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## Salt thickness and heterogeneity control the degree of coupling between sub- and supra-salt structure during salt-detached translation: evidence from physical models

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Salt flows like a fluid over geological timescales and introduces significant structural complexity to the basins in which it is deposited. Salt typically flows seaward due to tilting of the basin margins, and is therefore influenced by the geometry of the surface that it flows across (e.g. fault scarps or folds on the base-salt surface). This can lead to coupling of sub- and supra-salt structures, with the orientation and distribution of base-salt structures reflected in the structure of the overburden. However, precisely what controls the degree of strain coupling during salt-detached translation is still poorly understood, in particular the role played by salt thickness and lithological heterogeneity. This partly reflects the fact that it can be difficult to deconvolve the relative contributions of natural variables such as the magnitude of relief, sediment supply, and regional tectonic regime. In addition, seismic data provide only the present structural configuration of salt basins, from which their formative kinematics must be inferred. If we can develop a better understanding of how sub-salt structure controls the types and patterns of supra-salt deformation, we can produce better kinematic (structural) restorations of salt basins and, therefore, have a better understanding of the related mechanics.

In order to isolate the influence of salt thickness and heterogeneity on sub- to supra-salt strain coupling during salt-detached horizontal translation, we present a series of physical analogue models with controlled boundary conditions. We use a simple base-salt geometry comprising three oblique base-salt steps, and vary the thickness and composition of the ductile salt analogue in each experiment. X-ray tomography allows us to image the internal structure during model evolution and therefore gain a 4D picture of its structural development.

Results show that thicker and more homogeneous salt units experience more vertical movement (i.e. minibasin subsidence and diapiric rise) and the overburden structure is less explicitly coupled with the underlying base-salt relief. Conversely, thinner and more heterogeneous salt units restrict vertical movement, and therefore the resulting overburden structure is dominated by lateral movement and more closely coupled to the geometry of the base-salt surface. These results highlight the important role of base-salt relief in the subsequent structural evolution of salt basins

and why, despite broad similarities between different salt basins, there is significant variability in their structural styles.