

An interpretation of dehydration process in the subduction zone beneath Kyushu Island, Northwestern Japan

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The Japan Island Arc has different subduction settings; the young Philippine Sea plate (10-50 Ma) subducts beneath Kyushu Island in the southwestern Japan with dipping angles of about 60 degrees, while the Pacific plate older than 100 Ma subducts beneath Tohoku district in the northeastern Japan with dipping angles of about 45 degrees. It has been considered that these different subduction settings cause different volcanic activities and dehydration processes between Kyushu and Tohoku districts (e.g. Iwamori, 2007; Ichiki et al., 2009). In this study, we compiled the electrical conductivity (Handa et al., 1992; Handa et al., 1999; Ichiki et al., 2000; Hata et al., 2012) and seismic wave velocity (Nakajima et al., 2007; Zhao et al., 2012) models beneath Kyushu Island, and interpreted that dehydration process from subducting slabs and fluid transport process were consistent with each other between Kyushu Island and Tohoku district. The interpretation is 1) fluids dehydrated from subducting slab are absorbed in peridotites at the bottom of the mantle wedge. The hydrous minerals are dragged into the deeper part and dehydrated in the deeper mantle beneath the backarc region. 2) The fluids dehydrated from the hydrous peridotite indicate Rayleigh-Taylor instability in the upwelling process. This results in the volcanic and non-volcanic areas along the volcanic front of Kyushu Island.

An obvious negative free-air and/or Bouguer gravity anomaly is observed in the forearc region of Kyushu Island (Kono and Furuse, 1989; Shichi, 1997; cf. Nakada et al., 2002). The V_p/V_s and electrical conductivity values at ca. 40 km depth beneath the forearc region show higher than 2.0 (Saiga et al., 2010) and 0.02 S/m (Ichiki et al., 2000), respectively. These suggest that serpentine diapir underlies beneath the forearc region of Kyushu Island. However, these features have not yet been observed beneath the forearc region of Tohoku district. More observations focusing on the forearc region are required in the Tohoku district.

Keywords: Electrical conductivity, Seismic wave velocity, Subduction zone, Dehydration, Backarc, Serpentine