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Difference of the seismic crustal structure between the northern Yamato Basin and the southern Japan Basin, Japan Sea

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The Japan Sea is one of very well studied back-arc basins in the northwestern Pacific. In the eastern margin of the Japan Sea, the fault-fold belts developed by the deformation of the extension by the opening of the Japan Sea during the late Oligocene and the shortening since the late Pliocene (e.g., Sato, 1994). The seismic crustal model, however, has been inadequate to elucidate the crustal evolution process including the deformation in fault-fold belts in this margin and the detailed opening model of the Japan Sea. To understand this process in this margin of the Japan Sea, it is necessary to clarify the crustal structure model, not only in the Japan and Yamato Basins without this shortening, but also in its marginal area, which presumed to show the transition of the structure from the basin toward the island arc. From 2009 to 2012, the seismic survey using ocean bottom seismographs (OBSs), an air-gun array, and a multi-channel hydrophone streamer were undertaken in this margin. For this study, we will present the crustal structure models from the northern Yamato Basin to the coastal of the northeastern Japan Island Arc and from the southern Japan Basin to the coastal area.

The crustal thickness of the northern Yamato Basin is about 16 km and is less than that of a typical continental crust (Christensen and Mooney, 1995) and greater than that of a typical oceanic crust (White et al., 1992). From the velocity gradient, the crust of the northern Yamato Basin is divided to two parts; one is upper part having the steep gentle velocity gradient and the other is the lower part having the gentle gradient. These upper and lower parts have about 5 and 8 km thick, respectively. In this Basin, there is a little in the part of 5.5-6.4 km/s of the P-wave which corresponds to the island arc upper crust. Moreover, the lowermost lower crust in the central part of this Basin has the high velocity as compared to the surrounding area. This high velocity may show that the mantle temperature was slight high during the formation of the Yamato Basin. On the other hand, the crustal thickness of the Sado Ridge where it locates between the northern Yamato Basin and the coastal area is about 23 km. From the distribution of the P-wave velocity, the shallow and deep parts of the crust beneath this Ridge correspond to the island arc upper and lower crusts (Iwasaki et al., 2001).

The crustal thickness of the southern Japan Basin is about 10 km. This crust is thinner than those of the northern Yamato Basin. This crustal structure beneath the southern Japan Basin is similar to a typical oceanic crust (White et al., 1992), except for the lowermost lower crust having the high velocity. Therefore, the difference of the crustal structure between the southern Japan and northern Yamato Basins including those marginal areas may show that of the crustal evolution process during the formation of the Japan Sea.