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Radial faulting above salt-diapir overhangs: natural example, and physical and kinematic models

Interpretation of a 3-D, seismic-reflection data set from the South Liberty salt dome (Houston Diapir Province) reveals that the diapir comprises a narrow feeder overlain by a 3,800-ft-wide overhang emplaced by salt extrusion on the sea floor during early Eocene time. Subsequent inflation of the overhang stretched the roof strata, forming two sets of radial normal faults. The fault sets are located on two different stratigraphic levels separated by a thick, lower Oligocene shale section (Vicksburg Formation). Physical experiments of inflating diapir overhangs demonstrate that strain of the roof consists of radial and concentric extension of the overhang's crest, whereas its flanks merely undergo rigid-body rotation. Overhang inflation ceases once crestal stretching has opened a vent wide enough to allow for salt extrusion at the surface. Additionally, overhang inflation lasted longer in experiments where the overburden roof was less dense than salt. We designed a 3-D kinematic model quantifying the amount of concentric extension resulting from rigid-body rotation of the flanks. Model results indicate that strain in the roof is dominated by concentric, rather than radial, stretching. Radial stretching is highly inhomogeneous, varying from negligible along the flanks of the overhang to near infinite values above the overhang's crest, where the roof strata are entirely removed by faulting.