



FRONTISPIECE



Homocline formed in Middle Devonian Carbonates.
About three miles northwest of Permit 2859.
View to the north.

GEOLOGICAL REPORT
on
PERMIT 2859
NORTHWEST TERRITORIES

PREPARED FOR
PAYSON-COWELL SYNDICATE

by

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GEOLOGICAL MAP of Permit 2859, scale 1 inch = 2 miles - in Pocket

INTRODUCTION

LOCATION AND ACCESSIBILITY OF PERMIT AREA

Permit 2859 ($62^{\circ} 00' \text{ N} - 10' \text{ N}$; $123^{\circ} 30' - 45' \text{ W}$) is located on North Nahanni River about ten miles south-southwest of the Camell Bend of Mackenzie River. The area can only be reached by helicopter or float plane. The nearest base of supplies is Fort Simpson, located about seventy miles east-southeast of the permit area on Mackenzie River. Fort Simpson is connected with Fort Nelson, British Columbia by a winter road. The town has an air strip served by Pacific Western Air Lines and docks for float planes and barges.

The topography of the area reflects the structure of the underlying rocks and their relative resistance to weathering. The most important structure is a north-trending syncline or basin the low point of which lies in the central parts of the permit. The flanks of the syncline are composed of Middle Devonian carbonates which form the mountain ranges that border the permit area to the east and to the west. These mountains rising to altitudes of more than 4,000 feet are rugged and carry comparatively little vegetation. The valley of

North Nahanni River, which for a large distance is underlain by the weakly resistant shales of the Fort Creek Formation trends along the foot of the mountains. In the southern part of the permit the North Nahanni River forms a huge U-shaped turn. Inside of the turn there are intermediate hills, 1,000 - 2,000 feet in altitude which are formed in moderately resistant limestones, siltstones and shales of the Imperial Formation. These rocks, occupying the trough of the syncline, are the youngest strata in the area. A broad valley in the centre of the syncline, occupied by swamp, ponds, and small lakes suggests a recessive shale member at the top of the preserved Imperial section. Most of the permit is covered by forest. Swampy areas carry black spruce; on dry ground white spruce is dominant. In the valley of North Nahanni River there are some stands of poplar.

TYPE AND SCOPE OF SURVEY

Purpose of the study was to prepare a geological map of the surface and to evaluate the hydro-carbon potential of the permit. The work was carried out from Fort Simpson by means of a G-model helicopter supplied by Bullock Wings and Rotors Ltd. The geological work was done by Dr. H. P. Trettin, the helicopter was operated by C. H. Bullock pilot and R. L. McNevin, engineer. As most of the permit area is covered by forest, landing places for the helicopter are limited to the shores of North Nahanni River. Most of the time was spent on foot traverses to see some of the outcrops. Low hanging clouds prevented stratigraphic studies in the higher mountains.

GEOLOGY OF THE PERMIT

STRATIGRAPHY

Cambrian

No Cambrian rocks crop out in the vicinity of permit 2859. The nearest Cambrian rocks described occur in the Cap Mountains northeast of Fort Wrigley and in the vicinity of Clark Mountain, twenty miles east of the confluence of the Keele and Mackenzie rivers. Williams (1923, p. 738) has subdivided these strata in the following formations:

Saline River Fm.
(Middle Cambrian)

Banded calcareous shales with interbeds of red and green shale. 300' \pm

Red and gray shale containing salt and gypsum and selenite. 200' \pm

Mount Cap Fm.
(Middle Cambrian)

Gray and green fissile shales; red sandstone and shale. 200' \pm

Mount Clark Fm.
(Lower Cambrian)

Pink and red quartzite. 500' +

Red shale and ferruginous sandstone. 50'.

Hematite, red conglomerate, and sandstone. 70' +.

(Precambrian?)

Dark shales. 150'.

Gray and drab shales. 225'.

Silurian and Ordovician

Little information is available about the Ordovician and Silurian in the vicinity of the permit. In the Nahanni Range, south of the permit area, the post-Cambrian pre-Devonian strata consist predominantly of dolomite and have been subdivided in two members. The lower unit is reefal and composed of dark grey, crypto-crystalline, dense, massive dolomite. Fossils collected in these rocks indicate a Middle to Upper Ordovician age. In Red Rock Pass this unit is approximately 350 feet thick. The upper member, which is approximately 900 feet thick is made up of grey, dense, crypto-crystalline, well bedded dolomites. The upper part is siliceous and argillaceous and grades to dolomitic argillite. Poorly preserved fossils found in this unit were originally considered as Silurian but may be Ordovician. In the Mackenzie River area, in the general vicinity of Norman Wells, all post-Cambrian, pre-Devonian rocks were referred by Hume (1954, p.14 ff) to the Silurian Ranning group. However, new fossil identifications indicate that a substantial part of the Ranning group actually is Ordovician in age.

A partial section of the Siluro-Ordovician of this area

was measured by the writer near the head-waters of Summit Creek, north of Keele River and is included in the report on permits 2853 and 2854. The section covers more than 1,000 feet of dolomite. The lower part, 600 feet in thickness, is composed of sandy, silty, argillaceous, and pure dolomite which ranges in grain size from very fine micro-crystalline to fine crystalline. Algal (?) laminations, pellets, and intraformational conglomerates are characteristic of this unit which probably originated in a shallow water environment. The upper 400 feet is composed of micro- to crypto-crystalline, partly argillaceous, thin-bedded to massive dolomite that contains Upper Ordovician fossils. No significant porosity was observed.

At Mount Charles, in the Franklin Mountain Range, M. Y. Williams (1923, p.74) established the following Silurian stratigraphy.

Mount Kindle Fm.
(Middle Silurian)

Hard, light gray dolomite, thin bedded, cherty in lower 70 feet.
180'.

Chert, probably silicified dolomite.
60'.

Unfossiliferous beds. 30'.

Grey, magnesian limestone containing
Niagara corals. 210'.

Franklin Mountain Fm.
(Lower Silurian)

Grey, magnesian limestone. 470'.

Limestone and chert, pebbles and grit
in limestone matrix. 75'.

Grey limestone. 120'.

Cavernous limestone. 200'.

Possibly a re-identification of the fossils may lead to a
different chronology.

These data suggest that Ordovician and (?) Silurian
rocks are present in the sub-surface of permit 2859. Most likely they
are carbonates, perhaps predominantly dolomite, and their total
thickness may be of the order of 1,300 feet. Nothing can be said
about the porosity of these units.

Middle Devonian

Lone Mountain Formation

In the Nahanni Range, near Camell Bend, the Middle
Devonian Ramparts Formation is underlain by a thick sequence of un-
fossiliferous carbonates. Kindle and Bosworth (1921, p.448) considered

these strata as Silurian and named them "Lone Mountain Formation". However, in the Nahanni Range, south of the permit area, a Devonian fossil has been found in strata equivalent to the Lone Mountain Formation. The Bear Rock Formation of the Norman Wells area, which is probably correlative with the upper part of the Lone Mountain Formation, is now also being considered as Devonian (Basset, 1960). As no Lower Devonian fossils have as yet been collected in western or north-western Canada (Martin, 1959, p.2415) the Lone Mountain Formation probably is Early Middle Devonian in age. It seems reasonable to include with that formation all Devonian strata of the Mackenzie-Nahanni area that are younger than the Ramparts Formation.

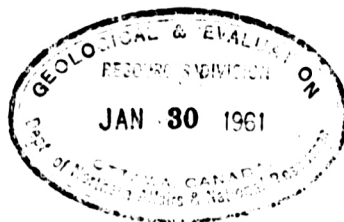
On Lone Mountain which lies about three miles east of permit 2859 Kindle and Beaworth (1921, p.448) measured the following section of Lone Mountain strata:

Light grey, to dark almost black dolomite and magnesian limestone, mostly fine grained but with some beds of saccharoidal texture. Fossils rare or absent. 1,500' ±.

Massive, dark grey limestone, some beds mottled with dark colored dolomite, corals present. 50' +.

PRELIMINARY REPORT
on
THE GEOLOGY
of
PERMIT 2859

YUKON TERRITORY



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PAYSON-COWELL SYNDICATE

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INTRODUCTION

Location and Accessibility of Permit Area

Permit 2859 ($62^{\circ} 00' - 10' N$; $123^{\circ} 30' - 45' W$) is located on North Nahanni River, about ten miles south - southwest of the "Camsell Bend" of Mackenzie River. On the east the permit area is flanked by the Nahanni Range with Mountains of more than 4,000 feet of altitude, on the west it is flanked by a range of about 3,500 feet altitude. The topography of the permit is characterized by a U-shaped turn of North Nahanni River and by intermediate hills 1,500 to 2,000 feet in altitude. The area can only be reached by helicopter and float planes. The nearest base of supplies is Fort Simpson, located about seventy miles east - southeast on Mackenzie River. Fort Simpson is connected with Fort Nelson, B.C. by a winter road. The town has an air strip and docks for float planes and barges.

Type and Scope of Survey

Purpose of the study was to prepare a geological map of the surface and to evaluate the hydro-carbon

potential of the permit. The work was carried out from Fort Simpson by means of a Model G Bell helicopter supplied by Bullock Wings & Rotors Ltd. The geological work was done by Dr. H. P. Trettin, the helicopter was operated by C. H. Bullock, pilot and R. L. McNevin, engineer. As most of the permit area is covered by forest, landing places for the helicopter are limited to the shores of North Nahanni River. Most of the time was spent on foot traverses to see some of the outcrops. Low hanging clouds prevented stratigraphic studies in the higher mountains. The work was done on September 22 and 24, 1960.

GEOLOGY OF THE PERMITS

STRATIGRAPHY

No Cambrian rocks crop out in the vicinity of the permit. The nearest Cambrian rocks reported occur in the Cap Mountain area, northeast of Fort Wrigley and in the vicinity of Clark Mountain, about 20 miles east of the confluence of Keele River with Mackenzie River. The stratigraphic sequence of these rocks is as follows:

Saline River Formation - Banded calcareous shales
(Middle Cambrian) with interbeds of red and
green shale 300'±

Mount Cap Formation - Grey and green shales;
(Middle Cambrian) red sandstone and shale
200'±

Mount Clark Formation- Pink and red quartzite
(Lower Cambrian) 500'±

Red shale and ferruginous
sandstone 50' hematite,
red conglomerate, and
sandstone 70'±

(Pre-Cambrian?) Dark shales 150'
Grey and drab shales 225'

No rocks of Ordovician age have been identified in the Camsell Bend area, but perhaps some of the rocks assigned to the Silurian actually are Ordovician in age.

About 1,800 feet of largely unfossiliferous carbonates, underlying Devonian strata on Lone Mountain about six miles east-northeast of the permit, have been assigned by Kindle to the Lone Mountain Formation. The upper part of this section consists of 1,500 feet ± of "light grey to dark, almost black dolomite and magnesian limestone, mostly fine grained with some beds of saccharoidal texture;

fossils rare or absent". These rocks are underlain by over fifty feet of "massive, dark grey limestone, some beds mottled with dark coloured dolomites; corals present."

On Lone Mountain the Lone Mountain Formation is overlain by Middle Devonian limestones described as follows:

Grey limestone, somewhat lighter colored than underlying unit; fossils present. 130'

Dark grey limestone, (Devonian). Fossils common; Productella is the dominant species. Favosites and other corals rather common. 80'

On the mountains south of Lone Mountain, Kindle's lower coral zone is overlain by approximately 500 feet of Middle Devonian carbonate. Some of the dolomite that underlies that zone may also be Devonian in age.

The Middle Devonian limestone is overlain by little resistant dark, bituminous shales that are usually between 1,000 and 2,000 feet thick. These shales are probably Upper Devonian in age and correlative with the Fort Creek Formation. The shales are poorly exposed in the permit area and crop out at only a few localities on North Nahanni River.

The dark shales are overlain by a fossiliferous sequence of shale, limestone, and siltstone of Upper Devonian age which underlie the middle and upper levels of the hills in the permit area. The limestones of this succession are fossiliferous and several collections were made which are presently being identified by Dr. S. J. Nelson of the University of Alberta in Edmonton. Lists of his fossil identifications will be included in the final report.

STRUCTURAL GEOLOGY

The major structural feature of the permit is a north-trending syncline or basin. The low point of this basin probably lies in the northern central parts of the permit. East of North Nahanni River the eastern limb of the syncline dips very steeply, about sixty degrees and more, to the west. In the other parts the dips are moderate to gentle. The syncline is separated from nearly flat lying strata to the east in some localities by a fault, in others by a sharp flexure.

In the central parts of the syncline, within the permit area, mostly Upper Devonian shales, limestones and siltstones are exposed. The flanks of the syncline are formed in thick Middle Devonian to Silurian limestones and dolomites.

CONCLUSIONS

The stratigraphic section of the permits contains some possible source rocks and some possible reservoir rocks but the structure of the area is unfavourable for accumulations of hydro-carbons. Under normal stratigraphic conditions hydro-carbons if present would have migrated from the basin of the permit area towards the structural highs in the adjacent mountain belts. But in these mountains Upper Devonian strata have been removed by erosion and Devonian and Silurian rocks are exposed at the surface. Therefore, it is probable that such hydro-carbons have been destroyed by erosion. However, if there were stratigraphic traps, such as local reefs, in the subsurface of the permit oil and gas may be concentrated here. Nothing is known about such reefs at present. The problem would require extensive facies studies in the Devonian and Silurian carbonates of the Nahanni and Mackenzie River areas.


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