



Oil to Source Rock Correlation and Implications for Petroleum System Analysis

Martin Schwangler¹, Nicholas B. Harris¹

¹University of Alberta, Earth and Atmospheric Sciences

The presence of natural oil-seeps and old, accessible well sites along the coast of western Newfoundland have refocused the interest on Late Cambrian to early Ordovician Cow Head and Northern Head Groups. Part of the Humber Arm Allochthon, these groups contain viable source rocks for petroleum exploration. Most oil seeps and old wells containing light oil are concentrated around the Parson's Pond area, an inlet located in the thrust belt of the northeastern Canadian Appalachians. During the Acadian Orogeny westward thrusting imbricated continental slope and rise deposits forming "in-sequence" thrust sheets consisting of repeated early Paleozoic strata. The former passive continental margin is represented by deep marine organic rich argillaceous rocks as well as carbonate deposits containing potential source and reservoir rocks.

Reservoirs are hosted in the overridden platform carbonates which are time-equivalent rocks of the proximal foreslope deposits of the Cow Head Group. Other potential reservoirs can be found in shelf proximal carbonate conglomerates associated with debris flows. Total organic content (TOC) concentrations of up to 10.35% and high hydrogen index (HI) values of over 840 [mg HC/g TOC] demarcate the Green Point Formation of the Cow Head Group and the Middle Arm Point Formation of the Northern Head Group as viable sources. Analysis show that high quality source rocks in those formations were deposited only in the latest Franconian to Tremadocian and are restricted to the most distal parts of the sediment aprons. Although extensive studies on the sedimentology of those deposits have been conducted, the connectivity between these source rocks and produced hydrocarbons and oil seeps is not well understood. Here, we present a systematic source rock analysis of the Cow Head and Northern Head Group in conjunction with detailed biomarker analysis to identify specific characteristics of the source rock as well as live oil and oil seep samples. These are utilized to establish oil families, which will be used for oil-to-source correlation and thermal maturity models for the expelled hydrocarbons. The results will give further input for a complete basin model and a better understanding of the petroleum system.

References

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