

Deep seismic structure in the margin of the southwestern Japan Sea off Tottori by ocean bottom seismographic experiment (3)

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To reveal the formation process of the Japan Sea, which is a back-arc basin in the northwestern Pacific, it is important to obtain the detailed deep seismic structure of the transition area between the Island Arc and the Sea. However, there are few seismic structures in the transition area of the Japan Sea. In this study, we investigate the detailed transitional structure and discuss the formation process of the southwestern Yamato Basin in the southwestern Japan Sea. This study is a part of an integrated onshore-offshore wide-angle seismic experiment conducted from the southwestern Japan Island Arc to the southwestern Yamato Basin in the southwestern Japan Sea in 2002.

In this experiment, the offshore survey line has the length of about 218 km from the Oki Trough, Oki Ridge to the southwestern Yamato Basin in the southwestern Japan Sea. Thirty-five ocean bottom seismographs (OBSs) were deployed along this line. However, the length of airgun shooting line is about 170 km because of the bad weather. Seismic signals from an airgun array (12,000 cu. inch) of R/V Kaiyo in JAMSTEC and ten land-explosives were recorded by the OBSs. Also, multi-channel seismic (MCS) reflection data were acquired along this shooting line.

To estimate the shallow structure, we used the profile of MCS and applied the tau-p method (Shinohara et al. 1994) to OBSs data. Then, the crustal structure was constructed using the ray tracing method (Cerveny et al. 1977; Zelt and Ellis 1988) and travel time inversion (Zelt and Smith 1992).

The results indicate that the thickness of the crust beneath the southwestern Yamato Basin and the Oki Ridge is estimated approximately 13 km and 19.5 km, respectively. The sedimentary layer has approximately 1 to 1.5 km thick in the Basin area and approximately 0.3 km in the Ridge area. Two crustal layers are identified beneath the sedimentary layer. The upper and lower crustal layers have approximately 4 km and 8.5 km thick, respectively, in the Basin area, whereas those have approximately 9 km and 10.5 km thick, respectively, in the Ridge area. From the southwestern Yamato Basin toward the Oki Ridge, the upper crustal layer thickens steeply, however, the lower crustal layer thickens gently. The crustal thickness of the Oki Trough supposed to be about 17.5 km.

The crustal structure beneath the southwestern Yamato Basin suggests to be the extended/thinned island arc crust since that of this Basin area is similar to that of the northern Yamato Basin, which is interpreted the extended/thinned island arc crust (Nishizawa and Asada 1999; Nishisaka et al. 2001). On the other hand, the structure beneath the Oki Ridge suggests to be the continental fragment since that of the Ridge is similar to that of the Kita-Oki Bank (Kurashimo et al. 1996).