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「ふつうの海洋マントル」プロジェクトで実施された爆破実験による北西太平洋の最上部マントル構造
Oceanic plate structure beneath the northwestern Pacific Ocean revealed by explosion experiments

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Plate tectonics is based on a concept that a rigid lithosphere moves over a weaker asthenosphere. Understanding of the plate tectonics is important to understand the Earth's system. However, the nature of the lithosphere and asthenosphere boundary (LAB) is not yet well determined. To understand the physical condition for the LAB, we have conduct a seafloor observation called " Normal Oceanic Mantle (NOMan) Project". We focused on the oceanic plate because the nature and evolution history of the oceanic plate is simpler than the continental plate so that it is easier to investigate its nature.

To analyze the upper mantle structures around the LAB, we conducted a seismic explosion experiments as a part of NOMan project.

Seismic explosion experiments were conducted at four shot sites with ten broadband ocean bottom seismometers and the size of explosions is 400 kg at two sites, and 200 kg at other sites. The profile lengths are about 700 and 400 km, respectively.

Previous studies in this area revealed the azimuthal anisotropy in the uppermost lithosphere (Shinohara et al., 2008), a sharp LAB at a depth of ˜80 km (Kawakatsu et al. 2009), and small-scale heterogeneities in the lithosphere (Shito et al., 2013).

We have detected first arrivals from all data whose epicentral distance is between 100 and 670 km. At these distant ranges, first arrival is passing though the mantle, that is, Pn wave is first arrival. The apparent velocities of longer shots are about 8.0 km/s. However, at a shorter shot, first arrival times with nearly same distance is apart about 3 seconds. It suggests that the uppermost mantle structure in this region is very heterogeneous or has azimuthal anisotropy. After analyzing, we found the azimuthal anisotropy in the uppermost mantle whose amplitude is about 4% and whose fast axis is nearly perpendicular to the magnetic lineations, which is consistent with Shinohara et al. (2008).

We also found that some Pn waveforms at ˜300 km is complicated although some others are simple, which may suggest the existence of the heterogeneities in the lithosphere.

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