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Seismicity and seismic velocity structure in trench-outer rise region reveled from the OBS observations in the Japan Trench

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After the 2011 Tohoku-oki earthquake, active seismicity of shallow-normal faulting earthquakes, including several M7-class earthquakes, has been observed in the trench-outer region of the Japan Trench. These shallow normal-faulting earthquakes occurred within the incoming/subducting Pacific Plate due to the bending of the oceanic plate subducting into the trench. We have conducted seismicity observations repeatedly in trench-outer rise region of the central part of the Japan Trench by using ocean bottom seismographs since 2011. Based on these observations, normal-faulting earthquakes with trench-normal T-axis were located down to a depth of about 40 km in the incoming/subducting Pacific Plate. Normal faulting earthquakes occurred also in the overriding plate. However, there is almost no seismicity observed along the plate interface and within the most seaward of 45 km of the overriding plate. The area of the aseismic wedge within the overriding plate corresponds to the huge coseismic slip area (> 50 m) at the shallowest part of the plate interface near the trench axis during the 2011 earthquake. Similar aseismic wedge is also observed in the source area of the 1896 Meiji-Sanriku tsunami earthquake. Seismic velocity structures estimated from travel time tomography by using arrival time data obtained in the repeated OBS observations suggest that the seismic velocity reduction within the incoming Pacific Plate toward the trench axis occurred in the uppermost 15 km of the oceanic mantle at least. The velocity reduction within the oceanic mantle could be a possible indication of the bending-related hydration/alteration of the oceanic plate in the trench-outer rise region.