Thermal Maturity, Source Rocks and Hydrocarbons in Cretaceous and Devonian Strata Within Summit Creek B-44 Exploration well, Central Mackenzie Valley, NWT, Canada

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Abstract
Early Cretaceous to middle Devonian strata at Summit Creek B-44 exploration well in central Mackenzie Valley, NWT, Canada, were assessed using microscopy and Rock Eval pyrolysis to assess per cent reflectance in oil (%Ro) maturation gradients, level of thermal maturation with respect to oil and gas generation and preservation and source rock potential. Two distinct segments comprise the vitrinite %Ro (VR) profile. At the top of the succession, VR is 0.28-0.36 %Ro in the latest Cretaceous to Paleocene Summit Creek Formation, increasing to 0.44 %VRo for Campanian-Maastrichtian East End Formation strata, and ~ 0.55 to 0.60 %VRo for Cenomanian to Albian Slater River and Arctic Red formations. A marked increase in maturity occurs between lower Cretaceous and late Devonian Imperial and older strata indicating significant erosion. Upper to Middle Devonian are at the end of the oil window with maturity ranging from ~ 1.1 to 1.3 %VRo. Fluorescence of Tasmanites alginite are consistent with VR levels. Rock Eval Tmax is generally ambiguous for Cretaceous strata due to high amount of recycled kerogen in the Upper Cretaceous as well as suppressive effects (e.g. high S in organic-rich Cenomanian Slater River). Good to very good Type I/II kerogen potential source rocks occur in Slater River Formation shales (4-8 % TOC; Hydrogen Indices of 300-500 over ~ 180m), although they are immature and have not generated oil. Excellent to very good, thermally mature potential source rocks (%Ro 1.1-1.2; Tmax ~ 455-465 °C) occur in the Canol, Bluefish and Hare Indian formations with TOC ranging from 3-5 % over ~ 140 m. Hydrocarbon fluid inclusions occur in late cements and microfractures in the Devonian source rocks and in Middle Devonian Bear Rock Formation dolomite with estimated gravity of > 45 to 55 °API. Very minor amounts of pyrobitumen in parts of the Bear Rock indicate that an oil likely existed prior to oil-gas cracking.