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The Montney at Waskahigan – Understanding Reservoir Quality of a Prolific Tight Oil Field in West Central Alberta, Canada.

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Introduction

The Montney Oil Field at Waskahigan was originally developed by Orlean's Canada, RMP Energy and Harvest Operations. Since 2011, over 60 horizontal wells have been drilled and completed by hydraulic fracturing. Tangle Creek Energy Ltd. (TCE) acquired the Waskahigan property from RMP Energy in October 2017. Subsequently 5 horizontal wells have been drilled and completed. To date, the first 2 wells drilled have since been put on production and have ranked amongst the top wells in Western Canada, IP >1,000 barrels oil/day (1400 BOE/D) (cf. Peters & Co. Energy Update June 2018 and RBC Capital Markets July 2018).

Herein we will present geological and petrophysical data highlighting the reservoir properties of the Montney at Waskahigan. Current geological and petrophysical studies include log-based petrophysics, core descriptions, profile permeability, thin-sections, SEM, XRD, XRF, ambient porosity, steady state permeability, stressed permeability, mercury injection capillary pressure, wettability and relative permeability tests.

Geological Setting

The Triassic Montney Formation in West Central Alberta is comprised of regressive-transgressive units or shingles of upward shoaling shoreface complexes deposited within a shallow marine environment Davies et al. (1997). The majority of the Montney production in Alberta is skewed towards the west-northwestern regions in overpressured tight siltstones,

however, there are significant oil pools trapped in a conventional setting in the west central regions (i.e. Ante Creek, Sturgeon Lake, Waskahigan, etc.).

In Waskahigan, the Montney is Griesbachian to Dienerian (Lower Triassic) in age. Marine sediments supplied from an arid coastline by ephemeral rivers and deltas were subsequently reworked locally by waves, storms and tides into sweet spots of coarse siltstones to very fine-grained sandstones. Reservoir development in Waskahigan is generally confined to the upper 20m of the section, below which, porosity decreases reflective of changing facies and decreasing grain size. The Montney Formation has been subdivided based on log character, supported by core interpretations and cuttings descriptions, into discrete units for development planning and reservoir mapping. Facies interpretation indicate an overall shallowing upward trend, with the best reservoir development located at the top of the Montney interval. Reservoir quality of the sediments may have also been enhanced by leaching related to the overlying unconformity, given the best porosity is usually found near the top of the Montney, regardless of what cycle lies under the Jurassic Nordegg. Horizontal wells in the area typically target within 10m of the Montney/Nordegg contact.

Method

The Montney reservoir is cored in four wells on TCE acreage, of which the core from the 100/12-07-064-23W5/00 well is presented here. Porosities from these cores range from below 3% to 14% and measured core permeabilities (K_{max}) range from $<0.02\text{md}$ to $>1\text{md}$ (Figure 1). Further plugs were taken for more rigorous testing such as stressed permeabilities, mercury injection capillary pressure, wettability and relative permeability. Results from these tests will be shown in correlation with reservoir facies. The aim of these tests is to provide a more complete picture of the reservoir properties that control multi-phase fluid transport in the Montney.

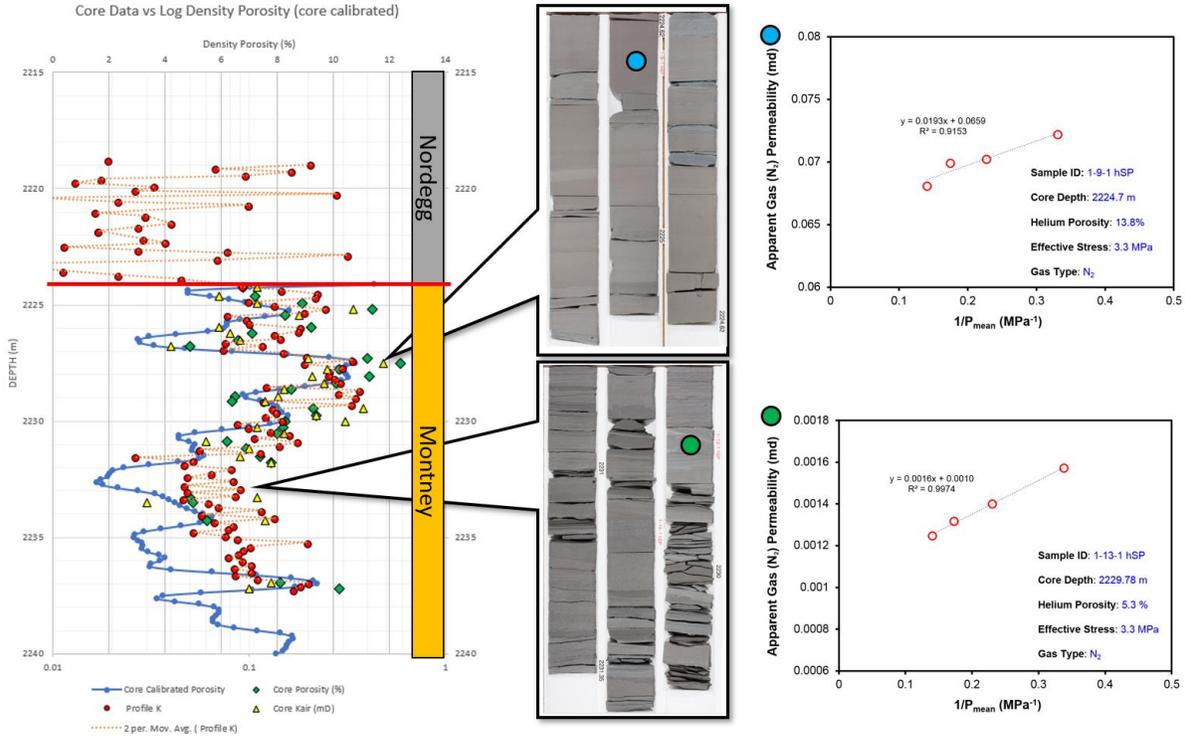


Figure 1. Comparison of core calibrated density porosity data (blue line) versus core porosity, kmax permeability and profile permeability measurements over the uppermost section of the Montney at the 100-12-07-064-23W500 location. Core photos showing the lithofacies comparison with petrophysical data. The upper core photo shows oilstained massive, graded v.f sandstone – coarse siltstone beds with minor fine-medium siltstone laminae. PDP permeability (corrected for slippage effects) is over an order of magnitude greater in the upper core photo (blue dot) than that of the lower core photo (green dot) displaying fine-medium siltstone laminated facies and lower permeability.

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References

Davies G.R., Moslow, T.F., and Sherwin, M.D., 1997, The Lower Triassic Montney Formation, west-central Alberta, Bulletin of Canadian Petroleum Geology, vol. 45, no. 4, p. 474-505.