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Laboratory study of fault healing in Carrara marble

Helen Lacey (1), Brian Evans (2), and Ulrich Mok (2)

(1) Department of Earth Sciences and Engineering, Imperial College London, London, United Kingdom (h.lacey14@imperial.ac.uk), (2) Earth, Atmospheric and Planetary Sciences, Massachusetts Institute of Technology, Cambridge, USA

High-pressure fluids on a fault plane can trigger fault movement, but precipitation from these fluids can also lead to cementation, which may alter fault plane strength and permeability and may reduce the probability of reactivation. Chemically reactive rocks such as carbonates present us with the opportunity to study this healing in more detail. This work reports upon the influence of precipitation upon the strength and frictional response of the fault plane in Carrara marble. Hold-slide experiments were undertaken on cores with pre-cut faults in the presence of either water or argon at identical conditions; T = 450^{o}C, P_c = 130MPa, P_p = 45MPa, hold time = 7200 s. When water was present, cementation occurred along the fault plane. When the fault plane was fully cemented, the sample was up to 16MPa stronger compared to those in experiments undertaken with argon as the pore fluid. In addition, the fully cemented faults produced a much more ductile response during slip. It is likely that in the presence of argon, the frictional strength depended on the asperities on the fault surface, i.e., fault roughness. In the presence of water, fault strengthening was accompanied by a major change in the fault topology. Apparently, slip along the cemented calcite grain contacts occurred in a much more ductile manner.