



Experimental Comparison of Load-Strengthening and Load-Weakening Behaviour Leading to Fault Reshear

Tom Mitchell (1), Richard Sibson (2), and Jörg Renner (1)

(1) Ruhr-University Bochum, Institute for Geology, Mineralogy, and Geophysics, Experimental Geophysics Laboratory, Bochum, Germany (tom.m.mitchell@btinternet.com), (2) Department of Geology, University of Otago, P.O. Box 56, Dunedin 9054, New Zealand

In this study, we assess the loading of faults to failure under different stress regimes in a triaxial deformation apparatus, both in dry and saturated conditions. We explore experimentally the reshear of an existing fault at particular values of $(\sigma_1 - \sigma_3)$ and σ_3' for contrasting loading systems - *load-strengthening* (equivalent to a thrust fault) with σ_1' increasing at constant σ_3' , versus *load-weakening* (equivalent to a normal fault) with reducing σ_3' under constant σ_1' . Prefailure and postfailure behaviour is compared in terms of damage zone development via monitoring variations in ultrasonic velocity and acoustic emission behaviour. In addition, we explore reshear conditions under an initial condition of $(\sigma_1' = \sigma_3')$, then inducing reshear on the existing fault first by increasing σ_1' (*load-strengthening*), then by decreasing σ_3' (*load-weakening*), again comparing relative damage zone development and acoustic emission levels. Experiments are conducted on sawcut granite samples with fault angles at a variety of orientations relative to σ_1 , ranging from an optimal orientation for reactivation to orientation for frictional lock-up.