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Clastic Shelf-Margin Failures of the Northern Gulf of Mexico (Jurassic-Tertiary): Mechanism for Deep-Water Sandstone Deposition and Generation of Pseudosequences

Clastic shelf margins are prone to failure, often at very large scales. Failure may occur wherever rapid sedimentation approaches the shelf edge; it is frequent during lowstands, but can also occur in strongly progradational highstands. Failures allow efficient transport of sand-rich marginal-marine sediment into deep water, where it is reshaped into reservoir-quality slope and basin sandstones.

Gulf of Mexico Basin margin failures are documented (so far) in Jurassic, Paleocene-Eocene, Eocene-Oligocene, and Miocene-Pliocene strata. Most examples include deep-water sandstones overlying the basal failure surface (BFS). Margin failures are recognized on seismic data, from distinctive well-log signatures, and from paleontologic data. The BFS is a composite of the original failure plane and subsequent scouring and molding.

Failures form allostratigraphic packages bounded by complex BFS "unconformities" at base and either a flooding surface or a subsequent BFS at top. These packages resemble the deep-water lowstand of a Type 1 depositional sequence, but are formed by structural dislocation and sediment infill and are only indirectly related to relative sea level. Most Type I sequences rich in deep-water sandstone may be associated with shelf-margin failures.

Failure events frequently repeat, resulting in stacked deep-water allostratigraphic units separated by BFSs. In areas of lesser subsidence, much of the prospective marginal-marine section may be eliminated by shelf-margin failure.

Recognizing clastic shelf-margin failures at any stage of exploration is critical to exploration success, play generation and play extension.