

Hydrocarbon Source Rock Characterization, Thermal Maturity And Implications For Shale Gas Potential Of Upper Triassic Strata, Northeastern British Columbia, Canada

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ABSTRACT

Numerous gas and oil fields are hosted in the Baldonnel and Pardonet formations of northeastern British Columbia, Canada. The source of the hydrocarbons in these fields has not been demonstrated using organic geochemical methods. However, lithologic characteristics, interpreted depositional settings, and some published organic carbon content values, have led to speculation that Upper Triassic strata of northeastern British Columbia, in particular the Pardonet Formation, may include important hydrocarbon source rocks.

In order to assess the hydrocarbon source rock potential of Upper Triassic strata in northeastern British Columbia, 9 outcrop and 6 drillcore locations were described and sampled for geochemical analyses. Geochemical analyses using Rock-Eval/TOC pyrolysis indicate a total organic carbon content ranging from 0.03 to 2.08 wt % for the Baldonnel (majority < 1.0 wt %) and 0 to 4.8 wt % for the Pardonet samples. Rock-Eval Tmax data indicate that Upper Triassic strata are late mature to overmature with respect to liquid hydrocarbon generation at the studied localities. One exception is the West Burnt River outcrop location (55°20'N; 122°20'W), where the Pardonet Formation is at early peak hydrocarbon maturity (Tmax=437°C), with Hydrogen Index values from 170 to 315 mg HC/g TOC, indicating Type II (oil-prone) kerogen. However, West Burnt River TOC values (0.6 to 1.4 wt %) are not as high as those observed at other outcrop localities and in core, possibly due to lateral facies variations, or to sampling bias (these samples are from the GSC Archives, and were not collected by the authors).

Geochemical data from outcrop and core suggest that the Pardonet Formation in northeastern B.C. had good to very good initial hydrocarbon potential, and has generated economically significant quantities of hydrocarbons. The Baldonnel

Formation had only poor to fair initial hydrocarbon potential, and was not self-sourcing.

Gas isotopic and gas compositional data, as well as biomarker analysis of oils and source rock extracts, are required to demonstrate whether the Pardonet, or some other, deeper unit, was the source of hydrocarbons found in Upper Triassic reservoirs in NE B.C. Mass balance calculations suggest that a much greater volume of hydrocarbons was generated from the Pardonet, than can be accounted for in known accumulations of oil and gas in Upper Triassic reservoirs. This leads us to speculate that the excess hydrocarbons may be in other (presumably younger) reservoirs, and/or retained within the Pardonet itself. If the latter is the case, then the Pardonet may also have potential as a fractured shale gas play. Comparison of our data with previous stratigraphic studies suggests that the best potential may occur within the lower P3 and the P4 units of Barss and Montandon (1981) and Davies (1997). Integration of the TOC and thermal maturity data provided here, with knowledge of rock lithology and thickness, the presence of effective bottom and top seals, and regional fracture patterns, may help to identify optimum regions for unconventional shale gas plays in the Pardonet Formation.

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- Davies, G.R. 1997. The Upper Triassic Baldonnel and Pardonet formations, Western Canada Sedimentary Basin. *Bulletin of Canadian Petroleum Geology*, v. 45, p. 643-674.