

Electrical structure beneath the eastern margin of Japan Sea

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Dynamics of the upper mantle beneath the eastern margin of Japan sea has been investigated by electrical methods. We carried out magnetotelluric (MT) survey both on land and at the seafloor. The MT profile traverses the back-arc basin of Northeast Japan and the arc itself along approximately 39.5N. The analysis of the observed data provides a two-dimensional (2D) electrical section of the region. We show the model and its interpretations in the presentation.

Recent geophysical and geochemical studies have elucidated source region of magma supply to the arc volcanism in Northeast Japan. Precise three-dimensional seismic tomographic images show that low velocity zone beneath the volcanoes extending to deeper mantle beneath the back arc side (e.g. Nakajima et al., 2001). Tamura et al.(2001, 2002) has proposed 'hot fingers' as the mechanism of the magma supply. The root of the fingers is not imaged by the land-based tomography because it lacks in seaward resolution. Imaging the back arc mantle is, consequently, worth endeavoring and it can be achieved by any geophysical exploration at the seafloor. Seafloor MT survey using ocean bottom electromagnetometers (OBEMs) is one of suitable approaches for the purpose. The electrical conductivity of the mantle rock is primarily dependent on temperature, although partial melt and water dissolved in olivine can enhance conductivity. Both melting and mantle hydration are important parameters to constrain in a back-arc setting suggesting that the study of conductivity structure will be useful to furthering our understanding of these regions.

For the seafloor observation of this study, we deployed six OBEMs in October 2002 and recovered five of them successfully after ten months measurement. High quality data were recorded by the four instruments. The data, which are available in the period range from 100 to 20,000 seconds, are expected to explore the mantle down to about 200 km depth. A 2D conductivity structure model obtained by the preliminary analysis of the seafloor data shows that a conductive zone exists in the mantle deeper than about 130 km beneath Sado Ridge (about 90 km offshore) and it extends to shallower mantle toward the east although the resolution of this feature should be tested in further analysis. This trend seems consistent with the low velocity zone downgoing toward the west beneath the island arc.

In the further analysis, we compile both the seafloor and land data and estimate a new 2D model including the island arc mantle. The land data are acquired at four stations on Ou mountain range and available in the period range from 20 to 14,000 seconds. In order to obtain more reliable model, we reanalyze the seafloor data and remove topographic effect which distorts the EM field especially on the seafloor and prevents the information of the underlying mantle structure, and then we invert the data corrected for the topographic effect.