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Analog modeling of thrust wedges involving reactivation of salt ridges: From passive diapirism to contraction

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In fold-and-thrust belts with preexisting salt structures (e.g. Pyrenees, Betics, Atlas or Zagros) any subsequent contractional deformation initiates and concentrates in these structures while the surrounding non-saline rocks structure remains almost intact. In this scenario, the inherited pattern and continuity of salt structures (ridges, isolated diapirs, salt walls or minibasins) and also their trend with respect to shortening are critical regarding contractional deformation. These factors will control how diapir reactivation and rejuvenation take place, especially affecting the kinematic and the structural style of squeezed diapirs, secondary welds and thrust welds.

Using an experimental approach based on sandbox models, this research aims to characterize how the contractional reactivation of minibasins and intra-minibasins salt ridges takes place. The experiments include two different deformation stages: 1) an initial stage where different minibasins sink by downbuilding and 2) a second stage of contractional deformation where these structures are squeezed. In order to have primary welded and unwelded minibasins, its growth during the downbuilding stage was carried out in different episodes. The polygonal structural network at the end of the downbuilding stage includes different sized, oriented and shaped (from circular to elliptical) minibasins, salt ridges and diapirs. Lateral changes of ridges orientations as well as changes on minibasins internal architecture acquired at the end of the downbuilding result in rapid structural style changes during subsequent contractional deformation. Shortening initially rejuvenates salt structures reactivating salt flow, then diapirs are squeezed and welded, and afterwards different folds, thrusts and strike-slip faults develop linking salt bodies.

This type of deformation has been described in different tectonic settings including inverted rift basins to complex thrust-and-fold systems or in the down dip ends of divergent plate margins. We finally compare the experimental results with different salt structures from the Zagros fold-and-thrust belt.