Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

U002-06 Room:IC Time:May 25 10:45-11:09

Alternating periods of high and low activity along the megasplay fault in the Nankai Trough

Michael Strasser[1*], Gregory Moore[2], Gaku Kimura[3], Arito Sakaguchi[4], Michael Underwood[5], IODP Exp 333 Scientists[6]

[1]MARUM, University of Bremen, Germany, [2]SOEST, Univ. Hawaii, USA, [3]University of Tokyo. Japan, [4]IFREE, JAMSTEC, Japan, [5]Univ. Missouri at Columbia, USA, [6]IODP

Data and results from Stage 1 and 2 operations of the ongoing Integrated Ocean Drilling Program (IODP) Nankai Trough Seismogenic Zone Experiment (NanTroSEIZE) ? a complex ocean drilling project that eventually attempts to drill, sample, and instrument the seismogenic zone to yield insights into processes responsible for earthquakes and tsunamis offshore the Kii Peninsula, southwest Japan ? characterize the shallow portion of the Nankai Through subduction zone along a transect from the Kumano forearc basin, the shallow megasplay fault zone, the frontal prism to the subduction inputs of the Shikoku Basin. This provides an extensive base for evaluating both long-term and short-term tectonic processes controlling evolution and current state of this subduction margin, as it relates to the present-day earthquake activity.

Here we present result from 3D reflection seismic data interpretation and IODP drilling and coring of slope-apron and slope-basin stratigraphic successions in the shallow megasplay fault zone area to document the tectono-stratigraphic development of the Quaternary Nankai accretionary wedge, the origin and evolution of the margin-dominating megasplay fault system and its effect on sedimentation pattern, seafloor deformation and sediment remobilization.

Three lithostratigraphic subunits are identified within the stratigraphic succession deposited in a slope basin in the front of the advancing splay fault over the last ˜ 2Myrs and several intercalated intervals comprise evidence for significant sediment remobilization periods which are in phase with enhanced activity along the megasplay fault and underlying growing anticline structures. At the tip of the megasplay fault, we document the growth of the fault and its interaction with slope sediments. Dating and collected geological data at drill Sites C0004 and C0008, where the slope sediments are overridden by the hanging wall, indicate that the splay fault initiated 1.95 Ma in the lower part of the prism as an out-of-sequence thrust. After an initial phase of high activity, the movement along the fault slowed down, but uplift and reactivation of the fault resumed about 1.55 Ma.

A remarkable lithological transition between a sandy turbidite sequence (subunit Ib) below and ash-bearing hemipelagites intercalated with mass-transport deposits (subunit Ia) above, was recovered at Site C0018 during the most recent IODP Exp 333 (Dec 2010 - Jan 2011). Within the underlying turbidite sequence, seismic data reveal that a series of small channels oriented perpendicular to the paleoslope was cut within a very short time period (˜1.55-1.24 Ma) and were filled within the next seismically-resolvable time step. Turbidite deposition ceased about 1 Ma, documenting a prominent change in sediment delivery and routing pattern in the study area. This correlates to a significant shift in the sediment depocentre within the Kumano Basin following ˜300 kyr of extensive landward tilting of the outer Kumano basin sediments, which has been interpreted to represent a major period of motion along the megasplay that formed the modern fault geometry.

Seafloor deformation by slumping is a dominant ongoing process on the slope in the shallow megasplay fault zone area, with numerous surficial slump scars evident in the seafloor topography. A sub-recent, presumably seismically-triggered mass-transport deposit has been recovered within the first two meter subbottom depth at Site C0018. This, as well as the occurrence of a thin mud-breccia layer in the shallow-most part of Site C0004, for which radioisotope dating indicates a deposition time consistent with the 1944 Tonakai earthquake, indicates that slope sediments not only provide long-term records of the structural evolution of the megasplay fault system but also may record the recent seismic activity of large megathrust events.

Keywords: IODP, NanTroSEIZE, Nankai Trough, Megasply fault zone, tectono-stratigraphic evolution, slope basin sediments