Formation Tectonics of the Tsushima basin in the Japan Sea by seismic exploration using ocean bottom seismographs

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The Tsushima Basin is located in the southwestern Japan Sea, which is a back-arc basin in the northwestern Pacific. Although many geophysical and geological investigations have been conducted to reveal the process and age of the formation of the Tsushima basin, they have not been revealed yet. In 1998 and 2000, to understand the formation process about the Tsushima basin, seismic refraction surveys using ocean bottom seismographs and airguns were carried out in the southern and the southeastern Tsushima basin. The surveys were also conducted in the marginal region of the Korean Peninsula and the southwestern Japan arc, which are supposed to be transition zone of crustal structure. In this study, the formation process of the Tsushima basin is considered from the obtained seismic velocity structures and other geophysical and geological research results about the Tsushima basin.

From this study, the P-wave velocity structure shows that the crustal thickness under the southern Tsushima basin is 15-16 km and 18-20 km beneath the marginal area. On the other hand, the crustal structure under the southeastern basin area has about 17 km thick and about 20 km thick under the marginal area. The thickness of the upper part of the crust increases towards the land. However, the thickness of the lower part of the crust seems more uniform, compared with the upper part. The layer whose P-wave velocity is about 5.8 km/s in the basin area has large velocity gradient. The maximum thickness of the sedimentary layer is about 5 km.

Some geological features in the sedimentary layer show that the formation of the Tsushima basin had started from about 24 Ma. From the seismic data, gravity and geomagnetism anomaly data, the profiles beneath the survey lines are suggested to be thinned/extended continental crust in the basin area and non-volcanic rifted margin under the marginal area. However, the crustal structures of the Tsushima basin seem to have local features, because the crust which is thicker than typical oceanic crust coexists with thinned/extended continental crust in the basin area and a thick magnetic body that is considered as igneous material exists in the lower part of the crust, which is seen under a part of the marginal region of the Korean Peninsula. The processes of the formation of the Tsushima basin is considered as follows; the rifting which is caused the separation of the Asian continent and the southwestern Japan arc, the formation of the lateral and normal faults, thinning/extending of the continental crust generated by the movement of some faults, and the formation of the thicker oceanic crust beneath the central part of the basin caused by the rotation of the southwestern Japan arc.