5

PRELIMINARY REPORT

on

THE GEOLOGY

of

PERMITS 2853 and 2854
NORTHWEST TERRITORIES

PREPARED FOR

PAYSON-COWELL SYNDICATE

by

Hans P. Trettin, Ph. D.

D. Bruce Bullock & Associates Ltd.

Consulting Geologists
CALGARY, Alberta

INTRODUCTION

Location And Accessibility Of Permit Area

Permit 2853 (64° 10' - 20' N; 125° 45' - 126° 00' W) is located north and south of Keele River and approximately thirty miles west of the Mackenzie River. It lies in the front range of the Mackenzie Mountains. The topography is characterized by northwesterly trending ridges formed in Devonian to Tertiary rock which have altitudes up to 3,000 feet and by the broad valleys of Keele River and its tributary Summit Creek. Most of the area is covered by trees, predominantly spruce. Only a few limestone ridges rise above timberline which lies near 2,500 feet of elevation. The local relief exceeds 200 feet.

Permit 2854 (64° 00' - 64° 05' N, 124° 45' - 125° 00' W) has only intermediate hills and plateau like surfaces. The altitudes range from approximately 500 to perhaps 1,500 feet. This permit is almost completely covered by forest or burnt over forest with secondary growth. Except for an old winter road leading from Mackenzie River to the

site of Redstone River #1 well about ten miles northeast of permit 2854 there are no roads in the area. It can only be reached by helicopter and float planes. The nearest base of supplies is Fort Norman which lies approximately fifty miles north of the permit area.

Purpose And Scope Of Survey

Purpose of the study was to prepare a geological map of the surface of the permits and to evaluate their hydro-carbon potential. The operation was based on Stewart Lake and was carried out by means of a Model G Bell helicopter. The camp was served by a Norseman float plane. Both aircraft were supplied by Bullock Wings & Rotors Ltd. The permits were mapped from the air and on the ground and this work was supplemented by photo-geologic work. Some additional stratigraphic studies were carried out. As landing spots are limited to the shores of rivers and larger creeks and to the peaks of high mountains, several foot traverses had to be made and the work was accordingly slow.

The field party consisted of Dr. H.P. Trettin, geologist, C.H. Bullock, helicopter pilot, R.L. McNevin, helicopter engineer, D.M. Christensen, Norseman pilot, and J. Umscheid, cook. C.H. Bullock also assisted in the stratigraphic work. Work was carried out during the period September 14 through September 21, 1960.

Some faunal collections were made and these are presently being identified by Dr. S.J. Nelson of the University of Alberta in Edmonton. His fossil identifications together with some detailed stratigraphic data and a geological map will be included in the final report.

GEOLOGY OF THE PERMITS

STRATIGRAPHY

The oldest rocks in the area north of Keele River are referred to the Katherine group which is Cambrian or older in age and consists of quartzite and bituminous shales.

All rocks of the Macdougal Mountains that could definitely be assigned to the Cambrian are included with the Macdougal group. This group is approximately 1,000 feet thick and consists of limestone, shale, and minor sandstone. Middle and Upper Cambrian fossils have been found in these rocks. In the Cap Mountains northeast of Fort Wrigley, and in the vicinity of Clark Mountains about twenty miles east of the confluence of Keele and Mackenzie Rivers the Cambrian system is represented by the Lower Cambrian Mount Clark quartzite, the Middle Cambrian Mount Cap shales, and the Middle Cambrian Saline River shales.

No Ordovician rocks have as yet been reported but some of the strata assigned to the Silurian are perhaps Ordovician in age.

The Silurian rocks of the Norman Wells area are referred to the Ronning group. Near Fort Norman, Stelck measured 600 feet of thin-bedded limestone and dolomite with shale most abundant near the base and with streaks of gypsum. In Redstone River #1 well, 714 feet of limestone and anhydrite were penetrated. In the vicinity of Ration Creek, about twenty miles northeast of the permit area the writer measured a section of more than 1,000 feet consisting largely of dolomite which contains some Silurian (?) chain corals in the upper part.

Of special interest for petroleum exploration is the early Devonian (?) Bear Rock formation which rests on the Silurian with unconformity. It is made up of brecciated dolomite and/or limestone with locally associated anhydrite. In some parts of the Norman Wells area the Bear Rock Formation is reported to have a good porosity. Published data about

the thickness of the Bear Rock Formation within the area of the Canol project range from about 220 feet to 800 feet. The log of Redstone River #1 well reports 652 feet of dolomitic limestone. On Mount Haywood, about twenty miles south of the permit area the writer examined several hundred feet of the upper part of that formation. The section consists of predominantly massive, partly brecciated micro- to crypto-crystalline limestone which has a trace to poor vuggy porosity.

The Bear Rock Formation is overlain by the Middle Devonian Ramparts Formation. In the Imperial Range and Norman Wells area the Ramparts Formation was subdivided into three units, a lower limestone member, the Middle Hare Indian Shale, and an upper limestone. These subdivisions can probably be recognized in permit 2853 but become indistinct in the vicinity of permit 2854. On Mount Haywood the writer measured more than 1,200 feet predominantly of micro- to crypto-crystalline, partly argillaceous, well bedded limestone interbedded with several

covered recessive units which probably consist of shaly limestone and limestone and shale.

The Upper Devonian series has been subdivided into two major units: The older Fort Creek Formation and the younger Imperial Formation. The Fort Creek Formation typically consists of dark shale. In the Norman Wells area there are some productive reefs which were included, by the Canol geologists, with the Fort Creek Formation but are included by others (Basset, 1960) with the upper part of the original Ramparts Formation. In the vicinity of Redstone and Keele Rivers such reefs have not been observed. Redstone #1 well penetrated 970 feet of dark shales referred to the Fort Creek Formation. On Dahadinni River, Bath reported approximately 1,000 feet of Fort Creek shales made up of an upper part of soft grey shales and a lower part of harder, more resistant, black bituminous shale.

In the vicinity of both permits the Imperial Formation consists predominantly of shale and siltstone with some sandstone and limestone.

In Redstone River #1 well the Imperial Formation is 1, 140 feet thick.

The Cretaceous rocks of the permit area have a minimum thickness of about 500 feet. Most of these rocks are covered by vegetation, but there are ledge forming strata of friable quartzitic sandstone that have fair porosity.

Outcrops of Tertiary rocks are scarce and limited to poorly consolidated friable sandstone with minor siltstone, shale and pebble conglomerate. Perhaps these rocks are Eocene in age.

STRUCTURE

Surface exposures in this permit range from Devonian to Tertiary in age. Most of the permit is occupied by two major northwesterly trending anticlines with a syncline in between. The southwestern anticline probably is bounded on its northeastern limb by a steeply dipping fault. The northeastern limb shows dips of sixty degrees. In the core of this fold most of the Ramparts Formation and perhaps some Bear Rock strata are exposed. In the core of the northeastern anticline there are surface exposures of Ramparts limestones. The high point of the fold probably lies southeast of the permit.

Permit 2854

Except for a belt of Cretaceous rocks along Redstone River most of this permit probably is underlain by Tertiary rocks. There are very few exposures of these rocks and they are so little resistant to weathering that their structure is only poorly expressed in the topography. To the northeast and to the west of the permit, northwesterly trending anticlines have been mapped. Northwest of the permit dips of about forty degrees have been observed, east of the permits at the Big

Bend Anticline, the dips are approximately seven degrees. It is probable that the permit is underlain by one or several northwesterly trending intermediate to gentle folds, but the structure of the area can only be worked out by seismic exploration or by test hole drilling.

CONCLUSIONS

The Cambrian, Devonian, Cretaceous and possibly the Silurian and Ordovician systems contain possible source rocks of oil and gas. The only promising reservoir rocks seen are Cretaceous sandstones but the Bear Rock Formation and the Silurian may also have some porosity. The structure of permit 2854 can only be solved by seismic work or by test hole drilling.

In permit 2853 there are two major anticlines but neither of them is promising as a trapping structure for hydro-carbon. In the core of both folds, several hundred feet or more of Ramparts limestone are exposed so that the petroleum possibilities would be restricted to early Middle Devonian and older reservoir rocks. The anticline in the western part of the permit is complicated by faults and shows very steep dips on the northeastern limb. The high point of the eastern anticline probably is located southeast of the permit area.

Hans P. Trettin, Ph. D.

G. Keith Williams, P. Eng.

BIBLIOGRAPHY

If not quoted otherwise, stratigraphic information is drawn from:

HUME, G. S. (1954): The lower Mackenzie area, Northwest Territories and Yukon Geol. Surv. Canada, Mem. 273.

Other references:

MARTIN, L. J. (1959): Stratigraphy and depositional tectonics of North-Yukon-Lower Mackenzie area; Am. Ass. Petrol. Geol., vol. 43, No. 10, pp. 2399-2455.

BASSET, H. G. (1960): Devonian Stratigraphy, Central MacKenzie River Region, N. W. T. Paper given at the "First International Symposium on Arctic Geology", Calgary, Jan. 1960.

PRELIMINARY REPORT
on
THE GEOLOGY
of
PERMITS 2812-2813-2814 and 2815
YUKON TERRITORY

PREPARED FOR

PAYSON-COWELL SYNDICATE

by

Hans P. Trettin, Ph. D.

D. Bruce Bullock & Associates Ltd.

Consulting Geologists
CALGARY, Alberta

INTRODUCTION

During the months of July and August of 1960, a party of D. Bruce Bullock & Associates Ltd. carried out field work for Payson-Cowell Syndicate in northern Yukon Territory. Purpose of the study was to prepare a geological reconnaissance map of permits 2812, 2813, 2814 and 2815, and to evaluate the hydrocarbon potential of that acreage. The work was carried out by means of a Model G2 Bell helicopter supplied by Foothills Aviation Limited. The operation was based on an unnamed lake in the southeastern part of permit 2814. The camp was served by a Norseman float plane supplied by Bullock Wings & Rotors Ltd. and operated by H. C. Evans. The geological team consisted of Dr. H. P. Trettin, party chief, Dr. H. B. Steghaus, geologist, and J. L. Cotterill, assistant geologist. The helicopter was operated by J. Aspinall, pilot and M. C. Brown, engineer. K. T. Johnson was the cook and D. C. Bullock his helper. Work was carried out during the period of July 29 through August 7, 1960 as part of a large exploration program in that area.

GEOLOGY OF THE PERMITS

STRATIGRAPHY

Rocks underlying the permit area are tentatively assigned to four major stratigraphic units. The oldest rocks are believed to be Ordovician and Silurian in age and consist of chert, slate, phyllite, and metamorphosed limestone. The sequence is several thousand feet thick.

This unit is unconformably overlain by a succession of limestone, slate, phyllite, and quartzite which contains some marine fossils in the lower part and plant remains in the upper part. The strata are believed to be Devonian in age. West and north of the permit area these strata are unconformably overlain by a limestone which is Devonian and/or Mississippian in age. In the British Mountains this limestone reaches thicknesses of more than 3000 feet but near the permits it thins and locally pinches out. This limestone may be present in the subsurface of permit 2815 but probably has been removed from the rest of the area by a Devonian or Carboniferous orogeny. It contains

colonial corals and may in part be reefal but has no porosity.

Most of the permit area is underlain by Mesozoic strata tentatively assigned to the Upper Jurassic and Lower Cretaceous. The Mesozoic rocks can be subdivided into a lower shale unit and an upper shale-siltstone-sandstone unit. These strata rest unconformably on beds that may range from Silurian to Carboniferous in age.

The Devonian or Carboniferous limestone and the black shales of Jura-Cretaceous age are possible source rocks of hydrocarbons, but possible reservoir rocks were not seen.

During the field work some faunal collections were made which are presently being identified by Dr. S.J. Nelson of the University of Alberta in Edmonton. His identifications will be included in the final report which will deal with the regional stratigraphy in greater detail.

STRUCTURE

The permits lie near the southern front of the Barn Mountains within a great plain that is bordered by Barn Mountains, Richardson Mountains, Ogilvie Mountains and British Mountains. Exposures are poor and only in the north-eastern and eastern parts of the permit area can structures be recognized. These structures are gentle folds and faults of unknown displacement. No favourable trapping structure for hydrocarbons has been recognized. A structural map of the permits will be included in the final report.

CONCLUSIONS

As neither promising reservoir rocks nor trapping structures are present in the permits 2812 to 2815, these permits are considered unfavourable for petroleum exploration. No further work can be recommended at this time.

Hans P. Trettin, Ph. D.

G. Keith Williams, P. Eng.