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# Link between heterogeneous dehydration and deformation during experiments on gypsum: implications for subduction zones

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The understanding of the influence of pore-fluid pressure and friction on stability of fault zones is of first order importance to unravel earthquake triggering. Here, 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 allowing to maintain the normal stress constant and to measure permeability during sliding. The evolutions of shear stress, pore-fluid pressure and permeability are continuously measured throughout the experiment until dehydration reaction reached completion. Tests are conducted with temperature ramp from 70 to 150 °C and with different effective confining pressures (50, 100 and 150 MPa) and velocities (0.1 and 0.4 $\mu$m.s-1). 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.

Microstructural analysis shows clear evidence of dehydrated product preferentially localized along Riedel shear structures. A conceptual model is then proposed to explain transient slip weakening during dehydration reactions incorporating the key role played by permeability, and to provide a framework to define the conditions required to trigger unstable events during dehydration reactions. Is clear that the reaction product forms preferentially on shear bands: whether that relates to permeability heterogeneities or to a more fundamental link between stress and reaction is a point to be discussed.