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# Interaction between salt flow and sedimentation in the Gulf of Mexico

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The northern Gulf of Mexico (GoM) is likely the most spectacular salt margin worlwide. Whereas salt was deposited in late Jurassic, a massive extrusion of allochthonous salt bodies occurred during the Cenozoic, as much as 8 km thick in some places, on top of which Neogene minibasins are deposited. The presence of minibasins, sometimes very deep, have strengthened the impression that salt tectonics was mainly driven by differential sedimentary loading. However, the kinematic analysis of relative displacements between minibasins using digital bathymetry of the slope area over a 450x250 km area indicates a consistent SW direction of salt flow at slope scale. Simultaneously, the shelf break has migrated over approximately 400 km since the Cretaceous with a sudden acceleration in middle-Miocene. In a salt basin, a shelf can form and stabilize only if the salt layer underlying the sediments stops flowing or is flowing at a very low rate. Therefore, at a given moment of basin evolution, a shelf break contour represents the boundary between the seaward part of the basin still deforming above the flowing salt and the landward part where salt has stopped flowing and where previous structures are sealed by sediments being deposited. If sedimentation is oblique to the direction of salt flow, transfer zones develop parallel to the salt flow during shelf break migration. In the northern GoM, where sedimentary progradation is dominantly directed to the south, transfer zones trend in a mean NE-SW direction indicating a SW directed salt direction, like in the slope, with a mean obliquity of around 55° between the directions of sediment progradation and salt flow. Structural analysis of 2D-3D seismics shows that massive salt extrusion and acceleration of shelf break migration are coeval with the failure of the salt basin front in middle-Miocene, allowing a frontal salt nappe to flow over more than 100 km. To test this kinematic interpretation, we carried out laboratory experiments where i) a silicone layer (salt) flows down an inclined plane and ii) a sand wedge (synkinematic sedimentation) progrades with an obliquity of 60° on the salt flow direction. Models display basin-scale deformation patterns directly comparable to those observed in the GoM with: i) domains of extension updip and contraction downdip, ii) frontal failure and formation of a frontal salt nappe, iii) formation of minibasins on top of the extruded salt and iv) shelf break migration with transfer zones parallel to the salt flow. Both the northern GoM and laboratory models illustrate that interaction between sedimentation and salt flow is a phenomena that primarily occurs at basin-scale. The direction of salt flow that is oblique to the direction of sediment supply excludes the commonly accepted idea that sedimentary loading could have been the main driving force of salt tectonics in the GoM.