Stratigraphic Architecture of the Shelf-to-Intrashelf Basin Transition along the Northern Margin of the Late Albian Maverick Intrashelf Basin, Lower Pecos River Canyon, Southwestern Texas

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ABSTRACT

The geomorphic expression of intrashelf basin systems and their associated facies patterns is extremely subtle, with shelf- to-basin dip angles that can average 0.3° across a 50 km slope profile. This presents an issue to stratigraphers working to understand facies variability at the reservoir-scale because the changes in stratal geometries at the shelf-to-basin transition will occur beneath the resolution of conventional subsurface datasets. In order to address this issue, outcrops that capture the shelf-to-basin transition from the late Albian (Cretaceous) Maverick intrashelf basin were mapped along a 15 km dip-oriented transect on the Lower Pecos River. This study takes a quantitative approach to characterize the relationships between dip angles, paleobathymetry, and sediment production along the shelf-to-basin profile. The goal of this research is to provide detailed documentation of an intrashelf basin that can function as an outcrop analog for fields producing from similar reservoir settings by improving the understanding of facies variability away from the wellbore.

Exposures along the Pecos River Canyon provides a unique opportunity to observe the transition from grain-dominated facies of the ramp crest into planktonic foraminifera mudstones-wackestones of the intrashelf basin. For this study, 475 m of detailed sections were collected at five localities and integrated with a high-resolution 3D digital outcrop model to document the relationship between vertical facies successions and stratal geometries of

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the intrashelf basin profile. The development of the differential topography and facies changes associated with the formation of the late Albian Maverick intrashelf basin is attributed to differential sediment accumulation rates between active rudist-skeletal shoal formation, versus deeper-water foraminiferal mudstones of the basin-center. Rudist bank deposition early in the Albian 6 Composite Sequence formed the positive topographic relief (1–3 m) that led to the localization of rapid shallow-water sediment accumulation. After the development of subtle topographic expressions, ensuing changes in relative sea level promoted the development at the margins that were dominated by rudist faunal assemblages. Shallow-water basin margins consist of either lagoon-inlet-barrier or foreshore-shoreface depositional environments with upper shoreface-foreshore facies demonstrating that the platform built to sea level. Within the same stratigraphic interval, skeletal wackestones and foram mudstones are deposited in an intrashelf basin setting. The location of a paleo-shoreline and faunal assemblages within the same high-frequency sequence allows for the estimation that the total shelf-to-basin relief of the Maverick intrashelf basin was greater than 50 m. The forced regressive highstand deposits of the Albian 21 high-frequency sequence form the final phase of high-progradation-rate basin filling. These prograding shoreface deposits downlap the condensed mud-rich intrashelf basin facies of the Albian 19 and 20 high-frequency sequences, and infill the topography formed by the differential aggradation of the intrashelf basin margins.

The primary goal of this study, is to capture a change in stratal geometry at the shelf-to-basin transition and lateral shift of facies from grain-dominated facies on the ramp into mud-dominated intrashelf basin deposits for the Albian 19 and 20 high-frequency sequences. The extensive and largely undeformed exposures along the Lower Pecos River Canyon and adjacent Amistad Reservoir highlight this transition and provide clear evidence for the constructional differential-accumulation-driven formation for the late Albian Maverick intrashelf basin. Similar constructional progressions have been called on for the Bab intrashelf basin and the Natih 'E' Formation in the Cretaceous of the Middle East.

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