

Frictional properties of subducting oceanic sediments and rocks at a shallow Japan Trench condition and slow slip rates

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We conducted triaxial friction experiments on gouges of subducting oceanic sediments and rocks at a confining pressure of 81 MPa, a pore pressure of 76 MPa, a temperature of 27.5 °C, and a constant slip rate of 1.155 $\mu\text{m/s}$. Samples used are basalt of the Philippine Sea plate cored from IODP Site C0012 off Kii Peninsula, chert of the Pacific plate cored from IODP Site C0019 near Japan Trench off Tohoku, and pelagic and hemipelagic clays of the Pacific plate cored from DSDP Site 436 off Tohoku. Experimental confining pressure, pore pressure and temperature are those supposed at the plate boundary fault zone near Japan Trench drilled through during the IODP Exp. 343. Confining and pore pressures were estimated from the density log profile obtained during the Exp. 343 and assuming a hydrostatic condition, respectively, while temperature was a value recorded in a hole at Site C0019 after 7 months of drilling. The steady-state friction coefficient after a displacement of ≈ 5 mm was ≈ 0.65 for basalt and chert, ≈ 0.4 for hemipelagic clay, and ≈ 0.1 for pelagic clay. Thus the frictional strength of pelagic clay is unusually low, which is ascribed to its abundance in clay minerals (≈ 89 wt%), particularly smectite (≈ 63 wt%). This implies that a décollement is likely formed in the pelagic clay layer at Japan Trench off Tohoku, which was in fact found to be true by drilling during the IODP Exp. 343. We will also show the results of friction experiments at a slip rate of 11.55 $\mu\text{m/s}$, and discuss the velocity dependence of steady-state friction as well.

Keywords: friction, basalt, chert, pelagic clay, hemipelagic clay, Japan Trench