Marine magnetotelluric investigation of the oldest Pacific lithosphere-asthenosphere system

Hogyum Kim[1], Kiyoshi Baba[2], Sang-Mook Lee[3], and Hisashi Utada[4]
[1]Seoul National University, kamhokam@gmail.com
[2]Earthquake Research Institute, The University of Tokyo, kbaba@eri.u-tokyo.ac.jp
[3]Seoul National University, smlee@snu.ac.kr
[2]Earthquake Research Institute, The University of Tokyo, utada@eri.u-tokyo.ac.jp

SUMMARY

To study the nature and the evolution of the oceanic lithosphere-asthenosphere system, the marine magnetotelluric method has been considered crucial for its sensitivity to temperature, hydration, melts, and other system properties. The Pacific Array project, which aims to investigate the system of the Pacific plate through international collaborative ocean bottom observations, has deployed ocean bottom electro-magnetometers in different locations on the plate. The joint Korea-Japan Oldest-1 array deployed seven ocean bottom electro-magnetometers as a part of the project, which offered an opportunity to study the lithosphere-asthenosphere system of the oldest Pacific plate (~175 Ma) utilizing the method. The obtained data were processed and corrected for the topographic effect to estimate magnetotelluric responses to the sub-seafloor electrical conductivity structure. We applied and took account of both deterministic and probabilistic approaches to the 1-D conductivity inversion. The inversion result revealed that the low conductivity layer's thickness analogous to the lithosphere is notably thicker (~170 km) than expected from widely accepted thermal evolution models of the oceanic plate. Various electrical properties, such as thermal evolution, hydration, and the existence of melt, were evaluated to interpret the conductivity structure of the system. Furthermore, we attempted to integrate other remote and in-situ observations, for example, bathymetry and seafloor seismic observation, to understand the resultant structure.

Keywords: Marine Magnetotelluric, Ocean Bottom Electro-magnetometer (OBEM), Lithosphere-Asthenosphere Boundary (LAB), Lithosphere-Asthenosphere System (LAS), Pacific Array