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Strike-slip fault propagation across crustal (interbedded) low viscosity anomalies: new insight from analogue modelling results

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Upper crustal propagation of sub-vertical strike-slip faults across relatively softer (i.e. low viscosity) bodies is investigated through a series of analogue modelling experiments. The low viscosity bodies are here generally considered in *sensu lato* and could potentially represent crustal magmatic chambers, evaporitic dome-like structures, or other mechanically soft anomalies occurring in nature, interbedded in upper-crustal rocks, generally exhibiting sill-like or inverted drop geometries. The aim of the experiments was to investigate the type of structures that are expected to be developed as a result of the interference arising from brittle strike-slip propagation across a topographical and/or mechanical barrier.

Four main different types of experiments were systematically carried out to evaluate the either isolated or combined effect of rheological and morphological (i.e. topographical) anomalies: 1) A benchmark experiment (essentially used to gauge the results arising from the rest of the experimental sets) comprising vertical strike slip faulting cutting across an isotropic brittle medium (represented by a colour-layered sand-cake); 2) A vertical strike-slip fault propagating across the same brittle medium, but cutting across a relatively small central rheological barrier (low viscosity body), represented by different mixtures of silicone putty (PDMS) and high-density powders (e.g. Wolframite powder); 3) The same experimental setting as before, except for the fact that in this case no mechanical/rheological anomaly exists, but instead a morphological barrier (i.e. a topographic central elevated domain) was prescribed; 4) Finally, the same vertical strike-slip fault was set to propagate across both a rheological and a morphological barrier (i.e. consisting in an elevation with an inner low viscosity body).

Differently orientated slices of the resulting sand-silicone models were obtained to reconstruct the 3D geometry of the resulting surface structures (Y-shears, Riedel faults, etc.) and of the deformed low viscosity body.

Preliminary results show that a specific structural pattern is developed in each case, which could potentially be used as a proxy for the governing geological/geodynamic (general) setting at stake. The main effect produced by the low viscosity rheological anomaly is represented by a delay in the propagation to the surface of typical brittle shear structures (Y-shears and Riedels) above the anomaly area. These structures are hence sparser, or event absent in this domain, since a significant part of the ongoing deformation is here accommodated by viscous strain. Additionally, the structural pattern perturbation caused by the existence of a (strictly) morphological anomaly is essentially manifested by a local deflection (synthetic rotation) of the same main brittle shear structures, which are also generally wider (less penetrative) above the topographic high.

In the experiments in which the combined (morpho-mechanical) effect of a local perturbation was investigated, the resulting structural patterns reflected the conjugated effects of both low viscosity and topography, namely depicting rotation of structures in the sand surface due to shear synthetic bulk vorticity in the underlying low viscosity anomaly.

These results, and all specifically obtained structural patterns were further discussed based on comparison with different selected natural examples.