



## **Progressive strain localization in passive margin salt basins during gradual basin tilting - Insights from seismic data and analogue modelling**

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Passive margins underlain by a weak salt detachment are partitioned into kinematically linked domains of upslope extension and downslope contraction. Typical deformation structures in the extensional domain are rafts, reactive diapirs and rollovers, whereas folds, thrust and squeezed diapirs occur in the contractional domain. While previous studies mostly focused on the evolution of large-strain syn-sedimentary rollovers and reactive diapirs, relatively less is known about early deformation processes and the localization of strain in both domains. In seismic reflection data from salt-bearing passive margin basins, widely distributed, small scale normal faults as well as short-wavelength folding can be observed in the oldest post-salt strata. Some of these early normal faults and folds evolve to reactive diapirs during ongoing gravity gliding, whereas others become buried.

To study the strain evolution of these early structures, we used scaled analogue experiments integrated with a high resolution strain analysis method (digital image correlation, DIC) to quantitatively constrain the structural development. The model results reveal that early-stage deformation occurs widely distributed in the upslope and downslope regions. In the upslope domain, extensional strain is accommodated by zones of diffuse extension, whereas short-wavelength folding occurs downslope. As tilting increases with further syn-kinematic sedimentation, the wide extensional domain narrows and becomes localized on many distinct graben structures. Meanwhile, the wavelength of the downslope folds increases forming polyharmonic folding. Later, as the supra-salt cover strata is further thickened due to sedimentation, extension is located to larger structures in the uppermost region leading to reactive diapirism as other extensional structures die out and get buried. Similarly, downslope contraction is concentrated on a few large folds and thrusts. Consequently, intermediate normal faults and folds are superimposed by syn-kinematic minibasins. Such early deformation hidden by later syn-kinematic sedimentation might have significant implications on hydrocarbon migration and storage within the lower most strata of minibasins.