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Model of construction of the Nankai margin from drilling results of the Nankai Trough Seismogenic Zone Experiment (NanTroSeiZE - IODP Expeditions 314, 315, 316, 319, and 322)

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The Nankai Trough Seismogenic Zone Experiment (NanTroSeize) is a multi expedition ocean drilling project dedicated to investigating fault mechanics and seismogenesis on a subduction megathrust through in situ measurements, sampling, and long-term monitoring. The focus is on a splay thrust system, which designates out of sequence thrusts (OOSTs) located at the updip limit of the seismogenic zone that are thought to slip coseismically during large earthquakes (Park et al., 2002). To this date, 11 sites were drilled from the Shikoku basin on the incoming plate to the Kumano forearc basin overlying the older accreted complex, documenting the sedimentary sections encountered throughout the accretionary complex in terms of lithology, physical properties, deformation, in situ stress and pore pressure, and characterizing the fault and wall rock composition of the frontal thrust and the OOST. In addition, data from long-term monitoring instruments (pore pressure and temperature measurements) placed in a sealed borehole in the OOST will be recovered in 2010. Major results of the drilling include: (1) determination of orientation of present and past principal stresses, indicating a relatively narrow zone of extension perpendicular to the trench located above the splay fault within the forearc basin (Kinoshita et al., 2008), (2) constraints on the structure and tectonic evolution of the margin, especially timing of accretion, erosion, OOST activity and forearc basin sedimentation, and (3) characterization of geology and physical properties of fault zones and deformation in the shallow domain (< 1km) with coexistence of compacted and dilated structures within faults zones. In the relatively shallow holes drilled, there is little evidence for fluid migration or fluid overpressures. However, Site C0001, located within the thrust sheet above a splay fault encountered dilated fractures, of which the cause (drilling induced or natural overpressure) is debated. Heat flow anomalies at the deformation front and in the trench suggest convection in the crust and/or in the sand rich trench fill.

Strasser et al, 2009 showed that the thrust drilled at Site C0004 was initiated at or near the deformation front and accommodated during a short period of time (1.95-1.80 Ma) $\sim$15 to 22% of the plate convergence, and suggest prism growth was reduced during that period of time. The subsequent OOST slip rate was slower. Observations of the present geometry of the frontal thrust, merged with the décollement, suggest a pause in the accretion, and calculations (Screaton et al, 2009) indicate that 13 to 34% of the convergence has been accommodated by trench sediment subduction. The recent activity of the frontal thrust thus appears analogous to the initial phase of the thrust drilled at Site C0004. We propose a model of construction of the margin in which major OOSTs and splay faults correspond to former decollements that were active during episodes of non-accretion. The uplift and tilting of the outer-arc high and landward migration of the forearc basin depocenter appears to post-date OOST activity, and we propose these are mostly the consequence of underthrusting below a ramp, followed by a change of decollement level.