Diapiric Influence on Channel Evolution in Deep-Water Minibasins: An Example from the Northern Gulf of Mexico

Dallas Dunlap[1], Oliver Duffy[1], Naiara Fernandez[2], Michael Hudec[1], Jacob Covault[1]
[1]Bureau of Economic Geology; [2]The University of Texas at Austin

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Abstract

Submarine channel-levee systems are primary conduits for sediment dispersal to deep-water environments and form significant hydrocarbon reservoirs. Submarine channels can traverse over long distances and deliver sediment to their terminus through a tortuous path influenced by eustasy, bathymetry, and active structural deformation. The submarine channel's response to these external controls can influence the stacking and lateral connectivity of thoroughgoing course-grained channel systems. To better understand the link between these controls and their resulting deposits, we utilize three-dimensional seismic-reflection data to investigate the downslope temporal evolution of a Pleistocene-age channel-levee system within three adjacent minibasins subsiding into allochthonous salt in the mid-lower slope of the northern Gulf of Mexico. Mapping and seismic attribute analysis of the channel-levee system revealed depositional architectures driven principally by local salt movement and the configuration of its deeper feeder systems, which varied from minibasin to minibasin. The most proximal minibasin (MB1) shows an asymmetric withdrawal of salt at depth below a rapidly subsiding depocenter adjacent to its partially welded minibasin flank. This configuration produced a narrow channel belt with vertically aggrading channel axes in its depocenter. The central minibasin (MB2) is winged by two salt diapirs that showed changes in their relative rates of growth through time. Competition between these two salt diapirs caused shifts in the direction of minibasin tilts that produced laterally migrating channels. The distal minibasin (MB3) and hosted channel system are located near folds and diapirs at the very distal edge of

allochthonous salt. Activity on these structures and associated high rates of mass wasting promoted an increase in intra-basinal lateral channel migration. It also conditioned the position of the channel system's minibasin exit point. Our study highlights how salt tectonics, in particular minibasin welding, influences the vertical and lateral stacking of submarine channel-levee deposits and for the broader hydrocarbon exploitation potential of these deep-water reservoirs.

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