

Potential hydrocarbon source rocks and thermal maturity of Proterozoic strata in Athabasca Basin, northern Saskatchewan, and Muskwa Assemblage, Cordillera, northeast British Columbia

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ABSTRACT

Middle to Late Proterozoic potential hydrocarbon source rocks occur in several regions globally, such as in West and Central Australia, Siberia and Oman, however, none have ever conclusively been shown to exist within Canada. Organic petrology and geochemistry studies of shales and carbonates from Middle Proterozoic Athabasca Group, Saskatchewan, and Middle-Late Proterozoic Muskwa Assemblage in the Cordillera of N.E. British Columbia, have been conducted to assess thermal maturity and source rock potential. Douglas Formation shales from western Athabasca Basin have total organic carbon (TOC) contents ranging from < 0.2 % to 3.2 %, with a significant number averaging 0.6 to 1.0 wt. %. Optical indices indicate these shales are at a thermal maturity level equivalent to ~ 1.4 %Ro vitrinite and were exposed to burial temperatures of ~ 165 to 195 °C. The Douglas Formation also contains crude oil inclusions, of which a high gravity population (>45-50 °API) was likely sourced directly within the shales. Microscopic organic matter and mineral assemblages also suggests that the shales likely accumulated in a marine setting. Substantial kerogen is also present in black shales and carbonates of the Muskwa Assemblage in northeast B.C. The Tetsa, George and Aida formations contain between 0.4 and 2.3 % TOC, and the microscopic constituents (e.g. anisotropic pyrobitumen), strongly imply that these units were likely good, and probably effective, hydrocarbon source rocks. Thermal maturity of the Muskwa formations ranges from ~ 2.6 to 3.7 %Ro vitrinite equivalent with estimated maximum temperatures of ~ > 220 to 270 °C.