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Structure and clay mineralogy: borehole images, log interpretation and sample analyses at Site C0002 Nankai Trough accretionary prism

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Our research focused on the characterization of fracture and fault structures from the deep Nankai Trough accretionary prism in Japan. Logging Data and cuttings samples from the two most recent International Ocean Discovery Program (IODP) Expeditions 338 and 348 of the NanTroSEIZE project were analyzed by Logging While Drilling (LWD) oriented images, geophysical logs and clay mineralogy. Both expeditions took place at Site C0002, but whereas Hole C0002F (Expedition 338) was drilled down to 2004.5 mbsf, Hole C0002N and C0002P (Expedition 348) reached a depth of 2325.5 mbsf and 3058.8 mbsf respectively.

The structural interpretation of borehole imaging data illustrates the deformation within the fractured and faulted sections of the accretionary prism. All drill holes show distinct areas of intense fracturing and faulting within a very clay-dominated lithology. Here, smectite and illite are the most common clay minerals, but the properties and the role they may play in influencing the fractures, faults and folds in the accretionary prism is still not well understood. When comparing clay mineralogy and fracture/fault areas in hole C0002F (Expedition 338), a trend in the abundance of illite and smectite, and in particular the swelling behavior of smectite is recognizable. In general, the log data provided a good correlation with the actual mineralogy and the relative abundance of clay. Ongoing postcruise preliminary research on hole C0002 N and C0002P (Expedition 348) should confirm these results.

The relationship between fracture and fault structures and the changes in clay mineralogy could be explained by the deformation of specific areas with different compaction features, fluid-rock interaction processes, but could also be related to beginning diagenetic processes related to depth. Our results show the integration of logging data and cutting sample analyses as a valuable tool for characterization of petrophysical and mineralogical changes of the structures of the Nankai accretionary prism. This is critical for our understanding of clay-fluid interaction and mechanical properties duing fault displacements and seismogenesis.