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Conundrums in loading-driven salt movement

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Salt evacuation and rise can be driven not only by extension and contraction, but also by differential loading. Overburden, regardless of its density contrast with salt, can subside if there is adequate pressure-head gradient due to lateral variations in overburden density and/or thickness. If the overburden is more dense, it will subside enough to create a topographic low which in turn accumulates more sediment, thereby initiating a feedback loop that drives ongoing subsidence and increase in minibasin thickness. However, if the average overburden density is less than that of salt, although the base of the thickest load sinks into salt, the top remains a topographic high so that further sedimentation in the same area is unlikely and subsidence should cease. Yet there are numerous examples where subsidence of less-dense sediment has continued in the absence of accepted mechanisms such as shortening or subsalt deformation.

Numerous analytic, numerical, and analog models have been applied to investigate this issue, but none seems to adequately explain or predict the early and ongoing subsidence of stacked synclinal minibasins filled with less-dense siliciclastic sediment. What are we missing? One possibility is that local density considerations do not account for more regional or three-dimensional flow patterns. It may be that inflation of salt, for example over presalt faults but maybe more common than thought, might overcome the density contrasts produced by less dense overburden. Ultimately, though, current models are based on the assumption and theory of static equilibrium for a solid floating on a liquid. Yet salt flow is very much a dynamic process. Maybe we need a new mechanical paradigm based on a more dynamic model.