Frictional Properties of Shionohira Fault Gouge (Part 2)
-A Comparison with Kuruma Fault Gouge at the Southern Extension of Shionohira Fault-

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The April 11, 2011 Fukushima-ken Hamadori Earthquake (the largest aftershock of the 2011 off the Pacific coast of Tohoku Earthquake) formed co-seismic surface ruptures trending in the NNW-SSE direction in Iwaki City, Fukushima Prefecture situated in southeast Tohoku, Japan. Ishiyama et al. (2011) named the fault Shionohira (hereafter called the “active segment”). A N-S trending geological fault with lineaments (named Kuruma Fault) exists along the southern extension of the active segment, although surface ruptures did not appear in this area (hereafter called the “non-active segment”). The authors have been elucidating the differences of active and non-active segments resulting from the 4.11 earthquake, and have reported on the low to high velocity friction experiments for the fault gouges sampled from the surface outcrops of only the active segment at the 2015 JpGU. The current report discusses results for both the active and non-active segments by conducting low to high-velocity friction experiments on the gouge collected from shallow borehole cores of both segments.
All experiments were conducted using a rotary-shear low to high-velocity frictional testing apparatus at the State Key Laboratory of Earthquake Dynamics, Institute of Geology, China Earthquake Administration. The apparatus is capable of producing slip rates of 0.2 microns/s to 2 m/s under dry and wet condition, at room temperature and at normal stresses of mostly 1MPa by using a TiAlCr alloy piston as a host specimen which exhibits similar behavior to those of rock specimens. Experiments were performed under drained condition because gouges were sealed by teflon sleeves. Gouge samples were taken from shallow borehole cores at depths of 20.90~20.95m of the Minakami-kita outcrop for the non-active segment, and at depths of 12.82~12.87m of the Shionohira outcrop and 5.96~6.00m of the Betto outcrop for the active segment.
As for the slip behavior of the fault gouge, three velocity regimes were recognized based on the velocity dependence of steady-state friction coefficient: low velocity-regime of below 10 to 100 microns/s showing almost no velocity dependence; intermediate velocity-regime of 100 microns/s to 1 mm/s showing clear velocity strengthening, and high velocity-regime of above 1 to 10 mm/s showing significant velocity weakening. Steady-state friction coefficients of dry gouges were 0.6 to 1.0 at low to intermediate slip velocity, whereas their values were low at about 0.1 at high slip velocity. On the contrary, wet gouges of both outcrop samples of Betto and Shionohira and borehole core sample of Betto measured below 0.2 at low slip velocity although core samples of Shionohira and Minakami-kita varied between a wide range of friction coefficient from 0.4 to 1.0. Gouges of Shionohira and Kuruma faults showed heterogeneous friction characteristics under wet conditions. Results of experiment using a new sample cell which can control water content will be discussed in the poster to illustrate how friction strength can change greatly depending on water content.

Keywords: frictional properties, fault gouge, Shionohira fault, low to high velocity friction experiment, Fukushima-ken Hamadori earthquake

