Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SEM37-02 Room:201B Time:May 22 14:45-15:00

First report on electrical conductivity imaging of ”Normal Oceanic Mantle”

Kiyoshi Baba[1*], Hisashi Utada[1], Noriko Tada[2], Hisayoshi Shimizu[1]

[1]Earthquake Research Institute, University of Tokyo, [2]Institute for Research on Earth Evolution, Japan Agency for Marine-Earth Science and Technology

Horizontal flow zone between up-welling and down-welling of the mantle convection, which occupies large portion of the ocean floor, is thought to represent ”normal” mantle that is away from tectonic activities. The research group of Normal Oceanic Mantle Project consists of researchers in Earthquake Research Institute (ERI), University of Tokyo, and Institute for Research on Earth Evolution (IFREE), Japan Agency for Marine-Earth Science and Technology (JAMSTEC) have investigated normal oceanic mantle by means of marine geophysical observations to elucidate two fundamental questions of the Earth Science; 1) What is the physical condition for the lithosphere-asthenosphere boundary (LAB)? 2) Is the mantle transition zone (MTZ) a major water reservoir of the Earth? We set the target field to two areas, which are northwest (area A) and southeast (area B) of Shatsky Rise in northwestern Pacific, and have carried out seafloor electromagnetic (EM) surveys using ocean bottom electromagnetometers (OBEMs) and electric field observation systems (EFOSs) since 2010. In this presentation, we introduce preliminary result for the estimation of electrical conductivity structure beneath the area A obtained by the data acquired in the pilot survey during June 2010 and August 2012.

The raw time series obtained by the OBEMs at four sites were processed to obtain magnetotelluric (MT) impedance tensor at each site. The MT responses were estimated accurately in the period range from 160 to 122,880 seconds. We first estimated one-dimensional (1-D) conductivity structure model which explains the data of all sites averagely correcting topographic effect on the observed MT responses, as we applied to the previous study for the Philippine Sea and off Bonin Trench in the Pacific Ocean (Baba et al., 2010). The obtained 1-D model shows the resistive upper layer and underling conductive zone, indicating cool oceanic lithosphere and asthenosphere, respectively. Although this kind of feature is common for oceanic upper mantle, there are some differences between the obtained models in this study and the previous study for off-Bonin Trench (Hereafter, we refer it area C). The thickness of the resistive layer is about 150 km, which is thinner than that beneath the area C (˜200 km). The conductivity value of the asthenospheric mantle is 0.03-0.1 S/m, which is slightly higher than that for the area C. The seafloor ages are about 130 Ma and 140-155 Ma for the area A and C, respectively. However, the 10-15 Ma difference for old mantle is not likely to produce such difference in conductivity structure. The MT responses predicted from the surface heterogeneity over the 1-D mantle structure fit the observed MT responses imperfectly, especially in terms of splitting between xy and yx elements. This fact suggests that the mantle is laterally heterogeneous and/or anisotropic. These issues should be investigated in the future analysis. Also, we will collect further data in area A and B, and analyze all available data in more detail to achieve the desired purposes.

Keywords: Normal Oceanic Mantle, northwestern Pacific, electrical conductivity, ocean bottom electromagnetometer, magnetotellurics