Velocity structure along the Ogasawara Ridge fore-arc region

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The Ogasawara Ridge is known as one of oldest arc on the Philippine Sea Plate. This Ridge has very complex structure. According to refraction survey crossing the ridge, the ridge has a very thin granitic layer with velocity of approximately 6 km/s, an andesitic layer with a velocity of 6.4-6.6 km/s and gabbroic layer with a velocity of 7.0-7.2 km/s (Takahashi et al., 2009). On the other hand, the thin crust with a thickness less than 10 km distributes beneath the shallowest topographic peak (Kodaira et al., 2012). According to geologic studies, boninites, fore-arc basalts, gabbros and peridotites were collected by Shinkai 6500 dives on the trench slope (Ishizuka et al., 2006). The observation is expected to be helpful for subduction initiation studies because these geological sequences are similar characteristics of ophiolite. Therefore, we carried out refraction survey using ocean bottom seismographs (OBSs) along the strike of the Ogasawara Ridge to detect such geological sequences using seismic imaging technique as one of site surveys for IBM drilling.

This survey was carried by using R/V “Kairei” of Japan Agency for Marine-Earth Science and Technology (JAMSTEC) in 2011 and we collected not only OBSs data but also multi-channel reflection data (MCSs) on a seismic line with a length of 250 km. Total 43 OBSs were deployed at an interval of 5 km and the airgun shooting with a total capacity of 7800 cu.in. was 200 m interval. First arrivals on OBS records are traced to offsets of 40-60 km, and the data is generally noisy suggesting complexity of fore-arc structure. If there is peridotite layer in the hanging wall side, the refractions with apparent velocity of about 8 km/s are identified, and discontinuous jump of the first arrivals should be at far side due to subducting oceanic crust. The observed refractions, however, have apparent velocities between 6.0-7.5 km/s to far side. Refractions with an apparent velocity of 8 km/s seem to be limited in narrow area. In addition, the jump of first arrivals is also identified on some OBS records, but it is not common character for whole of the line.

We introduce the tentative tomographic image obtained by using first arrivals and reflection points distribution. Although the plate boundary structure is very complex, the structure of the hanging wall is relatively homogeneous. Then, we compared the structural image obtained by this study with geologic observation.