

Crustal structures revealed by seismic reflection profiles and their relation to seismic activities in the western Nankai Trough

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To investigate structural characteristics and their relation to seismic activities in the Nankai subduction zone, we have conducted intensive seismic surveys including multi-channel seismic (MCS) and ocean bottom seismograph (OBS) surveys. We newly collected 2D MCS data off Ashizuri and Hyuganada during the cruise KM21-07 with R/V Kaimei from September to October in 2021. The 2D MCS survey lines were arranged in the area of a segmentation boundary of megathrust rupture in the western Nankai Trough and the area affected by the Kyushu-Palau Ridge (KPR) on the oceanic plate subducting to the northwest direction. Recent ocean-floor seismic observation revealed the distribution and temporal migration of tectonic tremors and very low-frequency earthquakes (VLFE) in the Hyuganada (e.g., Yamashita et al., 2015, 2021; Tonegawa et al., 2020). The intensive seismic surveys elucidate detailed geological structures that may be one of the important control factors of the seismic activities.

We recognized regional topographic variation on the subducting oceanic crust. In contrast to the deepening gradually to the north in the area off Ashizuri, the oceanic crust is steeply deepening to the west in the west side of subducting KPR in the Hyuganada. We identified continuous clear reflectors at the deep of the accretionary prism off Ashizuri and the deep reflectors appear to converge to the top of the oceanic crust, which likely consist of a thick underthrust sequence beneath the accreted sediments. The thickness of the underthrust sequence varies laterally and the distance from the trough axis to the convergent points also different among the seismic sections. The accretionary prism above the subducting oceanic plate comprises deformed sedimentary complex with fold-and-thrust structures partially covered by slope and forearc basins. Several anomalous structures with cone- and mound-shape are identified within the accretionary prism and sediments in the Shikoku basin. A prominent cone-shaped structure with a few kilometers height on the thick underthrust sequence is observed at the middle of a cluster of VLFEs located by Tonegawa et al. (2021). Although further investigations are required to clarify the geologic feature and physical properties of inside and around the anomalous structures, the spatial correlation implies that the structural anomalies in the accretionary prism may affect the VLFE occurrence in this area.

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