2005 Reconnaissance Program: Regional Geoscience Studies & Petroleum Potential, Peel Plateau & Plain, Northwest Territories & Yukon

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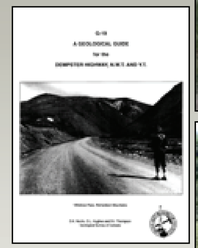
ROADSIDE GEOLOGY OF THE DEMPSTER HIGHWAY, INUVIK TO EAGLE PLAINS

BACKGROUND

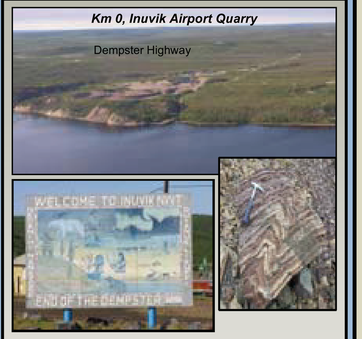
Part of the 2005 reconnaissance program focused on geology along the Dempster Highway (Hwy 11) from Inuvik, NWT to Eagle Plains, YT. The Dempster transects the northwest corner of Peel Region and exposes strata spanning the Proterozoic to Quaternary. Geology of 25 stops was documented in order to update data for a now out-of-print roadside geological guide for the Dempster Highway. The new guidebook will be an outreach product of the Peel Project.

The roadside stops illustrated here are based on kilometres from the highway sign marking the end of the Dempster near Inuvik. Mileages do not correspond directly to markers on the Dempster, since some of these have been displaced from their original positions.

Much of the information in the new guide will be based on the original for the Dempster Highway (Norris et al., 1992), published by CSPG (right). Several stops revisited in 2005 expose Imperial Formation, including: km 233, Vittrekwa Pass (top right); and km 80, Rengleng River (bottom right).



Km 0, Inuvik Airport Quarry



1 The oldest rocks in the region are exposed in a quarry near the Inuvik Airport (top). The succession consists of Proterozoic green and maroon mudstone, siltstone, shale, and dolostone beds that indicate a shallow marine environment.

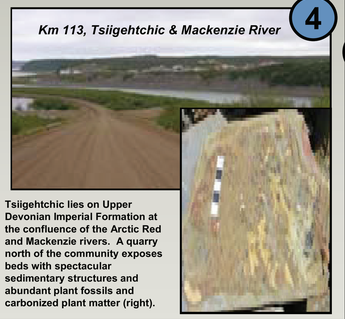
Km 73, Abandoned Quarry

3

Abandoned quarry near Rengleng River exposes black bitumen, conformable with beds of brown and grey, organic-rich siltstone, mudstone, and shale of Imperial Formation.

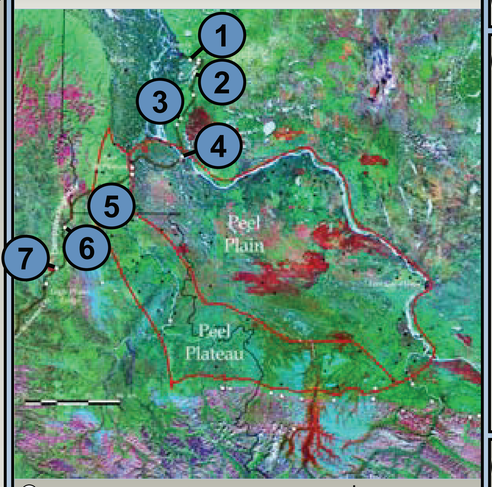
Km 113, Tsiigehtchic & Mackenzie River

4



Tsiigehtchic lies on Upper Devonian Imperial Formation at the confluence of the Arctic Red and Mackenzie rivers. A quarry north of the community exposes beds with spectacular sedimentary structures and abundant plant fossils and carbonized plant matter (right).

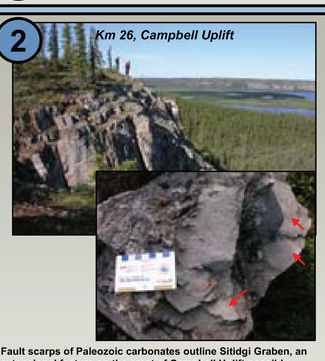
Landsat image of Peel Region



Dempster Highway stops & reconnaissance sections
Dempster Highway
Wells
NWT/YT Border

Km 26, Campbell Uplift

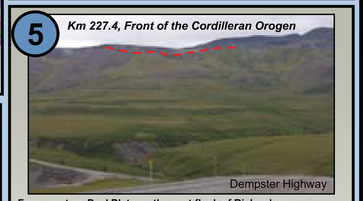
2



Fault scarps of Paleozoic carbonates outline Sitidgi Graben, an extensional feature on the crest of Campbell Uplift possibly related to mid-Tertiary reactivation of the uplift. Limestone (Arnica or Landry formation equivalent) contains abundant fossils, including stromatoporoids (right of scalebar).

Km 227.4, Front of the Cordilleran Orogen

5



From western Peel Plateau, the east flank of Richardson Anticlinorium contains an angular unconformity (dashed) between sandstone of the Jura-Cretaceous North Branch Formation and deformed silciclastic rocks of Upper Devonian Imperial Formation.

Km 254, Wright Pass

Near the NWT/Yukon border, the view south shows cuestas of Cretaceous sandstone (arrows) on the west flank of Richardson Anticlinorium.

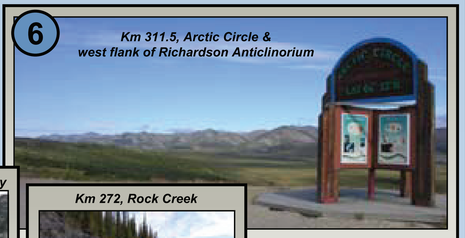
Km 321.5, Eastern Eagle Plain

7

A road cut exposes the unconformable contact between dark grey shale of the Ford Lake Formation and orange weathering conglomerate, sandstone, and black shale of the Tuttle Formation.

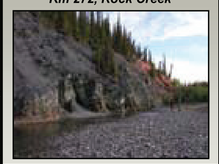
Km 311.5, Arctic Circle & west flank of Richardson Anticlinorium

6



Km 277.5, Road River Group quarry

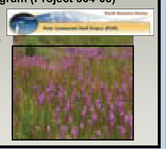
Km 272, Rock Creek



From the Arctic Circle, the view east to the western flank of Richardson Anticlinorium contains basinal facies of the Canol and Imperial formations in the foreground, with older strata of the Road River Group forming the peaks of the Richardson Mountains (above). A quarry in Road River Group (far left) exposes graptolitic black shale. Along Rock Creek (near left), black shale and siltstone of the Canol Formation are exposed. These Lower to Middle Paleozoic strata were deposited in a basinal setting called Richardson Trough.

ACKNOWLEDGEMENTS

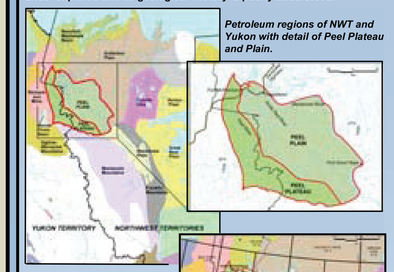
- Polar Continental Shelf Program (Project 304-05)
- Canadian Helicopters
- Aurora Research Institute
- Yukon Tourism and Culture



RECONNAISSANCE FIELD WORK: PEEL REGION, RICHARDSON MOUNTAINS, & MACKENZIE MOUNTAINS

BACKGROUND

Peel Plateau and Plain (Peel Region) lie along the northern Mackenzie Corridor. Peel Region has widespread hydrocarbon potential, but is under-explored and its geological history is poorly understood.



Petroleum regions of NWT and Yukon with detail of Peel Plateau and Plain.

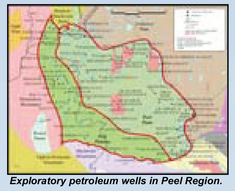
Much of the bedrock mapping and exploration drilling in the area dates back to the 1960's. Most 1:250,000 scale maps were published in the early 1980's by the Geological Survey of Canada (GSC, right).

Coverage of Peel Region by GSC maps (1:250,000 scale).

More than 70 exploratory wells have been drilled in Peel Region (below). Some wells had encouraging hydrocarbon shows, yet no major discoveries.

The primary objective of this project is to improve knowledge of regional geology, including:

- stratigraphy and correlation;
- depositional and tectonic histories;
- basin evolution; and
- petroleum geology and potential.



Exploratory petroleum wells in Peel Region.

The project is seamless across the NWT-YT border and utilizes the expertise of partners in the GSC, Northwest Territories Geoscience Office, Yukon Geological Survey, universities, northern communities, and industry.

NORTHERN ENERGY DEVELOPMENT - MACKENZIE CORRIDOR

Outputs

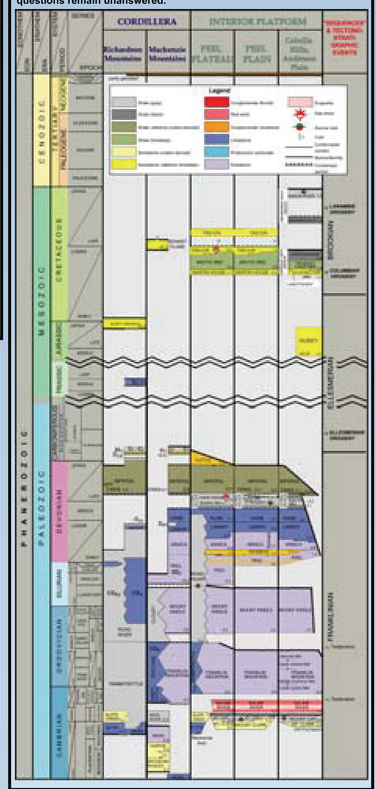
- New multidisciplinary geoscience analysis of Peel Region
- Hydrocarbon resource assessment (qualitative and quantitative) for this portion of northern Mackenzie Corridor

Outcomes

- Improved geoscience data synthesized in a digital product
- Stimulate new exploration and promote investment from energy sector to deliver new economic opportunities and benefits to Northerners
- New geoscience information is a tool for land and resource management decisions to support Northern, energy-related economic development
- Contribute to a secure, reliable domestic energy supply for Canada

REGIONAL GEOSCIENCE & PETROLEUM GEOLOGY PRIORITIES

The supracrustal wedge of Phanerozoic strata thickens westward from Peel Region toward the Cordillera. The succession can be generally described as a Paleozoic "passive" margin succession overlain by a Mesozoic foreland basin succession, akin to the Western Canada Sedimentary Basin (WCSB). Lack of a detailed stratigraphic framework with biostratigraphic control precludes comprehensive basin analysis of the region. This preliminary correlation chart summarizes the current state of knowledge, although many research questions remain unanswered.



PROJECT TIMELINE

The project "*Regional Geoscience Studies and Petroleum Potential, Peel Plateau and Plain, Northwest Territories and Yukon*" will be implemented over a four-year timeline:

Year 1 (2005-2006): reconnaissance field programs and project ramp-up phase;
Year 2 (2006-2007): primary field season;
Year 3 (2007-2008): data analysis and revisionary field work; and
Year 4 (2008-2009): completion phase of the project.

PRODUCTS & INFORMATION

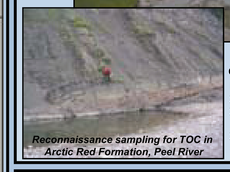
- Project web page www.nwtgeoscience.ca/petroleum/PeelPlateau.html
- Open File: "Synthesis of Geoscience Knowledge, Peel Plateau and Plain Region, Northern Mackenzie Corridor";
- Peel Petroleum Project database and GIS;
- Remote Predictive Map of Peel Region;
- Reports of reconnaissance field work; and
- Resource assessment.

CRETACEOUS PRIORITIES

Cretaceous strata of the Martin House, Arctic Red, and Trevor formations are exposed mainly where rivers incise Peel Plateau. Gaps in knowledge include:

- Sedimentology; spatial and temporal distribution and thicknesses of facies
- Relationship of tectonism to sedimentation
- Nature, extent, and timing of hiatuses
- Correlation of succession with north (Beaufort Sea) and south (WCSB)

Cretaceous outcrop along Snake River



Reconnaissance sampling for TOC in Arctic Red Formation, Peel River

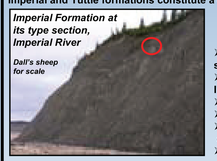
Petroleum Geology

Cretaceous sandstones are a conceptual play for natural gas and oil.

- Extent of Laramide structures
- Diagenetic history of reservoir sandstones
- Timing of hydrocarbon generation relative to structure

UPPER PALEOZOIC PRIORITIES

Imperial and Tuttle formations constitute a conceptual play. Imperial Formation outcrops extensively in Peel Region.



Imperial Formation at its type section, Imperial River

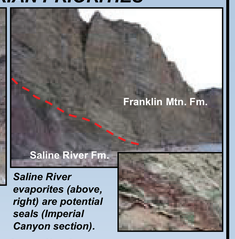
Dall's sheep for scale

Petroleum Geology

- Diagenetic history of reservoir siliciclastics
- Reservoir quality of Cordillera vs. Interior Platform
- Nature and timing of deformation
- Facies distribution
- Sequence stratigraphy and correlation
- Provenance of sedimentary rocks

CAMBRIAN PRIORITIES

Mt. Cap black shale was sampled for total organic carbon (TOC).



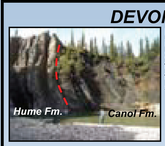
Saline River evaporites (above, right) are potential seals (Imperial Canyon section).

Petroleum Geology

Proven reservoirs for gas and condensate in Cambrian strata in the Colville Hills suggest a similar conceptual play in Peel Region. Problems include:

- Thermal maturity of strata
- Timing of hydrocarbon generation/ migration
- Correlation of Cambrian units, e. g., nature of sub-Saline River unconformity; extent of Mt. Clark reservoir sandstones
- Adequacy of current stratigraphic divisions
- Details of facies distributions, sedimentology, depositional environments

DEVONIAN PRIORITIES



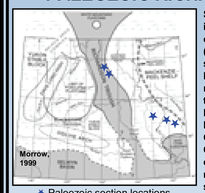
Devonian rocks were examined at several sites, including Flyaway Creek (left) and Mountain River (below). Samples of organic-rich facies were taken for TOC analysis and conodont samples were taken for biostratigraphy and thermal maturity analysis.

Petroleum Geology

Devonian platform carbonates constitute a conceptual play. Outstanding issues include:

- Spatial and temporal facies distributions
- Diagenetic history of carbonates
- Nature of structural and stratigraphic traps

PALEOZOIC RICHARDSON TROUGH



Paleozoic section locations

Study of sections that lie in both basinal settings of Richardson Trough (shaded, left) and the shallow-water platform of Mackenzie-Peel Shelf are necessary to understand the evolution of Peel Region during the Paleozoic. Road River Group (far right) and Canol Formation both contain potential source rocks (black shale) sampled for TOC.

ORDOVICIAN-SILURIAN PRIORITIES

Sections of Ronning Gp. (Franklin Mtn. and Mt. Kindle formations) and Delorme Gp. (Peel and Tatsieta formations) were examined along the northern front of Mackenzie Mountains. Priorities include:

- Refine biostratigraphy and correlation of surface to subsurface
- Nature of shelf-break transition zone to Richardson Trough
- Sequence stratigraphy

Petroleum Geology

Paleozoic platform carbonates constitute a conceptual play.

- Stratigraphic relationships along transition zone (nature of ancient shelf break)
- Spatial and temporal relationships of facies
- Diagenetic history of potential reservoir rocks
- Timing of hydrocarbon generation and pre-Laramide structuring