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Frictional properties of the shallow Nankai Trough accretionary sediments

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We have conducted friction experiments on sandstone, tuff, silty mudstone and clayey mudstone samples cored from the shallow Nankai Trough accretionary prism, using a triaxial apparatus recently installed at Chiba University, at a confining pressure of 37 MPa, a pore pressure of 29 MPa, a temperature of 42 degrees C, and an axial displacement rate of 1 micrometer/s. These pressure, pore pressure and temperature correspond to those supposed at the depth of 1 km below seafloor at IODP Site C0002. The results reveal that frictional properties of these samples change systematically according to the content of clay minerals, in particular of smectite. The content of clay minerals is 6.0 wt% in the sandstone sample, 17.2 wt% in the tuff sample, 34.1 wt% in the silty mudstone sample, and 42.0 wt% in the clayey mudstone sample. Except for the sandstone sample in which smectite is absent, smectite is the most abundant clay mineral in all the other samples, occupying 68-76 wt% of total clay minerals.

Steady-state friction coefficient decreases with increasing content of clay minerals, from 0.83 of the sandstone sample, through 0.74 of the tuff sample and 0.34 of the silty mudstone sample, to 0.27 of the clayey mudstone sample. Slip-dependent frictional behavior also changes according to the content of clay minerals; the sandstone sample exhibits slip hardening, while the other samples exhibit slip softening, which becomes more pronounced with increasing amount of clay minerals.

We will also report the velocity dependence of steady-state frictional strength at this condition as well as how frictional properties of these samples change at deeper conditions up to 5 km below seafloor.

Keywords: Nankai Trough, accretionary sediments, frictional properties