Frictional properties of the cataclasite adjacent to the ultrafine-grained black fault rock at the Pasagshak Point, Kodiak, Alaska

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In this study, frictional properties of cataclastic melange rock were investigated using a rotary-shear frictional testing machine. Samples for the experiments were collected from cataclastic argillaceous melange rocks at the Pasagshak Point, Kodiak Island, Alaska, which is likely the source of the recently proposed zone of the exceptionally thick seismogenic fault zone (unltrafine-grained black fault rock (BFR) or the black-layer, Rowe, et al., 2005).

Shear deformation experiments were performed on the cataclasite rock sample, at 5.0 MPa normal stress and at slip rates from 0.003 to 3 mm/s, with a rotary-shear, intermediate- to high-velocity friction apparatus at Kyoto University. To be used in the experiments, collected cataclasite sample were disaggregated, oven dried at 90 degrees cetigrade for 24 hours and then milled and sieved to prepare fine-grained particles smaller than about 0.1 mm. The experimental fault is composed of thin layer (less thatn 1.0 mm) of the disaggregated fine-grained materials, which is put between a pair of 24.8 mm diameter gabbro rock cylinders. A Teflon ring surrounds the fault in order to avoid a leak of the sheared material during the experiment.

Our results show that the level of friction recorded for the tested samples range from about 0.4 to 0.8, over the range of experimental conditions used in this study. The velocity dependence of friction of the tested samples is positive (velocity strengthening) for all the tested slip rates but for one case tested at the slowest slip rate condition. For a velocity step-up change from 0.003 to 0.03 mm/s, frictional strength of the sample shows clear negative dependence on the slip rate (velocity weakening). Data is still preliminary but such a transition in velocity dependence with the increase of slip rate could control the process of the shear zone development. Additional work to examine relationship between the velocity dependence and the composition of the tested materials, grain size distribution and the deformation textures over a wide range of experimental conditions is needed.