

Reservoir and Source Rock Potential of Late Devonian Imperial Formation, Southern Peel Plateau and Plain, NWT

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Summary

Late Devonian stratigraphy of the Peel Plateau and Plain is comprised of the upper portion of the Hare Indian Formation, the Canol Formation, and the Imperial Formation. The Imperial Formation is overlain unconformably by the Cretaceous Martin House Formation.

Previous field work has identified units within the Imperial Formation that have reservoir quality porosities. However, corresponding permeability values are low. Field work conducted in 2007 consisted of detailed sampling and sedimentology of previously measured sections to better understand reservoir quality units. Work was conducted on Flyaway Creek, a Snake River tributary, an Elbow Creek tributary as well as an Arctic Red River tributary. These sections occur on NTS map sheets 96 E/4, 106 H/5 and H/7, and 106 G/7. Samples were collected from Imperial Formation for analysis of permeability, porosity, palynology, and Rock-Eval/TOC.

Measured sections of the Imperial Formation have provided thicknesses ranging from approximately 300 to 700 m. Locally in the Mackenzie Mountain front the Imperial Formation is exposed at surface and any potential reservoirs have likely been breached. In the foothills however, and into Peel Plateau and Plain, the potential exists for either fault or fold bounded structural traps. Where the overlying Cretaceous shales have not been eroded they potentially provide an effective seal.

Imperial Formation is interpreted as a turbidite sequence that can be coarsely described as three, thick resistant cliff-forming sandstone units, which are separated by less resistant to recessive thick silty shale packages. The sandstones are very fine to fine-grained and show abundant bioturbation near the base of beds, including both horizontal tracks and traces as well as vertical burrows. Bioturbation decreases up section and sedimentary structures are better preserved. Imperial Formation sandstone is locally fossiliferous containing rugose horn corals, colonial corals, and brachiopods. Sandstone units at the Imperial River section are locally petroliferous. Palynology work indicates a marine depositional environment in the more northern localities and terrestrial to near-shore marine in the south (map sheets 105P and 95M). Thermal Alteration Indexes (3 – 4) and equivalent vitrinite reflectance (1.4 - 2.0%) indicate postmature (dry gas zone) sediments.

The sandstone units of Imperial Formation are medium grey, green grey, and olive green in colour. The greyer sandstones occur in the basal sand unit in the two western sections where there is a distinct lack of green sand in the basal member. The western sections also exhibit a notable decrease in coral and shell abundances. This possibly indicates a movement away from a shelf

edge bioclastic sediment source, which may correspond to a northern extension of the Jungle Ridge member recognized further south.

Results from samples collected in 2007 have illustrated regional trends in the Imperial Formation across the front range of the Mackenzie Mountains. Specifically, increasing thermal maturity and source rock potential to the west and increasing reservoir rock potential to the east.