

Seismic constraints on the crustal structure off the southwestern coast of Hokkaido, Japan Sea

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Offshore crustal structure studies have been conducted around Japan, with a primary focus on the Pacific side such as the Nankai Trough and Japan Trench via multichannel seismic reflection (MCS) and ocean bottom seismograph (OBS) surveying since the 1990s (e.g. Kodaira, 2009); moreover, seismic surveys have been conducted in the Japan Sea since the 2000s (e.g. Sato et al., 2018a). In 2018, we conducted a MCS and OBS survey off the southwestern coast of Hokkaido, which was one of the unsurveyed areas in the Japan Sea. Our survey area included the source region of the 1993 Hokkaido Nansei-Oki Earthquake, which is the largest earthquake among the shallow earthquakes that occurred in the Japan Sea since the Meiji period. Therefore, as our survey lines were oriented traverse the source region of the 1993 Hokkaido Nansei-Oki earthquake to the east and west, our data provided very important information for studying the relation between this earthquake source fault and its surrounding crustal structure. Furthermore, we targeted the Japan Basin, which is located to the west of the Hokkaido Nansei-Oki Earthquake source region. The Japan Basin is the widest basin in the Japan Sea, with previous studies estimating that it possesses a standard oceanic crustal structure and thickness (e.g. No et al., 2014; Sato et al., 2018b). Our survey area provides another key piece of information for comparison with a previous geomagnetic study because it overlaps with an area that has been defined by a striped pattern of geomagnetic anomalies (e.g. Kinoshita et al., 1995).

We conducted the seismic survey using the JAMSTEC R/V *KAIREI*. The survey area extends from the Okushiri Basin and Shiribeshi Trough to the Okushiri Ridge, the Japan Basin, and comprises nine MCS lines and one seismic refraction line using OBSs. Furthermore, the seismic refraction survey line was extended onshore to link with a land seismic survey in Oshima Peninsula, which was simultaneously conducted by the Earthquake Research Institute, University of Tokyo.

According to the provisional data processing results, clear shortening structures are imaged in the MCS data that cover the Okushiri Basin, Shiribeshi Trough, and the source region of the Hokkaido Nansei-Oki earthquake. However, a sedimentary layer with a thickness of approximately 2 km is observed in the Japan Basin, and clear reflectors, dense normal faults are observed throughout this sedimentary layer. Furthermore, a strong reflector is identified at approximately 7 km under the sedimentary layer, which we presumed to be the Moho. We image clear reflectors in the crust and uppermost mantle. Furthermore, the Moho reflector is poorly defined in the eastern margin of the Japan Basin, with a shortened structure and clear east-dipping crustal reflector imaged in this region.

The results of data analysis of seismic survey using OBSs indicate that the Japan Basin is a relatively homogeneous structure that possesses a standard oceanic crustal structure. However, the P-wave velocity structure indicates a thicker crust to the east of the region where the MCS data confirmed a shortened structure. Additionally, it is suggested that the crust thickens rapidly across the Okushiri Ridge.

Keywords: Japan Sea, 1993 Hokkaido Nansei-Oki Earthquake, Japan Basin, Okushiri Ridge, Seismic survey