Field Investigations from the Northern Western Canadian Sedimentary Basin: Hydrocarbon Potential of the Upper Devonian to Lower Carboniferous Tuttle Formation, Yukon Territory

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The Upper Devonian to Lower Carboniferous Tuttle Formation was an exploration target for oil and gas in the Eagle Plain and Peel Plateau regions of the Yukon and Northwest Territories in the 1960s and 1970s. To date, seven minor gas shows have been identified in the Tuttle Formation in the Peel region, which lies at the northwestern extent of the Western Canadian Sedimentary Basin. This study is part of a four-year project to investigate the sedimentology, stratigraphy and hydrocarbon potential of Upper Paleozoic strata in the Peel region.

The Tuttle Formation forms the upper part of a siliciclastic wedge that was deposited in the foreland basin of the Yukon and Ellesmerian fold belts. Field investigations, limited to the eastern Richardson Mountains, identified the Tuttle Formation as alternating resistant and recessive intervals. Resistant intervals, 23 to 54 m thick, comprise five lithofacies units including fining-upward sandstone, massive sandstone, siltstone, conglomerate, and diamictite. The sandstone and conglomerate lithofacies of the Tuttle Formation are characterized by tripolitic chert and quartz grains, ranging from fine-grained sandstone to pebble conglomerate. Recessive intervals, 55 and 144 m thick, consist of siltstone and shale and are mostly covered. Field investigations suggest that the Tuttle Formation represents deposition within a turbidite sequence.

Rock Eval/TOC results from samples collected in the field indicate that organic matter within the Tuttle Formation is composed of Type III and admixtures of Type II/III kerogen, which are typically gas-prone. Total organic carbon content values suggest that the Tuttle Formation has a good to very good potential to produce hydrocarbons, typically ranging between 1 and 4 % TOC. Thermal maturation (T_{max}) indicate that the organic matter is in the immature to mature stage of thermal diagenesis.

Porosity determination for outcrop samples ranged from 1.6 to 18.6%. Thin section analysis shows both intergranular and intragranular porosity, the latter observed most frequently in tripolitic chert. In many samples, porosity is occluded by clay minerals and quartz overgrowths. Permeability for outcrop samples ranged from 0 to 13.7 mD. Based on surface samples, the best prospects for reservoir rock are medium-grained sandstones.