2D resistivity modeling of the incoming plate in the NE Japan Trench area

*Hiroshi Ichihara[1,2], Takafumi Kasaya[2], Kiyoshi Baba[4], Tada-nori Goto[3], Makoto Yamano[4]

1. Graduate school of environmental studies, Nagoya University, 2. JAMSTEC, 3. University of Hyogo, 4. ERI, University of Tokyo

Resistivity in the oceanic crust can vary significantly with pore fluid. Electromagnetic surveys detected low resistivity areas in the oceanic plate in the vicinity of the Middle America Trench, that implies transportation of aqueous fluid to subduction zone (Naif et al., 2016). Japan Trench is an ideal research field to study incoming fluid because seismic and geochemical surveys implied significant hydration in bending faults in the incoming plate (e.g. Fujie et al., 2018; Park et al., 2021). However, resistivity distribution in this area have not been well clarified although marine natural source electromagnetic survey had been conducted because short period electromagnetic signal significantly decayed due to thick seawater. In this study, we reanalyzed marine electromagnetic data along the survey line at N38 degrees based on newly developed methods and examined their sensitivity to the crustal fluid area. Magnetotelluric impedances were reanalyzed based on FDICA-MT code (Sato et al., 2021) that adopted independent component analysis to remove instrumental and cultural noises. The quality of estimated impedances is better than that by conventional code (BIRRP, Chave and Thomson, 2004) especially in short period. Then we inverted these impedances into resistivity distribution using a 2D code MARE2DEM (Key, 2016) which used adaptively refined elements to treat marine magnetotelluric and marine control source EM data. The inverted resistivity model showed a high resistive zone in lithospheric area and underneath conductive zone. This trend is consistent with the 1-D resistivity model in the Pacific Plate (Baba et al., 2013; 2017). In addition, a conductive anomaly is detected around bottom of the high resistive zone in the land side of the trench. It may reflect high temperature or high fraction of fluid and melt area. On the other hands, the present resistivity model does not show low resistivity area around the outer-rise faults. In addition, sensitivity tests indicated that the impedances used for inversion do not have enough sensitivity. We discussed these reasons as follows. (1) Most components of impedance indicating strong three-dimensionality were removed and thus only a fraction of impedances was used for the inversion. (2) Data quality is not good because signal is decayed in the deep seawater and part of observation were conducted in the quiescence of solar activity. To overcome these problems, three-dimensional modeling and high-quality data acquisition by control source EM survey or MT observation in active period of solar activity are important.

Keywords: Outer rise , resistivity, magnetotelluric, OBEM, Off-Tohoku, oceanic plate

