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Depositional Systems, Facies Variability, and Reservoir Quality in Shallow-Marine Reservoirs in the Eocene Upper Wilcox Group in Fandango Field, Zapata County, Texas

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ABSTRACT

Deeply-buried (>13,000 ft [>3960 m]) reservoirs of shallow-marine origin in the Eocene upper Wilcox Group in Fandango Field in Zapata County, Texas have lowpermeability and moderate-to-low porosity values (commonly <1 md and <15%, respectively). From a dataset of 7 whole cores that collectively compose ~1070 ft (~326 m) of section within a depth range from 13,725 to 18,183 ft (4184 to 5544 m), this study interprets a wave-dominated, microtidal (diurnal tidal range <6.6 ft [<2 m]) setting for the upper Wilcox Group in Fandango Field. Upper-shoreface and proximal-delta-front facies in Fandango Field are upward coarsening and feature multiple, scour-based beds of planar-stratified, upper-fine-grained sandstone and burrowed beds with Ophiomorpha and lesser Planolites. In contrast, lower- and middle-shoreface facies are extensively burrowed, featuring Palaeophycus, Schaubcylindrichnus, and Asterosoma with subordinate Ophiomorpha. Modern depositional analogs for the upper Wilcox Group in Fandango Field include the wave-dominated Santee Delta and Cape Romain in South Carolina, whereas upper-shoreface and wave-dominated deltaic deposits in the Upper Cretaceous (Campanian) Pictured Cliffs Sandstone in the San Juan Basin in New Mexico and Colorado serve as an ancient facies analog.

Crossplots of grain size versus porosity and permeability in the upper Wilcox succession in Fandango Field from a dataset of 347 plugs from whole cores indicate that grain size and facies origin are poor predictors of reservoir quality, defined as porosity and permeability. However, some facies display variation in reservoir quality, expressed in terms of range and average values of porosity and permeability. Optimal reservoir quality occurs in sandy upper-shoreface/proximal-delta-front facies and transgressive deposits. Relatively high values of average porosity (14.2 to 16.5%) occur in amalgamated, fine-grained sandstone beds in upper-shoreface/proximal-delta-front facies, whereas lower values (<9%) are prevalent in lower-shoreface/distal-delta-front facies. Similarly, greater values of permeability occur within upper-shoreface/proximal-delta-front and transgressive deposits, with average values of 3.56 and 2.80 md in upper-shoreface/ proximal-delta-front and transgressive deposits, respectively. In contrast, average permeability values are much lower (0.14 md) in lower-shoreface/distal-delta-front facies.

This study concludes that grain size and facies variability in the upper Wilcox succession in Fandango Field are poor indicators of reservoir quality. Other factors such as diagenesis may control reservoir quality and should also be considered in reservoir development in Fandango Field and other fields in the South Texas Wilcox trend.