Lateral Hydraulic Connectivity Assessment of the Outbound Structural Province of the Deepwater Wilcox Formation, Northern Gulf of Mexico

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ABSTRACT

The deepwater Wilcox formation is a thick turbidite deposit across more than 34,000 square miles of the northern Gulf of Mexico. Since the first discovery in 2001, operators have seen a commercial success rate of >60%. Poor field-scale permeability is a challenge for these discoveries, and little is known about regional hydraulic connectivity. We present a preliminary assessment of regional hydraulic connectivity based of publicly available MDT formation pressures for the outbound structural province across Keathley Canyon (KC) and Walker Ridge (WR). Wilcox deposition spans two structural provinces: the more proximal Bucket Weld Province (BWP) and the more distal Amalgamated Salt Stock Canopy Province (ASSCP). All wells used in this study are in the ASSCP. The KC wells are relatively more inbound and thus closer to the structural province boundary. Those in WR are more outbound. Sediments in the Bucket Weld Province are described as being in isolated primary basins bounded by salt feeder structures or salt welds. Transitioning into the ASSCP salt feeder structures are less common and stratigraphic continuity should be greater. With greater stratigraphic continuity greater hydraulic connectivity is expected. However, our initial results do not support this. The KC wells in this study show pockets of connectivity. The WR wells in the study are further outbound and show no evidence of hydraulic connectivity. One proposed hypothesis for lack of connectivity in the Wilcox is diagenetic silica cementation. We see a trend of decreasing permeability with increasing temperature in WR. The Wilcox in KC is deeper than WR, but shows lower temperatures. This lower temperature is likely caused by a thicker allochthonous salt canopy inbound versus outbound. We hypothesize that the thinner salt canopy outbound leads to higher vertical effective stress, which can reduce regional permeability as well.

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