Thrust Faults within Basaltic Crust in the Nankai Trough

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To reveal the characteristics of thrusts within basaltic oceanic crust, we have analyzed and interpreted industry-standard three-dimensional seismic reflection data acquired in the Nankai accretionary prism off the Kii peninsula. The seismic volume which was applied pre-stack depth migration (PSDM) makes it possible to extract three-dimensional geometries of thrusts within basaltic crust. Furthermore, we use other seismic profiles acquired in the Nankai Trough region in order to map the thrust distribution within the basaltic crust. In the previous researches using seismic reflection data, we have often interpreted sedimentary sequence in order to reveal evolution of the decollement. However the decollement should also be influenced by the geometry of basaltic oceanic crust. Therefore the characterization of the basaltic crust below the decollement will also support the broader goals of the Integrated Ocean Drilling Program.

The thrust displacements within the basaltic crust originate continuous elevated crust surface; we observe that the dip of the thrusts has ~1 km offset at the crust surface. The thrusts within basaltic crust seem to be originated from Moho discontinuity which could be imaged as strong but discontinuous reflections at ~13 km below sea surface. The strikes of the thrusts are nearly parallel to the trough axis, and the dips of the thrusts are ~30 degree. These thrusts should be still active because their displacements seem to influence on the sedimentary sequence including the decollement. Furthermore, their locations are consistent with the hypocenters of the 2004 earthquake off the Kii peninsula and micro-earthquakes observed by ocean bottom seismometer.

Because the displacements along the thrusts within basaltic crust propagate to the sedimentary layer, the displacements disrupt layered sedimentary sequence. Furthermore, the geometry of elevated basaltic crust influences on the decollement propagation; sandbox experiments reveal that the underplating structure is originated after the elevated oceanic crust (e.g. seamount) passes below the accretionary wedge. These observations demonstrate that the thrust displacements within the basaltic crust are important for the decollement evolution in the Nankai Trough off the Kii peninsula.