FINAL

GEOLOGICAL REPORT

on

"THE MACKENZIE RIVER AREA BETWEEN

THE SANS SAULT RAPIDS AND THE RAMPARTS"

N.W.T. (Canada)

IMPERIAL OIL LTD., CANOL PROJECT

Assignment No. 31

By: J.M. Parker Party Chief

M.M. Barnes Helper

Date submitted:- February 15, 1944

Read and accepted by:- Theo. A. Link

Date:- 2/19/44

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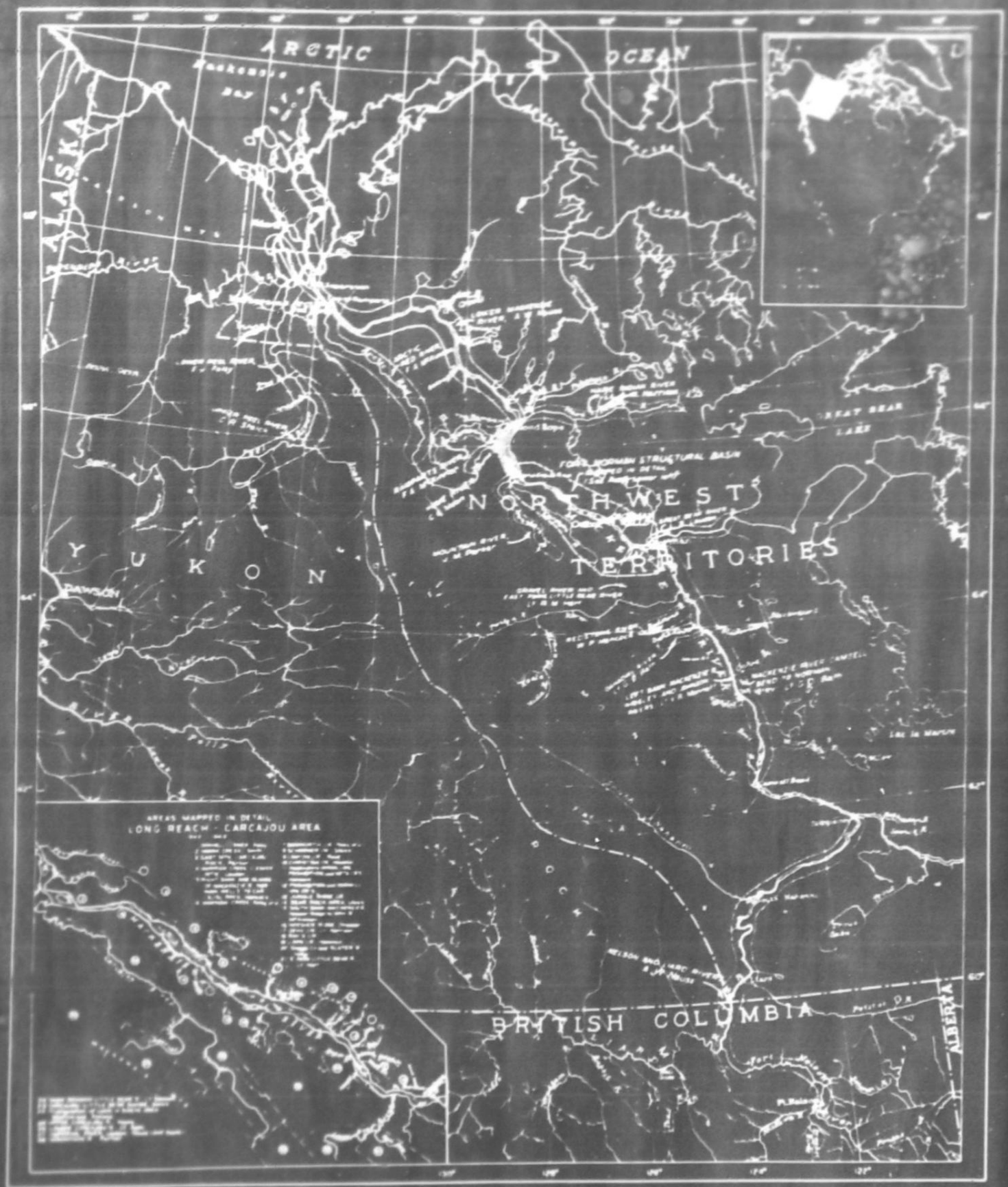
A B S T R A C T

An excellent rock sequence for the generation and storing of oil occurs at depth in the Mackenzie River area between the Sans Sault Rapids and The Ramparts. There are exposures of Lower Cretaceous coarse-grained sandstones lying on bituminous, porous, and corallina Devonian limestones at the north and south ends of the area.

It is possible that both reef-limestone stratigraphic traps and structural traps occur in the Cretaceous basin between Beavertail Mountain and The Ramparts. Seismograph work will be necessary to determine whether there are any good prospects, because outcrops are too few to delineate any structures which may be present, and surface outcrops give no direct indication of buried stratigraphic traps.



INDEX MAP OF
NORTH WESTERN CANADA SHOWING
MACKENZIE RIVER AREA, SANS SAULT RAPIDS TO THE RAMPARTS

Chapter I

INTRODUCTION

This report covers an area including both sides of the Mackenzie River from the Sans Sault Rapids to the middle of the Ramparts Canyon. (See index map). The area is bounded by north latitudes 65° 45' and 66° 20', and west longitudes 128° 30' and 129° 20'.

The first report on the area was made by McConnell (8), who took notes on the country as he canoed down the Mackenzie in 1888. Bosworth in 1914 (1), made sketches of Beavertail Mountain and The Ramparts while he was travelling down the Mackenzie in a steamboat. Link (7) in 1919 made a reconnaissance survey of the area, collected fossils, and outlined the general stratigraphy and structure. Kindle (6) visited the area in 1919 and measured a few sections and collected fossils.

In the summer of 1943, Party D of the Imperial Oil - Canol Project Geological staff was assigned to this area (Assignment No. 31) with instructions to study in detail the exposures at Beavertail Point, and in The Ramparts, to search the country adjacent to the Mackenzie for outcrops not previously reported, and to map the structure of The Ramparts area. An aerial reconnaissance was made on the evening of July 5th, to locate outcrops back from the Mackenzie River banks. Party D, consisting of Murray Hanna and the writer, were taken to the mouth of the Carcajou River in the motor launch "MacNiski" on July 6th. From there, the party travelled down the Mackenzie in two sixteen-foot canoes to the old river channel entrance in the middle of the Ramparts Canyon shown in photograph No. 6. They were picked up August 2nd, and returned to Norman Wells by the Motor Ship "T.A. Link".

A preliminary report on this area, file No. G.C. 43-29, was written in August, 1943.

Adjacent areas which were mapped by Canol geologists in the summer of 1943 are: the Donnelly River area, by Foley (3), the Mountain River area, by Parker (13), the Hume River area, by Moon (10), the Ramparts River area, by McKinnon (9), and the Mackenzie River area downstream from The Ramparts, by Nauss (11).

Field Procedure

Canadian Government maps of the Mackenzie River (scale: four inches to the mile) were used as base maps by the party. Two parts of the area were mapped by plane table traverses, the Beavertail Point area and The Ramparts area. The Ramparts area was mapped in detail so that structural contours could be drawn on the map. Two creeks, "Snafu" and Bluefish, which enter the Mackenzie from the east, were ascended short distances and mapped by Brunton-Pace traverses. (This Bluefish Creek is not to be confused with the Bluefish Creek which enters the Mackenzie River about ten miles downstream from Fort Norman). Nine fossil suites were collected during the survey.

Accessibility

The Mackenzie River is navigable by river steamboats. When the water level is low, large boats have difficulty going through both the Sans Sault Rapids and the rapids above The Ramparts. Most stretches of the Mackenzie are suitable for float plane landings. Travel inland from the river banks in the summer is difficult because of the heavy bush, swampy areas and innumerable lakes. Fort Good Hope is the only settlement in this map area.

The Sans Sault Rapids are about seventy miles down the Mackenzie from Norman Wells, and Fort Good Hope is about fifty miles farther downstream.

Chapter II

T O P O G R A P H Y

The main topographic units are the Mackenzie River Valley, the flat muskeg and lake country bordering it, Beavertail Mountain, and the Ramparts Plateau. All of this country was glaciated and pre-glacial relief was probably similar to present relief.

The Mackenzie River has no recent floodplain and its present width varies from 1600 feet to 19,000 feet. The Ramparts of the Mackenzie River is a narrow gorge cut through the Ramparts and Beavertail limestones and shales. This gorge has vertical limestone cliffs rising from fifty to 200 feet above the river as shown in photograph No. 2. The upstream entrance to the Ramparts is a spectacular funnel shaped neck where the river narrows from a width of 13,500 feet to 1600 feet in a distance of about 2.5 miles.

When the river is at a low water stage, there are bad rapids at the upper end of the Ramparts Canyon. These rapids are caused by the south dipping basal Cretaceous sandstones and the underlying upper beds of the Beavertail limestone. Hume (4) has ascribed the formation of this gorge to a post-Pleistocene waterfall which originally was located about six miles down in the gorge and has since receded, cutting the gorge as it went, until all that is left of the waterfall are the present rapids at the head of The Ramparts. A large abandoned channel (see Plate I and photograph No. 7) lies to the left of the present Mackenzie channel, and several branches from this abandoned channel join the present valley.

Beavertail Mountain is described in Foley's report on the Donnelly River Area (3).

Because of the presence, in the Ramparts area, of the resistant Beavertail and Ramparts limestones, that country is about 200 feet higher

than the adjacent area to the south.

Memoir 108, "The Mackenzie River Basin" by C. Camsell and W. Malcolm, Geological Survey of Canada, 1921, gives a general discussion of the topography, flora and fauna of this area.

Chapter III

STRATIGRAPHY

General

Devonian and Cretaceous rocks are present in the area surveyed. As shown on the areal map, Plate I, outcrops were found in only three localities: the west side of the Mackenzie opposite the Bath Hills, on Beavertail Point, and in The Ramparts area.

The erosional unconformity at the Devonian-Cretaceous contact is well exposed in The Ramparts. Pot holes and vertical joints in the Devonian (Beavertail) limestones are filled with Cretaceous sandstones to a depth of several feet. In the part of The Ramparts area covered, Cretaceous strata lie on various Devonian beds through a seventy foot stratigraphic interval. No angular discordance due to pre-Cretaceous orogenic movements was seen in the exposures of the Devonian-Cretaceous contact.

No Cretaceous beds were seen in place on Beavertail Point. However, Foley (3) found fragments of Cretaceous sandstone float on the north side of the point so it is assumed that Cretaceous sandstones lie on the Beavertail limestones in this area.

The type localities, definitions and origins of the formations present in this area, are discussed in the report on the Carcajou Ridge-East Mountain area (10). Fossils collected on this trip were identified at Norman Wells by Mr. C.R. Stelck.

Detailed Discussion of Stratigraphy

West bank of the Mackenzie opposite the Bath Hills.

The sandstone and shale beds exposed here are assigned to the upper part of the Sans Sault Formation. This section illustrates the cyclical

nature of the upper Sans Sault sediments. A detailed description of the section from top to bottom follows:

Limestone Concretionary bed	dark grey, weathers red brown, hard, fossiliferous	0.7 +/-
Shaly Sandstone	grey, weathers dark grey brown mottled	11.0
Limestone Concretionary bed	Same as above concretionary bed	0.7 +/-
Shaly Sandstone	Same as above shaly sandstone	5.0
Limestone Concretionary bed	Same as above concretionary bed .... lensing 0.6 -/- platy sandstones above and below this unit.	0.7 +/-
Shaly Sandstone	Same as above shaly sandstone	24.0
Limestone Concretionary bed	Same as above concretionary bed	0.7 -/-
Shaly Sandstone	Same as above shaly sandstone	9.0
Sandstone	Platy, light grey, abundant fucoids and Heliozoa. Some of the beds are shaly	24.0
Limestone Concretionary bed	Same as above concretionary bed	0.7 +/-
Sandstone	Same as above sandstone	4.0
Limestone Concretionary bed	Same as above concretionary bed	0.7 +/-
Sandstone	Same as above sandstone	6.0
		87.2 +/-

Suite 8525 was collected from these beds.

Suite 8525

Corbula sp.	Hoplite cephalopod
Inoceramus sp.	Fucoids

Beavertail Point

A limestone section of about thirty-five feet is exposed on Beavertail Point and on the small island west of the point. Fragments of Cretaceous sandstone were found by Foley (3). The limestones are "reef beds" that are placed in the Beavertail formation. Their description follows:

Limestone - Dark grey-brown to dark grey or black. The limestone is composed of 1/8" Cladopora corallites in a fine grained limestone matrix. Occasionally the matrix is not limestone but pure bitumen. The bedding planes are 0.7' to 1.0' apart and are wavy. Corals nearly always make up at least 50% of the limestone and frequently along bedding planes the limestone is 100% coralline. All of the beds are very petroliferous. The coralline and bituminous material may comprise whole beds instead of being limited to the partings. When this is the case the limestone is coarse grained and contains abundant crystalline calcite. The limestone weathers light to dark grey or grey brown. Suite 8526 was collected from these beds. These limestones are classified as good source and reservoir beds.

Suite 8526

Cladopora sp.	Eucomphalus sp.
Martinia sp.	Stromatoporoid
Pleurotomaria sp.	

The Ramparts of the Mackenzie River

Bosworth and Kindle (5) placed all of the limestone exposed in the canyon, in the Ramparts formation. Link (6), placed the upper limestone beds in the Beavertail formation. As shown in Plate II, the writer also believes that the upper limestones belong to the Beavertail formation. It is possible that the beds in the upper unit of the Beavertail formation are equivalents of reef limestones that overlie lower Fort Creek shales in

other areas. Because of the wedging beds and local disconformities in these reef limestones, it could not be determined whether a major erosional unconformity separates the upper and lower units in the Beavertail.

In order to map this area so that accurate structural contours could be drawn on the map, several sections were measured in great detail in The Ramparts. However, in drawing up a composite section of the area, it is impossible to correlate between most of the individual beds, especially in the Beavertail formation. Therefore, the section described below is generalized. The rock units are listed from top to bottom. Plate III illustrates correlations between this section and Mmus's (9) composite section obtained farther down the Mackenzie River.

Lower Cretaceous

Sans Sault Formation

Shale - blue-grey to black, slightly micaceous, blocky, weathers to small flakes, has very prominent vertical joints. Contains a few thin, limy laminae, and concretionary bands. The concretions are dark-grey to purplish-grey, weather red-brown, are often septarian, and range in size from a 0.2' to a 4.0' diameter. Cone-in-cone structures and petrified wood are present in some of the limy beds. These shales are an excellent cap rock. - 215'

Sandstone - grey to brown, medium to coarse grained, cross-bedded, ripple marked, contains conglomeratic stringers. Fucoids are abundant and a few plant remains were found. Some of the beds are shaly. The unit often has a prominent limestone concretionary bed at the top, and the sandstones in some localities are underlain by a 10' ± black, sandy shale containing lenses of coal and bitumen. The sandstones in this unit are good reservoir beds 13' ±

Total: ~228'

Middle Devonian (?)

Beavertail Formation

Limestone - light to dark grey, medium grained, fairly regular beds with bitumen partings. All of the beds contain some corals and Stromatoporoids and some of the upper beds are composed entirely of coral fragments in a bituminous matrix. Megaloden sp. is very abundant in some of these beds, and also in the unit below this one. Rubbly biohermal beds alternate with more regularly bedded limestones that weather and break to sharp angular edges. The upper beds in this unit might act as source beds and the whole unit is classified as a fair to good reservoir bed. Suites 8527 and 8530 were collected from these beds.

Suite 8527	Suite 8530
Martinia sp.	Cladopora sp.
Megaloden sp.	Eucomphalus sp.
Eucomphalus sp.	Pleurotomaria sp.
Cladopora sp.	Cyathophyllum sp.
Acervularia (?)	Cystiphyllum sp.
Stromatoporoids (two varieties)	Zaphrentis sp.
	Actinopteria sp.
	Atrypa spinosa
	Atrypa reticularis
	Schizophoria sp.

..... 65 feet

Limestone - light grey, medium grained, contains coral fragments which are usually larger than the fragments in the above unit. The limestone is coarser grained than the above beds and contains little bitumen except at the partings. The coral fragment content of one bed may vary from 10% to 90% within a few hundred feet. The beds themselves are lensing and range from the vanishing point to 25 feet in thickness. Included in this unit are two or three lensing groups of dark grey bituminous

beds 10' ± thick. This unit is classified as a good to an excellent reservoir bed. Suites 8531 and 8533 were collected from this unit. Photographs Nos. 1 and 3 show the upper and lower units in the Beavertail formation

Suite 8531	Suite 8533
Schizophoria sp.	Eucomphalus sp.
Alveolites sp.	Paracyclas sp.
Productella sp.	Atrypa spinosa
Cladopora sp.	Productella sp.
Cystiphyllum sp.	
Martinia sp.	
Gomphoceras sp.	
Atrypa spinosa	
Paracyclas elliptica	
Pleurotomaria sp.	
Cyathophyllum sp.	
Cyathophyllum sp.	
Reticularia sp.	

..... 130'

Total: 195' ±

Ramparts Formation (base not exposed)

Limestone dark grey, coarse grained, petroliferous. This is a Stromatoporoid limestone that also contains many corals. The corals are generally much larger than those found in the Beavertail limestones. These beds contain dark grey limy shales in irregular bands, and around the individual Stromatoporoid nodules. There are regular shale partings 18 and 24 feet above the base of this unit. Because of the shaly fillings around the nodules in these limestones this unit is not a good reservoir bed. 32.0'

Shale - Black, earthy. This bed was used as a datum plane in mapping and contouring the Ramparts area. The upper contact of this bed is an irregular biohermal zone. The shale contains abundant, very large Cladopora and Cystiphyllum ..... 2.5' +

Suite 8532 was collected from the above two units.

Suite 8532

Atrypa spinosa

Eucamphalus sp.

Cyathophyllum sp.

Cladopora sp.

Zaphrentis sp.

Martinia sp.

Paracyclas sp.

Limestone - Similar to the above limestone unit. 32 feet below the above shale bed is a 2.5' bed that contains abundant Stringocephalus sp. There are several shale partings in this unit. Suite 8529 was col cted from these beds. Neither this unit nor the one below it is considered as a reservoir bed.

Suite 8529

Stringocephalus sp.	Paracyclas (?)
Crinoid stems	Proetus sp.
Stromatoporoids	Atrypa spinosa
Cyathophyllum sp.	Cladopora sp.
Eucamphalus sp.	

..... 60'

Limestone - light to dark grey Stromatoporoid limestone. The matrix between the nodules is limy, not shaly, as in the above Stromatoporoid limestones .... 14'

Total: 108.5' +

Chapter IV

S T R U C T U R A L G E O L O G Y

General

The regional structure to the south of this area is discussed in the Carcajou Ridge-East Mountain report (12). North and west of Beavertail Mountain no more mountains are present in the Lower Mackenzie Basin. The strata are only slightly deformed in this basin and dips are usually less than two degrees.

Detailed Discussion of Structures

The outcrops opposite the Bath Hills

The dip of the beds exposed across the Mackenzie from the Bath Hills, is to the south, as shown on the areal map. These strata may be an exposure of the south limb of a small anticlinal nose which is present on the north flank of the Bath Hills. As Foley (3) stated in his report on the Donnelly River area, minor anticlinal structures are quite probable in a continuation of the Bath Hills and Beavertail Mountain anticlinal trends.

Beavertail Mountain

Beavertail Mountain is an asymmetrical anticline whose steep side faces south. The axis plunges to the west on Beavertail Point at about ten degrees. Close to the Mackenzie River, dips on the south side of the structure range from twenty to seventy degrees to the south, and on the north side of the structure from ten to fifteen degrees to the north.

The Ramparts Area

In the narrow part of the Ramparts Canyon, the beds dip south-westerly at a rate of 25 to 200 feet to the mile. South of the Canyon, the dips gradually flatten until, in the Bluefish Creek area, the beds are horizontal. It is assumed that the strata between Bluefish Creek and

Beavertail Mountain form a syncline, although there are no outcrops between those two localities.

North of The Ramparts, the beds continue a slow rise until finally the strike swings north-south about sixteen miles northwest of Fort Good Hope, and the beds dip to the west (see report on the Lower Mackenzie River area by Nauss (11)).

The structural contours shown on Plate I in The Ramparts area, Nauss' findings to the north of this area, and Harrison's (4) work in the Hare Indian River area, show that it is possible that there could be a low irregularly-shaped dome to the east of the Ramparts area. Bear Rock age beds are probably exposed at or near the surface in the highest part of this hypothetical dome.

Chapter V

HISTORICAL GEOLOGY

The geologic history of this area is summarized in the report on the Carcajou Ridge-East Mountain Area (10).

Chapter VI

OIL AND GAS MANIFESTATIONS AND MINERAL DEPOSITS

The Beavertail reef limestones exposed at Beavertail Point have a high bitumen content and the upper part of the Beavertail formation in The Ramparts contains some bitumen. The black shale, which sometimes underlies the basal Cretaceous sandstone in The Ramparts area, has bitumen in it in one locality. There is a strong odor of sulphur in the river water close to Beavertail Point. It is assumed this sulphur comes from underwater springs issuing from the Beavertail limestones.

Chapter VII

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Bituminous reef limestones are exposed at Beavertail Point and in The Ramparts, and these limestones are probably present at depth in the rest of the area. These reef limestones themselves are good reservoir rocks, and probably also source beds, and they are overlain by a medium to coarse grained basal Cretaceous sandstone which is an excellent reservoir bed. This sandstone is overlain by a thick shale series. Thus the stratigraphic sequence in this area is well suited for the accumulation of oil.

It is possible that both closed anticlinal structures with the above mentioned strata at depth, and reef limestone stratigraphic traps, are present in the area. The most promising area for anticlinal structures

is believed to be the area west of the Bath Hills and Beavertail Mountain.

If production is obtained from Bear Rock or older formations in the Norman Wells area, it would be advisable to do further field work in the Ramparts and Hare Indian River region to determine whether any suitable prospecting localities exist on the broad dome that may be present south of the Hare Indian River.

Recommendations

In the report on the Carcajou Ridge-East Mountain area (10) it was recommended that a seismograph survey be made from the mouth of the Mountain River downstream to P.M.O. 6, and also on Clam Shell Island. The area opposite the Bath Hills would be included in that seismograph survey. Seismograph work in this area might give information about the thickness of the reef limestone, in addition to outlining the subsurface structure. If encouraging results are obtained from this survey, seismograph work should be continued downstream for several miles from P.M.O. 6, so that the area opposite Beavertail Point would be covered.

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Photograph No. 1
7-18-43, 3:00 p.m., 1/100, f.8, inf., filter

WEST EAST

View from the Mackenzie River looking north just before entering the east side of the narrowest part of The Ramparts. The cliffs on both sides of the river are composed of coralline Beavertail limestones. The upper darker weathering beds in the Beavertail formation can be seen at the top of the right hand cliff, and a lensing bed in the lower Beavertail unit can be seen near the base of this cliff.

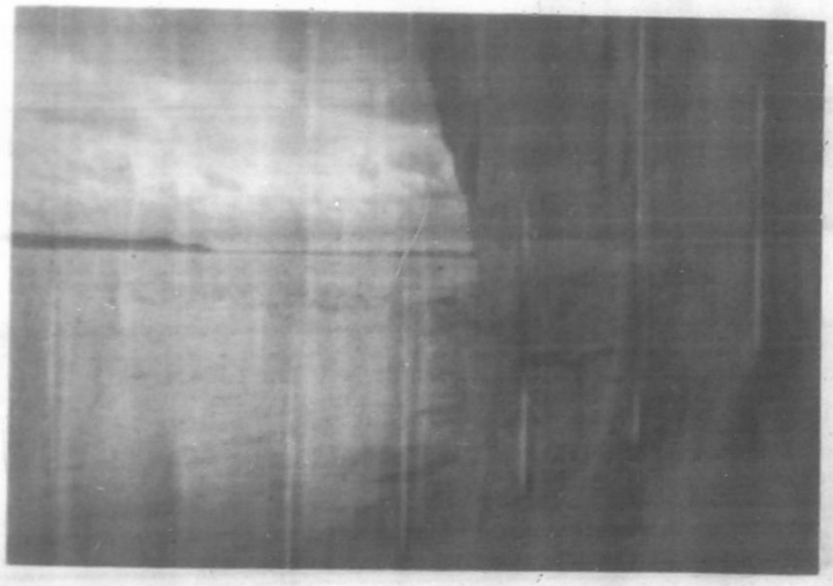
Photograph No. 2
7-19-43. 5:00 p.m., 1/100, f.16, inf.

NORTHWEST

SOUTHEAST

View of the Mackenzie River looking downstream, northeast, from just inside the entrance to The Ramparts.

Photograph No. 3
7-29-43. 4:00 p.m.. 1/100. f.5.6. inf., filter



WEST EAST

View to the southwest, looking upstream at the Beavertail limestone cliff at the west side of the entrance to The Ramparts. The darker weathering, more bituminous Beavertail beds can be distinguished in the upper half of the cliff. A man can be seen standing on the top of the cliff in the upper central part of the picture.

Photograph No. 4
7-22-43, 2:30 p.m., 1/100, f.11, inf.

NORTH SOUTH

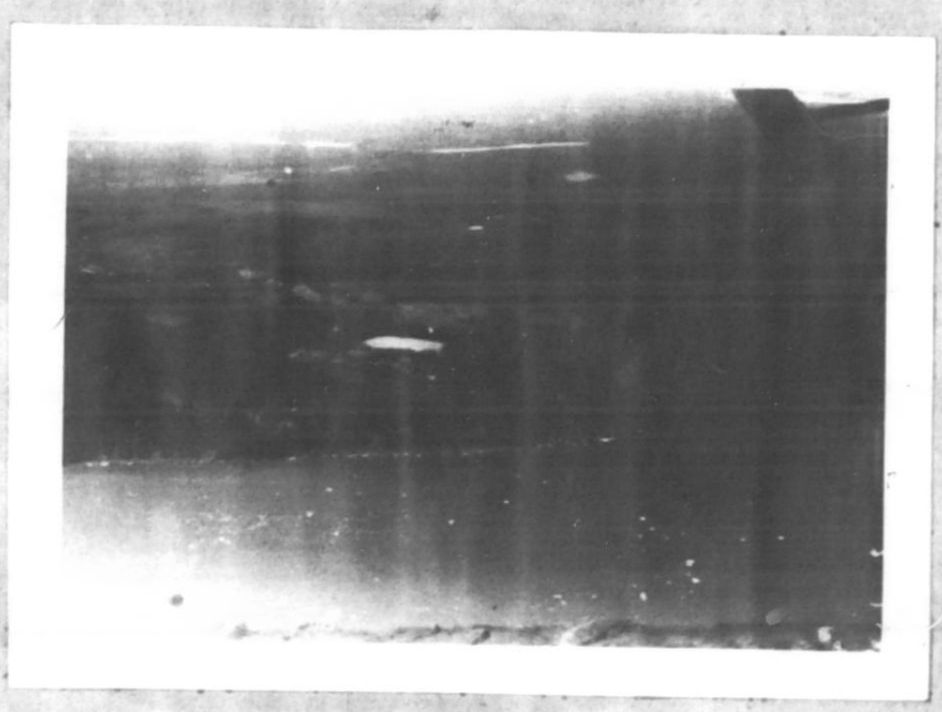
View to the east of the lower part of The Ramparts. The dip of the middle and upper Ramparts beds to the southwest, can be seen in the cliff at the left side of the river.

Photograph No. 5
Taken by Dr. T. A. Link, 1943.

NORTHWEST SOUTHEAST

Aerial view of The Ramparts of the Mackenzie River, looking downstream.

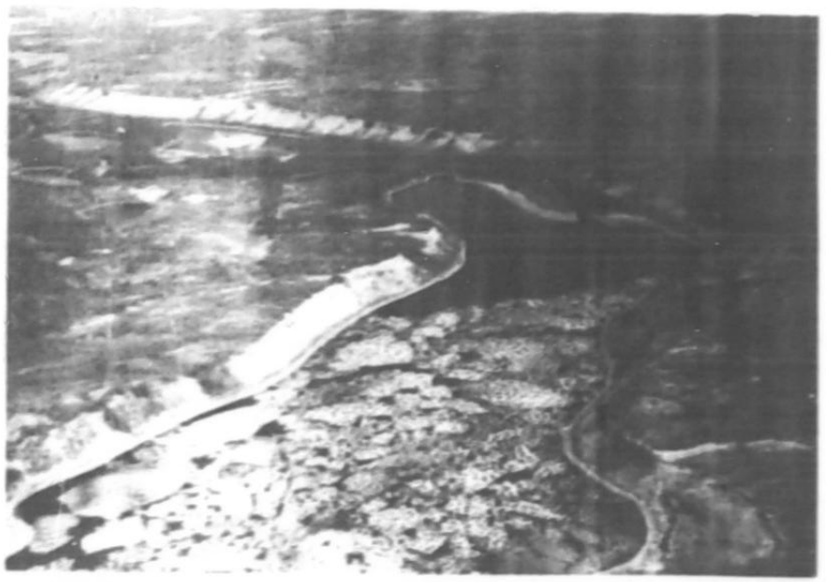
Photograph No. 6
Taken by Dr. T. A. Link, 1943.



SOUTHWEST NORTHEAST

Aerial view looking north-northwest at the outlet of one of the abandoned Mackenzie River channels that enters the central part of the present Ramparts Canyon.

Photograph No. 7
Taken by Dr. T. A. Link, 1943.



SOUTH NORTH

Aerial view looking west at part of the abandoned Mackenzie River channel which joins the present channel at the north end of the Ramparts.

APPENDIX

Edmonton, Alberta,
February 21, 1944.

TO: Dr. T. A. Link
RE: Fossil Identification

Attached is a tentative identification of fossils collected by Mr. J. M. Parker on Assignment No. 31, Sans Sault Rapids to Ramparts.

C. R. Stelck

KH/tm

FOSSIL IDENTIFICATION - SANS SAULT RAPIDS TO RAMPARTS

Suite No.	Date (1943)	Location	Fossil	Accession No.	Age
8524	July 8	Sans Sault Rapids, W. side River, Mackenzie R.	Inoceramus	42204	Cretaceous
			Fucoids	42205	"
			Hoplites	42206	"
			Tellina	42207	"
			Pleuromya	42208	"
8525	July 9	5 mi. downstream from 8524, Mackenzie River	Hoplites	42209	Cretaceous
			Inoceramus	42210	"
			Tellina	42211	"
8526	July 11	Beaver Point, Mackenzie River	Pleurotomaria	42212	Beavertail
			Martinia	42213	"
			Megalomus	42214	"
			Stromatoporoid	42215	"
8527	July 19	W. end Ramparts, Mackenzie River	Stromatoporoid	42216	Beavertail
			?	42217	"
			Megalomus	42218	"
			Pleurotomaria	42219	"
			Cladopora	42220	"
8528	July 19	Ramparts, Mackenzie R.	Cladopora	42221	U. Ramparts
			Alveolites	42222	"
			Cystiphyllum	42223	"
8529	July 30	Ramparts, Mackenzie R.	Stringocephalus	42224	U. Ramparts
			Paracyclas	42225	"
			Proetus	42226	"
			Stromatoporoid	42227	"
			Atrypa	42228	"
			Cladopora	42229	"
			Cystiphyllum	42230	"
			Crinoids, etc.	42231	"
8530	July 25	Ramparts, Mackenzie R.	Atrypa	42232	Beavertail
			Gastropods	42233	"
			Pachyphyllum	42234	"
			Algae	42235	"
8531	July 29	Ramparts, Mackenzie R.	Atrypa	42236	Beavertail
			Paracyclas	42237	"
			Pleurotomaria	42238	"
			Cystiphyllum	42239	"
			Stromatoporoid	42240	"
			Schizophoria	42241	"
			Martinia	42242	"
			Gomphoceras	42243	"
			Productella	42244	"
8532	July 30	Ramparts, Mackenzie R.	Atrypa	42245	U. Ramparts

Fossil Identification

Suite No.	Date (1943)	Location	Fossil	Accession No.	Age
8532	July 30	Ramparts, Mackenzie R.	Cladopora	42246	U. Ramparts
			Cystiphyllum	42247	"
			Paracyclas	42248	"
			Productella	42249	"
			Euomphalus	42250	"
			Pleurotomaria	42251	"
8533	July 31	Ramparts, Mackenzie R.	Paracyclas	42252	Ramparts
			Euomphalus	42253	"
			Atrypa	42254	"

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MAC. RIVER AREA
Between Sans Sault & RAMPARTS

PLATE II

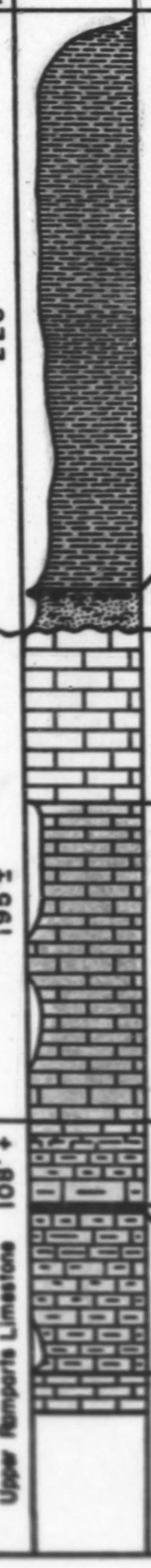
COLUMNAR SECTION OF THE RAMPARTS AREA
MACKENZIE RIVER, N.W.T. CANADA

SCALE: 1" = 100'

ASSIGNMENT No. 31, PARTY D.

J. M. PARKER
M. M. HANNA

JANUARY, 1944.



Sequence	System	Series	Formation	Member	Thickness	Description	Fossil Suites
MESOZOIC	CRETACEOUS	LOWER CRETACEOUS	Sans Sault	228'	215'+	Shale, blue-grey to black, slightly micaceous, blocky. Weathers to small flakes and has prominant vertical joints. Contains a few thin, limy laminae and concretionary bands. Cone-in-cone structure and petrified wood are present in some of the limy beds. The concretions are dark grey to purplish-grey; Weather red-brown, are often septarian, and range in size from a 0.2' to a 4.0' diameter	
					13'	Sandstone and shaly sandstone with a prominent concretionary band at the top. The sandstone is grey to brown, medium to coarse grained, cross-bedded, and contains conglomerate stringers, ripple-marks and fucoids. May be underlain by a 10'± black sandy shale containing coal and bitumen lenses. The sandstone contains plant remains.	SUITE 8530: *Cyathophyllum sp.*, *Cladopora sp.*, *Euomphalus sp.*, *Pleurotomaria sp.*, *Cystiphyllum sp.*, *Zaphrentis sp.*, *Actinopteria sp.*, *Schizophoria sp.*, *Atrypa reticularis*, *Atrypa spinosa*
PALEOZOIC	DEVONIAN	MIDDLE DEVONIAN	Beavertail	195'±	65'	Limestone, light to dark grey, medium grained, fairly regular beds with bitumen partings. All of the beds contain some corals and Stromatoporoids, and some of the upper beds are composed entirely of coral fragments in a bituminous matrix. Megalodon sp. is very abundant in some of these beds. In this series of beds, and in the ones below, rubbly biohermal beds alternate with more regularly bedded limestones that weather and break to sharp, angular edges.	SUITE 8527: *Megalodon sp.*, *Martinia sp.*, *Euomphalus sp.*, *Acervularia (?)*, *Stromatoporoids* (2 kinds), *Cladopora sp.*
					130'	Limestone, light grey, medium grained, contains coral fragments which are usually larger than in the above beds. The limestone is coarser grained than the above limestone beds and contains little bitumen except at partings. The coral fragment content of one bed may vary from 10% to 90% within a few hundred feet. The beds themselves are lensing, and vary from a feather edge to 25' in thickness. Included in this unit are two or three lensing groups of dark-grey, bituminous beds 10' ± thick.	SUITE 8531: *Schizophoria sp.*, *Alveolites sp.*, *Productella sp.*, *Cladopora sp.*, *Cystiphyllum sp.*, *Martinia sp.*, *Gomphoceras*, *Atrypa spinosa*, *Paracyclas elliptica*, *Pleurotomaria sp.*, *Cyathophyllum sp.*, *Reticularia sp.*
			Ramparts	Upper Ramparts Limestone 108'+	32'	Limestone, dark grey, coarse-grained, petroliferous. A Stromatoporoid limestone that also contains many corals. The corals are generally much larger than those found in the above limestones. Contains dark grey limy shale in irregular bands and around the individual Stomatoporoid nodules. There are regular shale partings 18 and 24 ft. above the base of this unit.	SUITE 8533: *Euomphalus sp.*, *Paracyclas sp.*, *Atrypa spinosa*, *Productella sp.*
					2½'	Shale, black, earthy. Upper contact an irregular biohermal zone. Many large Cladopora and Cystiphylum.	SUITE 8532: *Euomphalus sp.*, *Atrypa spinosa*, *Cyathophyllum sp.*, *Cladopora sp.*, *Zaphrentis sp.*, *Martinia sp.*, *Paracyclas sp.*
					60'	Limestone, similar to limestone described above. 32 ft. below the above shale bed is a 2 1/2 ft. bed that contains abundant Stringocephalus. There are several regular shale partings in this unit.	
					14'	Limestone, light to dark grey Stromatoporoid limestone, but the matrix between the nodules is limy, not shaly as in the above limestone.	SUITE 8529: *Stringocephalus sp.*, *Paracyclas sp.*, *Proetus sp.*, *Atrypa spinosa*, *Cyathophyllum sp.*, *Cladopora sp.*, *Euomphalus sp.*, Crinoid Stems, Stromatoporoids

31 F-2.243

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PLATE III

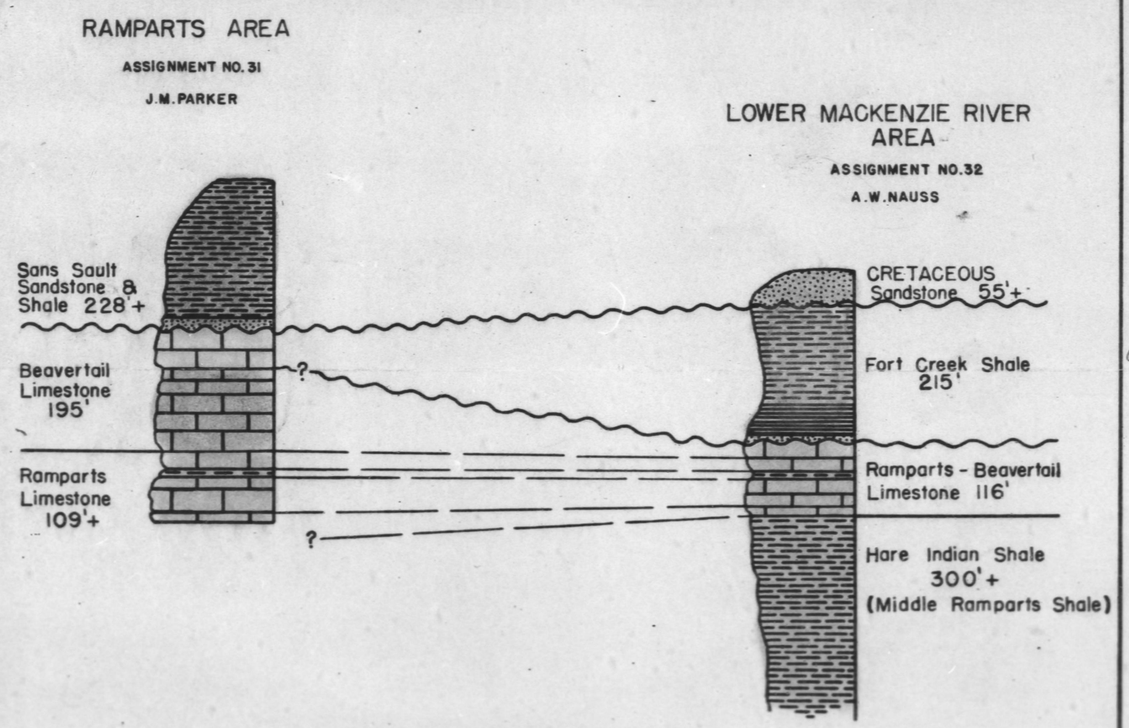
CORRELATION CHART
TO ACCOMPANY THE
RAMPARTS AREA COLUMNAR SECTION

SCALE: 1"=200'

ASSIGNMENT NO. 31

PARTY D

JANUARY, 1944.



Composite

F-2-237

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PLATE- I

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KEY

SYMBOL	FORMATION or MEMBER
Kss	Sans Sault
Dbt	Basal Limestone (Beaverfoot)
Dur	Upper Ramparts Member
Dmr	Middle Ramparts Member (Hume River Area)

AREAL GEOLOGIC MAP
of
The Mackenzie River Area
from
THE SANS SAULT RAPIDS TO THE RAMPARTS
N.W.T. Canada
January 1944

Scale - 1 inch = 1 mile

Map base compiled from government maps, C.P.A. and U.S.A.A.F. photographs, and party O plane table traverses.

Geology by Party O
Imperial Oil Ltd., Canol Project.
Assignment N° 31

- LEGEND -

Structural contour, the number refers to the elevation above or below sea level of the datum plane which is a 2.5 ft. shale bed that is 30 feet below the base of the Beaverfoot Formation

Scarp	Overturned Anticlinal Axis	Strike and Dip	
Slope	Anticlinal Axis	Photo Center	
Bluffs	Synclinal Axis	Govt. Traverse Stn. PMO 6	
Geological Boundries from field work	Fault	Oil Seep (?)	
From aerial photos		J. Gordon Turnbull Flag	
Vague, either from field work or photos		Glacial Grooves	
		Fossil Collection Locality and Suite N°	F-1028

T-2.35-77