

# **Background Geological Information**

## **YUKON CALL FOR BIDS # 3**

### **Parcel in Peel Plateau**

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# PEEL PLATEAU BACKGROUND GEOLOGY

## Introduction

Yukon's third call for nominations related to oil and gas rights was announced on May 17, 2001. It included portions of three oil and gas regions, namely the Eagle Plain, Peel Plateau, and Kandik Basin. The Call resulted in one parcel being nominated in the Peel Plateau. During September 2001, the nominated area was subject to a public review process to determine any environmental, socio-economic or surface access concerns.

The current Call for Bids, which takes the concerns expressed into account, closes on January 31, 2002. The Call for Bids package is available from the Oil and Gas Resources Branch web site at [www.yukonoilandgas.com](http://www.yukonoilandgas.com). It is also available in hard copy by phoning, faxing, writing or visiting the Branch as follows:

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The following documentation is designed to assist exploration companies by providing basic exploration information and directions on how to obtain further geological data.

## Geographic Description

Figure 1 shows the location of the nominated parcel relative to existing oil and gas wells, seismic lines and settled land claims. The parcel occupies an area near 66° north latitude and 134° west longitude, just south of the Arctic Circle. The selected parcel consists of 155 sections with an area of approximately 402 square kilometres. There are no towns or permanently inhabited areas within the parcel. The closest permanent settlement is Eagle Plains, approximately 100 km to the northwest of the parcel. Fort McPherson lies on the Peel River approximately 150 km to the north of the parcel.

Wetlands are present on over 25% of the Peel Plateau. The region has a high subarctic ecoclimate with continuous permafrost and low annual precipitation. Primary vegetation consists of open, stunted stands of black spruce and tamarack. Terraces and rounded plateaus with little topographic relief characterize Peel Plateau. Most of the region is covered by thin, discontinuous, hummocky to dissected glacial drift and organic deposits, although some portions escaped glaciation.

Peel Plateau is bound on the west by the Richardson Mountains and by the Mackenzie Mountains to the south. The eastern and northern portions of the Peel Plateau extend into the Northwest Territories.

## Regional Geology

The Peel Plateau lies at the northwest extent of the Western Canada Sedimentary Basin. It is underlain by a wedge of Cretaceous sedimentary rocks deposited in a foreland basin setting that unconformably overlies Paleozoic strata deposited in a continental margin setting. Strata of the

Peel Plateau range from Cambrian to Lower Cretaceous in age with a total thickness of four kilometres. An outline of the stratigraphy is shown in Figure 2.

The Peel Plateau region can be separated into two distinct geological regimes based on structural complexity: structural belts on the fringes of the mountains and a plains region. Strata adjacent to the Mackenzie and Richardson mountains have been disturbed by the Columbian and Laramide orogenic events. These disturbed strata occurring within an interval 10 to 45 km wide offer a diversity of structural traps. Beyond this area, strata are relatively undisturbed and blanketed by Cretaceous cover. A geological cross-section extending east-west through the plains region of the plateau shows the distribution of the units under the Cretaceous cover (Fig. 3).

## **Exploration History**

### **Seismic Surveys**

During the mid-1960's through to the mid-1970's over 3,000 line-kilometres of two-dimensional seismic data were acquired in the Yukon portion of the Peel Plateau. Seismic lines were concentrated within the disturbed strata zone flanking the Richardson and Mackenzie mountains. Digital data from NEB indicate that eight of these seismic lines intersect the nominated area, totaling 83 line-kilometres within the parcel (Fig. 1). No three-dimensional seismic has been run to date. The Peel Plateau has remained inactive for the past 23 years.

### **Exploratory Drilling**

Exploratory drilling in Yukon's Peel region concentrated along the Peel River drainage outboard of the disturbed zone, with no significant success. The first well (Shell Peel River YT J-21) drilled in the Peel Plateau, in 1965, was dry and abandoned. Eighteen additional wells, also abandoned, were drilled between 1965 and 1977, intersecting approximately 42 km of strata. One of these wells, Shell Peel River YT I-21 (TD 2072.6 m), lies abandoned within the nominated parcel.

### **Access**

Due to extensive wetlands and drainage features, surface access is most feasible during the winter when the ground, watercourses and water bodies are frozen. A network of historic trails and cut-lines were established during oil and gas seismic and well exploration in the 1960's and 1970's. The current condition of most of these is unknown. Most historic winter overland exploration access to this locality was from Fort McPherson, NWT.

Barges were also used to transport equipment and supplies to this region up the Peel River. However, lack of barges of appropriate size and antidotal evidence of lower water levels will make this option less viable.

This winter, DIAND and the Gwich'in Tribal Council (Rat River Development Corporation) have proposed the construction of a winter road east of the Peel River, from Fort McPherson southward. This proposed road will be located to the northwest of the call area, to access a waste site near the Shell Peel River YT J-21 well for clean up purposes. For the most part, it will follow existing cut-lines.

The recent issuance of an Exploration Licence (EL 415) on the NWT side of the border may also provide alternate access options to this region.

Access from the Dempster Highway, through passes in the Richardson Mountains, has not been explored as an option.

## Geological Mapping

The Geological Survey of Canada conducted 1:250,000-scale bedrock mapping in the Trail River map area (106L) during 1980 as part of Operation Porcupine. In 1984, Norris published a regional geological map for the northern Yukon and northwestern District of Mackenzie at 1:500,000-scale.

## Resource Assessments

An assessment of petroleum resource potential in the Peel Plateau was completed in 1999 by the National Energy Board and updated in November 2000. This report noted the following:

- Six conceptual plays, defined on the basis of structural complexity and lithology, are outlined and analyzed in the resource assessment. Five are oil and gas plays, one is gas only.
- The assessment identified the mean potential for 2.29 Tcf of marketable gas and 21.3 million barrels of recoverable oil in Peel Plateau.
- Paleozoic carbonate reservoirs are expected to contain over 80% of the marketable gas and over 88% of the recoverable oil.

A revised assessment, by the Geological Survey of Canada utilizing PETRIMES assessment methodology, is expected in early 2002.

## Reservoirs, Traps and Source

There are no producing zones in the Yukon's Peel Plateau; thus no proven reservoirs.

### Reservoirs

There are several potential reservoir types in the Peel Plateau region including:

- fractured or vuggy carbonates,
- fractured or porous clastics,
- isolated porous carbonate buildups, and
- pinch-outs of conglomerate and sandstone in a dominantly shale succession.

### Traps

Structural, stratigraphic and combination traps occurring in the Peel region include:

- broad, low-amplitude anticlines associated with the Late Cretaceous to early Tertiary Laramide Orogeny,
- thrust structures identified in the disturbed belt on the fringe of the plains,
- faulted coarse clastic rocks, and
- stratigraphic traps (i.e. carbonate to shale transitions).

### Sources

Source rocks identified in the Peel Basin include (youngest to oldest) (NEB, 2000):

<i>Stratigraphic Unit</i>	<i>Average %TOC</i>
Cretaceous Arctic Red Formation	1.17
Carboniferous Tuttle Formation	1.79
Devonian Imperial Formation/Ford Lake Shale	1.19
Devonian Canol Formation	3.73
Devonian Hare Indian Formation (Bluefish Member)	2.90
Devonian Hume Formation	1.92

## Data Sources

- **Landsat Images** –available from the Canada Centre for Remote Sensing (CCRS) (<http://www.ccrs.nrcan.gc.ca>).
- **Base Maps** – topographic base map NTS 106 L can be obtained from Natural Resources Canada (<http://maps.nrcan.gc.ca/topographic.html>).
- **Geological Information:** the Geological Survey of Canada has recently produced a CD-ROM in conjunction with the Yukon government with 1:250,000 scale data. Contact the Whitehorse Mining Recorder, phone (867)-667-3190.
- **Yukon Petroleum Resource Assessments** are available from Oil and Gas Resources Branch, Government of Yukon <http://www.yukonoilandgas.com>.
- **Well Information** is available from the National Energy Board and the Yukon government. Wells are named by operator/grid block name/unit letter – number – grid area (for example, Shell Peel River I-21-66-20-134-15). Peel River applies to a grid described by the northeast corner latitude (66°N) in 10 degree increments and the longitude (134°W) in 15 degree west increments. The grid area is further divided into 80 sections, and the section is divided into 16 lettered units. (See location scheme, Fig. 4).
- **Well Logs** are available from Oil and Gas Resources Branch, Government of Yukon (867)-667-3427, Geological Survey of Canada Calgary Core Facility, National Energy Board, M.J. Systems and International Datashare Corporation.
- **Cores** are stored at the Geological Survey of Canada Calgary Core Facility (phone: 403-292-7000).
- **Seismic Information** is available from the National Energy Board in microfiche form. See Figure 1 for a map of seismic lines-project numbers. (Commercial vendors also maintain data sets:
  - **SEG-Y (seismic) Data** available from Lynx Canada Information Systems. Phone (403)-269-7255 or email: [lynxcanada@home.com](mailto:lynxcanada@home.com).

## Key Publications

Dixon, J. 1996. Cretaceous and Tertiary. In: The Geology, Mineral and Hydrocarbon potential of Northern Yukon Territory and Northwestern District of Mackenzie. Geological Survey of Canada, Bulletin 422, p. 301-317.

Gordey, S.P. and Makepeace, A.J., 1999. Yukon Digital Geology. S.P. Gordey and A.J. Makepeace (comp.), Geological Survey of Canada, Open File D3826, Exploration and Geological Services Division, Yukon, Indian and Northern Affairs Canada, Open File 1999-1(D).

Hannigan, P.K., 2001. Petroleum Resource Assessment of the Arctic Circle/Dempster Highway Study Area. Whitehorse, Oil and Gas Resources Branch, Department of Economic Development, 80 p.

Link, C.M. and Bustin, R.M., 1989. Petroleum source potential and depositional setting of Phanerozoic strata in northern Yukon and Northwest District of Mackenzie. Bulletin of Canadian Petroleum Geology, vol. 37: 293-315.

Morrell, G. R., 1995. Petroleum exploration in Northern Canada: a guide to oil and gas exploration and potential. Northern Oil and Gas Directorate, Indian and Northern Affairs, Canada, 110 p.

Morrow, D.W., 1999. Lower Paleozoic Stratigraphy of Northern Yukon Territory and Northwestern District of Mackenzie. Geological Survey of Canada, Bulletin 538, 202 p.

National Energy Board, 2000. Petroleum Resource Assessment of the Peel Plateau, Yukon Territory, Canada. 2000 rev. ed. Whitehorse, Oil and Gas Resources Branch, Department of Economic Development, 64 p.

CD or paper copies can be obtained by contacting the Oil and Gas Resources Branch or visiting our website at [www.yukonoilandgas.com](http://www.yukonoilandgas.com).

Norris, D.K., 1981. Trail River, Yukon-Northwest Territories, Geological Survey of Canada, Map 1524A, scale 1:250 000

Norris, D.K., 1984. Geology of the northern Yukon and northwestern District of Mackenzie, Geological Survey of Canada, Map 1581A, scale 1:500 000.

Norris, D.K., 1997. Geology and Mineral and Hydrocarbon Potential of Northern Yukon Territory and Northwestern District of Mackenzie. Geological Survey of Canada, Bulletin 422, 401 p.

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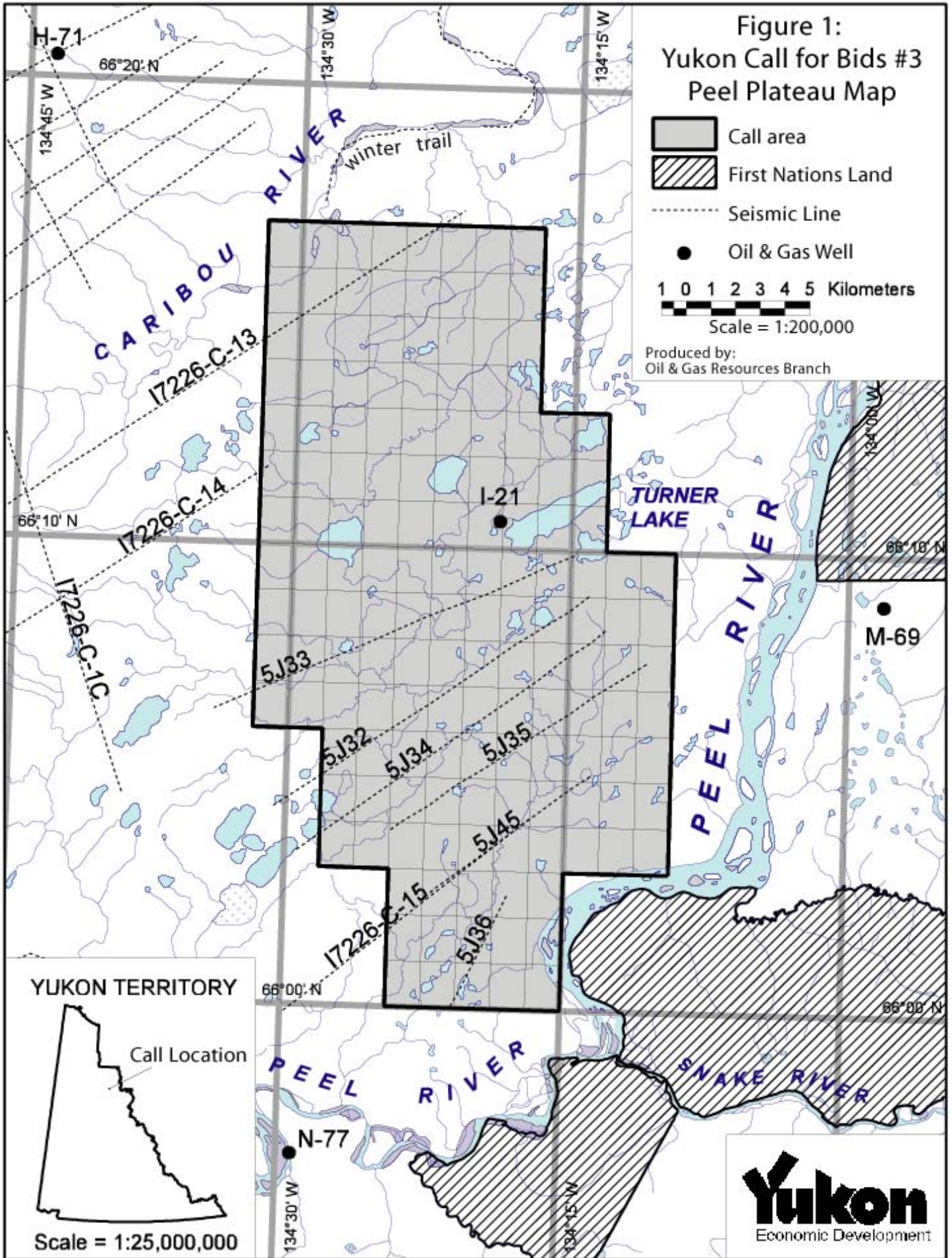
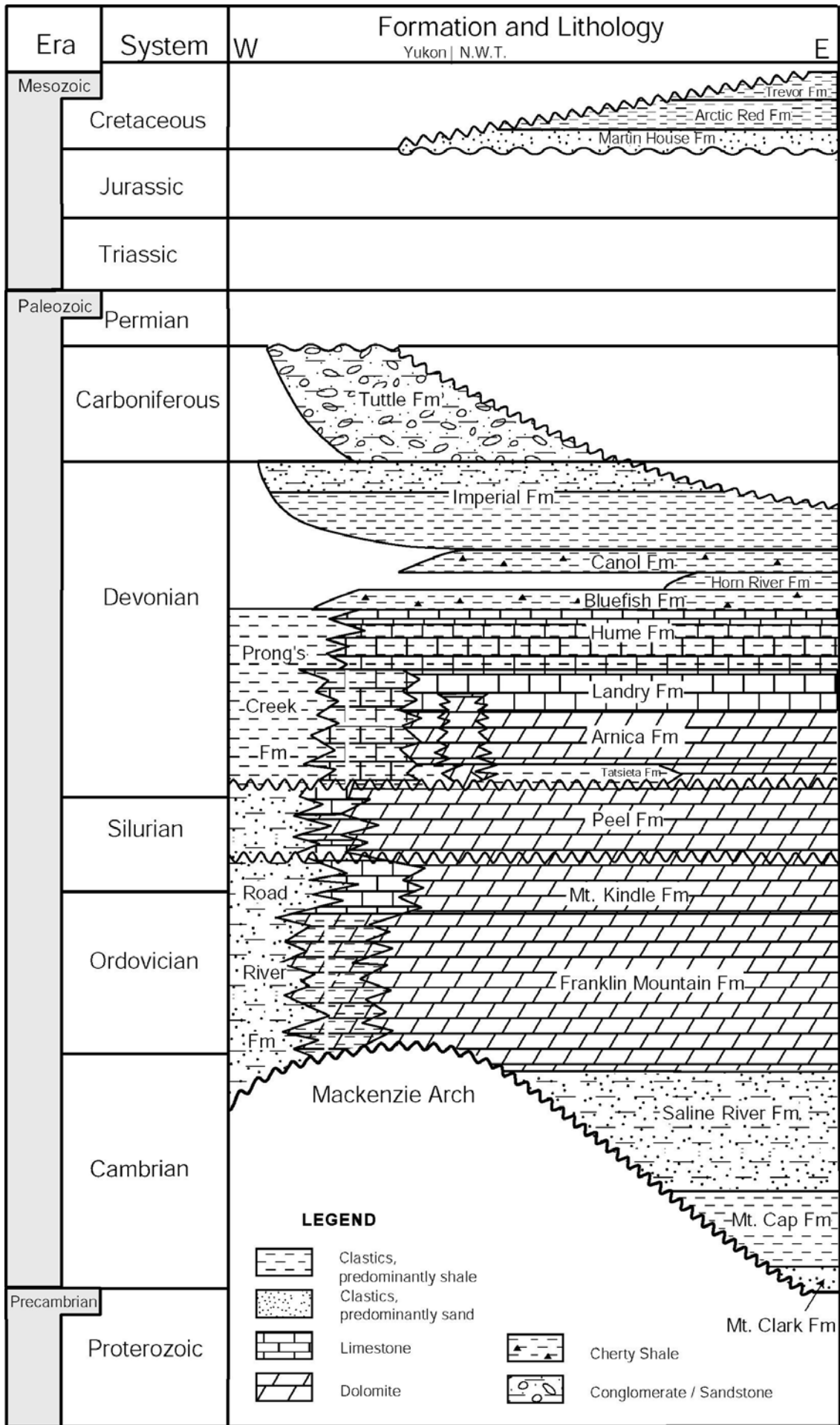


Figure 1: Location Map



Peel Plateau Stratigraphic Column

Figure 2: Stratigraphic Column (NEB, 2000)

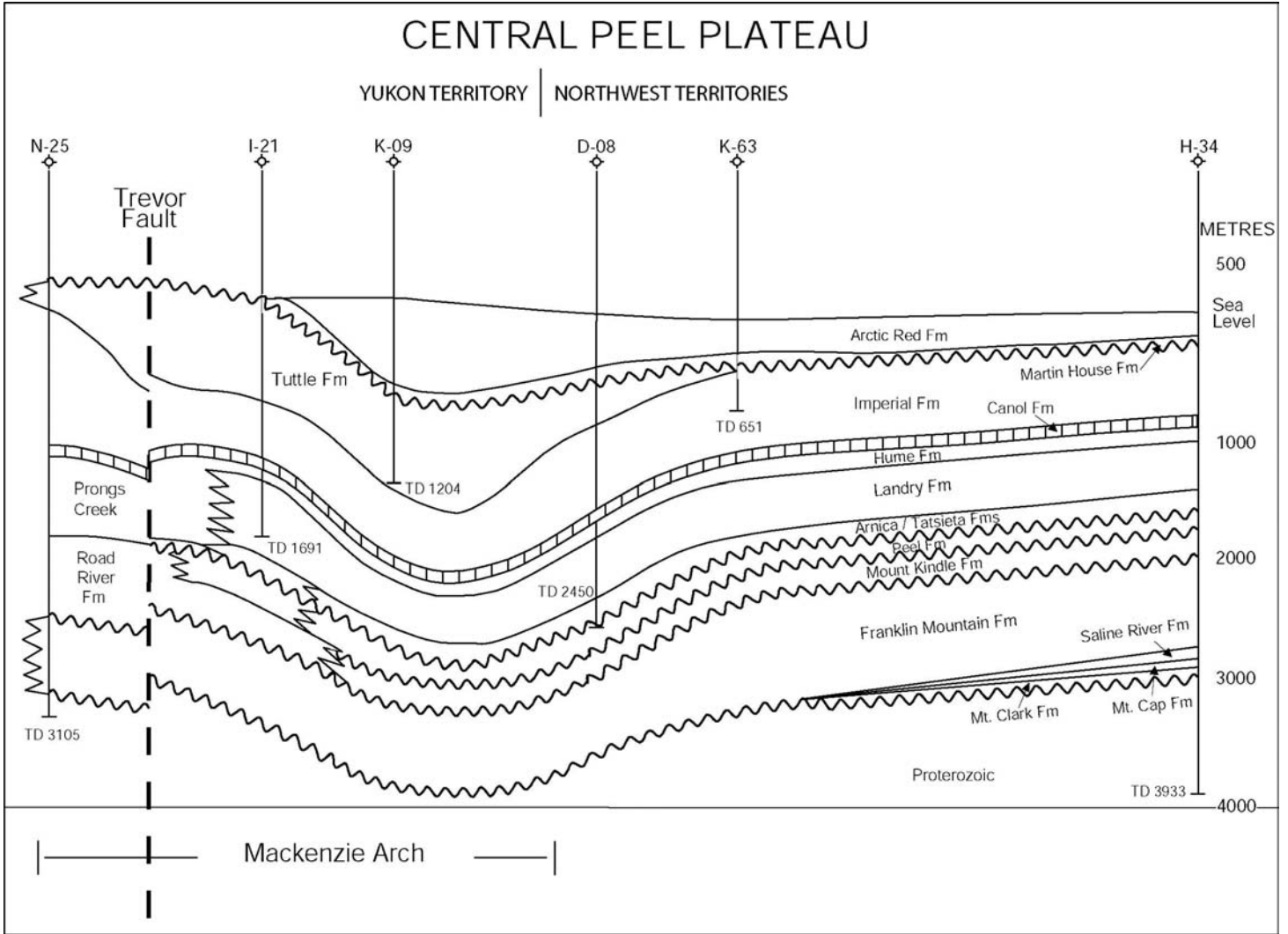
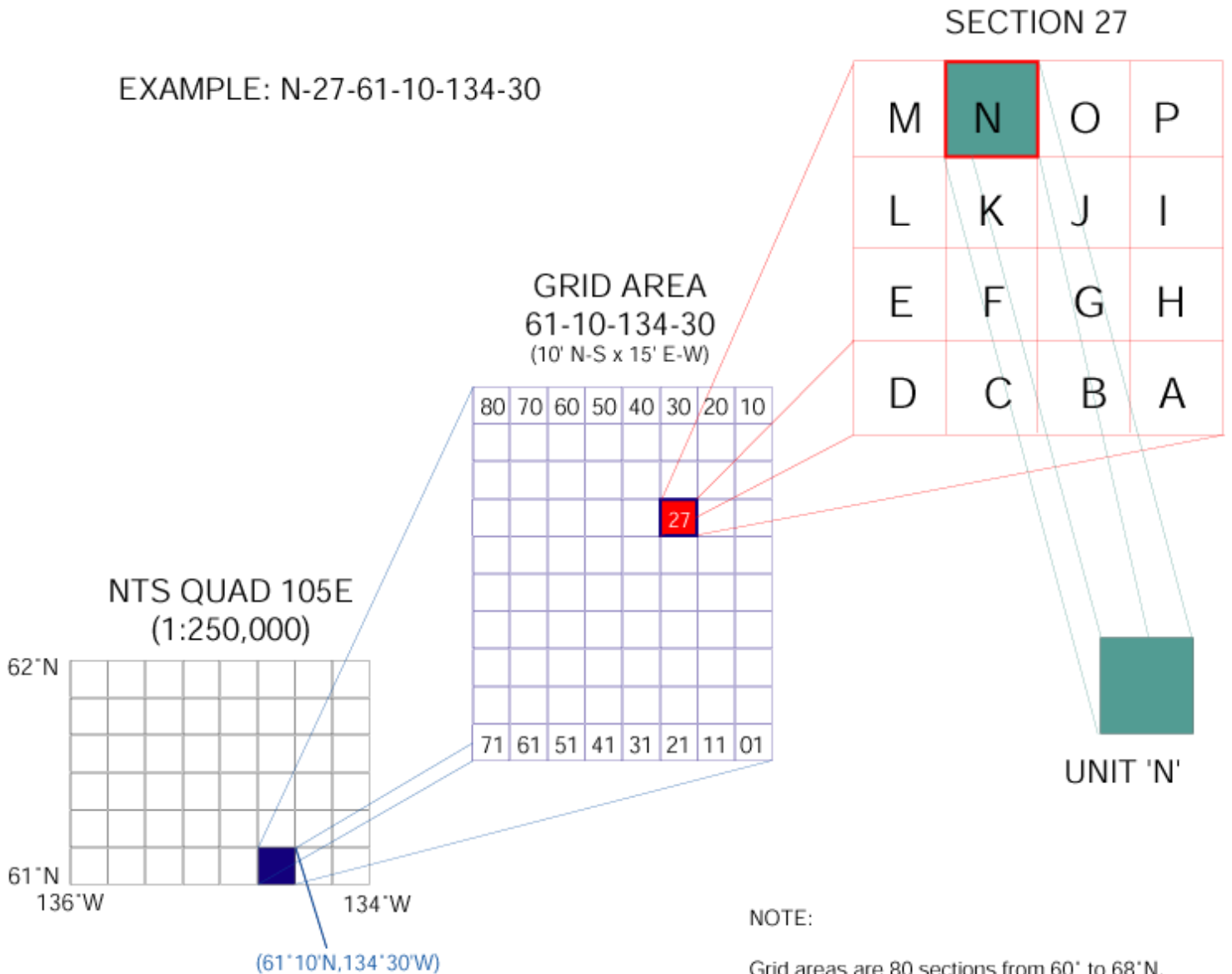


Figure 3. Diagrammatic cross-section through Peel Plateau (NEB, 2000)

EXAMPLE: N-27-61-10-134-30



NOTE:

Grid areas are 80 sections from 60' to 68'N.  
Grid areas are 60 sections from 68' to 70'N.