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The role of clay in thermal pressurisation of fault during rapid slip

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Within the frame of the ‘CRL’ (Corinth Rift Laboratory project) (Cornet et al, 2004) centered on the south western sector of the Gulf of Corinth (http://www.corinth-rift-lab.org), fault zone cores from the active Aigion fault have been collected continuously from depths between 708 m to 782 m. The Aigion fault was intercepted at a depth of 760 m, dipping at an angle of about 60˚: The heart of the fault is a zone of clay-rich material derived from radiolarites about 1m long. An extended laboratory experimental program has been performed for a complete characterization of the thermo-poro-mechanical behavior of drilled cores (Sulem et al 2004). It is shown that the fault gouge is a clay-rock mixture. Although the clay fraction is relatively small, it has a significant influence on the thermo-mechanical properties of the material. The clayey core of the fault has a very low fluid permeability and exhibits contractant volumetric behavior when heated. The sensitive parameter for the description of the thermo-poro-mechanical coupling is the thermal pressurization coefficient of the material. This collapse mechanism of the clay under thermal loading may activate fluid pressurization inside the fault and lead to substantial reduction of the apparent friction. The experimental data from the Aigion fault core are used in a numerical study of a rapidly deforming shear band. It is shown that the thermally collapsible character of this clayey gouge can be responsible for a dramatic reduction of effective stress and a full fluidization of the material. The thickness of the ‘ultra-localized’ zone of highly strained material is a key parameter that controls the competing phenomena of pore pressure increase leading to fluidization of the fault gouge and temperature increase leading to pore-fluid vaporization (Sulem et al 2006).

References

Cornet, F., Bernard, P., Moretti, I., (2004): The Corinth Rift Laboratory, *Comptes Rendus Geosciences*, **336**, 4-5, 235-242.

Sulem,J.,Vardoulakis, I., Ouffroukh, H., Boulon, M., and Hans, J., (2004): Experimental characterization of the thermo-poro-mechanical properties of the Aegion fault gouge, *Comptes Rendus Geosciences*, **336**, 4-5, 455-466.

Sulem, J., Lazar P., Vardoulakis, I., (2006): Thermo-poro-mechanical properties of clayey gouge and application to rapid fault shearing, *Int. J. Num. Anal. Meth. Geomech.*, in print