Gravity Spreading and Collapse of Sedimentary Overburden Along Salt-Bearing Continental Margins: Basic Mechanical and Kinematic Characteristics Illustrated by Analogue Modeling

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Vigorous gravity-driven deformation is a common feature along continental margins that (1) include an evaporitic layer in their sedimentary cover, and (2) have been subjected to significant flux of clastic sediments. The margin's bathymetric slope represents a gravity instability that triggers a general collapse of the suprasalt overburden. This collapse is accommodated by proximal extension (upper slope and part of the shelf), mid-slope translation, and distal shortening (lower slope and deep basin). Extension can lead to the formation of salt ridges, salt diapirs, and large listric normal growth faults. Shortening can generate buckle folds, salt-detached thrust faults, and allochthonous salt tongues.

The bathymetric slope, the primary parameter driving deformation, is mainly controlled by the sediment influx. Therefore, gravity-driven deformation of the salt and its overburden reflects the regional depositional history. When the depositional conditions generate or maintain a steep slope, salt tectonics is vigorous. When the overall slope angle is reduced (sediment bypass, or shift of the regional depocenters away from the area), salt tectonics slows down or stops. Sediment progradation or retrogradation causes shifts in the location of the three deformation domains (extensional, translational, and compressional), which results in reactivation of (1) diapirs or normal faults in compression, or (2) diapirs or folds and thrusts in extension.

The 3-D geometry of the salt structures is intimately related to the 3-D geometry of the sedimentary bodies. For example, sediment lobes generate complex networks of polygonal or subcircular depocenters (minibasins) bounded by salt ridges overlain by faulted roofs.