
Facies Variability and Reservoir Quality in the Shelf-to-Slope Transition, Upper Cretaceous (Cenomanian) Woodbine Group, Northern Tyler and Southeastern Polk Counties, Texas, USA

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ABSTRACT

The Cenomanian Woodbine Group in northern Tyler and southeastern Polk counties (Texas) represents a shelf-to-slope transition along the Upper Cretaceous shelf margin. The hydrocarbon-productive Woodbine section in northern Tyler County consists of a shallow-marine deltaic succession composed of delta-front, distributary-channel, transgressive, and highstand-shelf facies. This shallow-marine interpretation is based on: (1) *Skolithos* and *Cruziana* ichnofaunal assemblages, (2) upward-shoaling, high net-to-gross and sandy successions with an upward progression from lower-flow-regime ripples to upper-flow-regime planar stratification, and (3) the proximal paleogeographic position of the Woodbine succession along the underlying Lower Cretaceous Edwards Reef Trend.

In contrast to the productive, shallow-marine Woodbine trend updip and along the Cenomanian shelf edge in northern Tyler and northeastern Polk counties, Woodbine slope deposits downdip of the Cenomanian shelf edge are sandstone-poor, have poor to moderate reservoir quality, and therefore have limited potential for additional oil and gas development. These slope deposits typically contain thin (commonly <1-ft [$<0.3\text{-m}$]) beds of very fine-grained levee sandstones encased in sparsely burrowed mudstone. Sandy slope facies, consisting of channelized-levee deposits occurring within upward-coarsening successions, are composed of multiple upward-fining sandstone beds defined by incomplete Bouma sequences containing graded beds and thin (<2-in [5.1-cm]) zones of convolute bedding. Other sandy slope deposits are represented by heterolithic, erosion-based debris-flow facies with zones of chaotic bedding.

Permeability and limited porosity data from core plugs indicate that primary reservoir-quality facies in Woodbine shallow-marine systems occur in distributary-channel and proximal-delta-front facies, although original porosity has been modified by diagenesis. In contrast, Woodbine slope facies in western Tyler County have low reservoir quality and are nonproductive, although channelized-levee deposits are locally productive. Although there porosity and permeability decrease with depth, variation in reservoir quality also varies between and within both shallow-marine and deepwater facies, as a function of sedimentary facies that control grain size and stratification.

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