[redacted]

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[redacted]

By: W. P. Hancock - Field Geologist
F. A. McKinnon - Field Geologist
H. K. Reidford - Assistant Geologist
R. D. Skinner - Assistant Geologist
L. Castelli - Student Assistant

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[illegible] and [illegible] to the Imperial [illegible]
[illegible] definitely been [illegible]
[illegible] positive [illegible] the Goal [illegible]
are recommended on Whirlpool anticline on Mountain [illegible]
and on the Imperial anticline, near [illegible] Lake. [illegible]
River and Sammons Creek prospects are two additional [illegible]
ilities for locations on the Imperial anticline.

Geophysical surveys will be necessary before recommendations can be made for locations in the area between Carcajou River and the Mackenzie. Further geophysical work is also required to map out the trend and establish closure, before a second well can be located on the Morrow Creek structure

The active oil seep near Bath Hills is encouraging and warrants detailed surface geological work, in an effort to obtain information which would favor a location for a test well

INTRODUCTION

Field work during the 1944 field season was confined to the Norman - Carcajou Basin area and consisted mainly of checking over various prominent structural features which were mapped by Canol Project Geologists in 1943.

The summer's program was as follows:-

June 5 to June 14 - Morrow Creek, Ferry Island, and Sans Sault,

June 22 to July 23 - Carcajou River area, including Imperial anticline, Rainbow Arch, Sammons Creek, Trail Creek, etc.,

August 7 to August 27 - Imperial Mountains,

August 29 to September 3 - Blackwood Lake, Sammons Creek and vicinity,

September 7 to September 23 - Mountain River and Hume River.

Personnel engaged in geological field work during [illegible] consisted of [illegible], J. S. Scrimgeour, H. F. Reid-[illegible], with [illegible] work done by R. D. Sluzar.

Scale 4 inches to 1 mile, by W.P. Hancock.

Plate II- Vertical Sections, Mountain River Area -
Scale 4 inches to 1 mile, by W.P. Hancock.

Plate III- Geologic Map of Norman Carcajou Basin
Area - Norman Wells to Mountain River -
Scale 1 inch to 1 mile, by F.A. McKinnon.

Plate IV - Cross Sections, Carcajou River Area -
Scale 2 inches to 1 mile, by F.A. McKinnon.

Plate V - Geologic Map of Hume River Area - Scale
1 inch to 1 mile, by F. A. McKinnon.

STRATIGRAPHY

General Statement

The stratigraphy of the Norman - Carcajou Basin Area is fully discussed in the reports by Imperial Oil Limited - Canol Project geologists for the 1943 field season.

Stratigraphic data obtained [illegible] agree fairly well with the conceptions previously held, and [illegible] of the formations are necessary [illegible] Mountain River Area [illegible]

[illegible] formation

The [illegible] composed of angular blocks [illegible] dolomite, cemented in a calcareous matrix [illegible] nous and often notably bituminous. The formation [illegible] bedded zones which grade laterally into [illegible] also a well-developed gypsum horizon.

The age of this formation has not been determined, nor is its origin definitely known. Its thickness is fairly constant, about 400 feet.

DEVONIAN

Middle Devonian - Beavertail - Ramparts Formation

Formerly mapped as two separate formations, the Beavertail - Ramparts consists of a thick lower series of alternating dark grey limestones and limey shales, with an upper massive buff-colored limestone member. On the whole it is very fossiliferous except in the upper part.

The thickness of the Beavertail - Ramparts in the Carcajou River area is about 350 feet. In the central and westward parts of the Imperial Range it is over 2,000 feet thick, and this

[illegible] Sans Sault it is 1,517 feet thick, and at Narrow Creek it is 955 feet.

Upper Devonian - Fort Creek Formation

The Fort Creek has two main subdivisions; an upper soft grey crumbly member and a lower hard black platey part. The reef limestone, where present, generally occurs between the two. The formation is around 1,000 feet thick in the eastern part of the basin, and thins to about 90 feet in the western part. It is absent in the northwestern part, around Bath Mills.

Upper Devonian - Bosworth Formation

The Bosworth is composed of light grey to greenish or buff sandstones and micaceous shales. In the eastern part of the area it is over 1,000 feet thick. In the northwes' parts, around East Mountain, Sans Sault and Bath Mill, it is absent. On Mountain River it is about 1,300 feet thick.

CRETACEOUS

The Cretaceous formations, and a new correlation for them, are discussed in Part IV.

STRUCTURE

General Statement

The Norman - Carcajou Basin area is a wide synclinal basin in which several positive structural features occur. These positive features range in size from small flexures to large uplifts, which are accompanied by fairly complex folding and faulting.

[redacted] which averages 30 miles in width. It is bounded on the northeastern side by the long arcuate Discovery range, and on the southwestern side by the front of the Shackleton mountains.

Since the assignments for the 1944 season consisted mostly of evaluating certain previously-known structural features of the basin area, it seems advisable to discuss each of these from the standpoint of its structure. This is done in the following pages.

PART I - MACKENZIE RIVER PROSPECTS
(By F. A. McKinnon)

[illegible] Creek, Perry Island and Sans Sault [illegible] were examined in the early part of June, 1944, and a report was submitted immediately, to enable the Drilling [illegible] to organize a program for drilling during the [illegible]

Norman Creek Structure

This prospect was recommended by Hancock (5) in 1943. The anticlinal structure is clearly defined, lying in Illsworth beds. Geophysical surveys by both seismograph and gravity meter have confirmed its presence at depth. All indications are that this structure is not connected with the Hoosier Anticline.

Following the recommendations of the geological department, a well was drilled at this location during the latter part of the summer. This well reached the Bear Rock formation at 1,965 feet, and was suspended at a depth of 2,024 feet after encountering a very large flow of salt water in the Bear Rock.

Although the results of this first well have been discouraging, the structure is not condemned, and it is possible that with the help of further study of the results of geological and geophysical surveys, a new location may be recommended.

Perry Island

The presence of a structure between Perry Island and the south bank of Mackenzie River was suspected by Hancock during his survey of the islands of the Mackenzie in 1943. (5)

the left bank of the [illegible]

Further [illegible] of the [illegible]

1944, confirmed the structure, and a drilling [illegible]

The well drilled on this location during the summer reached the Bear Rock at a depth of 2,925 feet, and operations were suspended for the winter at a depth of 3,123 feet.

No favorable signs of oil were found. Present plans are that this well will be deepened during 1945, to test the formations underlying the Bear Rock dolomite. For the time being no further recommendations are made for this prospect.

Bath Hills Oil Seep

An active oil seep on Mackenzie River near the Bath Hills was reported by the gravity crew during the summer, and was visited by McKinnon late in September, 1944. At that time the river was at a low stage, and the seep, which ordinarily would be covered by water, was just at river level.

The oil exudes as small blebs from fractures in the massive limestones which are near the top of the Beavertail-Ramparts formation. The oil seep is surrounded by many strong sulphur springs. No free oil was obtained, but specimens of the oil covered rock and samples of film-covered water were collected and sent to the chemist at Norman Wells. Results of this analysis have not been submitted.

The source of the oil cannot be positively stated. However it is significant that the beds in this locality are folded, and that the rocks from which the oil flows are older than the reef limestone horizon in which oil is found at Norman Wells. This adds importance to the testing of the Bear Rock dolomite, which is notably bituminous in the adjacent area east of the Mackenzie River (3).

It is recommended that further field work in the Bath Hills be undertaken as soon as possible in 1945, in an attempt to obtain more information regarding the seep, and if possible to select a location for a test hole.

Baddaford, [illegible] and Stewart, occupied [illegible] River from the Canol Road to the Mackenzie during the period June 22 to July 29. The size of this party, and the amount of time available, made it possible to work inland on both sides of the river and cover far more of the adjoining country than was previously possible. (See Plate III)

The Imperial anticlinorium was studied in considerable detail, and a few revisions were made in the stratigraphy as reported by Bath in 1943 (1).

Imperial River Prospect

By the directive of May 10, 1944, the field parties were requested to make a particular study of the Imperial anticline in the vicinity of Imperial River, in an attempt to establish closure along the axis, and if possible to recommend a location to test the beds from Lower Fort Creek to Bear Rock. Previous work on this problem was done by Nauss (11) and Laudon (7).

Both Nauss and Laudon have considered the possibilities of a well location on the Imperial anticline at Imperial River [illegible]

[illegible] that the Beavertail limestone

[illegible] than 150 feet of Fort Creek

[illegible] the occurrence of blocks of lime-

[illegible] described as Lypothyridina castanea,

[illegible] lower 110 feet of the

[illegible] observations during

[illegible] described by Nauss are not in place,

[illegible] similar limestone bearing the same

[illegible] in the cliffs at least 200 feet above the river

at the same place. Thus Nauss' conception is shown to be

erroneous.

Laudon refers to this respect as follows:-

> "The structure is a closed dome on the top of the Imperial anticlinal structure. The least point of the structure is [illegible] of Imperial [illegible] the junction [illegible] River."

[illegible] of closure was apparently obtained

[illegible] the axis on Imperial River, as shown by the [illegible] strikes on his map. However, the dips and strikes recorded by the writers during the 1944 season do not concur with those of Laudon, and failed to establish closure along the axis.

Regarding the thickness of the beds covering the Beaver-tail limestone, Laudon assumed a minimum of at least 300 feet, but states that "it is altogether probable that the cover is greater than this."

ing, since there is little or no evidence of closure along the axis. However, it has been pointed out that this is the only presently known prospective test of the Beavertail and Bear Rock formations in this locality. If the winter program of geophysical exploration can be extended this far afield, further information may be obtained.

A location at the mouth of Imperial River would be difficult of access. It could probably be reached most easily

from the Canol-Whitehorse highway, by a winter road which would parallel the Carcajou on the north side, or by descending the river on the ice.

Link Lake Prospect

The presence of a closed high on the Imperial anticline about half way between Imperial River and Sammons Creek was first noticed by Dr. [illegible] A. Link while on aerial reconnaissance in the basin area. The structure was subsequently delineated by L. Desjardins on U.S.A.A.F. oblique aerial photographs, but was not examined on the ground prior to 1944.

[illegible] prospect [illegible] topographically as well as [illegible] be[illegible] axis [illegible] exposures of [illegible] Link Lake are brecciated and [illegible] Strong sulphur springs [illegible]

[illegible] very well defined in exposures [illegible] formations on both [illegible] along the axis [illegible]

[redacted] Mountain, just east of Sammons Creek is a [redacted] high, which is also a closed dome on the [redacted]. Bear Rock beds are exposed in its axial region, and they are surrounded by "rim rocks" of Beavertail limestone. The plunges to the east is gentle, but to the west must be rather sudden, since only a narrow strip of Bear Rock is exposed on Sammons Creek, several hundred feet lower than the central part of the structure.

As a test of the formations below the Bear Rock, this structure is larger, and possibly more favorable in that regard, than the Link Lake prospect. However, it is much less accessible. The country is high and rugged, pitted with innumerable sink holes, and thickly covered with brush. Furthermore, the banks of the Carcajou in this vicinity are high and steep, with no valleys large enough to offer means of access to the [redacted] river. For reasons of inaccessibility, the [redacted] is regarded with less favor [redacted]

Rainbow Arch and Vicinity

[redacted]

distance [redacted]

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...th, as follows:-

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...Rim where

...

...traced

...ver

...xposure occur.

...ends, ...h

...

...evidence is lacking, the chances

...tail ...ing to Roosier Ridge,

...structural ...ridges that are

...echelon arrangement of these folds would also

...ties. However, it still remains ...eo-

...either local closure along the

...a stratigraphic trap at the ...e of the reef limestone,

...h is well ...loped at Roosier Ridge but apparently not present

...

(2) Rainbow anticline, next to Shavetail anticline,

...particularly exposed in the Beavertail limestone at Rainbow Arch

...Canyon, with near locked locality exposed immediately

to the west. This fold also dies out near Imperial Lake. To the

east it has been traced for about six miles, but its further

extension is indefinite.

Sammons [illegible]

west the country is brush covered and

several miles, but from all observati

appears that this "Brasshat" fold is p[illegible]

finally becomes the main central anticline of the [illegible]

Mountains uplift. The rise to the west is gentle and gra[illegible]

with no indication of local closure anywhere.

(d) The fourth fold in this series has been named the Sammons anticline. It is a rather tight fold, and has been traced only about a mile east of Sammons Creek. No information was obtained regarding its westward extension.

(e) The fifth fold on Sammons Creek is the main Imperial anticline, which is a clearly-defined major structural feature extending from Hopkins Lake to Sammons Creek, but which has not been traced westward from Sammons Creek.

(f)(g) The sixth and seventh folds mapped on Sammons Creek are small and not clearly defined. They are found in lower Fort Creek beds, near the junction of Sammons Creek and Blackwood Creek, but have not been traced eastward or westward.

Trail Anticline

The existence of the so-called Trail anticline has never been definitely proven. Exposures of Cretaceous beds along Sprague River and on Trail Creek duplicate the possible presence of a synclinal fold, but evidence is not sufficient to complete

lying on

picture, instead of mapping

in 1943.

The results of this work

slight regional dip to the south. The

indicated by the gravity data, except that the

map shows a positive anomaly east of Darwin River

West Mountain. However, no interesting structural

found by surface geological work in this locality.

[redacted] an area of [redacted] impossible [redacted] were no lakes large enough for [redacted] landings and no streams large enough for [redacted] travel. The survey party was landed on Imperial [redacted], on the north side of the range, four to five miles west of Rainbow Arch. From a base camp at this lake, supplies were packed up into the mountains, and left in caches, which were used later during an 8 - . day fly trip through the range. Although this procedure made it possible to work out the main structural features of the range and to obtain considerable data on the stratigraphy of the area, limits of time and distance prevented the accumulation of as much information as would normally be [redacted] opinion of the writers that the [redacted] sufficient from the standpoint of [redacted] in the area.

As was pointed out in the descriptions of the folds on Sammons Creek, the three most northerly of the seven folds can be traced westward from Carcajou River. Of these three, the two outer ones, Shavetail and Rainbow anticlines, appear to die out near Imperial Lake. The third fold, the "Brasshat" anticline, appears to rise and widen to the west, and forms the main central anticlinal fold of the Imperial range. For about fifteen miles west of Sammons Creek this fold rises gently and gradually at one to four degrees, to reach a maximum elevation of approximately 2,250 feet. This elevation is structural as well as topographic. Dips on the south flank over this distance average 10 to 12 degrees. On the north flank the beds turn over very suddenly, and for most of the length of the range are nearly vertical.

Absence of exposures and relative inaccessibility of the area to the south of the range have limited the amount of information, and little is known of structural conditions here or of the possible westward extensions of the remaining folds on Sammons Creek.

Beavertail-Ramparts and Bear Rock beds are exposed throughout the central part of the range, but without a more precise plot of the topography of the range it is impossible to represent the distribution of these formations on a map. Most of the range is covered by beds of the Beavertail-Ramparts formation, with Bear Rock beds exposed in the creek bottoms and in the central part of the range where the forces of erosion have cut deeply into the mountains

From the standpoint of stratigraphy [illegible]
to note the [illegible]
[illegible] interval between [illegible]
ments on Carbajou River show [illegible]
stones and limey shales between the [illegible]
top of the Bear Rock. Fifteen miles west [illegible] interval has
thickened to at least 2,000 feet. Most of this thickening occurs
in the lower part of the formation, and is apparently due to the
introduction into the section of a series of soft grey to dark
grey limey shales. The thickness of this series on Mountain River
is reported to be 1,716 feet. (13)

No recommendations are made in the Imperial range, for the following reasons:

(1) The Bear Rock dolomite is exposed throughout much of the central part of the range, and other more accessible locations are available as excellent tests of pre-Bear Rock horizons.

(2) There are no local closures within the range.

(3) The most accessible part of the range would be extremely difficult to reach with heavy equipment.

The first geological survey of Mountain River was made in 1943 by J. M. Parker (13) who ran a plane-table traverse through the Imperial mountains and mapped the Whirlpool and Turnbull anticlines, recommending a well location on Whirlpool anticline.

Mountain River was descended during the 1944 field season for the purpose of further study of the Whirlpool anticline and to mark a drilling site on this structure. The Turnbull anticline lying below (north of) the Whirlpool anticline was also studied, and further examination was made of the Imperial anticlinorium.

Mountain River emerges from the Mackenzie mountains about 50 miles due west of Norman Wells, and flows through concessions 6 and 8 of the Imperial Oil Limited - Norman Exploration holdings in the Norman Wells area, to enter the Mackenzie River just above Sans Sault Rapids, 70 miles downstream from Norman Wells.

The writer and H. K. Reidford were landed on Florence Lake by C.P.A. Norseman on September 7th. The party proceeded to Mountain River via Lake Doris and Virgin Creek, using two canoes. That part of the Imperial anticlinorium adjacent to Mountain River was examined, completing the study of this structure, which was begun by the field parties on the previous assignment during August 1944. A plane-table survey was made along Mountain River across the Whirlpool anticline. The plane table survey was tied in to a previous

[redacted] a comparative table of formations [redacted]

[redacted]

The Paleozoic section as measured and described by Parker (13) where Mountain River cuts through the Imperial range is left unchanged except for revisions in nomenclature. These revisions were made to conform to conclusions reached in the study of the Imperial range, and have been confirmed by data obtained from the Sans Sault No. 1 well.

The following formation descriptions are a summary of those given by Parker.

Devonian or Silurian - Bear Rock Formation

This formation has been divided into two sections.

Comparative Table of Formations

Mountain River Area

[illegible] W. R. Hancock 1944

Age	Formation	Thickness	Age	Formation	Thickness
			CRETACEOUS Upper	Little Bear, sandstone & shale	150+
				Slater River, shale & bentonite	1000+
CRETACEOUS	"Link" sandstone & sh.	335+	CRETACEOUS Lower	Sans Sault, sandstone & shale	3850
	"Sperry" shale	2150			
	Sans Sault, sandstone & shale	1410			
DEVONIAN Upper	Bosworth, sandstone & shale	1200	DEVONIAN Upper	Bosworth, sandstone & shale	1200
	U. Fort Creek, shale	90		Fort Creek, shale	90
	Reef Limestone & Ls. Fort Creek, shale	390	DEVONIAN Middle	Beavertail-Ramparts, limestone & shale	1716
	Beavertail, limestone	80			
	Upper Ramparts, ls.	100			
DEVONIAN Middle	Middle Ramparts, shale	700			
	Lower Ramparts ls.	446			
	Bear Rock, limestone & dolomite	200+		Bear Rock, limestone & dolomite breccia	200+

from the [illegible]

[illegible]

The upper section [illegible] 150 feet thick.

Both sections may be regarded as [illegible] rocks.

Middle Devonian - Beavertail-Ramparts Formation

Included in this is the uppermost 350 feet of limestone which Parker called Reef Limestone, correlating it in general stratigraphic position with the Reef Limestone at Norman Wells. No subdivision into individual formations or members is made by the writer, and details of description may be found in Parker's report. Parker measured a total thickness of 1,716 feet for these sediments, composed of 800 feet of relatively pure limestone, 200 feet of shaley limestone with shale bands, and 700 feet of shale with limestone beds.

Bituminous matter was found locally but not abundantly, in both the limestones and shales. Source and reservoir rocks appear to be present in the section.

Upper Devonian - Fort Creek Formation

This formation consists of 90 feet of black platey bituminous shales and thin shaley limestones. The formation is a probable

source rock for oil but not likely in any great quantity because of its thinness. It would provide a cap rock for oil accumulation in the limestone below.

Upper Devonian - Bosworth (Norman) Formation

Parker mapped this section in detail on the north flank of Imperial range. It consists of 1,200 feet of shales, sandy shales, sandstones and limestones.

Almost as thick a section is exposed on Whirlpool Creek. This section was mapped for structural information and no attempt was made to subdivide it according to lithology or faunal zones.

The formation is thought to have little or no importance as source or reservoir rocks.

MESOZOIC

Cretaceous

The stratigraphy and correlation of the Cretaceous sediments in the Norman Wells area is probably more confused in the literature than that of any other rock group. This is partly due to the scarcity of megafossils, partly to the lack of any number of correlatable lithologic horizons, and partly to the introduction of unnecessary new formation names, having indefinite and widely separated type localities, resulting in ambiguous correlations.

[illegible] Mountain River, Parker (13) divided the Cretaceous [illegible] oldest to youngest these are the [illegible] "Link" formations. Nauss (11) [illegible] for the Cretaceous on Imperial River. [illegible], it appears that not only [illegible] of the Mountain River non- [illegible] same categories on

Imperial River, but the same [illegible] on the former river has been mapped as both "Sperry" and "Link" in age. In this report the name Sans Sault is retained because it is the first name assigned to the sediments of Lower Cretaceous age in the area. The names Slater River and Little Bear are used in preference to "Sperry" and "Link", because the above mentioned confusion regarding the latter terminology is avoided, and there are lithological bases for using the Slater River and Little Bear terminology, both of which are prior names.

Lower Cretaceous - Sans Sault Formation

This name was assigned by Parker (14) to the Lower Cretaceous sediments exposed in the Mackenzie River Valley. The type section is at the Sans Sault rapids in the Mackenzie River, and is defined as "all bed from the base of the Lower Cretaceous upward to the base of a non-sandy, thick shale section". Beudanticeras of affine (a lower Cretaceous ammonite) associated with Inoceramus Pleuromya, Corbula, Gastroplites, Lima, Pecten and Pinna [illegible]

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[illegible] characteristic [illegible] to the [illegible] this section [illegible] from beds of equivalent age in the Bear Rock - Slate [illegible]

[illegible] by virtue of the [illegible] bentonite seams are excellent correlating horizons because they are generally widespread and restricted in time range. It is logical, therefore, to correlate the bentonitic shales on Sea Creek, Carcajou River and Mountain River with the Slater River formation. These beds on Carcajou River near Imperial River are the equivalent of the "Sperry" formation as mapped by Nauss (11) on Imperial River. Bentonitic shales at the mouth of Virgin Creek on Mountain River were mapped as "Sperry" by Parker, but on the north flank of Whirlpool anticline these same beds were placed at the top of the Cretaceous section, in the "Link" formation. These shales are now called Slater River. Only 70 feet of the bentonitic shales are exposed on Mountain River, but a thickness of 1,000 feet is assigned to this formation by the writer, on the basis of assumed structural conditions (Plate 2), and regional considerations.

Upper Cretaceous - Little Bear Formation

In its type section on Little Bear River the rocks assigned to this formation consist of sandstones, locally conglomeratic, sandy shales, and coal seams. The beds are lenticular and even local correlations are uncertain.

Beds of equivalent age are thought to be present throughout much of the Norman Wells area but their correlation is difficult. In general any sandy series lying above recognized Slater River type shales may be tentatively correlated with the Little Bear series. The K3 division of the Cretaceous on Loon Creek (4) and the "Link" formation in its type locality on Imperial River (11) are placed in this category. On the Mountain River not more than 150 feet of sandy beds, which may be equivalent to the Little Bear formation, are exposed. These lie [illegible] on the flanks of the syncline north of Whirlpool anticline, and on the north flank of the Turnbull anticline.

STRUCTURE

[illegible] River crosses the western extremity of the [illegible] structural basin. This basin is 20 miles wide, [illegible] Mountain to the Mackenzie mountain front. [illegible] by the Imperial anticlinorium. The [illegible] Mountains from Imperial [illegible] in this [illegible] anti-

this report.

No work was done between the Mackenzie mountains and Imperial anticlinorium so there is nothing to add to Parker's account of the structure of this part of the area. The Imperial anticlinorium is considered elsewhere in the report of the 1944 field work.

Whirlpool Syncline

Whirlpool syncline lies between Imperial anticlinorium and Whirlpool anticline. This basin is somewhat asymmetrical. Dips up to 50 degrees were recorded in the Cretaceous beds on the south limb and the highest dip observed in these beds on the north limb was 19 degrees. The basin is about 6 miles wide, measured from the base of the Cretaceous.

Whirlpool Anticline

The Whirlpool anticline is a slightly asymmetrical fold of considerable structural relief. Its axis trends north 68 degrees

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itic shales is approximately 3,500 feet above the base of the Cretaceous section. Although the thickness of these shales is not known in this area, it seems safe to assume, from regional considerations, that it is at least 1,000 feet. Using the above figures, and projecting the exposures into the subsurface in accord-

feet is [illegible] the north flank of the [illegible] line A-B.

Where the anticlinal axis crosses [illegible] the river, the Bosworth beds indicate a plunge of 8 to 16 degrees to the southeast. The amount of plunge apparently increases to the east, for the top of the Bosworth is estimated to be 1,800 feet below the surface where section CD crosses the axis. Section EF illustrates the nearly east plunge of the Bosworth beneath Mountain River, and the gentle westward plunge at Whirlpool Creek. Between Whirlpool Creek and the Bosworth exposure on Mountain River there is no structural control. Section HI pictures the structure between these points as relatively flat with the eastward plunge beginning abruptly near the edge of the river valley.

Cross-section FG is drawn at right angles to the trend of the structure in the vicinity of Whirlpool Creek. Using the thickness of the Bosworth as recorded by Parker on the north limb of the Imperial range, and the dip values recorded in these beds along Whirlpool Creek, the base of the Bosworth formation is shown to be 180 feet from the surface at the crest of the fold on section FG. Assuming a uniform thickness of the Bosworth from Imperial range to this area, the crest of the fold here is at least 6,395 feet structurally higher than the north bounding synclinal axis on the river. Using the same assumptions the structural relief with respect to the Whirlpool syncline is at least 4,370 feet.

[illegible] but its [illegible] and [illegible] northward towards the Teton Ridge arch can be postulated. The structural relief of the [illegible] flank is 6,595 feet, of the south flank 4,870 feet, giving an effective north-south relief of 4,870 feet. The fold plunges steeply to the south-east where crossed by the Mountain River. A low plunge to the southwest was measured on Whirlpool Creek. The maximum possible width of the closed area is seven miles. Its length is not definitely known, but the closure appears to extend eight to ten miles to the west of Mountain River. The steep eastward plunge of the anticline probably limits the eastward closure to one or two miles east of the Bosworth exposures on Mountain River. This gives a possible overall length of the closed area of nine to eleven miles. The relatively deeper north-bounding syncline suggests that beyond the closed area the structure may be monoclinal.

The structure is rated as very good for a test of the Beavertail-Ramparts and older formations in this area.

Turnbull Anticline

Very little is known regarding this [illegible] due to lack of sufficient exposures. [illegible] axes are about five [illegible]

...of the anticline the top of a 15

...at lb

...feet, or at

...strike north

...This is the

...At the Turnbull No. 2

...the top of the section here is

...correlative with the sandy (Little Bear?)

...Downstream the dip decreases

...axial axis is located about 12,000 feet

...the axis of Turnbull anticline is drawn about

...and the Tower

...is drawn on the basis of the above

...northeast-southwest structural relief

...

...to give a classification and rating

...It will be obtained in the test of the Whirlpool

...surveys will be warranted to evaluate the

...structure

reservoir for oil developed from one or both of the [illegible] rocks. The Bear Rock formation is generally regarded as a source rock, but has yielded only salt or sulphur water in these wells which have penetrated it to date. Warm sulphur springs issue from this formation where the Mountain River cuts through Imperial range. Possibilities of the Silurian are not known in this area, but where studied in other areas, both source and reservoir rocks are present.

Structurally the area studied is favourable for accumulation of oil. Whirlpool anticline, which is closed in all directions, and which has an effective north-south structural relief in excess of 4,000 feet, is the most promising structure. It is possible that fracturing related to the development of the fold may have added to the original effective porosity and permeability of the potential reservoir rocks.

A well location was chosen on the west bank of the river about 800 feet from the edge of the valley. This location was marked prior to the traverse up Whirlpool Creek, and as illustrated on section XX (Plate 2), the structure may be higher further south-west along the axis. The following formation thicknesses may be [illegible] at this location:

Surface material
Bosworth shale and sandstone

last September, the river was very shallow (two to four feet) except along cutbanks. Movement of the equipment could be facilitated by travelling up the frozen river in mid-winter, after which a road could be constructed from the location along the west bank of the river to Fond Du Lac.

structures

commendations re Drilling

Structures with [illegible] prospects are as follows:

Class A - Immediate drilling prospects.

1. Whirlpool Anticline - This is a prominent closed Structure with Bosworth beds exposed in its axial region, and with well-defined closure both across and along the trend of its axis. The structure should be drilled at least through the Bear Rock, and it may be advisable to test the lower formation, if the results of deepening the Sans Sault well are encouraging.

2. The Link Lake Prospect - Closure along the axis of the Imperial Anticline has been determined in the vicinity of Link Lake. Unless other deep [illegible] indicate that the

2.

an important

was successful.

3.

Creek Prospect). This

the Link Lake prospect,

sible. Success in

warrant a location near

Recommendations re Geophysical Surveys

1. Perry Island - Surface geological

1944 gravity survey, did not confirm a

here. Detailed geophysical work is

2. Trail Creek - Surface information

the gravity survey did not cover

[redacted] oil seep is [redacted]. Field work should be commenced in the [redacted] as soon as possible in the Spring of 1945. The area in the vicinity of the oil seep should be examined in detail, to obtain all possible information relative to the seep, and if possible to make a location for a test hole.

2. Norrow Mountains and Discovery Range - Further work is recommended in the area north of the Mackenzie, from the Norrow mountains to Oil Creek. This survey should attempt to discover any manifestations of structural conditions which would favor the accumulation of oil in this area where the reef limestone is known to be present.

[illegible] Carcajou Rock - Re-examination

[illegible] exposures on these mountains would determine [illegible] mapped by Parker as "Dks" are actually [illegible], stratigraphically equivalent to [illegible].

[illegible] was reported by the gravity party, [illegible] water near the north [illegible] of Mackenzie River about one mile below [illegible] point of Judith Island. If this spot [illegible], samples of the gas should be collected for analysis.

The Cambrian section on Upper Carcajou River [illegible] examined for more information relative to [illegible] petroliferous beds reported [illegible].

[illegible] Surveys during the first part of [illegible] will doubtless raise other incidental [illegible] re checking by field [illegible].

1. Bath, Lt. [illegible]

2. Foley, E. J. [illegible]
Canol Project, [illegible]
Final Report No. [illegible]

3. Foley, E. J. "The Donnelly [illegible]
Oil Limited - Canol [illegible]
ment 26, 1943 Final Report No
G.C.-44-3.

4. Hancock, W. P. "The Loon Creek Area" - Imperial Oil Limited - Canol Project, Assignment 4, 1943. Final Report No. G.C.-44-13.

5. Hancock, W. P. "The Right Bank and Islands of the Mackenzie River, Norman Wells to Carcajou Ridge" - Imperial Oil Limited - Canol Project, Assignment 38, 1943. Final Report No. G.C.-44-4.

6. Hancock, W. P. and McKinnon, F. A. "Geological Report on Morrow Creek, Perry Island and Sans Sault" - Imperial Oil Limited - Norman Exploration, Report No. EX.G-44-1, June, 1944.

7. Laundon, Dr. L. R. "The Imperial River Area" - Imperial Oil Limited - Canol Project, Assignment 18, 1943. Final Report No. G.C.-44-36.

8. Link, T. A. "The Fort Norman Area" - Imperial Oil Limited Report, 1920.

9. McKinnon, F. A. "The South Bank of Mackenzie River Between Mosquier Ridge and Mountain River" - Imperial Oil Limited - Canol Project, Assignment 7, 1943. Report G.C.-44-5.

10. Mann, C. G. "The [illegible] River Area" - Imperial Oil Limited - Canol Project, Assignment 15, 1943. Final Report No. G.C.-44-34.

11. [illegible] "The [illegible] - Imperial River Area" - [illegible]

12. Parker, J. M. "The Mackenzie River Area Between Sans Sault Rapids and the Ramparts". Imperial Oil Limited - Canol Project, Assignment 21, 1943. Final Report No. G.C.-44-23.

13. Parker, J. M. "The Mountain River Area" - Imperial Oil Limited - Canol Project, Assignment 19, 1943. Final Report No. G.C.-44-24.

14. Parker, J. M. "The Carcajou Rock - East Mountain Area" - Imperial Oil Limited - Canol Project, Assignment 6, 1943. Final Report No. G.C.-44-22.

15. Stelck, C. R. "The Bear Rock - Bluefish Area" - Imperial Oil Limited - Canol Project, Assignment 1, 1943. Final Report No. G.C.-44-20

FIGURE 1
Bosworth-Fort Creek Contact exposed on Carcajou River opposite the mouth of Imperial River

FIGURE 2
Fort Creek shales exposed on Carcajou River near the axis of Imperial Anticline

FIGURE 3
View looking eastward down Sammons Creek, showing the syncline between "Brassiat"(on the left) and Sammons anticline.

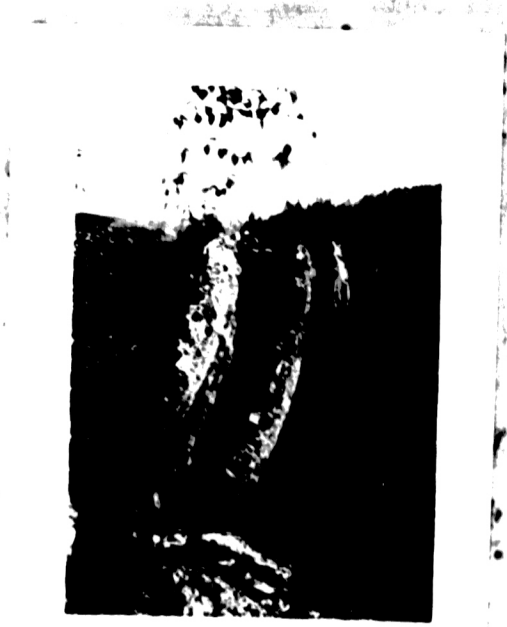

FIGURE 4
Closer view of the steeply-dipping Beavertail-Ramparts beds on the north flank of Sammons anticline. Note the abrupt change in dip just above the creek.

FIGURE 5
Small thrust fault in basal Fort Creek beds on Sammons Creek, north flank of Sammons Anticline.

FIGURE 6
Upper Bear Rock beds exposed near the axial region of the Imperial Anticline on Sammons Creek.

FIGURE 7
View looking eastward across Carcajou River at Rainbow Arch. The arch is composed of Beavertail limestone. The small scarp in the distance is in lower Fort Creek Shales

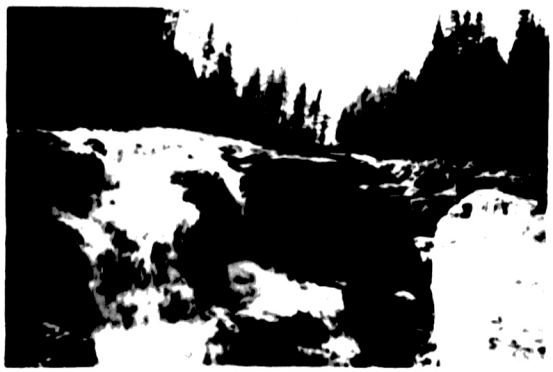

FIGURE 8
Shavetail Creek, west of Carcajou River at Rainbow Arch. Massive Beavertail limestone exposed.

FIGURE 9
View looking northwestward from the north side of Imperial Range across Imperial Lake, showing West Mountain (left center) and East Mountain (right) on the horizon.

FIGURE 10
View looking northward across the Carcajou - Mackenzie basin, from a high point on the south side of Imperial Range, approximately fifteen miles west of Rainbow Arch.

FIGURE 11
View looking northward across the central part of the Imperial Range.

FIGURE 12
Showing the southward-dipping beds of the Beavertail-Ramparts formation on the south side of Imperial Range.

FIGURE 13
View looking westward along the south side of the Imperial Range showing southward-dipping beds of the Beavertail-Ramparts formation.

FIGURE 14
View looking eastward from the same point as above, showing the central part of the Range with the Discovery Range in the far distance.