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Wilrich Member: Core-Based Reservoir Evaluation

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Summary

Promising initial production numbers in the Lower Cretaceous Wilrich Member has identified this particular member of the Spirit River Formation as a key liquids-rich play in the WCSB deep basin. The Wilrich Member is the first in a series of progradational cycles identified above the Bluesky Formation (MacDonald et al., 1998). A number of sandy, shallowing upwards cycles have been identified as the main target for hydrocarbons within the Wilrich Member. For the most part in literature, these cycles have been classified as mainly shoreface type deposits.

Integrated Resevoir Solutions Division (IRS) of Core Laboratories saw the potential for a comprehensive core-based reservoir study. The IRS group launched the study late 2014, with seven initial member companies, and has been diligently working on both new core contributions and legacy cores located at the AER over the past year. This study's main purpose is to characterize the Wilrich Member using basic and advanced rock property methods, interpreted core descriptions, thin section analysis, geomechanics, fluid sensitivity studies and completion/production analyses.

The current study area encompasses a large area from the Brazeau River Field in the south to the Karr and Kakwa Fields to the northeast. A total of 11 cores have been submitted into the study and provide coverage across this area parallel to the deformation front. Core descriptions and interpretations of these cores have revealed that the Wilrich Member is much more diverse depositionally. From offshore silts to foreshore sands to storm-dominated prodelta silts, sands and muds to delta front sands to delta plain and non-marine signatures such as distributary channels and swamp/marsh deposits. These environments vary across the study area with three primary reservoir units identified: distributary channel sands, shoreface sands and delta front sands – all with unique petrophysical attributes which are summarized below:

1. Distributary Channel Sands
    - Upper fine to medium grained sand, low angle cross-bedded, pebble lags on base
    - Average total porosity: 12.1%; Average effective porosity: 10.9%
    - Max permeability (Klink): 6.63E+00 mD
    - Average water saturation: 42%
2. Shoreface Sands
    - Fine grained sand, low angle to trough cross-bedded, carbonaceous material
    - Average total porosity: 6.3%; Average effective porosity: 4.7%
    - Max permeability (Klink): 8.05E-02 mD
    - Average water saturation: 34%
3. Delta Front Sands
    - Very fine to fine grained sand, massive/cryptically bioturbated
    - Average total porosity: 5.1%; Average effective porosity: 3.1%

- Max permeability (Klink): 1.81E-02 mD
- Average water saturation: 32%

Being able to identify these key reservoir facies spatially will ultimately aid in optimizing and directing further development of the Wilrich Member.

References

MacDonald, D.E., Langenberg, C.W., and Strobl, R.S. 1998. Cyclic marine sedimentation in the Lower Cretaceous Luscar Group and Spirit River Formation of the Alberta Foothills and Deep Basin: Sequences, Stratigraphy, Sedimentology: Surface and Subsurface. Can. Soc. Pet. Geol., Mem., v. 15, p. 143-154.