

Structures characterizing the megasplay fault across shallow slope sediments of the Nankai accretionary prism

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LWD measurements at Hole C0022A and coring at Hole C0022B during IODP Expedition 338 confirm the early suggestion from seismic reflection imaging that a branch of the mega-splay fault crosses shallow slope sediments and may thus get close to the sea bottom. At C0022A, the evidence include (1) the presence of moderately to steeply dipping fractures between 86.6 and 105.5 mbsf and (2) the presence of a low-resistivity zone at the same interval, with a particularly low resistivity interval at 100-101 mbsf. At C0022B, the evidence include (1) three age reversals recognized between 76.48 and 84.48 mbsf, between 132.38 and 142.70 mbsf, and between 142.70 and 148.46 mbsf, (2) a bedding disturbed interval from 73.49 to 143.82 mbsf, (3) poor core recovery in the interval of 94.5-99.5 mbsf, suggesting highly fractured or disturbed material, and (4) the presence of three intervals of clay characterized by a composite planar fabric (338-C0022B-10T-5, 49-51 cm, 10T-CC, 19-20 cm, and 11H-1, 18-19 cm). By comparison with the nearby 3D seismic reflection image, the C0022A low-resistivity image at 100-101 mbsf could correspond to the megasplay fault core zone where displacement is supposed to be the largest. The sudden drop in core recovery at this interval indicates that coring at Site C0022 likely missed the megasplay fault core zone. Conversely, coring likely sampled secondary fault zones characterizing the damage zone of the megasplay fault branch at Site C0022. Post-cruise investigations aim at examining all structures and microstructures associated with this supposed damage zone.

Based on CT scan images, seven intervals were selected from Core 10T (three from section 5, one from core catcher) and from Core 11T (three intervals). For each interval, a slab was cut, dried, epoxied and polished before being analysed by XRF scanner for compositional mapping. Polished thin sections were made from the most deformed-looking parts of the slabs.

XRF scanning analysis brings two main results: At least three gently dipping planar surfaces outlined by iron sulphide (most likely pyrite) cross the cores. It is not clear whether these surfaces are faults or not but, in one case (11T-1, 72-83 cm), the surface separates clays with different Ca contents, suggesting some offset. The presence of iron sulphide along the surfaces may be related to fluid flow having allowed recrystallization of this mineral species. Shipboard observation revealed three intervals characterized by weakly marked planar fabrics. Two of these intervals (338-C0022B-10T-5, 49-51 cm and 11H-1, 18-19 cm) are characterized by a depletion in Ca and Sr and an enrichment in K with respect to the surrounding sediments.

Lastly, preliminary optical microscope observation indicates that some incipient non-coaxial shear deformation (asymmetrical sand lenses and composite planar fabric) affected the intervals with planar fabrics. Put together, these results indicate that deformation so far recognized in C0022B cores is weak to moderate. This is not an unexpected result given (1) the young age of the sediments and (2) the fact that samples likely come from the damage zone a few meters and not from the core zone.

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