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Patterns of Permian Basinal Sedimentation in the Western Delaware Basin, Cutoff, Brushy Canyon, and Cherry Canyon Formations, West Texas, USA: A New Stratigraphic Model for Deep-Water Clastics

Outcrop to subsurface correlation of a fan complex across three shelf feeder systems document sediment dispersal patterns through four distinct phases in a cycle of basinal deposition. Gross interval and net sand isopach maps constructed from over 200 outcrop measured sections and 65 well logs were correlated across the 55 km long and up to 400 m-thick Brushy Canyon outcrop and nearby subsurface including shelf margin, submarine canyon, slope, and proximal basin floor strata over a 3,000 km² area.

Carbonate mass transport complexes (Cutoff Formation) underlying Brushy Canyon sandstones establish a regional base-of-slope and local topography that influences lower Brushy Canyon depositional patterns. The middle Brushy Canyon depocenter is basinward of this inherited base-of-slope reflecting significant bypass and transmission of sediment. Upper Brushy Canyon strata show a slope-centered thick reflecting a shelfward step in the depocenter culminating in starvation and deposition of organic-rich siltstone. The Brushy Canyon top is locally incised by carbonate mass transport complexes of the Getaway Limestone Member (Cherry Canyon Formation) that mark the onset of the next basinal cycle of deposition. These phases are observed at a higher frequency recorded by the stacking patterns of internal fan cycles.

Phases of basinal deposition commence and end with slope readjustment that precedes significant clastic deposition. Mass transport complexes determine gradient, topography, gravity flow run-out length, and position of shelf feeder systems. Sandy basinal strata show a predictable and repeatable upward change in the position of fan depocenters, grain size population, facies, and sediment bodies composing component fan cycles.