Seismicity observations in the source region of the 1896 Meiji-Sanriku and 1933 Showa-Sanriku Earthquakes

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Subduction zone megathrust earthquakes have some interaction with intra-plate normal-faulting earthquakes in trench-outer rise region. For example, after the 2011 Tohoku-Oki earthquake (Mw 9.0), many M7-class normal-faulting earthquakes occurred in the trench-outer rise region seaward of the largest co-seismic slip area during the 2011 Tohoku-Oki earthquake. Large outer-trench normal-faulting earthquakes have potential to generate large tsunamis resulting in severe damage in coastal area. Hence, to know the potential source region of the outer-trench normal faulting earthquake is important to assess the relating Tsunami hazard. In northern part of the Japan Trench, the 1933 Showa-Sanriku earthquake, M 8.1 outer-trench normal-faulting earthquake, occurred 37 years after the 1896 Meiji-Sanriku Tsunami earthquake (M ~8.5). Tsunamis generated by both earthquakes caused severe damage in coastal area. The observations using routine land seismic stations suggest the long-lasting aftershock activity in the source region of the 1896 and the 1933 earthquakes. However, due to the large distance from the coast and large water depth beyond the maximum operational depth of conventional ocean bottom seismographs (OBS), precise locations of the earthquakes in the source region of the 1896 and the 1933 earthquakes have not been obtained. Recently, the JAMSTEC has been utilized ultra-deep ocean bottom seismographs (UDOBS), which can be deployed up to 9000 m water depth. We have conducted seismicity observations using OBSs including the UDOBSs from July to September 2015. Based on the preliminary analysis, there are three epicentral lineations in the outer trench region. These lineations are almost parallel to the trench axis. One lineation in the southeastern part of the OBS network is the aftershock activity of the Mw 7.6 outer-trench normal-faulting earthquake occurred 40 minutes after the 2011 Tohoku-Oki earthquake. The other two lineations are located just seaward of the trench axis. These lineations have almost the same length with the fault model of the 1933 Showa-Sanriku earthquake estimated by Kanamori (1971). The seismic activity along these lineations likely corresponds to the aftershock activity of the 1933 earthquake.

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