

Azimuthal anisotropy and seismic discontinuity in the oceanic lithosphere revealed by active source surveys

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We have conducted a seafloor observation called Normal Oceanic Mantle (NOMan) project to understand the physical condition for the lithosphere-asthenosphere boundary, which is not yet well determined from 2010 to 2014 in the northwestern Pacific Ocean using broadband ocean bottom seismometers (BBOBSs) and ocean bottom electromagnetometers (OBEMs).

During NOMan project, 6 extensive seismic refraction and reflection surveys by airgun sources have been conducted in the outer rise region of the northwestern Pacific region, westward of the NOMan project observation, to investigate structural changes in an incoming plate.

We observed clear seismic phases in the source-receiver distance range of 400-900 km and interpreted these phases as P-wave reflections from a depth of 50-60 km. The reflection points were located in area whose latitudes are between 36°N and 41°N and longitudes are between 149°E and 153°E, at east of the Nosappu Fracture zone.

Since we observed air-gun signals from various azimuthal directions, we can also analyze the azimuthal dependence of the propagating velocities. The obtained arrival times suggest that the peak-to-peak amplitude of azimuthal anisotropy above the reflectors are about 2 % at most. Previous studies in the northwestern Pacific Ocean show stronger anisotropy (5-10 %) in the uppermost mantle, a few kilometers beneath the Moho, by using Pn-wave. These may suggest that intensity of azimuthal anisotropy decreases with depths up to 50-60km bsf.

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