Lateral heterogeneity of nominally ’normal’ oceanic upper mantle in the northwestern Pacific

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Old (>130 Ma) ’normal’ oceanic upper mantle, which is expected to be cooled over time just by thermal conduction, has been investigated through marine magnetotellurics. One-dimensional electrical conductivity profiles were obtained for areas in the northwest (Area A) and the southeast (Area B) of the Shatsky Rise in the northwestern Pacific (Baba et al., 2017). Supposing that the bottom of resistive upper mantle layer is defined as the depth where the gradient of resistivity changes from minus values to almost zero, the thicknesses of resistive layer for Area A and Area B is about 100 km and about 150 km, respectively. The profiles are significantly different in the thickness, although the lithospheric mantle ages are almost the same; 130 Ma in Area A and 145 Ma in Area B. This means that it is difficult to explain this difference by the half-space model (Lister et al., 1990) or the plate-cooling model (Stein and Stein, 1992).

In this study, we investigate the lateral heterogeneity of the upper mantle beneath the two areas separately by using a three-dimensional inversion approach (Tada et al., 2012; Baba et al., 2013). For Area A, we found that a high electrical conductivity anomaly elongated from the northeast to the southwest in the area at the depths deeper than around 100 km, which is mostly parallel to the seafloor age of 130 Ma and Kuril Trench. On the contrary, there is little horizontal heterogeneity from the shallow lithosphere to the deeper asthenospheric mantle in Area B. In this presentation, we will interpret the three-dimensional features to discuss the cause of the difference between Area A and Area B.