

Crustal structure in the Nankai Trough seismogenic zone based on renewed depth images and seismic attribute analysis

*Kazuya Shiraishi¹, Yasuhiro Yamada¹, Masataka Kinoshita², Gaku Kimura³

1. Japan Agency for Marine-Earth Science and Technology, 2. Earthquake Research Institute, The University of Tokyo, 3. Tokyo University of Marine Science and Technology

To better understand geological structure in the Nankai Trough seismogenic zone, we investigate deformations in the accretionary prism based on renewed depth images and seismic attribute analyses. We reprocessed subareas of the Kumano-nada 3D MCS data acquired in 2006: 25 km x 12 km area including IODP C0002 site in Phase 1 (2015-2016) and 20 km x 12 km area including IODP C0006 site in Phase 2 (2017-2018). We also reprocessed 2D MCS data along a 50-km line crossing C0002 site in NW-SE direction, which was selected from a 2D survey ODKM03 in 2003 with a longer streamer cable (6 km) than streamer cables of the 3D survey (4.5 km). Quality improvement of reflection signals was achieved by applying recent broadband processing and advanced process to attenuate noise and multiple reflections. Depth domain reflection images were obtained after applying new pre-stack depth migration methods. Then, we calculated several seismic attributes from the 3D reflection image volumes, such as coherence and structure dips which are useful to interpret structural features.

As a result of our investigation, deformed structure within the inner accreted sediments and its relation with the megathrust fault are clearer than before. Anticlines are identified just below the Kumano forearc basin and fragmented reflections can be seen below the anticlines. Characteristic patterns of folds can be recognized on the horizontal section of the coherence cube, which are corresponding to the anticlines on the vertical sections. These reflection features imply development of fold structures due to thrust faults with branched minor faults. In the reprocessed 2D section, curved reflectors with stepwise displacement are imaged in the region of 4 - 6 km depth. These reflectors may represent multiple thrust faults with back-thrusts, and the thrust faults are consistent with the structural features in the 3D images. The detachments of the thrust faults seem to converge to wavy points on the megathrust fault surface. Furthermore, details of deformation and fracture in the outer accretionary prism are imaged clearer than the previous images. Lithological boundaries with displacement along imbricated thrusts can be traced beyond the fault, and conjugate faults due to horizontal compression which cut the in-sequence thrusts are recognized on the horizontal section from superimposed view of the coherence and dip angles. Reflectors within underthrust sediments beneath the imbricated thrust layer are clearly imaged. Some of the reflectors can be identified as parts of detachment of the thrust faults. The topographic relief of the oceanic crust should be considered when the deformed structures in the overburden sediments and distribution of décollement are revisited.

Acknowledgements:

This research is supported by JSPS KAKENHI (JP15H05717).

Keywords: Nankai Trough seismogenic zone, crustal structure, reflection seismic, seismic attribute