



Research Highlights: Petroleum Potential of Paleozoic Rocks, Peel Plateau and Plain, Northwest Territories and Yukon

Len P. Gal*

Northwest Territories Geoscience Office, Yellowknife, NT, Canada

len_gal@gov.nt.ca

Introduction

This poster presents a number of analytical results and interpretations related to Paleozoic strata in Peel Plateau and Plain (Peel area), with a focus on petroleum systems and potential.

The work presented here is part of the multi-agency, 2005-2009 *Regional Geoscience Studies and Petroleum Potential, Peel Plateau and Plain* project. Project partners are Northwest Territories Geoscience Office, Yukon Geological Survey, and Geological Survey of Canada, with involvement by industry and academia. The project is due to wrap up in Spring 2009, project deliverables include a Project Volume comprised of several stratigraphic and structure-based chapters, and an accompanying Digital Atlas.

Franklin Mountain Formation vuggy (hydrothermal?) dolomite

Cambro-Ordovician Franklin Mountain Formation is widespread throughout Peel area. It is largely comprised of peritidal dolomudstone, but stratabound, coarse-crystalline, vuggy dolomite outcrops occur west of the Arctic Red River. These porous dolomites are tens of metres in gross thickness, and may have reservoir potential in the subsurface. Surface samples have yielded up to 9% porosity and 2 mD permeability. Reconnaissance examination of well cuttings revealed coarse white euhedral dolomite crystals (probably from fracture or vug linings) in several wells, which may be similar to the surface exposures. Two wells with cored intervals feature similar vuggy dolomite, and these also bear textural resemblance to hydrothermal dolomite (HTD).

Arnica Formation reservoir possibilities

Lower Devonian Arnica Formation (mainly peritidal dolostone) has reservoir potential throughout Peel area in a variety of lithologies. In the west near the platform margin, organic limestone biostromes and bioherms are common, with some primary inter-organic porosity. In mid-shelf areas of south Peel area, porous sucrosic dolomite occurs over considerable thicknesses. In southeastern Peel area near a facies change to evaporite rocks (Fort Norman Formation), interpreted solution collapse breccias have considerable (but variable) inter-clast and intra-clast porosity. Porous, possible HTD related to the Deadend Fault adjacent to southern Peel area (and other Laramide thrust faults) represents a further reservoir opportunity.

Oil stain (solvent extraction) analyses

Oil staining is relatively common in southeast Peel area (and adjacent areas) in rocks ranging from Siluro-Ordovician Mount Kindle to Upper Devonian Imperial formations. Several samples at three locations were collected. Analyses has shown that there are two distinct families of oils: Devonian-aged with similarities to the Norman Wells field, and the other likely a Cambrian to Ordovician source, akin to Colville Hills oil samples. Cambrian Mount Cap Formation is thus a probable potential source rock in the region, although its extent in Peel area is not well delineated.

Burial History

Using sparse vitrinite reflectance and Rock-Eval data, one-dimensional burial history models were developed for a number of Peel area wells. The models included additional thicknesses of Devonian-Mississippian and Cretaceous strata, both of which were subsequently removed by pre- and post-Cretaceous erosion, respectively. In most cases, the resultant burial history diagrams suggest that the Bluefish Member and Canol Formation reached maturity after burial under a thick (about 3 km) pile of Cretaceous (Albian) clastic rocks in the foreland trough of the Mackenzie Mountains. The mid- to late Cretaceous maturity/expulsion has important implications for the timing of structural traps associated with Laramide deformation. Lower Paleozoic rocks (including Cambrian Mount Cap Formation) mainly reached maturity under the Devonian-Mississippian clastic pile, and subsequent Cretaceous burial pushed them into high maturity or overmaturity.

Conclusion

These findings, and their impact upon conceptual petroleum plays and petroleum systems will be incorporated into a number of chapters of the forthcoming Project Volume. The analytical data, and supporting spatial materials and photos will be released in the accompanying Digital Atlas.