Recognition, Correlation, and Hierarchical Stacking Patterns of Cycles in the Ferry Lake–Upper Glen Rose, East Texas Basin: Implications for Grainstone Reservoir Distribution

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Core descriptions and regional log correlation/interpretation of Ferry Lake–Upper Glen Rose strata in the East Texas Basin exhibit the uniformity of cyclicity in these shelf units. The cyclicity is defined by an upward decrease in shale content within each cycle accompanied by an upward increase in anhydrite (Ferry Lake) or carbonate (Upper Glen Rose). Core-to-log calibration of facies indicates that formation resistivity is inversely proportional to shale content and thus is a potential proxy for facies identification beyond core control. Cycles (delineated by resistivity log patterns) were correlated for 90 mi across the shelf; they show little change in log signature despite significant updip thinning due to the regional subsidence gradient.

The Ferry Lake–Upper Glen Rose interval is interpreted as a composite sequence composed of 13 high-frequency sequences (4 in the Ferry Lake and 9 in the Upper Glen Rose). High-frequency sequences contain approximately 20 (±5) cycles; in the Upper Glen Rose, successive cycles exhibit decreasing proportions of shale and increasing proportions of grain-rich carbonate. High-frequency sequences were terminated by terrigenous inundation, possibly preceded by subaerial exposure. Cycle and high-frequency sequence composition is interpreted to reflect composite, periodic(?) fluctuations in terrigenous dilution from nearby source areas. Grainstones typically occur (stratigraphically) within the upper cycles of high-frequency sequences, where terrigenous dilution and turbidity were least and potential for carbonate production and shoaling was greatest.

Published mid-Cretaceous geographic reconstructions and climate models suggest that precipitation and runoff in the area were controlled by the seasonal amplitude in solar insolation. In this model, orbital variations, combined with subsidence, hydrography, and bathymetry, were the primary controls on Ferry Lake–Upper Glen Rose facies architecture and stratigraphic development.

3-D Seismic Delineation and Geologic Explanation of Channelization in the Frio Formation of Javelina/East McCook Field, Hidalgo County, Texas

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Sinuous channel-form features were recognized on seismic amplitude time-slice maps of the shallow Oligocene Frio Formation on several proprietary 3-D seismic surveys in west-central Hidalgo County, Texas. A case study of channel morphologies observed in the Frio Formation within the 50-mi^2 3-D seismic survey in Javelina/East McCook field was undertaken to better delineate the distribution, lithology, origin, and hydrocarbon potential of these features.

Ten separate channellike amplitude features are observed in flattened time slices within a 200-ms (approximately 1,100-ft) interval on 3-D seismic. The channels have various azimuthal orientations and varying degrees of sinuosity. Several features have lengths that span the 3-D survey area (10 mi); apparent channel widths range from 200 to 2,000 ft. The channelized seismic events tie to an interval of interbedded mudstones and claystones with siltstones. Two of the channels seen on seismic, and which were penetrated by wells, correlate to siltstone and mudstone intervals that have gross thicknesses of 30 to 60 ft. The lithologies and dimensions of the two channels indicate that they are probably small mudstone/siltstone-filled tributary/distributary channels deposited in a coastal floodplain environment; a comparison of the apparent channel dimensions to the dimensions of small channels/bayous of the modern-day Texas Gulf Coast supports this interpretation. Correlation of wells adjacent to the channels indicates that sandy point-bar facies are not present in association with the channel fill, which discounts the idea that high-quality reservoirs are flanking these particular mud-filled channels.