Mass-wasting processes and tectono-stratigraphic evolution of an accretionary prism: Results from 3D-seismic interpretation and IODP drilling in the Nankai subduction zone

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This presentation aims towards investigating the temporal and spatial distribution of submarine landslides deposit in an accretionary prism margin, and how we can use such deposits as "proxies" to reconstruct the tectono-stratigraphic evolution of such active tectonic environments. We us 3D seismic data interpretation in the IODP Nakai Trough Seismogenic Zone Experiment (NanTroSEIZE) area offshore Kii Peninsula, SW Japan, that reveals a peculiar slope-basin stratigraphic succession, composed of stacked Pleistocene-to-recent mass-transport deposits (MTDs). A nearby small slope basin has been drilled during IODP NanTroSEIZE Stage 1a expedition 316 (Site C0008). Data from this site located seaward of a prominent out-of-sequence thrust (megasplay fault) show the potential of using MTDs to reconstruct slope failure activity as it relates to the structural evolution of the accretionary prism. A conceptual splay-fault development model, constructed on the basis of seismic reflection data, seismic-to-core correlation and bio- and magnetostratigraphy age constraints allows for "calibration the geological record" and investigation of the genetical link between sediment mass-transport processes and the tectono-stratigraphic evolution of the slope basin and adjacent splay-fault system. Results document the time period between 1.95 Ma and 1.8 Ma to be a high activity phase during an early stage of splay fault activity. It resulted in gravitational mass movements along the upthrusted and uplifted prism and in subsequent deposition of MTDs in the adjacent slope basins. Our reconstruction for the subsequent time period between 1.8 Ma and 1.24 Ma shows alternating periods of high- and low splay fault activity that are linked in an out-of-phase mode to accretionary prism forward growth and in-sequence frontal imbrication.

Apart from the deepest section, Site C0008 lacks clear evidence for MTDs, likely due to a significant hiatus in its upper part, suggesting erosion related to a prominent slope collapse structure seaward of the mega splay fault. However, seismostratigraphic mapping of MTDs identified in the 3D seismic data covering the lower slope basin seaward of this collapse structure show that the stacked MTD succession in this basin may also record the splay fault activity younger than 1.24 Ma. This succession has been proposed for future IODP drilling (IODP Proposal 738-APL Nankai Trough Submarine Landslide History (NanTroSLIDE)), as it is ideally suited to constrain timing, causes and consequences of submarine landslides in one of the worldwide best studied accretionary complex. Expected dating results from the proposed IODP drilling will allow for absolute age constraints of individual MTDs. High-resolution data on the spatial and temporal distribution of submarine landslide along the Nankai Trough accretionary prism will then provide further constraints on the relation of mass wasting and the tectono-stratigraphic evolution of the margin.