Seismic crustal sturcture around sea floor borehole seismic station WP-1

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1. Introduction

The Western Pacific region including the Philippine Sea Plate is characterized by many island-arcs and trench systems and back-arc basins associated with subduction of the oceanic plate. The Philippine Sea plate is divided into two regions by the Kyushu-Palau Ridge running from north to south. There are the Shikoku basin and the Parece-Vela basin in the eastern part, and the West Philippine basin exists in the western part. It is important to study a seismic structure of the Philippine Sea plate to consider the formation process of the plate and to estimate the development process of an island-arc and trench system. In 2001, broadband seismometers were installed at Hole 1201D by ODP Leg195 in the eastern edge of the West Philippine basin (WP-1). A seismic observation at the WP-1 continues, therefore it is also important to obtain an upper lithosphere structure around the station. We conducted seismic surveys with ocean bottom seismometers (OBS), the borehole seismometer and controlled sources to obtain the seismic crustal structure around the WP-1 observatory during KR02-03 and KR02-12 by the R/V KAIREI, JAMSTEC.

2. Data and Analysis

During KR02-03 in March 2002, we conducted seismic survey using an airgun (GI gun) as a controlled source. The ship speed was about 4 knots, and the GI gun with a capacity of 3 liters was fired every 60m. The length of the profile parallel to the Kyushu-Palau Ridge is about 130km. Two OBSs were deployed on the profile at a distance of 10km from the WP-1. During KR02-12 in October 2002, we conducted seismic survey again using 4 Bolt airguns as controlled sources. The ship speed was about 4 knots and an airgun array with total capacity of about 100 liters was fired every 100m. Four OBSs were deployed on a 120-km-long line parallel to the Kyushu-Palau Ridge (line1) and 80-km-long line perpendicular to the line1 (line2). Airgun signals were also recorded by single channel hydrophone streamer towed from the shooting ship in both experiments. A seismic velocity model for shallow structure is derived from using a tau-p inversion of individual OBS records. A deep structure beneath the profile is estimated by forward modeling using a two-dimensional ray tracing method.

3. Conclusion

The seismic structure in the eastern part of the West Philippine basin is similar to those of typical oceanic crusts (White et al. 1992). The uppermost layer (Layer 1) of the crust consists of sediments. P-wave velocity of Layer 1 is 2.2km/s and the thickness is about 520m. These results are consistent with the results from drilling of ODP Leg195. The P-wave velocity at the top of the second layer (Layer 2) is 4.9 km/s and the thickness is about 1.5km. The velocity at the top of Layer 2 has a largest velocity at the top of Layers in typical oceanic crusts. The top of third layer (Layer 3) has a P-wave velocity of 6.6 km/s and Layer 3 is approximately 3.5 km thick. The total thickness of the igneous crust is about 5 km, and is comparable with that of the thinnest model of typical oceanic crusts. The P-wave velocity of the uppermost mantle is approximately 8.0km/s.