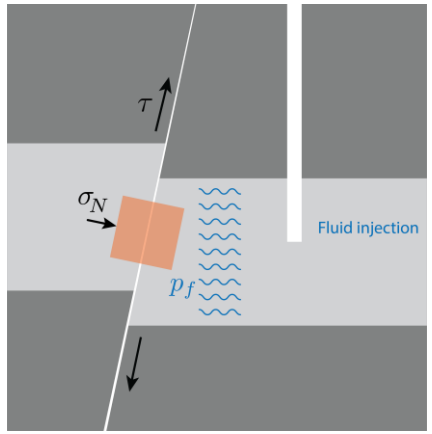
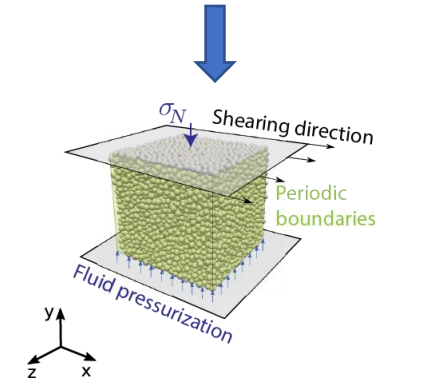
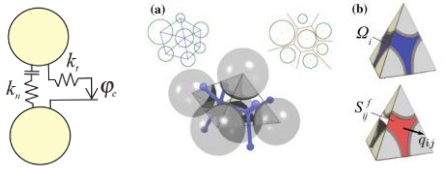
Grain scale investigation of shear reactivation by fluid pressurization

Hien N.G. Nguyen[1], Luc Scholtès[2], Yves Guglielmi[3], Frédéric V. Donzé[4], Zady Ouraga[5], Mountaka Souley[5]

[1]Université de Lorraine, [2]Université Clermont-Auvergne, [3]Lawrence Berkeley National Laboratory, [4]Institut des Sciences de la Terre, [5]INERIS



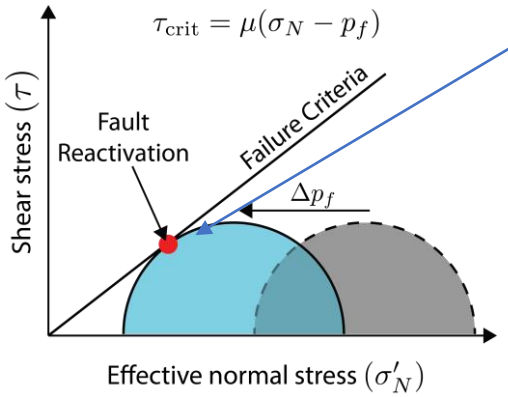




DEM PFV (Scholtès et al 2015)

Numerical model

Fluid over-pressurization may trigger reactivation of fault



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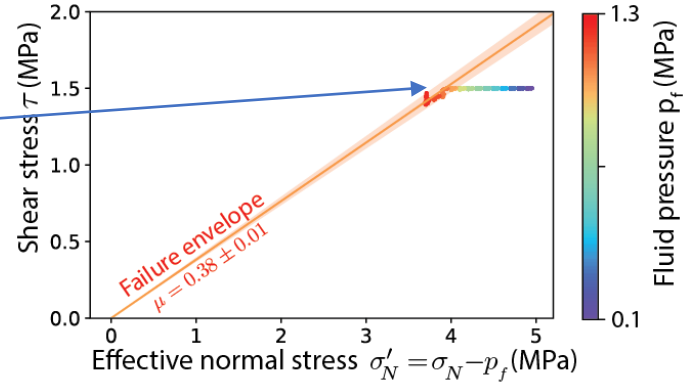
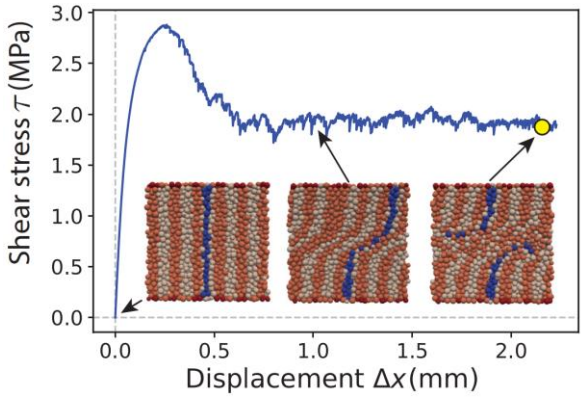
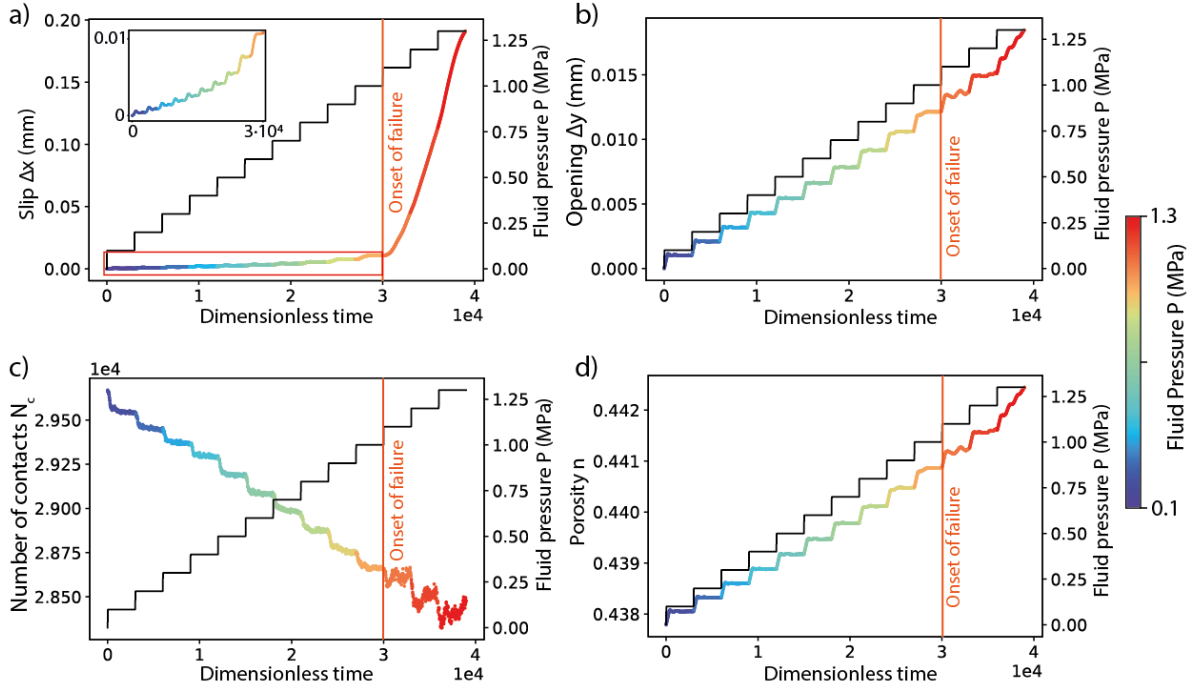
Failure occurs when

$$\tau \geq \tau_{critical} = \mu\ \sigma_N - p_f$$





Direct shear test to localize shear within layer



Macroscopic behavior of fault slip caused by fluid over-pressurization

Grain scale investigation of shear reactivation by fluid pressurization (2)

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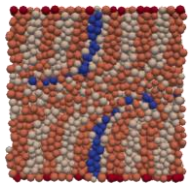
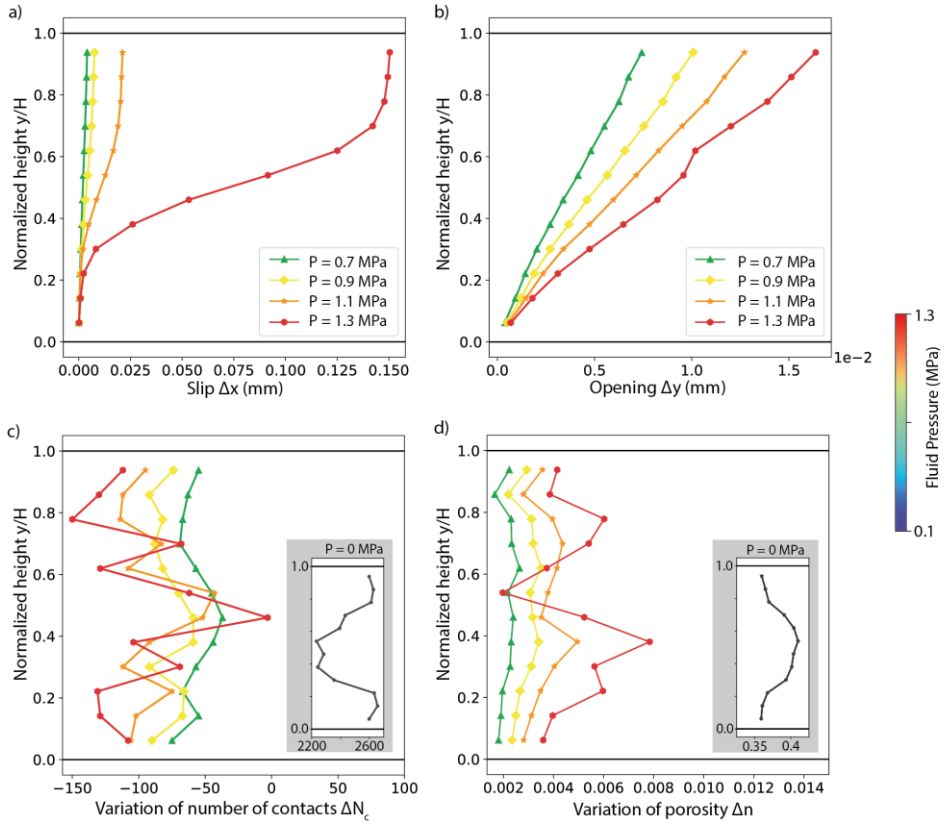
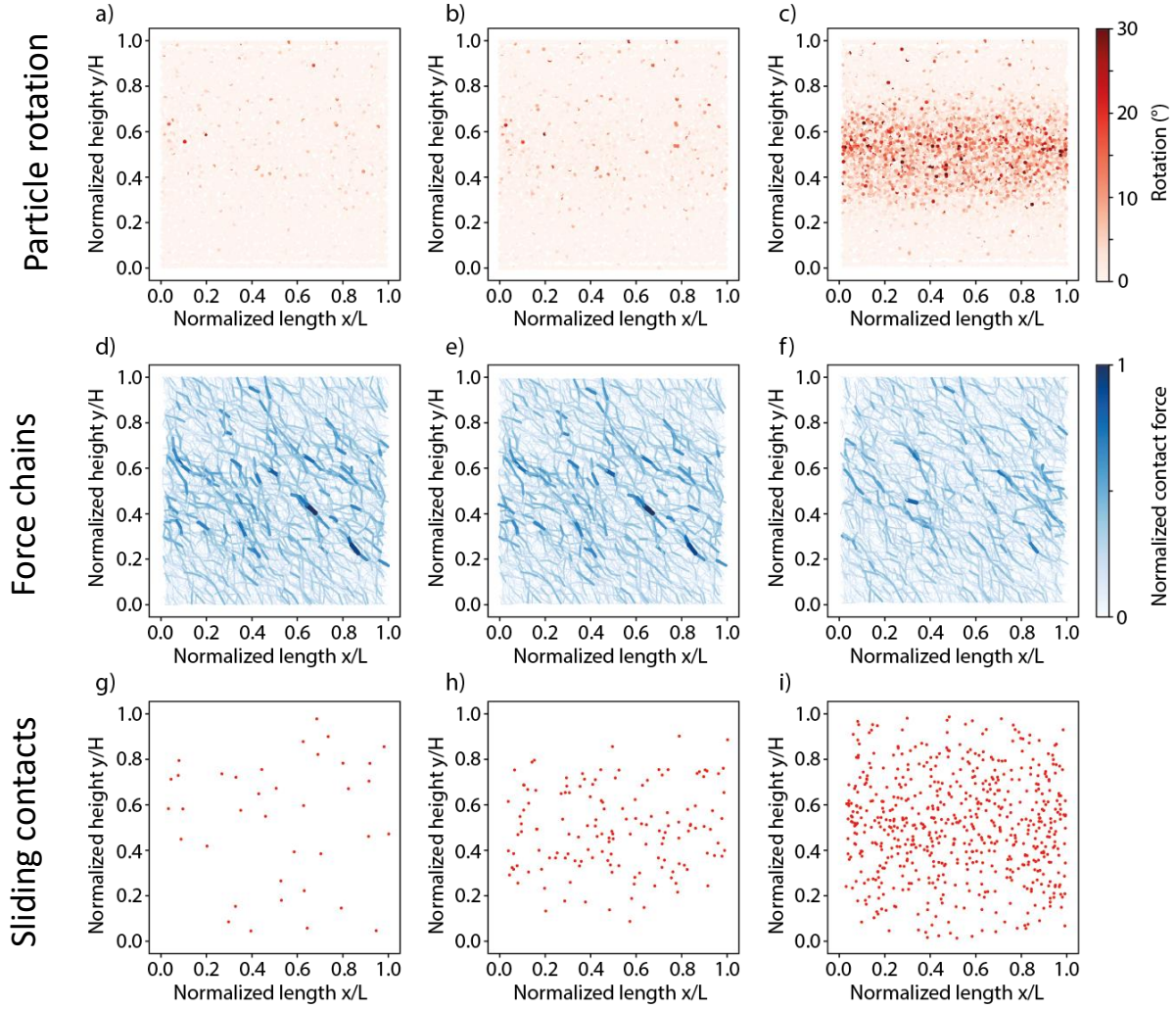




Profiles of the shear layer (section view)

- Fluid induced reactivation can be either stable or unstable depending on the deformation mode
- Slow steady creep is accommodated through distributed bulk deformation at sub-critical stress states
- Accelerated dynamic slip results from intense grain rearrangements localized within the shear band



Microscale analysis of the shear layer during fluid pressurization