Frictional Properties and Microstructures of Main Fault Gouge of Mont Terri Rock Laboratory, Switzerland

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Friction experiment was conducted on samples of main fault of Mont Terri Rock Laboratory, Switzerland and then microstructures of experimented fragments were observed by a JCM-6000. Samples were taken at the depths of 47.2m and 37.3m of borehole BSF-1, and at 36.7m, 37.1m, 41.4m and 44.6m of borehole BSF-2, which were drilled from the drift floor at the depth of 260m from the surface. Friction experiment was conducted on above 6 samples using a rotary shear low to high-velocity friction apparatus at Institute of Geology, China Earthquake Administration in Beijing at a normal stress of 3.95 to 4.0 MPa and at slip rates ranging 0.2 microns/s to 2.1mm/s. Cylindrical specimens of Ti-Al-V alloy with 40 mm in diameter were used as rotary and stationary pistons and the alloy pistons exhibit similar behaviors as host rock specimens. A Teflon sleeve was used around the piston to confine the sample during a test.

Main experimental results are summarized as follows.
1) Mud rocks in Mont Terri drill holes (BFS-1, BFS-2) have the following ranges of steady-state or nearly steady-state friction coefficient μ_{ss}: μ_{ss} *(wet)*: mostly 0.1~0.3, μ_{ss} *(dry)*: mostly 0.5~0.7
Dry gouges have about twice as large friction coefficients than wet gouges.
2) However, fault rock (37.3 m, BFS-1) with scary fabric has: μ_{ss} *(wet)*: 0.50~0.77, μ_{ss} *(dry)*: 0.45~0.78 (no difference between the two) This is probably because the clay contents of this rock is less (~ 33 %) than those in other rocks (67~73 %).
3) Initial peak friction coefficient μ_p is more or less on the same order of magnitudes as μ_{ss} although μ_p can increase with increasing contact time and cementation in natural environments.
4) Deformed gouges are characterized by well-developed slip zones adjacent to the rotary and stationary pistons, accompanied by slickenside surfaces with clear striations. Those slickenside surfaces are similar to those developed in the drill core samples used in our experiments.
5) Slip zones are unclear in deformed fault rock from 37.3 m (BFS-1), and probably slickenside surfaces form easily in clayey mudrocks.

Keywords: friction experiment, Mont Terri Rock Laboratory, friction coefficient, back scattered electron image

