# Mantle wedgestructure beneath an eastern part of the Japan Sea revealed by long-term broadband seafloor seismic observation

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The Japan Sea is a typical back-arc basin in the northwestern Pacific. The Japan Sea seems to possess areas of various stage of back arc opening process. Information of a seismic structure is useful for consideration of the formation and development of the Japan Sea. Therefore many seismic surveys of crustal structures have been performed and several models for the formation of the Japan Sea have been proposed. However there is a little information of the seismic structure of the mantle beneath the Japan Sea. The deep seismic structure is essential for consideration of the opening of the Japan Sea because a mantle activity is thought to relate strongly to the opening. To obtain the deep structure of the eastern part of the Japan Sea, the long-term broad-band seismic observation had been carried out during three years in the Yamato Basin and Yamato Rise in the Japan Sea.

In addition, seismic survey was conducted in the Yamato Basin on the profile passed through the long-term broadband Ocean Bottom Seismometers(OBSs). The objectives of this survey are to obtain the crustal seismic structure for correction of travel times observed by the long-term OBSs and for consideration of the formation process of the Yamato Basin. The thickness of the crust is twice as thick as in normal oceanic crust. In addition, a thin layer with 6km/s of P-wave velocity are confirmed. The thickness of the crust and the 6km/s layer suggests that the Yamato Basin has a stretched continental crust.

In this study, there were two broadband seismic stations of OBSs and many surface waves were recorded within the Japan Sea. Phase velocities of Rayleigh waves in the Japan Sea were estimated by using the two-station method. The 1-D seismic structure model of the upper mantle was estimated by using a trial and error method of comparison between the measured and theoretical phase velocity cruves. The S-wave velocities at the uppermost mantle and at the depth of 150 km are 4.4km/s and 4.2km/s, respectively.

From the long-term seismic observation in this study, the seismic body waves passed through the mantle beneath the Japan Sea have been observed. For tomography analyses, it is essential that seismic waves pass a region of a study. The three-dimensional P- and S-wave velocity structures beneath the eastern part of Japan Sea are determined by travel time tomography method developed by Zhao et al(1992,1994). As a result, P and S wave tomographic images to a depth of 500 km beneath the Japan Islands arc and the Japan Sea are obtained. The region below the Japan arc island to a depth of 100 km has low velocity. This low-velocity zone continues to a depth of 300km beneath the Yamato Basin in parallel with the subducting pacific plate. In contrast, the region to a depth of 150 km beneath the Yamato Basin shows relatively high velocity.

The estimated 1-D S-wave model from Rayleigh wave does not have large low-velocity zone in the upper mantle. On the other hand, the S-wave velocity structures beneath the typical oceanic plate and the oceanic plateau, which have the same age as the Japan Sea, show a clear low-velocity zone in the mantle. This comparison indicates that there might be no mantle activity when the Yamato Basin was formed.

The tomographic P-wave image has a high velocity anomaly in the mantle wedge extending down to a depth of approximately 150 km beneath the Yamato Basin. The regions where sea floor spreading is active at present usually have a low-velocity zone below a spreading center. From existence of the high velocity anomaly beneath the Yamato Basin, there is a possibility that the mantle activity did not play an important role in the formation of the Yamato Basin.

For the formation of the Yamato Basin, there have been a controversy: a sea floor spreading occurred at the formation of the Yamato Basin or not. The results of this study strongly suggest the hypothesis that Yamato Basin was formed by results of thinning of the continental crust.