度構造と温度構造から求められたマントルの流体分布

Geo-fluids distribution in mantle inferred from the electrical conductivity and simulated thermal structures beneath Kyushu

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The Kyushu Island, at which the oceanic Philippine Sea Plate subducts into the mantle beneath the continental Eurasia Plate, is characterized by the northern and southern volcanic regions and the central non-volcanic region. Magmatism in the subduction zones is triggered by the addition of the oceanic slab-derived aqueous fluids (water) to the mantle, because solidus of the mantle rock falls by the addition of the aqueous fluids and partial melting of the mantle occurs. Thus the determination of geo-fluids (the aqueous fluids and the melts) distribution is essential to understand the magmatism in the Kyushu subduction zone including the non-volcanic region between the two volcanic regions.
We obtained an electrical conductivity structure (model) beneath the entire Kyushu Island using three-dimensional inversion analyses and found three conductive anomalies, which indicate the different intensity and spatial extent for the three regions, at the mantle in the model [Hata et al., 2015]. The difference is considered to originate in the content of geo-fluids in the mantle. We determined the temperature and melt fraction distributions (structures), as a function of a fixed water content, inferred from the electrical conductivity structure beneath the Kyushu Island by using petrological laboratory-derived results [Hata and Uyeshima, 2015]. The laboratory-derived results are the relation between electrical conductivity and temperature for four nominally anhydrous minerals (Olivine, Orthopyroxene, Clinopyroxene, and Garnet) and hydrous basaltic melt in solid and liquid phases of the mantle, and the relation between melt fraction and temperature for mantle rocks (peridotites) under a condition of isobaric hydrous mantle melting.
In this study, we aim to determine the content of both geo-fluids in the mantle beneath the Kyushu Island. Thus we use a fixed thermal structure, which is a simulated thermal model associated with the subduction of the Philippine Sea Plate [e.g., Yoshioka et al, 2008]. Then we determine the geo-fluids distribution by integrating the simulated thermal structure of the mantle, field-derived electrical conductivity structure of the mantle, and laboratory-derived electrical conductivity of the four mantle minerals and the basaltic melt. We will describe our approach to determine the content of the geo-fluids and show the water content distribution and the melt fraction distribution in the mantle beneath the Kyushu Island.

