

Reservoir Properties and Sedimentary Characteristics of the Falher G (i.e. Wilrich) Tight Gas Resource Play, Deep Basin, Alberta

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Summary

Within the Deep Basin of Alberta, the primary reservoir unit of the Falher G is a prograding shoreface facies association at the base of a progradational parasequence set traditionally referred to as the Falhers, and occurring at the top of, and coeval with, the Wilrich shale. The sequence stratigraphic framework, depositional origin and lateral facies continuity of the Falher G was defined in outcrop and adjacent subsurface by Zonneveld and Moslow (2004) where its lateral equivalence with the Wilrich has been documented. Due principally to its lack of conglomerate facies and associated high permeability, the Falher G has been ignored until recently as a reservoir unit with potential economic significance for natural gas production. However, the advent of horizontal drilling, multi stage completions technology and a unique set of reservoir characteristics have combined to make this one of the most prolific tight gas resource plays in the western Canada sedimentary basin.

Consistent with other tight gas sandstone plays, the Falher G is characterized from core analysis as being of low to moderate porosity (6-8%) and very low permeability (0.1 to .01 md). From detailed petrographic analyses, and in sharp contrast to other Falher units in the Deep Basin, Falher G shoreface sandstones are a fine-to medium-grained, well sorted, feldspathic litharenite to lithic arkose. Up to 30% of the bulk fabric of the rock is plagioclase. Commonly less than 50% is quartz and 15% is clay with minor amounts (< 5%) of detrital dolomite, calcite, pyrite and volcanic rock fragments. Half of the clay fraction is authigenic chlorite, an iron-bearing clay, which is observed under SEM to coat individual constituent grains and line rather than occlude intergranular pore throats. Emplacement of authigenic chlorite within the fabric of Falher G shoreface sandstones probably occurred at relatively shallow depths of burial and early enough within the diagenesis of the Falher G to inhibit the precipitation of quartz overgrowth cement, thus preserving a limited but significant component of intergranular porosity and permeability within the matrix of the facies. In addition, and as observed in both thin section and macroscopically in core, reservoir quality is enhanced by partially- open, vertical to oblique, natural fractures lined with either calcite or dolomite.

The bulk composition and mineralogy of the Falher G infers a volcanic-plutonic source terrain, a geological attribute also unique to the Falhers in the Deep Basin, and results in a reservoir facies with a conductivity, density and gamma-ray radiation much higher than would normally be expected from a

sandstone of this age and geographic position. This makes detailed petrological analysis of the Falher G critical to proper log analysis, net pay calculations and petrophysical modeling. These unique formation properties and subsequently enhanced reservoir quality help to account for the surprisingly high deliverability and production that has exceeded expectations as derived from a standard log evaluation unaided by analysis of rock properties.

References

Zonneveld, J.-P. and Moslow, T. F., 2004, Exploration potential of the Falher G shoreface conglomerate trend: evidence from outcrop: Bulletin of Canadian Petroleum Geology, 52, 23-38.