Geophysical Research Abstracts
Vol. 17, EGU2015-7117, 2015
EGU General Assembly 2015

Application of Flow Laws to the Rheology of Shear Zones

Greg Hirth
Brown University, Providence, USA (greg_hirth@brown.edu)

A limitation in the application of experimental flow laws is that lab data are often obtained from single phase aggregates, rather than rocks. Using a combination of microstructural observations, thermobarometry, metamorphic petrology and thermochronology (where possible), we have identified several scenarios where shear zone rheology appears to operate at conditions where the nominally stronger multi-phase rock deforms by diffusion creep and the single-phase regions of the same rocks deform by dislocation creep of the weak phase. Examples include mafic rocks from the oceanic crust (Mehl and Hirth, 2008), hydrated mafic rocks from lower continental crust (Getsinger et al., 2013) and ophiolites (Homburg et al., 2010), and peridotites from both oceanic transform (Warren and Hirth, 2006) and ophiolites (Skemer et al., 2010). In each case, the extrapolation of experimental data provide evidence that the texture of the poly-phase rock evolves such that the effective viscosity of poly-phase regions deforming by diffusion creep is comparable to that of the single-phase regions deforming by dislocation creep. As such, these scenarios suggest that in many situations using flow laws for single phase aggregates actually provides a reasonable approximation for shear zone rheology. In this presentation, I will provide examples of these scenarios, discuss mechanisms for the grain size evolution of the poly-phase rocks that facilitate the production of the "uniform viscosity layers" in shear zones, and the implications of these observations for the rheology of shear zones and the interpretation of post-seismic geodetic data.