

Devonian and Cretaceous Hydrocarbon Source Rocks, Central Mackenzie Valley, Northwest Territories

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Summary

In the mainland sedimentary basins of the Northwest Territories, there is potential for the discovery of new shale oil and gas reserves where known high quality, mature source rocks are present. A second phase of the Mackenzie Plain Petroleum Project was initiated in 2014 by the Northwest Territories Geoscience Office Petroleum Group. The study builds on phase one of the project that coupled field-based stratigraphic research with data from subsurface exploration wells in order to expand the petroleum geoscience information for the Central Mackenzie Valley. The work aims to expand datasets that characterize the hydrocarbon source rock potential of two organic-rich intervals: 1) Devonian Horn River Group (Hare Indian, Ramparts, and Canol formations), and 2) Cretaceous Slater River Formation.

During the 2014 field program in Mackenzie Plain area, Horn River Group strata were described and sampled from three sections and one station, and Cretaceous outcrop was sampled from four sites. In addition, five previously measured Devonian sections and stations were re-visited to fill in data gaps including conodont biostratigraphy and detailed measurement of a proposed type section for the upper Hare Indian Formation (Bell Creek member) at the Carcajou River section. At the Hume River outcrop, both the Canol Formation and the overlying organic-rich, basal Imperial Formation have a petroliferous odour. These units were sampled for total organic carbon (TOC) and lithogeochemistry data, which will be integrated with spectral gamma ray measurement from both units. Chemostratigraphy is a robust tool that aids in differentiating the visually homogenous Devonian shale packages. Cretaceous outcrop, mainly Slater River Formation, was sampled to evaluate source rock potential (TOC and thermal maturation trends).

The Horn River Group contains organic-rich shale intervals with fair to excellent source rock potential (average TOC values greater than five weight percent). The Canol Formation is a known source rock for the conventional oil reservoir at Norman Wells, NWT and its high silica content may enhance its ability to be fractured hydraulically as a shale reservoir. Thermal maturation data for the Canol Formation suggest strata are within the oil window through much of Mackenzie Plain; however, data gaps exist to the west and northwest of Mackenzie Plain (within the Peel Plain area), and in the southern part of Mackenzie Plain. Information from outcrop studies will be integrated with forthcoming subsurface data from exploration wells to improve mapping of thermal maturation trends through the Central Mackenzie Valley.