ILLUSTRATION 2

0230-72-1P

GEOLOGY
OF THE
N.W.T. FORT PROVIDENCE NO. 1 GAS DISCOVERY

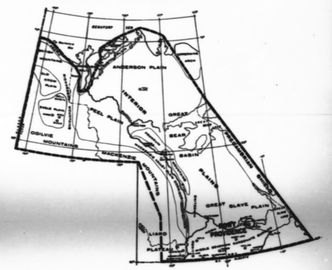
MIDDLE DEVONIAN CARBONATE BARRIER COMPLEX
GREAT SLAVE PLAIN
NORTHWEST TERRITORIES

DISCOVERY DATE · 1951

PREPARED BY
VEEZAY GEODATA (1977) LIMITED PARTNERSHIP
CALGARY, ALBERTA

1982

REGIONAL LOCATION MAP



1982 MACKENZIE BASIN CANADA LANDS EXPLORATION PROGRAM

WELL DATA SUMMARY
of
DISCOVERY WELL
N.W.T. PROVIDENCE NO. 1

LOCATION: Lat. 61° 29' 45" Long. 117° 37' 00"
Great Slave Plain, N.W.T.

ELEVATION: RB: 493' (150.0m) GL: 485' (147.8m)

SPUDDED: January 16, 1951

COMPLETED: July 30, 1951

STATUS: Suspended

TOTAL DEPTH: 1678' (511.0m)

LOGS RUN: None

CORED INTERVAL: 1504' - 1529' (458.7-465.9m) cores unavailable

DRILLSTEM TESTS: 1. 1492'-1517' (455.3m-462.8m) (Base Nisku Lonely Bay and Chinchaga) GTS at .250 mmcf/d (1.1 x 10³ /d 3 Hr. 45' (137.2m) gas cut mud.

RESERVOIR DATA

HYDROCARBON BEARING SECTION: Lonely Bay Formation of Middle Devonian age.

RESERVOIR ROCK: Cryptocrystalline to very finely crystalline limestone.

TRAP TYPE: A combined structural/stratigraphic trap localized along a northeasterly trending fault.

POTENTIAL PRODUCTIVE INTERVAL: 1315' - 1455' (399.3m - 443.0m)

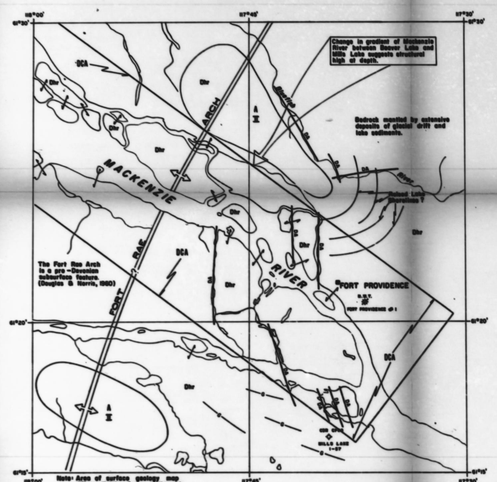
GAS CHARACTERISTICS: (volume percentage)

Carbon Dioxide	4.52
Methane	91.37
Ethane	0.12
Nitrogen	3.39
Helium	trace
Oxygen	.41
Total -	100.00 %

All other reservoir characteristics are unavailable.

SURFACE AREAL GEOLOGY AND STRUCTURAL INTERPRETATION MAP
OF THE
N.W.T. FORT PROVIDENCE # 1 GAS DISCOVERY
IN THE
GREAT SLAVE PLAIN

SCALE 1 : 100,000



LEGEND

AGE	SYMBOL	FORMATION
UPPER DEVONIAN	Dhr	Hay River Fm; Sh, ls, u. reef

GEOLOGIC SYMBOLS

Faults, fold axes and contacts are marked where clear; position is indicative, approximate where inferred, and dotted where concealed by post-orogenic deposits.

- Bedding appears horizontal on air photographs
- Trace of bedding in vertical exposure; dot denotes horizontal (dip measured 180-270° from trace of arrow)
- Recognizable dip 1° or less
- Dip group 1; 1° to 5°
- Dip group 2; 5° to 15°
- Dip group 3; 15° to 25°
- Dip group 4; 25° to 45°
- Dip group 5; 45° to nearly vertical
- Bedding appears nearly vertical on air photographs.
- Overturned bedding
- General dip of beds having subordinate folds
- Dip and strike, either of the same or different formations
- Dip component
- Dip measured photogrammetrically
- Strike and dip interpreted from geomorphic evidence
- Possible dip steps
- Strike line of accessory steps or benches
- Strike measured photogrammetrically or on air photographs
- Field observed information
- Field observed published or open file information
- Field observed dip from published or open file source
- Dip measured photogrammetrically
- Cleavage (inclined, vertical)
- Contact
- Apparent unconformable contact
- Dry hole
- Stratigraphic break
- Explosion locations
- Corrective map beds
- Outcrop area
- Fracture or joint
- Exploration alignment, possible structural significance
- High-angle fault, U denotes upthrown side
- Strike-slip fault showing direction of relative movement
- High-angle gravity fault; hold circles on downthrown side
- Thrust fault; triangles on upthrown side; barbs on hanging wall side
- Anticline, arrow shows plunge; diamond denotes culmination of an anticline
- Syncline, arrow shows plunge; dot denotes culmination of a syncline
- Axis of anticline appears to coincide with fault trace
- Axis of syncline appears to coincide with fault trace
- Structural terrace
- Monocline
- Prominent scarp, steep slope or horizontal ridge
- Site 100 or off 100
- Glacial striation showing direction of ice movement
- Facies and/or nomenclature change
- Location of Canada Topo-measured stratigraphic section
- Fault, anticline and syncline based on published or open file seismic information.
- Fault based on published or open file information

STRUCTURAL CONTOUR SYMBOLS

- Outline of detailed structural contour area
- 252 Datum elevation in meters from bore hole information.
- Stratigraphic thickness in meters measured photogrammetrically.
- Structure datum elevation calculated in meters and derived from structural elevation measured with a Zeiss PG 2 stereoscopic plotting instrument. Elevations in bore hole data which have been projected to datum using quantitative information derived photogrammetrically.
- 200 Structure contour in meters drafted where inferred
- Dip measured photogrammetrically.

GEOMORPHIC SYMBOLS

- Linear stream segment, interpreted on strike controlled
- Curvilinear stream segment, interpreted on structurally controlled
- Circle and dip interpreted from geomorphic evidence
- Joints and lineaments based on geomorphic evidence Arrow indicates direction of plunge
- Drainage density is a measure of stream length per unit area. Drainage density is classified as follows:
  - 0 - Nodal Drainage density
  - 1 - Jointed Drainage density
  - 2 - Photogenic Trend density
  - 3a - Radial-Jointed Drainage density
  - 3 - Topographic density
  - I - very well defined by geomorphic evidence
  - II - well defined by geomorphic evidence
  - III - moderately defined by geomorphic evidence.
- Drainage density is a measure of change in the nature and frequency of a feature or of some other map fact. Structural and/or lithological
- Trend of geomorphic evidence which may reflect an unfolded feature
- Glacial striation
- Dune or wind aligned ridge or furrow Arrow indicates predominant wind direction.
- Glacial meltwater channel

WELL SYMBOLS

- Location or drilling
- Dry and abandoned
- Oil well
- Gas well
- Oil with gas well
- Capped gas well
- Capped oil well
- Suspended well

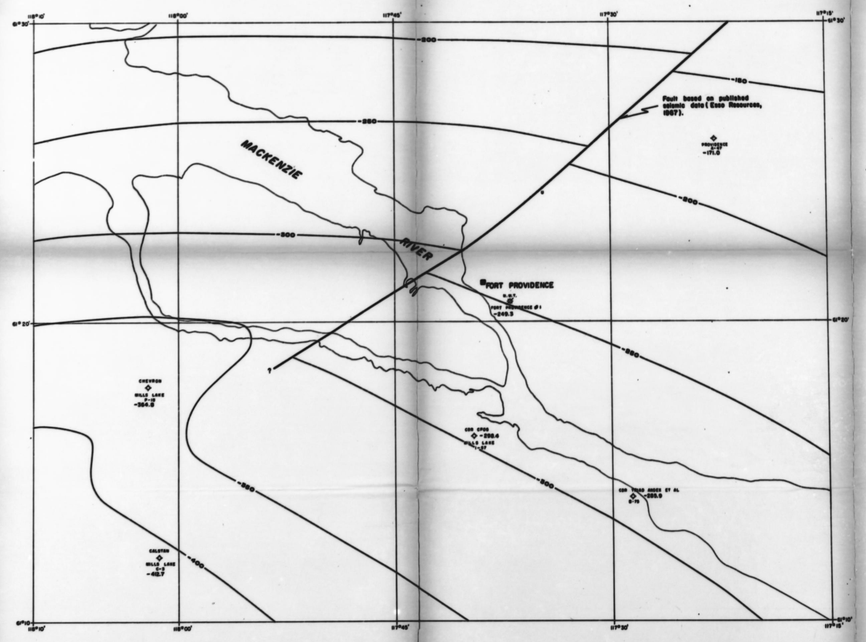
WELL INFORMATION AS OF JANUARY 1983

STRUCTURAL CONTOUR MAP OF THE FORT PROVIDENCE AREA

CONTOUR INTERVAL · 50 METERS

STRUCTURAL DATUM · TOP OF LONELY BAY FORMATION OF MIDDLE DEVONIAN AGE

SCALE 1 : 100,000



STRUCTURAL GEOLOGY
of the
FORT PROVIDENCE, N.W.T. NO. 1 GAS DISCOVERY

The Fort Providence N.W.T. No. 1 gas discovery lies north of the Middle Devonian carbonate barrier complex in the Great Slave Plain. This geomorphic, tectonic and structural zone runs from between the Canadian Shield on the east and the Cordilleran zone on the west. Bedrock consists of mainly Cretaceous and Upper Devonian clastics, and the plain is surmounted in places by isolated occasional remnants of Cretaceous sandstones. Regionally, Paleozoic strata dip gently westward at the rate of 3 m/km to the Lizard Range line where the rate of dip of the sediments increases to 20 m/km to the east of the Fort Providence map area. Paleozoic strata dip southwest at about 5 m/km.

Major epeirogenic earth movements have caused high angle faults and associated flexures in this area. The Various orogeny of late Devonian time and the Laramide orogeny of late Permo-Triassic to early Tertiary time may have contributed to this orogenesis. This probably is responsible for the structure of the area along with renewed movement on previously established Precambrian fault zones.

A second, northeasterly trending structural pattern is evident in this area. Lineaments and faults of this trend are evident on the map and have glacial deposits with characteristics of underlying bedrock. Distinctive alignments mapped in the area may be reflections of underlying structure which is related to northeasterly trending Precambrian fault and flexure zones which were reactivated throughout subsequent periods of tectonism. Lineaments and structural features of this trend are recent and perhaps inactive. This northeasterly trending structural fabric plays an important part in hydrocarbon entrapment in the southern Mackenzie Basin. Laramide structures provide traps, and in addition, reservoir characteristics are enhanced by fracture porosity created by this orogenesis.

In the Fort Providence area the dominant structural element is a northeasterly trending fault downthrown to the northwest which has been outlined by published seismic surveys. The fault has little surface expression being obscured by extensive glacial drift and lake deposits. This fault is mapped near the culmination of the Fort Sue Arch which trends northeast. The Fort Providence structure (part of the Fort Sue Arch) is represented by a gentle warping of the beds and is believed to be of pre-Devonian origin.

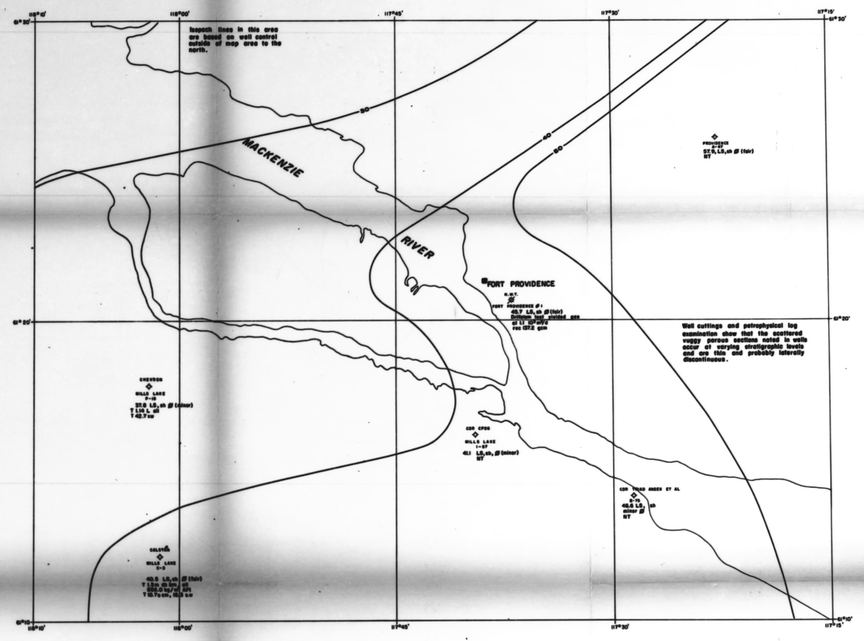
Northeasterly trending faults are associated with similar dominant trends present to the south, which affect sediments present in the Middle Devonian carbonate barrier complex. The throw on this fault is approximately 60 m which is sufficient to supply some structural closure and may assist in the trap in the Fort Providence well.

The potential for additional hydrocarbon traps in this area is probably limited to structural/stratigraphic traps in the Devonian and associated with facies and/or stratigraphic changes in conjunction with reliever anticlines. Fracture porosity would play an important part in reservoir characteristics. Because of the lack of widespread porosity present in the Lonely Bay Formation, any such accumulations would probably be small.

STRATIGRAPHIC MAP OF THE LONELY BAY FORMATION OF MIDDLE DEVONIAN AGE

FORMATION ISOPACH INTERVAL · 10 METERS

SCALE 1 : 100,000



STRATIGRAPHIC LEGEND

- Depositional or erosional limit of stratigraphic unit prior to buried by overlying units.
- Facies change
- Unconformity
- Isopach contours in meters
- Geologic cross section

WELL INFORMATION AS OF JANUARY 1983

DRILLSTEM TEST ABBREVIATIONS

T	Tested
f	fresh
g	gas, gassy, gas-cut
m	mud, muddy
o	oil, oily, oil-cut
cond	condensate
w	water, watery, water-cut
s	salt, salty, (incl. brackish).
NT	Well was not tested.
NAT	Not adequately tested
NATm	Not adequately tested due to minrun

SAMPLE CONTROL STATIONS

Thickness of Lonely Bay Fm
DOLOMITE + secondary lithologies
◇ 65.2 L.S. Ss.-Dolomite test results for porosity (%)
porosity grade

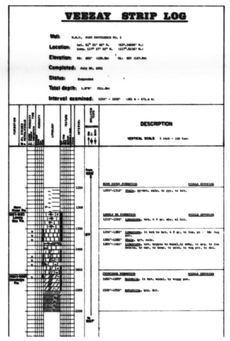
STRATIGRAPHIC SUMMARY
of the
LONELY BAY FORMATION
in the
FORT PROVIDENCE N.W.T. NO. 1 DISCOVERY WELL

The Fort Providence N.W.T. No. 1 discovery well lies 10 km north of the Middle Devonian carbonate barrier complex front in the Great Slave Plain. Small quantities of shut-in natural gas were recovered from Lonely Bay Formation limestones. These cryptocrystalline to very finely crystalline limestones have secondary porosity which has been estimated at less than 6 percent. This Middle Devonian formation ranges from 20 m to 60 m in thickness in this area and is from Eifelian to early Givetian in age. It thins to the northeast, and isopach lines parallel a major northeasterly trending fault mapped in this area suggesting fault movement contributed to sedimentation patterns. Stratigraphically, the Lonely Bay Formation gradationally overlies the early Middle Devonian Chinchaga Formation and underlies the late Middle Devonian Hare River Formation. The Lonely Bay Formation is correlative with the Lower Hay River Formation. The term Lower Hay River Formation is used for rocks inside the carbonate barrier complex.

The limestones represent deposition in a poorly aerated, shallow water, low energy environment. Stratigraphic relationships, faunal assemblages, sedimentary criteria in addition to slightly bituminous shales support this broad interpretation. The Lonely Bay in the Fort Providence area was deposited over a broad platform overlying Chinchaga anhydrites. Both the scattered porosity and permeability are believed good. A drillstem test indicated a maximum gas flow rate of 1.1 10³ m³/d (40 mcf/d).

Potential hydrocarbon source rocks are the Middle Devonian Hare River shales and bituminous zones in the Lonely Bay Formation itself. From published seismic data a northeasterly trending fault downthrown to the northwest has been outlined in the Fort Providence area. This fault, in the Fort Providence N.W.T. No. 1 discovery well, and is interpreted as having a vertical displacement of approximately 60 m. The upthrown side on the southeast may provide structural closure. Seismic interpretation suggests that the upthrown side could be prospective for localized hydrocarbon traps in the Paralel fault zone present perhaps in conjunction with reliever anticlines.

Because of the lack of good reservoir characteristics any additional hydrocarbon accumulations would probably be small.

VEEZAY STRIP LOG

Well: N.W.T. FORT PROVIDENCE NO. 1
Location: Lat. 61° 29' 45" N. Long. 117° 37' 00" W.
Lsd. 11-27-117-17 W.6M.
Elevation: RB: 493' (150.0m) GL: 485' (147.8m)
Completed: July 30, 1951
Status: Suspended
Total depth: 1,678' (511.0m)
Interval examined: 1504' - 1529' (458.7 - 465.9 m)