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Defining Systems Tracts and Sequence Stratigraphic Architecture from Well Logs: Example from the Oligocene/Lower Miocene Section, Offshore Mustang Island, South Texas

A 16,500-foot composite log was assembled from several wells. The log, limited microfossil data, and wireline-log sequence analysis provided the basis for a site-specific, sequence stratigraphic section benchmark log (S5). Wireline logs were used to interpret lithology, parasequences, and set stacking patterns (progradational, aggradational, and retrogradational), marine-condensed sections (=maximum-flooding surfaces), and evidence of river entrenchment (thick, blocky sandstone log patterns superimposed on highstand progradational parasequences).

The S5 benchmark log exhibits lower Oligocene (Rupelian) Stage (Nonion struma) through lower Miocene (Aquitanian) Stage (Robulus chambersi). It displays principally third-order sequences, systems tracts, and stratigraphically significant surfaces. Some fourth-order sequences and tracts, especially in third-order lowstand tracts, are depicted where necessary for clarity. Six third-order sequences encompass Frio and Anahuac rock units. Sequences are distal, younger parts of a major Oligocene, basinward-thickening, regressive wedge and a major landward-thinning, transgressive wedge, respectively. Lithofacies comprising systems tracts vary and are diachronous.

A correlation network was based on two methods: (1) well-to-well loop ties of key shale markers, which are primarily high-frequency, marine-condensed sections and autocyclic flooding surfaces. Sandstones within marker-bed-bounded intervals were considered time-equivalent. (2) Correlation of depositional systems tracts, sequences, maximum-flooding surfaces, paracyclic flooding surfaces, and Type 1 unconformities of all frequencies provided chronostratigraphic verification. A maximum second-order flooding surface (mid-Anahuac=24.57 Ma) provided a reliable regional chronostratigraphic marker as a reference horizon.