Crustal structure from the Japan Sea back-arc basin to the margin off SW Hokkaido deduced from the seismic survey

*Takeshi Sato[1], Tetsuo No[1], Shuichi Kodaira[1], Seiichi Miura[1], Tatsuya Ishiyama[2], Hiroshi Sato[2]

1. Research and Development Center for Earthquake and Tsunami, Japan Agency for Marine-Earth Science and Technology, 2. ERI, Univ. of Tokyo

The Japan Sea is a back-arc basin in the northwestern Pacific. Along the eastern and southern margins, destructive earthquakes occurred (e.g., the 1983 Nihon-kai-Chubu Earthquake, and the 1993 Hokkaido-Nansei-Oki Earthquake). Moreover, along the eastern margin, fault-fold belts developed as a result of deformation caused by extension associated with the opening of the Japan Sea and by the later compression (e.g., Okamura et al., 1995; Sato, 1994). Results of seismic surveys from the Japan Basin to the eastern margin of this sea indicated that structures related back-arc opening might play a role in the location of large earthquakes and the distribution of the deformation zone including active faults and folds along the margin of the Japan Sea (e.g., No et al., 2014). This result demonstrates that the elucidation of the back-arc opening process is important for understanding not only back-arc extension along the Asian continental margin, but also the mechanism of large earthquakes and the distribution of subsequent deformation in the Japan Sea back-arc basin. In the SW Hokkaido, the 1993 Hokkaido-Nansei-Oki Earthquake (Mj 7.8) occurred and the dip and distribution of active faults show a complication pattern. However, we have little information of detailed opening, deformation processes and mechanism of large earthquakes in this area due to the inadequate detailed crustal structure obtained by sufficiently dense OBS spacing in seismic surveys.

To obtain the crustal structure, we conducted the active-source seismic survey using ocean bottom seismographs (OBSs) and multi-channel streamer (MCS) in the margin of the Japan Sea off southwestern Hokkaido ranging from the Japan Basin to the coastal area on land in 2018. This survey was used at 57 OBSs, a tuned air-gun array having 7,800 cu. inch and MCS system. This survey line has about 243 km length and is a part of an integrated ocean-land seismic survey line.

In record sections of several OBSs, not only the first arrived phases but also later phases reflected from interfaces in the crust and uppermost mantle are visible. Also, the MCS profile clearly images the sedimentary layer and the undulations of the basement. The crustal structure in the Japan Basin resembles the typical oceanic crust (e.g., White et al., 1992). In the transition between the Japan Basin and the southern Okushiri Ridge, the crustal structure drastically changes. The area from the southern Okushiri Ridge to the Okushiri Basin has the upper crust with a P-wave velocity of 5.4-6.2 km/s corresponding to the continental upper crust. Moreover, the P-wave velocity distribution has a variation in this area.

