Implications of an Evolving Channel/Levee System on Reservoir Distribution: An Example from the Upper Miocene to Lower Pliocene Gulf of Mexico

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Summary

Recent drilling of a seismically defined channel/levee system in the Mississippi Canyon area, deep-water Gulf of Mexico, has provided new insight into their architectural development and associated reservoir distribution. Both asymmetry of channel morphology and degree of channel sinuosity (straight vs. curve) lend to varying distributions of net/gross ratios of sand in relation to proximity to channel margin. Over 100 meters of whole core were taken in this area and provided detailed calibration of reservoir characteristics from channel axis to channel margin to levee/overbank (ranging from proximal to distal).

Early development of channel systems favors deposition within channel bases and is attributed to weaker confinement of sustained flow deposition. Also at this time, overbank deposition has more attributes of crevasse splay (high net/gross) deposition rather than true levee facies typically dominated by highly ripple laminated facies. As channel continues to aggrade, system becomes more confined with only the larger flows contributing to the levee/ovebank environment with channel axis acting as a zone of bypass and only passively infilling during waning flow and abandonment. This abandonment phase is attributed to updip avulsion and results in rapid shale deposition within channel and overbank setting creating a master top seal over the entire channel/levee complex.

The depositional model derived from core and log data allowed for additional drilling in marginal areas where seismic geometry and amplitude were not well imaged. Results were successful away from the inferred channel margin and provided an important test of the impact of understanding the channel architecture of an evolving channel/levee system.