

Seismological constraint on fault processes from trench axis to outer-rise in Japan Trench

*Shuichi Kodaira¹, Yasuyuki Nakamura¹, Gou Fujie¹, Koichiro Obana¹, Seiichi Miura¹

1.R&D Center for Earthquake and Tsunami Japan Agency for Marine-Earth Science and Technology

JAMSTEC has been conducting marine seismological studies from the trench axis to the outer-rise of the Japan Trench since the 2011 Tohoku-oki earthquake occurred. The trench-to-outer-rise seismological study consists of two projects: one is a high-resolution seismic reflection survey in the trench axis and the other is a large-scale seismic reflection/refraction survey with earthquake observation in the outer-rise. Previous seismic studies discovered a small-scale fault-and-thrust structure in the incoming/subduction sediment at the trench, where the co-seismic slip reaching to the trench axis is observed. Based on those results, we propose a hypothesis indicating that the small-scale fold-and-thrust structure at the trench can be a structural proxy of a seismic slip reaching to the trench. In order to examine a lateral variation of a slip to the trench along the Japan Trench, seismic studies done by 2014 covered an area from 38 N to 40.5 N, and a further survey carried out at the south from 37 to 38 N in 2015. The seismic images obtained show that, i) the frontal small scale fold-and-thrust structures are generally observed from 38 -40.5 N, except around 39.5 N where thin (less than 50 m thick) incoming sediment to the trench is imaged, ii) width of the fold-and-thrust structure seems to become larger toward the north, iii) the structural character indicating a frontal fold-and-thrust seems to be unclear toward 37 N from 38 N. A purpose of the seismological study in the outer-rise is to obtain a seismological constraint on a distribution of potential fault of an outer-rise normal fault earthquake. Although no clear image of a normal fault from seafloor to the mantle is imaged, seismic reflection images near the trench around 38 N shows i) clear Moho reflection of the incoming plate is observed to the trench from the outer-rise with partially obscure Moho reflections, and ii) clusters of the normal fault aftershocks extending to the mantle in an area where the Moho reflection is obscure. Those structure and seismic activity are interpreted to reflect a distribution of the potential outer-rise normal fault. We will investigate seismic reflection imaged obtained around 39 N to examine if similar structural characters are observed.

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