Frictional properties of incoming sediments and rocks at shallow conditions of the Japan Trench subduction zone

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In order to examine the frictional properties of incoming sediments and rocks at shallow conditions of the Japan Trench subduction zone, we conducted triaxial friction experiments on gouges of the following samples at a confining pressure of 150 MPa, a pore water pressure of 50 MPa, temperatures of 25–200˚C, and axial displacement rates changed stepwise among 0.1, 1 and 10 μm/s. We used hemipelagic and pelagic clay samples cored from the cover sediments on the Pacific plate off Sanriku, a chert sample cored from the footwall of the plate boundary thrust near the Japan Trench, and a basalt sample cored from the oceanic basement of the Philippine Sea plate off Kii Peninsula.

The results show that the steady-state friction coefficient μ_{ss} decreases with increasing content of clay minerals at a given temperature. Although μ_{ss} of a given sample does not change noticeably with increasing temperature up to 100˚C, it increases with increasing temperature from 100˚C to 200˚C. *a*–*b* value (rate dependence of μ_{ss}) decreases with increasing temperature, and becomes negative at 200˚C where all samples showed stick-slip. However, the transition temperature at which *a*–*b* value becomes negative is different among four samples; ≈50˚C for the chert sample, ≈100˚C for the basalt sample, ≈ 125˚C for the hemipelagic clay sample and ≈150˚C for the pelagic clay sample. This implies that the transition temperature from aseismic faulting to seismic faulting is different among incoming sediments and rocks, suggesting that a heterogeneous distribution of asperities at the Japan Trench subduction zone as inferred from seismic studies possibly reflects the heterogeneous distribution of fault-zone materials along the plate boundary megathrust.

Keywords: frictional properties, incoming sediments and rocks, shallow Japan Trench subduction zone

