Laboratory study on frictional behaviour of rock blocks of meter scale. Method and preliminary results

Ostapchuk A.A. (1), Kocharyan G.G. (1), Pavlov D.V. (1), Gridin G.A. (1), Morozova K.G. (1), Panteleev I.A. (2)

(1) Sadovsky Institute of Geosphere Dynamics of Russian Academy of Sciences, Moscow, Russia

(2) Institute of Continuum Mechanics of the Ural Branch of the Russian Academy of Sciences, Perm, Russia

e-mail: ostapchuk.aa@idg.ras.ru

The search for physical mechanisms that determine the fault behavior and explain the nonlinear processes of evolution at different scale levels is an extremely difficult task. Laboratory and numerical experiments are usually simplified to the limit, and the small size of the laboratory samples greatly limits the experimental scopes, both in terms of setting up experiments and in terms of measurements.

The work presents a unique in Russia laboratory setup of a meter scale, constructed in IDG RAS, to investigate the evolution of different sliding regimes on rock discontinuities. The technique of conducting experiments is described and the results of first experimental series are resented.

The laboratory fault was a loaded contact of two diabase blocks about 75 cm long, the contact gap was filled with a granular material. The normal stresses reach 10 MPa. Varying the gouge composition and the rate of shear loading allowed to realize a wide spectrum of sliding regimes: stable creep, regular stick-slip, aperiodic slow slips. It is shown that variations in loading rate can lead to a dramatic change in sliding regime.

An intensive frictional crushing of filler grains was detected in experiments under normal stresses of about 2MPa. Besides that, structural phase transitions of quartz (corresponding local temperature rises to 700 degrees Celsius) were revealed during the high amplitude stick-slip. Perspective items that could be simulated at this setup – the pre-seismic stage of nonlinear behavior of the principle slip zone under peak shear strength.