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Reworking of structural inheritance at strike-slip restraining-bends: templates from sandbox analogue models

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Structural inheritance plays a fundamental role during crustal deformation because pre-existing fault and shear zones typically provide weakness zone suitable to fail again when affected by a new regional stress field. Re-activation of structural inheritance is expected to unavoidably increase the complexity of structural architectures, whose geometric and kinematic patterns can significantly deviate from what expected in newly deformed crustal sectors. Availability of templates from analogue models can provide a very effective tool to help unraveling such a structural complexity. For this purpose, we simulated the reworking of a set of basement hosted pre-existing fault zones at strike-slip restraining fault bends. In the models, the mechanical stratigraphy consists of a basement, made of a mixture of dry kaolin and sand to slightly increase cohesion, and a sedimentary cover made by pure dry sand. Inherited fault zones are confined to the basement and coated by a thin veneer of silicone putty. In the experimental programme, the geometry of the left-lateral restraining bend is maintained the same, with a bending angle of 30° of the restraining fault segment. The strike of the inherited fault zones, measured counterclockwise with respect to that of the master strike-slip fault zone outside the restraining bend, was 0°, 30°, and 60° in different experiments, respectively. An end member experiment without inheritance was also run for comparison. Our experimental results show that the angle that the inherited fault zones make with the restraining bend plays a fundamental role in governing the deformation pattern. When structural inheritance is near parallel to the master strike-slip fault zone, synthetic shears form and severely compartmentalize the transpressional pop-up anticline growing on top of the restraining bend. Fault-bounded blocks undergo sinistral escape during transpression. On the other hand, when structural inheritance makes a high angle to the master strike-slip fault zone, antithetic shear zones form and enhance dextral escape of fault-bounded compartments. The intermediate case (30°) shows the interaction of both left-lateral synthetic and right-lateral antithetic shearing. Comparison with natural prototypes support the effectiveness of our experimental results.