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Frictional property and microstructures of splay fault at seismic slip rate

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Megasplay faults branching from the plate boundary megathrust are thought to efficiently transmit seismic slip to the near surface. During IODP Expedition 316, drilling was carried out in the shallow portion of the megasplay fault system (Site C0004) in the Nankai accretionary prism off Kumano, where earthquake ruptures may propagate repeatedly during great subduction earthquakes such as the 1944 Tonankai earthquake. At Site C0004, the megasplay fault shows clear evidence of repeated localization of displacement to 10-mm-thick dark shear zones within microbreccias. We performed friction experiments on microbreccias taken from the interval immediately below the dark shear zones at slip rates of 0.013-1.3 m/s and normal stresses of 0.6-2.0 MPa under dry and wet conditions. We monitored the changes in temperature and moisture during experiments. The microstructures of experimental shear zones were examined by using an optical microscope, a scanning electron microscope, and a transmission electron microscope. Based on experimental and microstructural results, we determine the frictional property and characteristic microstructure of the splay fault at seismic slip rate and discuss their implications for earthquake rupture propagation along the megasplay fault.