Evolution of a Salt Diapir within the Mississippi Salt Basin, USA: Interaction of Salt Migration and Sediment Deposition

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ABSTRACT

Utilizing proprietary 3-D seismic data, the growth history of a shallow piercement diapir within the Mississippi Salt Basin has been interpreted as five distinct phases of salt mobilization: (1) Initial loading by Late Jurassic sedimentation mobilized tabular salt, forming a northeast-southwest-trending ridge flanked by discontinuous primary salt welds. (2) Early Cretaceous sedimentation restricted salt withdrawal to dimensions defined by primary salt weld development parallel to ridge orientation. Dominant salt withdrawal was from the northeast. Thickening of the interval was accompanied by development of a linked ridge-salt stock system. (3) Late Cretaceous loading of the ridge, in combination with burial compaction and subsidence along the flanks of the salt stock, led to the collapse of deep-seated feeders, development of bulb-shaped morphology, and a decrease in salt sourced from the northeast portion of the ridge, along with an increase in salt sourced from the southwest. (4) Vertical migration driven by subsidence and burial compaction along the flanks of the diapir, and a shift from rapid deposition of thick clastic overburden to slower overburden deposition of the Selma Chalk and Midway Shale, exposed the salt stock at the sea floor in a passive state. (5) Deposition of thick Wilcox clastics buried the diapir, causing a rejuvenation of vertical salt migration and continuation of drag fold development along diapir flanks during shallow piercement. We conclude that phases of salt mobilization correlate with phases of depositional loading, making it possible to develop a more detailed evolutionary history of salt structures in interior salt basins than proposed in the past.