Seismic images from the outer rise to the Japan Trench for site characterization of new IODP subduction zone drilling projects

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Results of IODP 343/344T JFAST, which was done as a rapid response drilling to the seismogenic fault of the 2011 Tohoku-oki earthquake, shows important new findings to understand a cause of a large slip reaching to the trench axis, e.g., a very low dynamic frictional coefficient obtained by temperature monitoring and a laboratory experiment using a core sample. However, continuous core down to the plate boundary fault have not been recovered. Moreover, since JFAST is a single drill hole to the fault zone, the results from JFAST cannot reveal along- and across-trench variation of physical and chemical property of the fault. In order to examine physical and chemical properties to control variation of the fault slip, two across-trench drilling transects are proposed in the large slip zone and a small slip zone. Another IODP project, H-ODIN, is proposed to drill a fault zone of a large normal fault earthquake in the outer rise close to the Japan Trench. JAMSTEC has been conducting marine geological/geophysical projects to cover the axis of Japan Trench and the outer rise as a part of two JSPS projects. The seismic data from those survey are used to make site characterization of the two IODP projects. In order to meet scientific objectives of JTRACK , and also a technical limitation (i.e., a drilling target should be at around ~1000 m below the seafloor in an area where water depth around 7000 m), we selected the two drilling transects at 38 N as a large slip zone and 38.5 as a small slip zone based on differential bathymetry data and high resolution seismic data. H-ODIN needs to drill an outer rise normal fault. However, a clear normal fault in the Japan Trench have not been imaged. In order to identify a potential normal fault extending from the seafloor to the mantle we, therefore, use seismicity data and deep penetration seismic profiles. Because, some of clusters of the aftershocks of the 2011 Tohoku-oki earthquake, predominantly normal fault aftershocks, extend to deeper in the mantle (~40 km deep) in an area where the Moho reflection is obscure, which is interpreted to be formed by a fault reaching the uppermost mantle through the Moho. In our presentation, we show the new seismic data showing seismic characters of the candidate sites of JTRACK an H-ODIN.

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