

Progress report and future perspective on NanTroSEIZE drilling

Masataka Kinoshita^{1*}, Demian Saffer², Lisa McNeill³, Eiichiro Araki¹, Timothy B. Byrne⁴, Saneatsu Saito¹, Mike Underwood⁵, Harold Tobin⁶, Juichiro Ashi⁷, Gaku Kimura⁷, the Expedition 319 Scientists¹, Exp322 Science Party¹

¹JAMSTEC, ²Pennsylvania State University, ³University of Southampton, ⁴University of Connecticut, ⁵University of Missouri, ⁶University of Wisconsin - Madison, ⁷The University of Tokyo

The Nankai Trough Seismogenic Zone Experiment (NanTroSEIZE) program is designed to investigate fault mechanics and seismogenesis along subduction megathrusts through direct sampling, in situ measurements, and long-term monitoring in conjunction with allied laboratory and numerical modeling studies. In 2007 through 2008, IODP Expeditions 314, 315, and 316 were carried out as NanTroSEIZE Stage 1. A transect of eight sites was selected for riserless drilling to target the frontal thrust region, the midslope megasplay fault region, and the Kumano forearc basin region.

In 2009, the second stage of NanTroSEIZE was carried out, including two IODP Expeditions 319 and 322. Expedition 319 included riser drilling, analyses of cuttings and core samples, downhole measurements and logging, and casing at Site C0009 in the Kumano forearc basin as well as riserless drilling, logging while drilling (LWD), casing, and observatory operations at Site C0010 across a major splay fault that bounds the seaward edge of the forearc basin near its updip terminus. Site C0009 marked the first riser drilling in IODP history. This allowed several scientific operations unprecedented in IODP, including carefully controlled measurements of in situ pore pressure, permeability and minimum principal stress magnitude, real-time mud gas analysis, and laboratory analyses of cuttings throughout the entire riser-drilled depth range. We conducted a leak-off test at one depth interval and successfully deployed the wireline Modular Formation Dynamics Tester 12 times to directly measure in situ stress magnitude, formation pore pressure, and permeability. At riserless Site C0010, operations included drilling with measurement while drilling (MWD)/LWD across the megasplay fault to 555 mbsf, casing the borehole with screens at the depth of the fault, conducting an observatory dummy run, and installation of a temporary pore pressure and temperature monitoring.

Expedition 322 (Subduction Inputs) was designed to document characteristics of incoming sedimentary strata and igneous basement prior to their arrival at the subduction front. Coring was conducted at two sites in the Shikoku Basin on the subducting Philippine Sea plate. Site C0011 is located on the northwest flank of the Kashinosaki Knoll, whereas Site C0012 is located near the crest of the knoll. Coring at Site C0011 failed to reach the total depth target. Coring at Site C0012, however, penetrated 33 m into igneous basement and recovered the sediment/basalt interface intact at ~540 mbsf. Site C0012 finally provides a reliable geochemical reference site for the subduction zone.

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