

Implications of gypsum dehydration on fault mechanics

The effects of dehydration reactions on hydraulic and mechanical properties of rock are analysed to better understand the conditions required to trigger earthquakes. Triaxial experiments are conducted using gypsum and a direct shear sample assembly that allows a constant normal stress to be applied and permeability to be measured during sliding. The evolutions of shear stress, pore-fluid pressure and permeability are continuously measured throughout the experiment until dehydration reaction reached completion. Results show that gypsum dehydration induces transient stable slip weakening that is controlled by pore-fluid pressure and permeability evolutions followed by unstable slip on fully dehydrated product. A microstructural analysis on deformed samples shows clear evidence of dehydration reactions related to the development of Riedel shear structures. A conceptual model is then proposed to explain transient slip weakening during dehydration reactions.