Application of Production Decline Curve Analysis to Clastic Reservoir Facies Characterization within a Sequence Stratigraphic Framework: Example—Frio Formation, South Texas

John D. Pigott[1] and Bryant W. Bradley[1,2]

[1]ConocoPhillips School of Geology and Geophysics, University of Oklahoma, Sarkeys Energy Center, Ste. 710, 100 E. Boyd St., Norman, Oklahoma 73019

[2]Chevron, Houston, Texas

ABSTRACT

Viewed within a dynamic 3D accommodation perspective, petrophysical log motifs of 113 wells in the adjoining Captain Lucey and Richard King fields of Jim Wells and Nueces counties, South Texas, reveal the overprint of fourth-order autocyclic processes of regression and transgression within a general third-order allocyclic sea level fall. Five reservoir sand environmental assemblages sealed by transgressive systems tract (TST) shales identified within the clastic shelf wedge of the Oligocene-Miocene Frio Formation are: lowstand systems tract (LST) delta 1, regressive systems tract (RST) to LST delta plain distributaries, RST–LST distributary crevasse splay, TST barrier island, and LST–RST delta 2.

Production decline curve analysis (PDCA) of 18 reservoirs in 12 of 20 currently active wells of these two fields demonstrate a systematic relationship between reservoir elements and their associated depositional environments. The deltaic 1 and deltaic 2 environments (delta front sands) have the best reservoir quality sands of the five, exhibiting linear lowest decline rates with the highest average flow permeabilities (80 md) and largest drainage areas (290 ac). A close second in drainage area (214 ac) is the barrier island sand with lower average flow permeability (7 md). The fluvial sand exhibits the highest decline rates with good drainage area (214 ac) and modest average permeability (32 md). The poorest reservoir quality is the crevasse splay sand with rapidly declining rates, lowest average permeability (1 md) and smallest drainage area (110 ac).

The strong relationships between PDCA and depositional environments in these South Texas Frio Formation sands point to the potential applicability of PDCA—depositional facies linkages as a reservoir performance predictor in fields elsewhere.

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