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# Strength and Stability of Frictional Sliding of Gabbro Gouge under Elevated

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As most earthquake focal depths are concentrated in the upper crust (e.g., Chen and Molnar, 1983), previous studies on rate dependence of frictional strength have focused on granite that is typical in the upper crust (Lockner et al., 1986; Blanpied et al., 1995). However, recent re-assessment of focal depth of many earthquakes reveals that some of them have been generated in the continental lower crust (Maggi et al., 2000). Moreover, teleseismic imaging of the structure across the San Andreas Fault also suggests the existence of deep fault that cuts through the crust (Zhu, 2000). With this background, more attention should be paid to intermediate and mafic rocks in the lower crust. Frictional resistance and the related rate-dependence of such rocks are critical to understand the mechanical behavior of deep faults that cut the lower crust. Specifically, this is crucial for answering two important questions, namely, (1) is it likely for earthquake to nucleate in the continental lower crust? (2) How much stress can the lower crust support?

To investigate strength of frictional sliding and stability, we conducted experiments on oven-dried gabbro gouge at elevated temperatures with a triaxial testing system using gas as the pressure medium. A gabbro gouge layer of 1 mm thick (particle size of the gouge≤76 μ) was placed along an inclined saw-cut (35° to the loading axis) in a 20-mm-diameter cylinder sample to simulate a fault with gouge.

Two series of experiments were conducted with normal stresses of 200 MPa and 300 MPa, respectively, with temperatures up to 615°C, applying rate steps during shear deformation. For both normal stresses, the friction strengths are comparable at least up to 510°C. With normal stress of 300 MPa, the values of steady state rate-dependence decreases systematically with increasing temperature, and stick-slip occurred at 615°C.

Keywords: Friction; lower crust; rate dependence; stability.

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