

Allochthonous Salt Tectonics in the Flinders Ranges, South Australia: Testing Models of the Subsurface With Exposed Analogs

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Wells penetrating allochthonous salt often encounter structurally complex zones immediately beneath the salt. Strata may be folded, overturned, or repeated, and may be significantly older than the subsalt minibasin fill. A variety of models have been put forward to explain these observations and, by extension, the processes by which salt sheets advance: (1) the basal-shear model, in which subsalt strata are deformed during translation of the salt and its overburden; (2) the accretionary-wedge model, in which frontal thrust imbricates get overridden by the salt; (3) the debris-flow model, in which the “gumbo” represents slumps derived from the scarp at the toe of the advancing sheet; and (4) the drape-fold model, in which strata are rotated in the evolving scarp.

We test these models using analogs in the Flinders and Willouran Ranges of South Australia, where Neoproterozoic evaporites and surrounding minibasin strata are exposed. Selected study areas include a multi-level canopy that is partially welded and a salt sheet with a ramp-flat geometry at the base of salt. In both cases, preliminary results show that debris flows containing clasts of the evaporite and its carapace are ubiquitous, and that halokinetic drape folding is locally developed. We find little, if any, evidence of subsalt shearing or thrusting related to salt emplacement. The results, while not necessarily representative of allochthonous salt bodies in other basins, are compatible with well results from the Gulf of Mexico. The implication is that allochthonous sheets advance primarily by salt inflation, slumping of the resulting scarp, and breakout of the salt, with only minor components of subsalt shear or thrust imbrication.