

Tectonic Evolution of Eastern Margin of Japan Sea

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The life span of major oceanic plates is significantly longer than the back-arc basin's it. The reason why back-arc basins disappear in short time is not clear so far. However, most scientists may be thinking that back-arc basins have a fate to involved in orogenic belt at convergent plate margins. The mechanism of back-arc basin formation is also not clear, but may relating to the subduction of oceanic plates. Because most back-arc basins are locate in the western Pacific subduction zone where the Pacific and Philippine Sea plates are certainly subducting. Japan Sea is one of the back-arc basin in the western Pacific convergent margin. Especially, north-eastern margin of the Japan Sea shows significant ongoing convergent structures. The tectonic and dynamic phenomena may give some ideas for the fate of back-arc basins in the western Pacific region. Since 1993, two large earthquakes attacked the eastern margin of the Japan Sea where is the just boundary between the Eurasian plate and the North American plate. Then this area has lately attracted considerable attention of geological hazard point of view.

Okushiri Ridge locates in the north-eastern edge of the Japan Sea that formed in early Miocene based on the results of deep sea drilling by ODP (Ocean Drilling Program) Legs 127 & 128. Okushiri Ridge shows an active convergent structure where the oceanic crust of Japan Basin subducts and/or obducts against to the Hokkaido. Okushiri Ridge is recognized as one of the ongoing example of ophiolite emplacement in back-arc basin (Kuramoto 1989, Tokuyama et al., 1992). Some thrusting structures show inverted structures that originate to the structures of formation of the Japan Sea. Significantly high heat flow value (156 mW/m²) is measured by downhole measurement during

deep sea drilling, ODP Leg127. Average heat flow value in the Japan Basin is approximately 110 mW/m², and 100 mW/m² in the Yamato Basin respectively. There are two basic ideas to the high heat flow value on the Okushiri Ridge. One is the frictional heat from the thrust plane add an extra heat to the surface. The other is the fluid flow from the relatively deep crust. If the excess heat flow is assumed as the frictional heat on the thrust fault plane, the stress on the fault plane should be over 200 MPa. The estimated stress may significantly high compare with a usual reverse fault. It is suggesting that the excess heat flow on the Okushiri Ridge is the result of the fluid flow from the deep crust. Small biological colonies have been found at the northern part of the Okushiri Ridge by submersible dives. It may support the idea of fluid flow on the Okushiri Ridge.

Off-NE Japan of the Japan Sea is mapped by mostly single channel reflection seismic surveys. It is making clear that there are significant active deformation zones since Plio-Pleistocene. Some deformation structures show the basin inversion structures that may reflect the change of stress field at the area. Cross section balancing method has been applied to check the total convergence since after the formation of the Japan Sea. Preliminary results show the bulk convergence may several kilometers in E-W direction at this area. Against the area, the Okushiri Ridge area shows approximately 10 km conversion in E-W direction. The degree of conversion is not constant along the eastern margin of the Japan Sea. It may showing that the difference of crustal structure of Japan Sea, the basement of Japan Basin shows an oceanic crust against the Yamato Basin which shows a semi-continental crust.