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The role of inherited discontinuities on fault propagation: impact on fault modeling techniques

The impact of fault on fluid flow has motivated a lot of work to describe how fault networks grow. Geologists working on this field have repeatedly observed on outcrops that faults are strongly controlled by preexisting discontinuities: lithological boundaries or inherited faults. However due to the limitation of numerical models this phenomenon is still poorly studied. We present here analogue experiments designed tackle this issue. These experiments have been performed under a medical CT scanner. The acquired 3D blocs are interpreted in a geomodeler where faults are represented as surfaces evolving with time.

This paper demonstrates how lithological interfaces disturb the vertical propagation of faults and how inherited faults control the younger fault characteristics:

Propagation of fault through a lithological boundary induces vertical fault segmentation controlled by the nature of the boundary. The geometry of relays can be modified at these boundaries.

Inherited faults control the geometry of younger faults. Reactivation has a major impact on the geometry of the relays between the youngest faults. This influence is illustrated when the new faults grow in the same intervals than the inherited and in layers postdating the inherited faults. Such a description is used to define new criteria to detect fault reactivation from seismic, when no striation can be observed on faults.

The implications of these results on fault modeling techniques are highlighted. A particular emphasis is laid on reactivation and on the evolution of fault connectivity because of their influence on hydrocarbon migration and on fluid flow in complex reservoirs.