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Do listric fault exist in salt tectonics?

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Gravity driven deformation occurs on most passive margins, and deltas. This mainly happens when a brittle sedimentary cover glides downslope, on top of a décollement layer, generally salt or under compacted-shales.

Ductile flow of the basal décollement layer is accommodated by a combination of pure shear and simple shear. This changes its thickness through time. Meanwhile, sedimentation/erosion on the margin changes the thickness of the brittle cover. The resulting mechanical coupling between brittle and ductile layers will therefore vary through time and produce complex and heterogeneous strain patterns.

In this setting, the so called “listric growth faults” and associated rollovers develop in the extensional parts of these systems. They can grow either on synthetic -i.e. seaward dipping- or antithetic -i.e. landward dipping (Niger delta, Campos basin. . .). The fault dip of the later being in kinematic opposition with the sense of displacement at the scale of the whole extensional system.

In order to address that apparent kinematic paradox we used series of experiments composed of two layer slabs, with Newtonian silicone putty at the base to represent a basal salt décollement and dry sand on top to represent the sedimentary overburden. Models are allowed to deform under their own weight. Different syn-kinematic sedimentation rates and different basal slope angle are used.

We demonstrate that the commonly accepted kinematic model of listric fault does not apply to either of these situations. A reappraisal of the kinematic significance of listric faults/rollover systems is therefore proposed. The validity of models postulating an initial and permanent curvature of listric faults is questioned.