

Possible low-velocity zone in the overriding plate at the updip limit of the megathrust earthquake rupture zone in the central-western Nankai Trough

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The central-western Nankai Trough is one of the best locations to study the plate boundary slip behavior in the subduction zone because the slip distribution of the megathrust earthquake (1946 Nankai earthquake), inter-plate coupling, and slow earthquake activity have been well investigated. To understand the structural characteristics controlling the slip style along the plate boundary in this region, we conducted seismic reflection profiling along densely spaced survey lines. A three-dimensional depth map of subducting Philippine Sea plate was created from the interpretation of each pre-stack depth migrated profile. The depth map showed an arcuate depression on the surface of the Philippine Sea plate which runs ~100 km along the Tosabae Trough. The velocity model used in the pre-stack depth migration (PreSDM) was horizontally smooth around this apparent depression because the reflection data used in this study was not sensitive to the velocities in these depths. On the other hand, velocity models previously derived from a nearby refraction seismic survey line showed a low-velocity zone in the hanging wall beneath the Tosabae Trough. A preliminary result from waveform inversion (FWI) along a survey line off Cape Muroto also showed a low-velocity zone, and a preliminary PreSDM image imaged using the FWI velocity model exhibited smoothed surface of the Philippine Sea plate rather than topographic depression on the plate surface. We interpreted that the depression illustrated on the depth map actually indicated the low-velocity zone along the Tosabae Trough. This low-velocity zone was located at the boundary between the large slip zone of the 1946 Nankai earthquake and the zone with slow earthquake activity. The low-velocity zone in the overriding plate might constrain the updip limit of the megathrust rupture zone.

Keywords: Nankai Trough, seismic reflection imaging, subducting plate, low-velocity zone