

Wide angle seismic experiments in the Western Pacific in 2006 (1)

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We had started to investigate precise seismic structure in the Western Pacific region under the national continental shelf survey project in 2004. In this paper, we report preliminary results of 2006 seismic refraction experiment using a tuned airgun array of 36 airguns with a total volume of 8,040 inch³ as a seismic source. Nine seismic lines were surveyed to obtain crust and upper mantle structural models of the Daito Ridges region in the northern Philippine Sea and of Marcus-Wake Seamounts region on the western Pacific Basin. The total length of the profiles was 5,400 km. The specifications of a series of surveys are the same as previous ones. We shot the airgun array at an interval of 200 m (90 s) for each line. Ocean bottom seismographs (OBS) deployed at every 5 km interval were used as receivers. The total number of the OBS amounted to 1071.

Travel time data obtained by the OBSs were modeled by a tomographic inversion (tomo2D, Korenaga et al., 2000) and two-dimensional ray tracing (Kubota et al., 2005). The final velocity model is derived from appropriate combination of the travel time inversion and the interactive ray tracing. Finally, the 2-D synthetic seismograms are calculated by a finite difference method, E3D (Larsen and Schultz, 1995) and compared with the observed amplitude data.

At the northern end of the Kyushu-Palau Ridge (KPR), two crossing profiles were designed to reveal the KPR subduction/accretion structure below the landward slope of the Ryukyu (Nansei-Shoto) Trench. Preliminary result of the tomographic inversion shows the rather thick crust of the KPR exists beneath the Ryukyu Trench region. In addition, high velocity materials in the shallow part beneath the Hyuganada region, which may be related to the seismic asperity of 1968 Hyuganada earthquake (Mw 7.5).

Three profiles were shot to obtain the crustal models of the transition between the remnant island arc KPR and Shikoku Basin. Two of them were across the entire Shikoku Basin perpendicular to the direction of the magnetic lineations, that is, parallel to the backarc spreading direction. At the western end of the lines, we obtained KPR crustal sections with thick crust. The transition structure of the KPR and Shikoku Basin is characterized by a very thin crust.

Two profiles were conducted at the Daito Ridges. There exist thick crusts and several reflectors in the crust and/or upper mantle beneath the bathymetric highs.

On the western Pacific Basin, two long seismic lines were carried out to elucidate the transitional structure between Marcus-Wake Seamount chain and a standard oceanic. The crusts beneath the seamount chain are significantly thicker than those of the oceanic basin. Variation in Pn velocities of the oceanic basin was detected.