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沈み込みにともなう海洋プレートの構造変化

Structural changes within the oceanic plate during subduction

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The subduction of the oceanic plate generally causes earthquakes and volcanoes in the island arc. To understand the various crustal activity in the subduction zone, it is essential to clarify the detailed structure of the incoming oceanic plate and its structural changes during the subduction.

In the northwestern Pacific region, the old oceanic plate (Pacific plate) formed in the eastern Pacific ridge is subducting from the Japan and Kurile trenches beneath the island arc of Japan. In 2009, to reveal the detailed crustal and mantle structure of the oceanic plate and its structural changes during the subdcution process, we conducted a refraction and reflection wide-angle seismic survey south off Hokkaido. We designed a 500km-long seismic experimental line to be perpendicular to the Kurile trench and the pattern of the magnetic lineations. Along this survey line, we deployed 80 Ocean Bottom Seismometers (OBSs) at intervals of 6km and we shot a large airgun array towed by R/V Kairei at 0.2km intervals. During shooting, we obtained MCS reflection data using a 444-channel hydrophone streamer (6km long).

The quality of the obtained wide-angle and MCS seismic record section is good, and we can observe clear reflection from the oceanic Moho in the both data. In addition, in the wide-angle seismic section, we observe a refraction phases with apparent velocity of much more than 8.0km/sec from north to south.

We modelled P-wave velocity structure of the incoming Pacific plate by the traveltime analysis method with use of both MCS reflection traveltimes and wide-angle refraction and reflection traveltimes. Our results indicate that the P-wave velocity of the oceanic crust and the top of the oceanic mantle is almost homogeneous in the south of the outer rise region, however, the P-wave velocity gradually decreases to the north beneath the outer rise and outer slope of trench axis; the P-wave velocity beneath the well-developed horst and graben structure is about 5% lower than that in the southern area. One plausible explanation for the reduction of the P-wave velocity is that the large normal faults (as indicated by the well-developed horst and graben structure) promoted the hydration of the old oceanic plate during subduction.

キーワード:海洋地殻,沈み込み帯,構造探査, P波速度構造,ハイドレーション,海底地震計

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