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Subducting structure in the northern end of the Nansei-Shoto Trench deduced from MCS profile and topography

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A large number of earthquakes occur at subduction zones and their vicinity, and sometimes a large earthquake with a severe damage occurs there (e.g. 2011 Tohoku-Oki earthquake in the Japan Trench region, Tokai-Tonankai-Nankai earthquake in the Nankai Trough region). The Nansei-Shoto Trench is the subduction zone where the Philippine Sea plate subducting below the Eurasia plate.

Japan Coast Guard carried out the refraction and the multi-channel reflection seismic survey in the northern end of the Nansei-Shoto Trench. The Survey line named ECr11 is perpendicular to the trench-arc-backarc system and traverses the Nansei-Shoto arc between the Yaku-Shima Island and Tokara Islands. ECr11 roughly overlaps the refraction seismic survey profile of Iwasaki et al.(1990) in the area from the forearc to trench. Iwasaki et al.(1990) used explosives and an air-gun array as seismic sources. They deduced ”a huge sedimentary wedge, whose thickness exceeds 12km, overlying the subducted oceanic lithosphere” and the structure of the subducted oceanic plate. To obtain the structure from the shallower part to the deeper part of the subduction zone, we deployed ocean bottom seismographs more closely than Iwasaki et al.(1990), and carried out the refraction and multi-channel reflection seismic surveys along same survey line.

We report the shallower part of the subduction zone in the northern end of the Nansei-Shoto Trench and spatial distribution of active faults deduced from the multi-channel reflection seismic profile (MCS profile) and topography.

Specifications of multi-channel reflection seismic surveys are as follows.

Source: 5.7l (350 inch^3)x3 tuned air-gun array (air-gun cluster)
Shot interval: 50 m
Record device: streamer cable (3,000m length and 240 channel hydrophone (12.5m interval))
Record length: 12 sec

Many lineations that parallel to the Nansei-Shoto Trench locate on the Philippine Sea plate before subducting beneath the Nansei-Shoto Trench confirmed from the MCS profile and the topography. These lineations are deduced the normal faults formed by bending of the Philippine Sea plate that accompanies with subduction.

In the MCS profile, clear reflectors are detected at the top of the subducting oceanic plate. We can trace these reflectors about 80km landward from the trench axis.

Keywords: Nansei-Shoto Trench, Philippine Sea Plate, subduction zone, reflection seismic survey, seafloor topography