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CARBONATE SEQUENCE STRATIGRAPHY - A CURRENT ASSESSMENT

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ABSTRACT

Sequence stratigraphic analysis, integrating seismic and geologic data, provides an improved stratigraphic architecture that has resulted in better prospect risking and better reservoir management of hydrocarbon producing properties. Sequence analysis subdivides stratal packages into chronostratigraphic units composed of genetically-related facies. Sequences are composed of stratal units that develop in response to changes in shelfal accommodation. These packages of rock are bounded by specific stratal discontinuity surfaces that can be identified in outcrop and on well logs, and where sediments are thick enough, on seismic data. These surfaces are basinwide in extent and are associated with significant changes in facies architecture. The degree of subaerial alteration during sequence boundary formation will vary depending on the climate, the original mineralogy of the underlying highstand platform, and time. If the original mineralogy of the carbonate platform contains abundant aragonite and hi-Mg calcite, the degree of alteration can be extensive. If the lowstand climate is relatively humid there occurs platform-wide solution that may extend deep into a highstand platform depending on the magnitude and duration of the sea-level fall. If the climate is arid to semi-arid, only relatively minor karstification is predicted to occur. Low-Mg calcite dominated systems show extensive karstification only during major multi-million year periods of subaerial exposure.

In general, sequence boundaries are regional onlap surfaces. In basin and basin-edge areas, they are characterized by onlap of gravity flow deposits, in-situ platform deposits, or evaporites. Submarine erosional truncation commonly occurs at platform margins and on the slope. Abrupt facies truncation or dislocation is also commonly present at sequence boundaries. Toplap, indicative of sediment bypassing, is a common pattern found below sequence boundaries in areas of rapid progradation.

Generally, the bulk of carbonate deposition occurs during sea-level highstands. Significant transgressive carbonates will develop where paleo-oceanographic conditions permit the carbonate 'factory' to keep up. Depositional slope angle plays a critical role in the development of lowstand systems tract geometries. In-situ, lowstand carbonate platforms and banks can develop in Type-1 sequences. (1) in down ramp positions, and (2) on the slope and toe-of-slope of low-angle platforms. Steep, by-pass margins present a special case, as both highstand and lowstand sedimentation may develop toe-of-slope onlap geometries. Lowstand deposition is characterized by abundant coarse debris eroded from the platform margin and slope areas. Highstand deposition is a mix of fine and coarse sediment derived from an actively growing platform.

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