ふつうの海洋マントル（NOMan）プロジェクトの成果

Five years of the Normal Oceanic Mantle (NOMan) Project

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The Normal Oceanic Mantle (NOMan) project was carried out for 5 years from 2010, aiming to solve two fundamental questions on the ’normal’ oceanic mantle from observational approach, which are: (a) Cause of asthenosphere lubrication, and (b) Amount of water in the mantle transition zone. We selected two study areas (A and B) of similar seafloor age (about 130 and 140 Ma, respectively) in the northwestern Pacific Ocean where the mantle below is supposed to be normal. This presentation will give an overview of five years of the NOMan project, especially of its observational activities and a summary of preliminary results so far obtained.
6 scientific cruises were carried out during the five years' NOMan Project, from June 2010 to September 2014. We deployed state-of-the-art ocean bottom seismic and electromagnetic instruments (BBOBS-NXs and EFOSs) in area A that are handled by ROV for installation and recovery, as well as conventional instruments (BBOBSs and OBEMs of free-fall/self-pop-up type) both in areas A and B. The seafloor age difference between study areas A and B is only about 10 Ma, which was thought small enough for the temperature difference between two areas to be ignored at the first order approximation. So we originally expected that corresponding results in area B show close similarity to those in are A. However, a result of 1-D array analysis of the surface waves indicated certain difference in the lithosphere-asthenosphere structure between areas A and B. 1-D inversion results of multi-station seafloor magnetotelluric (MT) data also show a clear difference between these two areas. Furthermore, MT results in surrounding areas obtained by previous projects imply the presence of further large-scale lateral heterogeneity in the old oceanic mantle in the northwestern Pacific toward the subduction zone. For the moment, we are trying to invert each of NOMan geophysical dataset as accurately as possible so as to characterize the mantle structure and its lateral variation. Later we try to clarify the cause for these lateral variabilities, as it can be one of the key issues to understand the lithosphere-asthenosphere system in the old oceanic mantle.
For the key question (b), high-quality data obtained by the long-term seafloor observations are used to investigate the MTZ structure. In particular, electric field data obtained by EFOS (with 2 km electrode separation) provide longer period MT responses sensitive to the MTZ. Resulting MT and GDS (Geomagnetic Deep sounding) responses are almost consistent with the NW Pacific semi-global 1-D model (Shimizu et al., 2010). This indicates that the MTZ conductivity below the study region has weak lateral variation (well approximated by a 1-D model). Assuming geotherm in the MTZ from the receiver function analyses, this 1-D profile is consistent with the conductivity of MTZ minerals containing at most 0.1-0.5 wt.% water.

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