Geophysical Research Abstracts
Vol. 19, EGU2017-5770, 2017
EGU General Assembly 2017

Influence of microscale weak zones on bulk viscous strength

Christopher Gerbi (1), Scott Johnson (1), Deborah Shulman (1), and Keith Klepeis (2)

(1) School of Earth and Climate Sciences, University of Maine, Orono, Maine, USA (christopher.gerbi@maine.edu), (2) Department of Geology, University of Vermont, Burlington, Vermont, USA

Rock bulk strength is a function of many factors, including temperature, phase assemblage, arrangement of those phases, and operative deformation mechanisms. We explore the quantitative effects of the spatial distribution of phases and deformation mechanisms on bulk strength. To begin, we document that weak phases in naturally deformed rocks exhibit little interconnection within a microstructure. Rather, weak zones, analogous to viscous shear zones at larger scales, can interconnect or bridge weak phases. These zones typically form at high stress sites, comprise multiple minerals, and deform by mechanisms independent of those in the surrounding minerals. The presence of weak zones strongly affects the bulk strength of the rock, disproportionate to the mode of the weak zones. For example, the development of 1% mode of a weak zone at a high stress site can reduce the bulk strength of the rock nearly an order of magnitude. Calculation of the bulk strength of the rock by some averaging algorithm of the deformation mechanisms operating outside the weak zones will overestimate strength. Instead, accurate calculations and predictions of bulk strength require accounting for the presence and geometry of weak zones, and by extension, the spatial and temporal distribution of deformation mechanisms operating throughout a rock. The concept of weak zones – in contrast to weak phases – is scale-independent and applies to shear zone networks at the outcrop scale and larger.