GeoConvention 2015
GEOSCIENCE
new horizons
Telus Convention Centre • 4-8 May 2015 • Calgary, AB Canada

Basin Modeling in Western Newfoundland Using Oil Seep Samples

Martin Schwangler[1],Nicholas B., Harris[1], John W. F., Waldron[1]
[1]University of Alberta, Earth and Atmospheric Sciences

Drilling operations on the Port au Port Peninsula, western Newfoundland, in 1994 and 2004, together with the presence of numerous oil-seeps along the coast, have focused interest on the Humber Zone, the structural front of the northern Appalachians as a potential region for future oil exploration.

Western Newfoundland is situated at the eastern margin of the Gulf of St. Lawrence and preserves the tectonically-rich history of the northeast Canadian Appalachians. The breakup of Rodinia was followed by the development of an extensive, passive continental margin represented by the continental slope and rise deposits of the Humber Arm Allochthon; these contain potential source and reservoir rocks. The Late Cambrian to Ordovician sedimentary Green Point Formation of the Cow Head Group and the more distal Northern Head Group in the Humber Arm Allochthon are type I/II source rocks with a TOC content of up to 10.35%. Hence, they are comparable to time-equivalent prolific source rock, e.g. Utica Shale, in the Appalachian Basin further to the south. The onset of the Taconian Orogeny and migration of a peripheral bulge led to subtle uplift of the carbonate shelf and subsequent karst development in the footwalls of reactivated extensional faults. The structural highs of the Aguathuna Formation are pervasively dolomitized and tight. However, porous zones in the formation average 9.8% porosity and 21 mD. Those early Ordovician platform carbonates represent time-equivalent rocks of the proximal foreslope deposits of the Cow Head Group. Acadian deformation overprinted earlier Taconian structures. New Lithoprobe seismic profiles show promising inverted basins beneath the allochthon, reflecting the possibility of deeply buried high porosity carbonate successions of the St. George Group as potential oil reservoirs.

We will test a model for the timing of oil generation relative to the development of traps during the Acadian Orogeny. This will give a better understanding of the petroleum system in the basin with potential new reservoirs. To conduct the model we use geochemical properties and subsurface information collected from existing well data. For further constraint, we utilize previous studies on the tectonic evolution of the basin and thermal maturity data from oil seep samples.

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