Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

SEM36-P06 Room:Poster Time:April 30 18:15-19:30

Electrical resistivity features of the back-arc areas in the NE Japan subduction zone

ICHIHARA, Hiroshi[1*] ; TADA, Noriko[1] ; BABA, Kiyoshi[2] ; KASAYA, Takafumi[1] ; ICHIKI, Masahiro[3] ; KAIDA, Toshiki[3] ; OGAWA, Yasuo[4]

[1]JAMSTEC, [2]ERI, University of Tokyo, [3]Tohoku University, [4]Tokyo Institute of Technology

Electrical resistivity in the crust and upper mantle depends on the pore-fluid distribution, salinity, and connectivity of fluid-filled rock pores. Thus imaging of resistivity distribution based on magnetotelluric surveys gives us fundamental information about fluid distribution of subduction zones. Marine magnetotelluric survey is important to understand dynamics of the NE Japan subduction zone because dehydration of subducting Pacific plate occurs under the Japan Sea. In this study, we discuss resistivity distribution around back-arc areas in the NE Japan subduction zone based on the marine MT data.

We collected natural EM signals with ocean bottom electro-magnetometers (OBEMs) in the eastern Japan sea area between April and August 2013 by MR13-02A and NT13-18 JAMSTEC scientific cruises. In addition, 3 land MT stations were settled in islands in the Japan Sea (Tobishima, Awashima and Sado islands) between April and October 2013. These recorded time-series data were converted to a frequency-domain impedance tensor based on the BIRRP program [1]. The remote reference technique [2] was applied in the data processing using horizontal magnetic field data from Kakioka Station in the period range between 10 and 20000 seconds. As results, high-quality MT responses and geomagnetic tippers in both the trench and back-arc areas.

We calculated phase tensors [3] based on MT impedances by this and previous studies [4] to discuss re-sistivity distribution beneath the back-arc area. The phase tensor ellipse indicates high Φ_{max} (>65 degrees) and Φ_{min} (>50 degrees) in the long periods (>8000 seconds). Large β of phase tensor and large amplitude of geomagnetic transfer function are also shown. These features cannot be explained with bathymetry and sediment effects based on the 3-D forward modeling [5]. Thus strong three-dimensionality and deep conductor possibly distributed beneath the Japan sea. In order to discuss detailed resistivity structure, 3-D inversion approaches are required by using a newly developed 3-D MT inversion code for marine data to treat complicated ocean bottom and land topography [6].

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Keywords: back arc, NE Japan subduction zone, magnetotelluric, OBEM, phase tensor