

Exploration/Development History and Sedimentological Drivers of Reservoir Performance of the Mississippian Madison Frobisher-Alida (Rival) - Midale Fields, Burke County, North Dakota

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Abstract

Development of the upper Frobisher - Alida (A.K.A. Rival) oncolithic / peloidal grainstone and the Midale micro-sucrosic dolostone sub-intervals of the Mississippian Madison Formation in northern Burke County, North Dakota, has spanned a 65-year period and been characterized by three phases with different approaches. Initial vertical development drilling from 1955 - 1994 included nearly 600 wells in 15 main fields and has resulted in a cumulative production of ~52.2 MMBO, ~90.9 BCF of gas, and ~79.7 MMBbbls of water. Horizontal development in conventional (open hole) wells began in 1994 and has contributed an additional ~5.8 MMBO, ~15.1 BCF of gas and ~37.6 MMBbbls of water from 88 multi-lateral wells for a total of 234 laterals. From 2012-2019, 43 unconventional style (fracture stimulated) wells added ~3.1 MMBO, ~18.7 BCF and 26.4 MMBbbls of water. Each phase of exploration and development experienced variable results but unlocked additional resource. Production trends are tied to core lithofacies in the Rival subinterval related to the Rival paleo-shoreline trend as well as dolomitization of the overlying Midale reservoir. This study also incorporates observations of oil fluorescence from core chips gathered across the field to show an example of the use of core chip fluorescence even from legacy cores dating back to the 1960's as an indicator of hydrocarbon charge and reservoir performance. This look back on the Rival-Midale play presents a case study for what works and what doesn't for future development of intraformational Madison Formation targets prevalent across the Williston Basin.