

## Along-axis structural variation of the Japan Trench incoming plate revealed by densely spaced reflection profiles

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The incoming structure of the subduction zone is one of the key factors which control the megathrust fault slip behaviors. Recently a variety of seismic activity, including tremors, repeaters, and very low frequency earthquakes (VLFE), have been observed in the Japan Trench subduction zone, where the 2011 Tohoku earthquake ruptured the central part of the trench. We obtained more than 100 seismic profiles along survey lines with 2-8 km line separation to map the structural characteristics of the incoming Pacific plate in the vicinity of the Japan Trench. Based on the interpretation of the time-migrated reflection profiles, we mapped the thickness of the sediments on the incoming plate, the dip direction (eastward or westward) and the throw of the bending-related normal faults, and trench-fill and graben-fill sediments. In the central part of the Japan Trench, where the Tohoku earthquake occurred, the input sediment thickness is largely <300 m, westward dipping normal faults is numerous in number, and sediment fills are not remarkable. On the other hand, outside of the Tohoku earthquake rupture zone, the input sediment thickness is thicker, eastward dipping normal faults are dominant, and trench- and graben-fill sediments were deposited. At the northern boundary of the Tohoku earthquake rupture zone ~39-39.5°N, the thickness of the incoming sediments is variable or very thin. These observations contradict the previous studies suggesting that great megathrust earthquakes have occurred in subduction zones where thick sediments subduct. In the northern and southern Japan Trench, where the thickness of the incoming sediments is relatively thick, tremors and VLFE were observed. The graben-fill sediments deposited at the eastward dipping normal faults could increase the thickness of the incoming sediments and also could partially modify the properties of the input materials. These might host the preferable conditions for slow earthquakes in the northern and southern Japan Trench.

Keywords: Japan Trench, subduction input, sediments, bending-related normal fault, sediment fill