

Imaging the Nankai Seismogenic Zone in the NanTroSEIZE Transect

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The Nankai Trough has long been recognized as a region characterized by recurring, destructive great earthquakes. As part of the Nankai Trough Seismogenic Zone Experiment (NanTroSEIZE), we acquired the first-ever commercial marine 3D seismic reflection survey collected for academic research and for engineering site survey of drilling based on Japan-US collaboration. The survey forms the basis for planning Integrated Ocean Drilling Program (IODP) drilling in the Kumano Basin region south of the Kii Peninsula, Honshu, Japan, and was designed both to establish the regional structural/tectonic and stratigraphic framework and to define drilling targets, including a 6-7 km deep riser hole that is planned to penetrate into the seismogenic part of the Nankai Trough subduction thrust.

The new 3D volume images the ocean crust to a depth of 8.5 sec (~11 km), and reveals excellent details of a complex 3-D network of thrust faults across this segment of the Nankai Trough. Thrust packages in the frontal accretionary prism are highly variable along strike, partly because of disruption by a subducting seamount. The primary thrusts that extend through the accretionary wedge and sole into the basal decollement are highly irregular with 1.5-2.5 km down dip spacing and typical along strike extents of ~1-3 km. These faults are recognizable by the displacement of the deformed stratigraphic horizons that comprise the accretionary wedge. The decollement is a strong, continuous positive-polarity reflection through most of the frontal region.

Beneath the upper slope and Kumano basin, we image a splay fault system, first recognized by Park et al. (2002) cutting across the older part of the accretionary prism that can be traced from deep below the accretionary wedge at ~7 s (~10 km depth), where it lies ~0.5 s (~1 km) above the top of the subducting crust, discontinuously up through the accretionary wedge along several branches all the way to the frontal accretionary thrust region. Deep segments of the splay fault are continuous along strike across the entire 12 km survey width, with shallower segments continuing typically 3-5 km along strike. Many segments along the splay fault system have reversed polarity reflections relative to the seafloor, high amplitudes relative to adjacent stratigraphic horizons, and are potentially active fluid conduits fed by deep sources.

More than 2 sec of sediment in the Kumano forearc basin are imaged. The deepest part of the section is strongly folded, while the seaward portion is progressively tilted landward due to repeated motion on the megasplay fault.

The NanTroSEIZE drilling program is becoming ready for a six-month, two-ship operation, Chikyu & U.S. SODV, scheduled to begin in September, 2007. This unique 3D seismic data set will play a key role in the interpretation of the coring and logging data.