Frictional behaviour of serpentinite gouge from Hahajima seamount at low to high velocities

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Serpentine is occasionally associated with the creeping segment of active faults, such as the San Andreas fault. The low friction and slip stability of serpentine investigated in previous studies are proposed as a cause of fault creep motion without seismic activities. Recent studies of seismic reflection at Izu-Bonin and Mariana forearcs indicate the possibility that serpentine, a low density material, exists at the aseismic region of the subducting slab. Many serpentine seamounts have been reported from the region between the trench and the volcanic fronts of the forearcs. Petrological analysis of serpentine breccia constituting the seamounts suggested that the origin of a seamount was a diapir of serpentined peridotite rising from the boundary between the subducting slab and mantle wedge up to the seafloor. Thus we conduct friction tests of serpentine-bearing gouge of a serpentine seamount and investigate the role of serpentine in the subduction earthquakes.

The samples used in this study are serpentine-bearing gouge of the Hahajima seamout. The Hahajima seamounts is located at southeast of the Hahajima Island on the Bonin Ridge. We took part in the 2003 3rd sea survey [KH03-3] of the Ocean Research Institute of Tokyo University and could collect a large amount of brecciated serpentine rocks by five dredge hauls. The fine-grained matrix parts of the brecciated rocks were ground by hand and passed through a 500-um-diameter sieve to produce gouge samples. The friction tests at low slip rates are conducted in a double-direct-shear apparatus and the tests at high slip rates are conducted in a rotary-shear apparatus. Gouge layers are sandwiched between a pair of solid sample blocks. The one of the pair is fixed and the other is sheared. Normal stress is held constant at 0.6 MPa and the slip rates range from 0.01 [um/s] to 1.0 [m/s]. All experiments are performed at room temperature and under unconfined, dry conditions. In our poster presentation, we discuss velocity dependence of dynamic friction of serpentine-bearing gouge and compare with other gouge, such as Nojima fault gouge (granite-bearing gouge).