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Relationship of the crustal structure and its deformation from arc to back-arc basin in the eastern Japan Sea deduced from the seismic survey

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The Japan Sea is a back-arc basin in the northwestern Pacific. Based on geophysical, geological, and petrological results, it is suggested that the opening of the Japan Sea was initiated by crustal rifting and the separation of Japan Island arcs from the Asian continent in the Early Oligocene, followed by the ocean floor spreading in the Late Oligocene (e.g., Tamaki et al., 1992). After 3.5 Ma, the crustal shortening by a strong compression occurred in the eastern margin (e.g., Sato, 1994). In the eastern margin, because of the extension associated with the opening of the Japan Sea and this shortening, the deformation such as active faults and folds formed have developed and large earthquakes with magnitudes-7 class repeatedly occurred (e.g., Okamura et al., 2007). The Japan Sea has a unique setting in terms of the connection between the back-arc basin opening and the crustal deformation. However, we have little information concerning with a crustal structure formed by the back-arc opening in the margin and the deformation. To obtain the information, we have been carrying out active-source seismic surveys using ocean bottom seismographs (OBSs) and multi-channel streamer system (MCS) to cover the eastern margin of the Japan Sea.
The obtained results show a difference in crustal structures between the northern and the southern parts of the eastern Japan Sea. In the northern part from the arc to the back-arc basin, the crust is divided into three types; the rifted island arc crust, the thicker oceanic crust and the oceanic crust, based on the comparison of the P-wave velocity distribution and the crustal thickness of a typical oceanic crust (White et al., 1992) and of the northeastern Japan Island arc crust (Iwasaki et al., 2001). On the other hand, the southern part from the arc to the back-arc basin has two crustal types, which are the rifted island arc crust and the thicker oceanic crust. In the northern part, the deformation is distributed in a structural boundary between the rifted island arc crust and the thicker oceanic crust, and in the rifted island arc crust. On the contrary, in the southern part, the deformation is only distributed in the rifted island arc crust.