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Minibasin Obstruction by Base-Salt Welding on a Salt-Detached Slope: An Example from the Northern Gulf of Mexico

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Salt-detached gravity-gliding/spreading systems that detach on salt with a highly rugose base-salt surface display complex strain patterns. Using a regional 3D seismic data set, we examine a large salt-stock canopy system with a highly rugose base in the central-east US Gulf of Mexico slope, into which minibasins both subside and translate downslope. Some minibasins are welded at their bases, and others are not. We suggest that basal welds inhibit or obstruct downslope translation of minibasins to varying degrees. We map the degree of minibasin obstruction across the slope, and show how this controls both the kinematics of the individual basins, and the more regional pattern of supra-canopy strain.

Above the canopy, the distribution of strain is complex and variable. Minibasins that become obstructed modify the local strain field, typically developing a zone of shortening immediately updip and an extensional breakaway zone immediately downdip. We also find major differences in the degree to which minibasins can be obstructed, ranging from severe (e.g. caught in a feeder) to mild (e.g. welded to a flat or gently-dipping base of salt). Applying this concept to a salt-detached slope with variable degrees of minibasin obstruction provides a mechanism that explains differential translation of minibasins and the origin of complex 3-D strain fields in the past, and critically, helps us predict present-day stress fields. Our findings also have implications for determining stress-related drilling hazards and sediment routing through minibasin populations. The results may be applicable both to systems detached on allochthonous salt sheets (e.g. Gulf of Mexico; Scotian Margin, offshore eastern Canada), and systems where the salt is autochthonous but has significant local basal relief (e.g. Santos Basin, offshore Brazil).