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Results from IODP Expedition 348: Deep Drilling Above the Plate Interface, Nankai Trough Subduction Zone

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During IODP Expedition 348 from October 2013 to January 2014, Site C0002 was drilled to more than 3000 meters depth into the inner accretionary wedge at the Nankai Trough, setting a new depth record for scientific ocean drilling. It is the first hole to access the deep interior of an active convergent margin. Site C0002 is part of the NanTroSEIZE transect off the Kii Kumano region of Japan, imaged with 3D seismic reflection and drilled on a series of Chikyu expeditions to shed light on the processes around the up-dip edge of seismogenic locking and slip. At Site C0002, riser drilling has passed through the approximately 900 m thick Kumano forearc basin and pierced the underlying Miocene age accretionary wedge. The zone from 865 to 3056 meters below the sea floor was sampled via limited coring, extensive LWD logging, and continuous observations on drill cuttings that all reveal the materials and processes in the deep interior of the inner wedge. Predominantly fine-grained mudstones with common turbiditic sands were encountered, complexly deformed and exhibiting well-developed scaly clay fabrics, variable bedding dip with very steep dips prevailing, and veins that become more abundant with depth. The biostratigraphic age of the sediments in the lowermost part of the hole is thought to be about 9 to 11 Ma, with an assumed age of accretion of 3 to 5 Ma.

Physical properties suggest that the inner wedge from 1600 to 3000 mbsf has quite homogeneous properties. P wave speeds from sonic logs increase with depth to approximately 1600 meters, but are constant to slightly decreasing with depth from 1600 to 3050 meters. We hypothesize that this change in trend indicates the onset of elevated pore fluid pressure, but structural and lithologic factors may also play a role. A borehole leak-off test (LOT) and a series of borehole pressurization and injection tests were also performed, which we synthesize to estimate the least principal stress, Shmin. Furthermore, downhole pressure while drilling (PWD) measurements recorded during borehole packoff events provide information on the maximum principal stress, SHmax. Taken together, the LOT and PWD observations suggest that the inner wedge at about 2000 meters depth is currently in a strike-slip stress regime, despite its position as the hanging wall of a main plate boundary thrust.

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