

No. 26

165

FINAL  
GEOLOGICAL REPORT  
on  
"THE LOWER MACKENZIE RIVER AREA"  
N.W.T. (Canada)  
IMPERIAL OIL LTD., CANOL PROJECT.  
Assignment No. 32

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Date submitted:- February 4, 1944

Read and accepted by:-

Neon Link

Date:- Feb. 5th. 1944.

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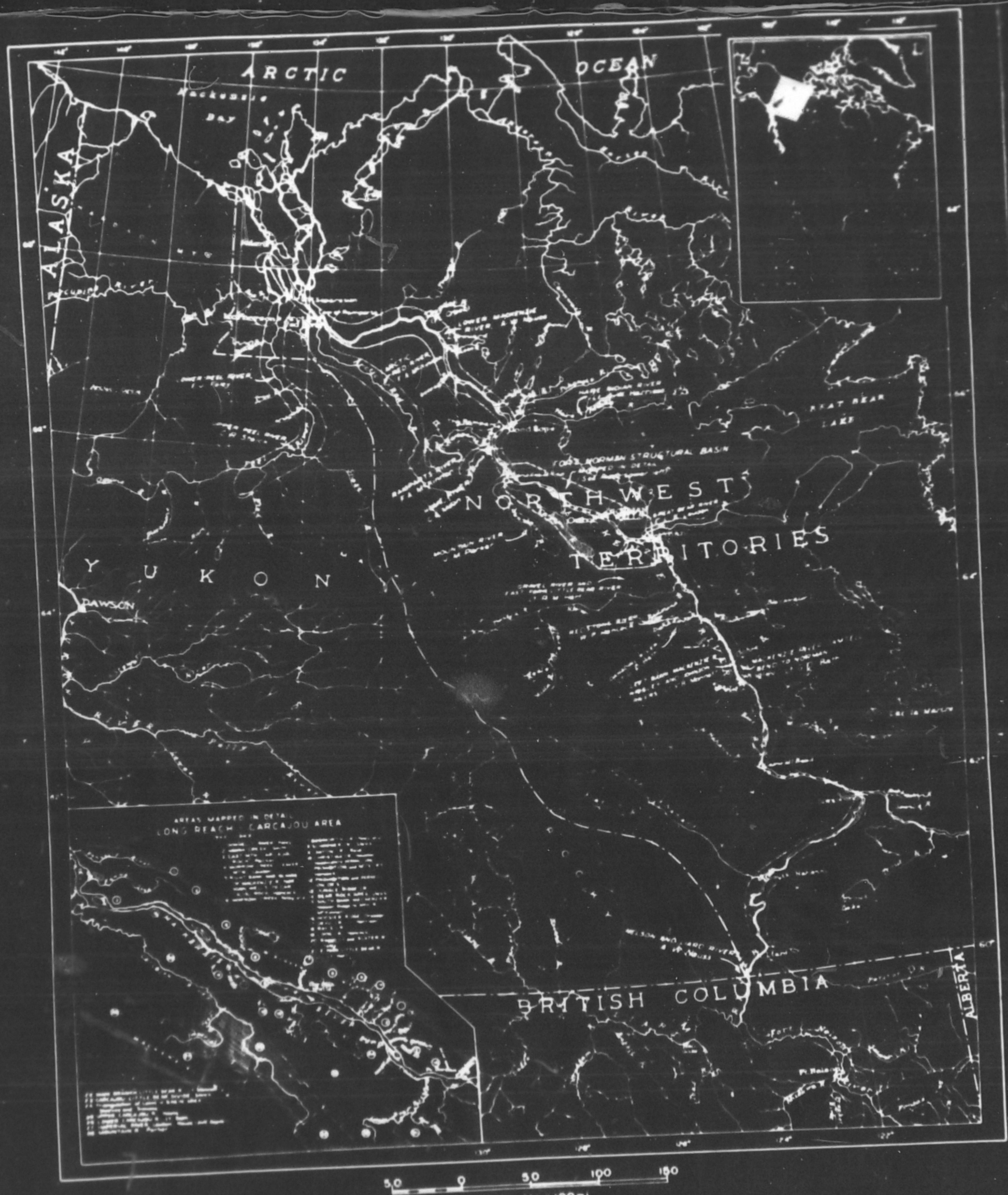
N.W.T.  
(Canada)

A B S T R A C T

The "Lower Mackenzie River area" is a widespread plain. Flat-lying Devonian formations outcrop along the Mackenzie River. These are, in ascending order: The Hare Indian shale, Ramparts-Beavertail limestone, Fort Creek shale, and Bosworth sandstone and shale. A disconformity at the base of the Fort Creek shale cuts out the Ramparts-Beavertail limestone to the west. Petroiferous beds occur in all the Devonian sediments except the Hare Indian shale. The upper part of the Beavertail is a reef limestone thirty feet thick in the Ramparts Plateau Area northwest of Good Hope. The Bosworth sandstone contains abundant plant remains and rare marine fossils and was formerly mapped as Cretaceous.

Only one outcrop on the Mackenzie River, in the Lower Mackenzie River area, exposes the Cretaceous. This outcrop, twelve miles northwest of Good Hope, consists of coarse sandstone, resting disconformably on Hare Indian shale. The regional dip is toward the southwest, and Cretaceous sediments occupy the syncline which borders the Mackenzie Mountains to the southwest of Mackenzie River. At the head of the Mackenzie Delta a reversal occurs which is probably due to the downwarping of the formations during the accumulation of the delta sediments. Bosworth sandstone is exposed at the crest of this structure.

West of the Mackenzie Delta, the Richardson Mountains are formed of gently folded Jurassic sandstones and shales. These anticlines are easily recognized and outlined, and the Devonian strata are deeply buried. These mountains are thought to have geologic conditions favorable to the occurrence of oil. They are only about four hundred miles from Fairbanks Alaska, over much less rugged terrain than the route from Norman Wells to Whitehorse.



INDEX MAP OF  
NORTH WESTERN CANADA SHOWING  
LOCATION OF UPPER CARCAJOU-IMPERIAL RIVER AREA

## Chapter I

### INTRODUCTION

The area under consideration lies along the Mackenzie River from the Ramparts, five miles above Good Hope, to Point Separation at the head of the Mackenzie Delta, a distance of about 240 miles (Plate I).

Party I, consisting of A.W. Nauss, H.K. Reidford, K. Payne and W.L. Clemis, were landed by boat in the Ramparts of the Mackenzie and the river was descended by canoe to Point Separation. From there a trip was made to Black Mountain on the west side of the Mackenzie Delta 20 miles northwest of Aklavik. The survey of the Lower Mackenzie River area commenced August 10, and was completed September 21.

All tributaries with any prospect of outcrops were ascended two to eight miles. Numerous outcrops several miles from the river, located by means of aerial photographs, were visited. The area was mapped by pacing the distance to the nearest landmark observed on the aerial photos.

Accessibility. The area is easily accessible to boats along the Mackenzie River. In the fall, just before freeze up, the level of the river drops rapidly due to the early freezing of springs and streams in the mountains and to the fact that much of the late precipitation in the mountainous portion of the Mackenzie drainage basin falls as snow and does not reach the river until the following spring. The low stage of water thus formed causes such a swift current in the Ramparts that boats have great difficulty in returning upstream and have frequently been forced to tie up at Good Hope for the winter.

Oil could be transported, during several months in the summer,

by tanker, through the Arctic Ocean from the Mackenzie River mouth. However, the Arctic ice would present some navigation difficulties.

Any large development in the Mackenzie Delta region should consider the possibilities of a transportation route directly to Fairbanks, which is only 430 miles from Point Separation. This route would have a choice of several low passes over the mountains west of the Peel River. The pass west of Fort McPherson is only 2600 feet above sea level (McConnel 1891, p. 118). Four fifths of the distance from this pass to Fairbanks is over non-mountainous terrain. One of the most favored routes is from the Mackenzie River Delta up the Rat River over the low divide into the Porcupine River, which joins the Yukon River.

The writer acknowledges the able assistance of H. K. Reidford, K. A. Payne and W. L. Clewis in the field. C. R. Stelck identified the fossils which were collected during the field work. L. Desjardins, R. Merrill and T. Blanchet of the Imperial Oil Limited Photogrammetry Department, plotted the geographic features, other than the Mackenzie River, on the base map, from oblique photographs. Information, obtained from F. A. McKinnon on the Arctic Red River, aided in determining the approximate position of the Cretaceous contact, and in deciding that sandstones exposed in the Lower Rampsarts are of Devonian age. E. J. Foley first drew attention to the Point Separation structure.

## Chapter II.

## TOPOGRAPHY

The Mackenzie River flows from Good Hope to Point Separation through a muskeg-covered plain dotted with innumerable lakes some of large size. Several escarpments formed of hard flat-lying beds face the river in this area. Twelve miles below Loon River, on the north side of the Mackenzie and 400 feet above it, is an escarpment trending S. 75 degrees E. The south side of this escarpment is a cliff on which is exposed Ramparts limestone.

The "Grand View" Hills lying four miles inland southwest of the river rise to about 500 feet above the level of the Mackenzie. These hills are formed of flat-lying Devonian sandstone which is more resistant to erosion than the underlying shales. Still farther downstream, six miles below Tutsietta River, on the north side of the Mackenzie there is another escarpment (600 feet high) on which is exposed Fort Creek shale disconformably overlying Hare Indian shale. This escarpment trends east-west. The flat muskeg lying south of it is an old higher flood plain of the Mackenzie.

To the west of Tree River, there are a number of narrow channels now partly occupied by lakes. These can be traced southward to the Arctic Red River and are probably its abandoned outlets. At Arctic Red River Post the Mackenzie has cut a narrow channel 200 to 400 feet deep in hard Devonian sandstones. The river banks are steep and vertical in places. This narrow channel is known as the "Lower Ramparts" of the Mackenzie.

## Chapter III

## S-T-R-A-T-I-G-R-A-P-H-Y

General

The formations exposed below the drift in the Lower Mackenzie area range in age from Middle Devonian to Lower Cretaceous. The oldest beds that crop out in this area are Hare Indian shales of Middle Devonian age. These shales are overlain by Ramparts-Beavertail limestones, which gradually become thinner towards the west due to bevelling at the disconformity at their top. The Upper Devonian Fort Creek shale overlies the Ramparts-Beavertail limestones disconformably. At Thunder River, the Fort Creek shales rest directly on Hare Indian shale and the Ramparts-Beavertail limestones are absent.

The Fort Creek shales are overlain by a near-shore equivalent of the Bosworth formation which consists of fine grained sandstones and shales containing plant remains. These beds were formerly assigned to the Cretaceous (McConnel 1911, p. 111).

The only Cretaceous rocks exposed along the Mackenzie River between Good Hope and Point Separation occur in an outcrop on the south side of the river 1½ miles northwest of Good Hope, and consist of medium grained and conglomeratic quartz sandstone.

## DEVONIAN

Hare Indian Shale - The Hare Indian shale which outcrops at the mouth of the river with that name, was named by Kindle and Bosworth (1921, p. 45). It underlies the type outcrops of the Ramparts limestone in the Ramparts. In other reports this shale is referred to under the name "Ramparts" (Foley 1944 b, pl. 5).

Lithology - The Hare Indian shale consists of grey crumbly shale which is silty in places. Limestone beds two to six inches thick occur in the

upper fifty feet and these become more numerous upwards until the formation is predominantly limestone. The greatest thickness of this shale exposed is 291 feet, at the mouth of Escarpment creek. The base is not exposed. The upper contact with the Ramparts limestone is gradational. Near Tutsietta River and Thunder river, the Ramparts is absent and the Hare Indian shale is overlain disconformably by Fort Creek shale.

Paleontology The following fossils were collected from the Hare Indian shale and identified by C.R. Stelck:

Brachiopods

Atryna reticularis

Cyrtina

Leiorhynchus

Martinia

Trilobites

Proetus

The Proetus is abundant in the upper part of the formation and is useful in recognizing it.

Correlation It is believed that towards the southeast, about 100 miles beyond the area considered in this report, the Hare Indian shale grades laterally into the limestones of the Ramparts formation. It is roughly synchronous with the middle Ramparts on Discovery Range and in the Mackenzie Mountains.

Origin The lateral change of facies suggests that the terrigenous Hare Indian shale is on the landward side of the Ramparts limestone. It is therefore, probable that the Hare Indian shale was derived from a land area to the north, and represents a near-shore facies of the middle Ramparts limestones.

Ramparts-Beavertail limestone

Lithology In their most complete development on the Ramparts Plateau, the Ramparts-Beavertail limestones comprise four units which are distinguished from each other by their lithology and paleontology. These are as follows:

- 30° Buff rubbly slightly petroliferous reef limestone, Cladopora
- 25° Massive light buff petroliferous coral limestone.
- 6° Purple shale.
- 50° Buff concretionary and blocky limestone which fractures into small pieces and weathers dark grey, Stringocephalus burtini.
- 10° Thin bedded rubbly and blocky limestone, Newberria laevis, Atrypa spinosa, Atrypa reticularis.

The greatest thickness of these limestones was measured in the Ramparts of the Mackenzie, five miles above Good Hope, and found to be 160 feet thick (Photo No. 1). The upper contact of the Ramparts-Beavertail is a disconformity. The overlying Fort Creek shale lies on lower beds toward the northwest until finally, at the type locality of the Fort Creek, at Thunder River, it rests directly on the middle part of the Hare Indian shale.

Paleontology The following fossils were collected from the Ramparts-Beavertail limestones in the Lower Mackenzie area and identified by C.R. Stelck:

Cerata

Alveolites  
Aervularia  
Cladocorn  
Cyathophyllum  
Cystiphyllum  
Helicophyllum  
Prismatophyllum

Crinoid stems  
Stromatoporoids

Brachiopods

Atrype devoniana  
Atrypa reticularis  
Atrypa spinosa  
Cyrtina  
Leiorhynchus  
Martinia  
Newberria  
Schizonophoria  
Spirifer  
Stringocephalus

Mollusks

Euomphalus  
Orthoceras  
Pleurotomaria

Trilobites

Goldius  
Odontocephalus

Kindle (1916, p. 247) reports the following fossils from an outcrop of Ramparts limestones thirty miles northwest of Good Hope, just inside the Arctic Circle.

Acervularia davidi  
Camarotoechia sp.  
Atrypa reticularis  
Newberria laevis Meek  
Cyrtina panda Meek  
Martinia meristoides

The reef limestone at the top of the Beavertail is porous and highly petrolierous on the outcrop. It is overlain by Fort Creek shales and should be an ideal reservoir bed, if present under sufficient cover in suitable structures.

Fort Creek Shale

The Fort Creek shale was named by Kindle and Bosworth (1921, p. 47) for outcrops at the mouth of the stream which is locally known as Thunder River. This stream was named Fort Creek by Bosworth and Kindle because the site of old Fort Good Hope is only a few miles away. On most published maps the name Thunder River is incorrectly applied to

the river which is locally known as Trevor River.

The Fort Creek shale consists of three members in the Lower Mackenzie River area (Plate II). The lowest member is a medium grained calcareous quartz sandstone two to five feet thick, on the Cutaratou River, where it contains abundant brachiopods of the genus Hypothyridina. At Thunder River, this member is about 45 feet thick and consists of fine grained black flaggy petrolierous sandstone with plant remains and a few brachiopods.

Overlying this sandstone is about 50 feet of black platy sulphurous bituminous shale. In places it is burnt brick red by forest fires. On Cutaratou River this member contains a light oil in considerable quantity. Small droplets of oil occur on the outcrop and give it a brown color. The only fossil collected from this member is Tentaculites. This unit may be considered as a good source bed.

The upper part of the Fort Creek shale is grey flaky and crumbly shale with some fragments of fine grained sandstone. The greatest thickness of this shale exposed is 160 feet. The top of this unit was not seen and it may be considerably thicker. This unit would make an ideal cap rock for the retention of oil in structures.

#### Bosworth formation

From Thunder River to Point Separation sandstones and shales containing plant remains and few invertebrate fossils crop out. These were previously considered to be Cretaceous in age and McConnell reported Inoceramus ten miles above Tree River. A diligent search was made in this locality, but no fossils were found. At outcrop No. 88 (Plate III) Upper Devonian fossils were found in the highest beds exposed. These sandstones are fine grained, greenish-grey, and flaggy like those of the Bosworth formation near Norman Wells and are therefore assigned to the Bosworth

formation. The shales are grey and crumbly, but in the lower part are more silty than the Bosworth shales near the Discovery Range.

The formation may be divided into three members: a lower grey silty shale, a middle sandstone unit, and an upper grey shale. The basal unit consists of grey silty shale and argillaceous siltstone with some thin sandstone beds (Plate II). The base of this unit was not seen and the thickness may be considered greater than 150 feet.

The overlying medium grained greenish grey blocky and flaggy sandstones, with interbedded grey silty shales, are continuously exposed in the Lower Ramparts of the Mackenzie just above Arctic Red River Post, and downstream to Point Separation (Photo No. 2). These sandstones and shales contain abundant plant remains. They have a total thickness of about 500 feet. They also occur on Grand View Hills (Plate III).

The uppermost member of the Bosworth formation occurs in numerous outcrops on Tree River and consists of smooth grey, crumbly, homogeneous shale with some thin fine grained sandstone beds. In one of these sandstone beds or the Mackenzie River crinoid stems, ostracodes, and brachiopods were found. The greatest measured thickness of these beds was 350 feet but the total thickness may be greater.

Origin The fact that the Bosworth sandstones in the Lower Mackenzie River region are coarser and contain more plant remains and fewer marine fossils than equivalent beds at Norman Wells suggests that in the Lower Mackenzie area these sediments were closer to the land mass from where they were derived. This is further supported by the fact that the Bosworth sandstones grade into limestone toward the south. (In central Alberta the Upper Devonian is predominantly limestone).

The poorly sorted and angular character of the Bosworth sands, together with the lateral variations from sandstone containing plant

remains to sandstone with marine fossils, suggest that this formation is a delta deposit.

#### CRETACEOUS

The only Cretaceous rocks observed occur in an escarpment twelve miles northwest of Good Hope. At this outcrop fifty five feet of coarse cross bedded quartz sandstone was examined. This sandstone contains a few conglomerate streaks with angular black shale pebbles. It overlies the Hare Indian shale disconformably, and all the younger Devonian beds are absent. This sandstone is believed to be the basal transgressive beach sand deposited along the shore of the advancing Cretaceous sea.

## STRUCTURE

General

The dip of the bed rock in the Lower Mackenzie River area is very gentle and rarely exceeds one degree. The regional dip is to the southwest and south. From Good Hope to Tree River the regional dip is to the south. These dips show up in the distribution of formations (Plate III).

Two structures were observed on which the dips departed from the regional. These are the Loon River structure and the Point Separation anticline.

Loon River Structure or Flexure

From Escarpment Creek to the bend in the Mackenzie at "Payne" Creek, the elevation of the top of the Hare Indian shale gradually decreases (Plate IV). This, together with approximate barometric elevations on the same horizons on Nelli-Alice Lake, indicates that the dip in this district is toward the west. The strike of the beds south of Good Hope is northwest, and the change from a northwest to north strike occurs in the vicinity of Loon River. This structure may be a northwest continuation of one of the anticlinal uplifts of the Franklin Mountains. The Loon River structure has no closure and cannot be considered as an oil prospect.

The Point Separation Anticline

From Arctic Red River toward Point Separation the Bosworth sandstones gradually rise in the banks of the Mackenzie River. This south dip continues to within one half mile of Point Separation where a reversal to a north dip occurs (Plate IV).

Dips and strikes on the Point Separation structure suggest

that it plunges gently to the southwest, but strike determinations were not sufficiently accurate to make this conclusive. The apparent closure along the Mackenzie River amounts to only 50 feet, but it is believed that the northward dip continues for some distance under the Mackenzie Delta sediments.

This structure may have been caused by the settling of the Mackenzie Delta region during the accumulation of the delta sediments, thereby reversing the southward regional dip. If this is the case one would expect the Point Separation anticline to be a major structure.

The oil prospects of the Point Separation structure depend to some extent, on whether or not limestone reservoir rocks underlie the Fort Creek shale at this locality. At Thunder River the Beavertail and Ramparts limestones are absent at the disconformity at the base of the Fort Creek shale. However, on Campbell Lake, 50 miles northeast of Point Separation, Middle Devonian limestone outcrops occur (Kindle 1916, p. 246). Hence, there is a good chance that limestones underlie the Fort Creek shale in the Point Separation anticline.

## Chapter V

## RICHARDSON MOUNTAINS

From Point Separation a trip was made to the Aklavik Range of the Richardson Mountains on the west side of the Mackenzie Delta (Plate III). The Peel Channel was followed to its junction with the Husky Channel. The latter was then ascended for ten miles. The Aklavik Range is not more than one mile from the Husky Channel at this point (Photo No. 3).

The top of these mountains forms a plateau which has an elevation of about 1500 feet above sea level (Photo Nos. 4 & 5). This plateau is undulating. It is entirely above tree-line, and only small bushes and brush grow in the ravines. The Donna River Valley cuts through the plateau in a general northerly direction and has a depth of about 800 feet.

Good outcrops occur on Black Mountain and along Donna River (Photo No. 6). Two formations one of shale, the other of sandstone, are exposed. These are as follows:

1000 feet of fine, medium, and coarse-grained buff and rusty blocky quartz sandstone, containing glauconite, some conglomerate layers, a few silty shale beds, Belemnites,

800 feet of dark grey crumbly silty shale, abundant ironstone concretions and layers.

An identical section occurs on Mount Goodenough 20 - 30 miles farther south (Camsell 1906, p. 46). J.J. O'Neill (1924, p. 16) collected fossils from the sandstones in the section described above and sent them to T.W. Stanton who identified them as follows:

Pentacrinus sp. parts of columns

Pecten sp. coarse ribbed form

Pecten sp. Large smooth form, possibly two species

Lima sp.

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Aucella sp. cf. A. fischeriana (D'orbigny)  
Panope? sp.  
Natica sp.  
Pseudomelanis sp.

Stanton writes, "The Aucella fixes the age as either Upper Jurassic or Lower Cretaceous, more probably the former".

The shale in the above section may be the correlative of a shale which outcrops on the Firth River 125 miles northwest of Black Mountain (O'Neill 1924, p. 13, and Smith 1939, pp. 46 and 56). The Firth River shale was assigned to the Middle Jurassic on the basis of several species of the ammonite Cadoceras.

Several miles north of Black Mountain an anticline, about one mile wide and trending north and south, forms the mountain front at the edge of the Mackenzie Delta. The dips are gentle and do not exceed twenty degrees. The oldest beds exposed are the shales of the above section.

West of this first anticline the dips are again toward the east for a distance of two or three miles and represent the east flank of a second anticline trending north and south.

In summary, the Richardson Mountains west of the Mackenzie Delta consist of anticlines which trend north and south and have gentle dips. The oldest beds observed were Mesozoic in age and at least one anticline in the area has no older beds exposed on its crest.

On these anticlines the possible Devonian reservoir limestones if present, are deeply buried. Such a condition may extend over a fairly large area in the Richardson Mountains. The area is thought to be a good prospective oil province, and structures in it could be easily found by geological surveying.

## OIL AND GAS MANIFESTATIONS

No active oil or gas seepages were observed during this survey of the Lower Mackenzie River area, but bituminous and petroliferous shales, limestones, and sandstones were observed at a number of localities, and the inhabitants report oil and gas seepages in a number of places. Most of these reports appear to have originated because of the inability of these people to distinguish between petroleum and vegetable scums or ferruginous deposits from springs.

The most petroliferous beds observed occur in an outcrop of Fort Creek shale three miles up the Cutaracu River. Forty feet of platy shale, with interbedded highly petroliferous blocky sulphurous shale, are exposed. One of these blocky shale beds is three feet thick and has a dark brown color due to its petroleum content. This shale was examined with a hand lens and small droplets of brown petroleum were observed.

Outcrops of bituminous and petroliferous shales of the lower Fort Creek are common from Escarpment Creek to Thunder River. Some of these outcrops have the brick-red burned shale similar to that which occurs in the Fort Creek shale near Norman Wells.

On the Ramparts Plateau thirty feet of reef limestone occurs at the top of the Beavertail. It is porous and has a strong petroliferous odor, and under ideal circumstances would make an excellent reservoir bed.

A petroliferous odor was noticed in the basal sandstone unit of Fort Creek at Thunder River. This odor differed from that which is characteristic of the petroliferous beds in the Fort Creek at other localities in being more pungent, and the odor was suggestive of certain paraffinic low gravity oils. This type of odor has also been recognized by the author from the basal Bosworth sandstone in the Lower Mackenzie



## Chapter VII

### CONCLUSIONS AND RECOMMENDATIONS

The Point Separation anticline is the only structure in the Lower Mackenzie area which may be considered as an oil prospect. It is, however, far from transportation facilities to the regions of consumption, and only a large field would pay transportation costs.

The Fort Creek shale, where last observed at Thunder River is petroliferous. It may also be petroliferous under the Point Separation structure. Middle Devonian reservoir limestones may also be present below the Fort Creek shale. Some additional geological information could probably be obtained by exploring the lakes and rivers along the east side of the Mackenzie Delta.

The Richardson Mountains west of the Mackenzie Delta are anticlinal in structure, and the lowest beds exposed in some portions are Mesozoic (O'Neill 1924, p. 16, Camsell 1906, p. 46). The petroliferous beds of the Devonian are deeply buried in some of these structures. The geological conditions in parts of the Richardson Mountains are ideal for the occurrence of oil, and their geology should be thoroughly studied.

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Photo No. 1.

Looking at the east bank of the Ramparts of the Mackenzie River, showing Ramparts and Beavertail limestones.



Photo No. 2.

Looking northwest from Arctic Red River down the Mackenzie River. Cliffs of flat-lying Bosworth sandstone at the right.



Photo No. 3.

Looking east at the Mackenzie Delta from the top of the Aklavik Range.

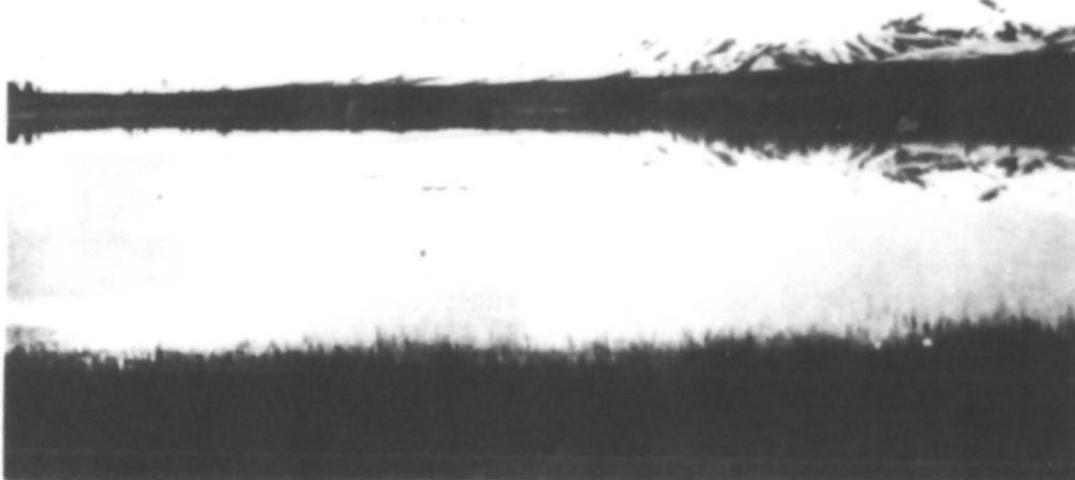


Photo No. 4.

Looking west from a small lake in the Mackenzie Delta toward Black Mountain in the Aklavik Range, showing gently dipping Mesozoic sandstones.



Photo No. 5.

Looking west at the Aklavik Range 2 miles north of Black Mountain. At the right side of the picture, sandstone beds dip gently toward the observer.



Photo No. 6.

Looking west across Donna River, showing the undulating character of the top of the Aklavik Range. A large snow-covered outcrop of Jurassic (?) shale can be seen on the opposite bank of the river. The overlying sandstones can be seen in the foreground at the right.

APPENDIX

MEMORANDUM

December 21, 1943.

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

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The attached is a tentative identification of fossils  
collected by Dr. A. W. Hauss on Assignment No. 32 - Ft. Good Hope  
to Red River Post.

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C. R. Stelck.

KH/cm

FOSSIL IDENTIFICATION - FT. GOOD HOPE TO RHD RIVER POST

Dr. A. W. Hauss

<u>DATE</u>	<u>SUITE NO.</u>	<u>FOSSIL</u>	<u>LOCATION</u>	<u>ACCESSION NO.</u>	<u>AGE</u>
Aug. 17	No. 18	Atrypa	Ramparts Plateau Lower Mackenzie	42012	Hare Indian River.
"	"	Martinia	L "	42013	"
"	"	Cyrtina	"	42014	"
"	"	Leiorhynchus	"	42015	"
Aug. 16	No. 17	Stringocephalus	Ramparts Plateau Lower Mackenzie	42016	Ramparts.
"	"	Newberria	"	42017	"
"	"	Atrypa spinosa	"	42018	"
"	"	Cladopora	"	42019	"
"	"	Martinia?	"	42020	"
"	"	Goldius (Trilebite)	"	42021	"
Aug. 17	No. 18	Martinia	Ramparts Plateau Lower Mackenzie	42022	Hare Indian River
"	"	Leiorhynchus	"	42023	"
"	"	Atrypa reticularis	"	42024	"
Aug. 16	No. 17	Leiorhynchus	Ramparts Plateau	42025	Ramparts.
Aug. 21	No. 32	Hypothyridina	Lower Mackenzie Cataract River	42026	Ft. Creek
Aug. 16	No. 14	Martinia	Ramparts Plateau	42027	"
		Cladopora	Lower Mackenzie	42028	Ramparts
"	"	Alveolites	"	42029	"
"	"	Crinoid stem	"	42030	"
"	"	Schizosphoria	"	42031	"
"	"	Atrypa reticularis	"	42032	"
"	"	Atrypa spinosa	"	42033	"
"	"	Martinia	"	42034	"
Aug. 15	No. 12	Atrypa	Airport Creek Lower Mackenzie	42035	Ramparts
"	"	Schizosphoria	Immediately below Newberria zone.	42036	"
"	"	Cladopora	"	42037	"
"	"	Cyathophyllum	"	42038	"
Aug. 15	No. 11	Cladopora	Airport Creek Lower Mackenzie	42039	Ramparts
"	"	Stromatoporeoid		42040	"
"	"	Cyathophyllum		42041	"
"	"	Atrypa reticularis		42042	"
"	"	Martinia			
"	"	Euomphalus			
"	"	Atrypa spinosa		42043	"
Aug. 10	No. 4.	Newberria	Ramparts 10° Newberria Zone Lower Mackenzie	42044	Ramparts
"	"	Atrypa spinosa	"	42045	"
"	"	Cyathophyllum	"	42045	"
Aug. 16	No. 15	Newberria	Ramparts Plateau Lower Mackenzie	42046	Beavertail Reef

Fossil Identification - Page 2

<u>Date</u>	<u>Suite No</u>	<u>Fossil</u>	<u>Location</u>	<u>Accession No.</u>	<u>Age</u>
Aug. 16	No. 15	Cyathophyllum	Ramparts Plateau Lower Mackenzie	42047	Beavertail Reef
"	"	Atrypa reticularis	"	42048	"
"	"	Atrypa spinosa	"	42049	"
Aug. 16	No. 17A	Newberria	4' Section Newberria zone, Ramparts Plateau Lower Mackenzie	42050	Ramparts.
"	"	Cystiphyllum	"	42051	"
"	"	Atrypa spinosa	"	42052	"
"	"	Prismatophyllum	"	42053	"
Aug. 10	No. 4	Newberria	Big Ramparts 10' Newberria Zone Lower Mackenzie	42054	Ramparts
"	"	Cladopora	"	42055	"
"	"	Atrypa reticularis	"	42056	"
"	"	Cyathophyllum	"	42057	"
"	"	Pleurotomaria	"	42058	"
----	No. 1	Newberria	30' above river level in Big Ramparts, New- berria zone, 1 mi. below Indian Village. Lower Mackenzie	42059	Ramparts.
"	"	Stringocephalus	"	42060	"
"	"	Atrypa	"	42061	"
"	"	Heliophyllum	"	42062	"
Sept. 10	No. 58	Ostracods, etc.	Left Bank river, near Pierre Creek, Lower Mackenzie.	42063	Devonian
Aug. 10	No. 1	Cladopora	Big Ramparts, Lower Mackenzie	42064	Ramparts - Beavertail
"	"	Talus	"	42065	"
"	"	Odontoccephalus	"	42066	"
"	"	Atrypa	"	42067	"
"	"	Leiorhynchus	"	42068	Ramparts.
Aug. 13	No. 11	Newberria	Airport Creek, Newberria zone, Lower Mackenzie	42069	Ramparts.
Aug. 15	---	Stringocephalus	Loon River Camp Lower Mackenzie	42070	Ramparts.
"	"	Spirifer	"	42071	"
"	"	Cyathophyllum	"	42072	"
"	"	Atrypa	"	42073	"
"	"	Newberria	"	42074	Cretaceous
Aug. 21	---	Bouleanticeras	Fleet Cataract Rv. Lower Mackenzie	42075	"
Sept. 2	No. 58	Plant fragment	Travier River Lower Mackenzie	42076	Devonian?
Sept. 3	No. 65	Crinoid stems	Below Travier Rv.	42077	Devonian.
Aug. 25	No. 40	Cyathophyllum	Above Tutsietta Rv.	42077	L. Ramparts.
Aug. 16	P. 5	Cladopora	Ramparts Plateau Lower Mackenzie	42078	Ramparts.
"	"	Newberria	"	42079	"
"	"	Cyathophyllum	"	42080	"

Fossil identification = page 5

<u>Date</u>	<u>Suite No.</u>	<u>Fossil</u>	<u>Location</u>	<u>Accession No.</u>	<u>Age</u>
Aug. 16	P. 8	<i>Atrypa spinosa</i>	Ramparts Plateau Lower Mackenzie	42081	Ramparts.
"	"	<i>Atrypa reticularis</i>	"	42082	"
"	"	<i>Acervularia</i>	"	42083	"
Aug. 21	No. 29	<i>Hypothyridina</i>	Cataratou Rvr. Lower Mackenzie	42084	Basal Ft. Creek
"	"	<i>Odontocephalus</i>	"	42085	"
Aug. 10	No. 4	<i>Cladopora</i>	Big Ramparts. Lower Mackenzie	42086	Ramparts.
Aug. 17	P 11	<i>Atrypa devoniensis</i>	Ramparts Plateau Lower Mackenzie	42087	Ramparts.
"	"	<i>Newberria</i>	"	42088	"
Aug. 26	No. 43	<i>Hypothyridina</i>	Below Tutsietta Rvr. Lower Mackenzie	42089	Pt. Creek
"	"	<i>Martinia</i>	"	42090	"
Aug. 19	No. 23	<i>Martinia</i>	S.Side Hellicalice Lake, Newberria zone. Lower Mackenzie	42091	Ramparts.
Aug. 13	P. 3	<i>Atrypa reticularis</i>	Loon River Camp Lower Mackenzie	42092	Ramparts.
"	"	<i>Prestus</i>	"	42093	"
Aug. 10	No. 5	<i>Orthoceras</i>	Above Good Hope Lower Mackenzie	42094	Ramparts.
Aug. 25	No. 40	<i>Prestus</i>	Above Tutsietta Rvr. Lower Mackenzie	42095	Basal Ramparts ls.
"	"	<i>Atrypa spinosa</i>	"	42096	"
Aug. 13	-----	<i>Cladopora</i>	Airport Creek below Sta. 4 Lower Mackenzie	42097	L.Ramparts
"	"	<i>Atrypa reticularis</i>	"	42098	"
"	"	<i>Newberria</i>	"	42099	"
"	"	<i>Martinia</i>	"	42100	"
"	"	<i>Cyrtina</i>	"	42101	"
Aug. 10	No. 6	<i>Stringocephalus</i>	Above Good Hope Lower Mackenzie	42102	Ramparts
-----	-----	<i>Stringocephalus</i>	Lower Mackenzie	42103	Ramparts
"	"	<i>Cladopora</i>	"	42104	"
"	"	<i>Stromatoporeoid</i>	"	42105	"
Aug. 16	P. 10	<i>Newberria</i>	Ramparts Plateau Lower Mackenzie	42106	Ramparts
"	"	<i>Stringocephalus</i>	"	42107	"
Aug. 13	P 2	<i>Atrypa</i>	Loon River Camp Lower Mackenzie	42108	Hare Indian River
Aug. 21	No. 27	<i>Atrypa</i>	Cataratou River Lower Mackenzie	42109	Basal Ft. Creek
Aug. 21	No. 26	<i>Prestus</i>	Cataratou River Lower Mackenzie	42110	Hare Indian River
"	"	<i>Fossil?</i>	"	42111	"
-----	-----	<i>Stringocephalus</i>	Ramparts Lower Mackenzie	42128	Ramparts.

COLUMNAR SECTION  
LOWER MACKENZIE RIVER AREA

SCALE 1" = 100 FEET

ASSIGNMENT №32

PARTY I: A.W. Nauss, H. Reidford, K.A. Payne, W.A. Clemis

Age	Formation	Column	Thickness	Description	Fossils
CRETACEOUS					
	Disconformity		50'	Massive, coarse, cross bedded quartz sandstone. Some conglomerate streaks	Plant stems
			350'	Smooth, grey, crumbly, homogeneous shale. Some thin fine grained sandstone beds.	Crinoid stems Ostracodes
			500'	Interbedded fine and medium grained greenish grey, blocky and flaggy sandstone and grey silty shale.	
UPPER DEVONIAN	BOSWORTH		150'+	Grey silty shale and argillaceous siltstone. Some thin sandstone beds	Plant remains Crinoid stems
			160'+	Grey flaky shale, some fragments of fine grained sandstone	
	Disconformity		40'	Black platy and burnt red, in places oil soaked shale, sulphur	Tentaculites
	BEAVERTAIL		5'	Med grained blocky calcareous quartz sandstone	Hypothyridina
			40'	Buff, rubbly reef limestone	Cladopora
MIDDLE DEVONIAN	RAMPARTS		25'	Massive light buff coral limestone Petroliferous 6" purple shale at base	
			50'	Buff concretionary and blocky limestone, fractures into small pieces	Stringocephalus burtini
			10'		Newberria laevis, Atrypa spinosa, Atrypa reticularis
	HARE INDIAN SHALE		300'	Grey silty shale with thin limestone beds in the upper part which become more abundant upwards	Atrypa reticularis Proetus, Martinia

CONFIDENTIAL  
PLATE III

GEOLOGIC MAP  
of  
LOWER MACKENZIE RIVER AREA

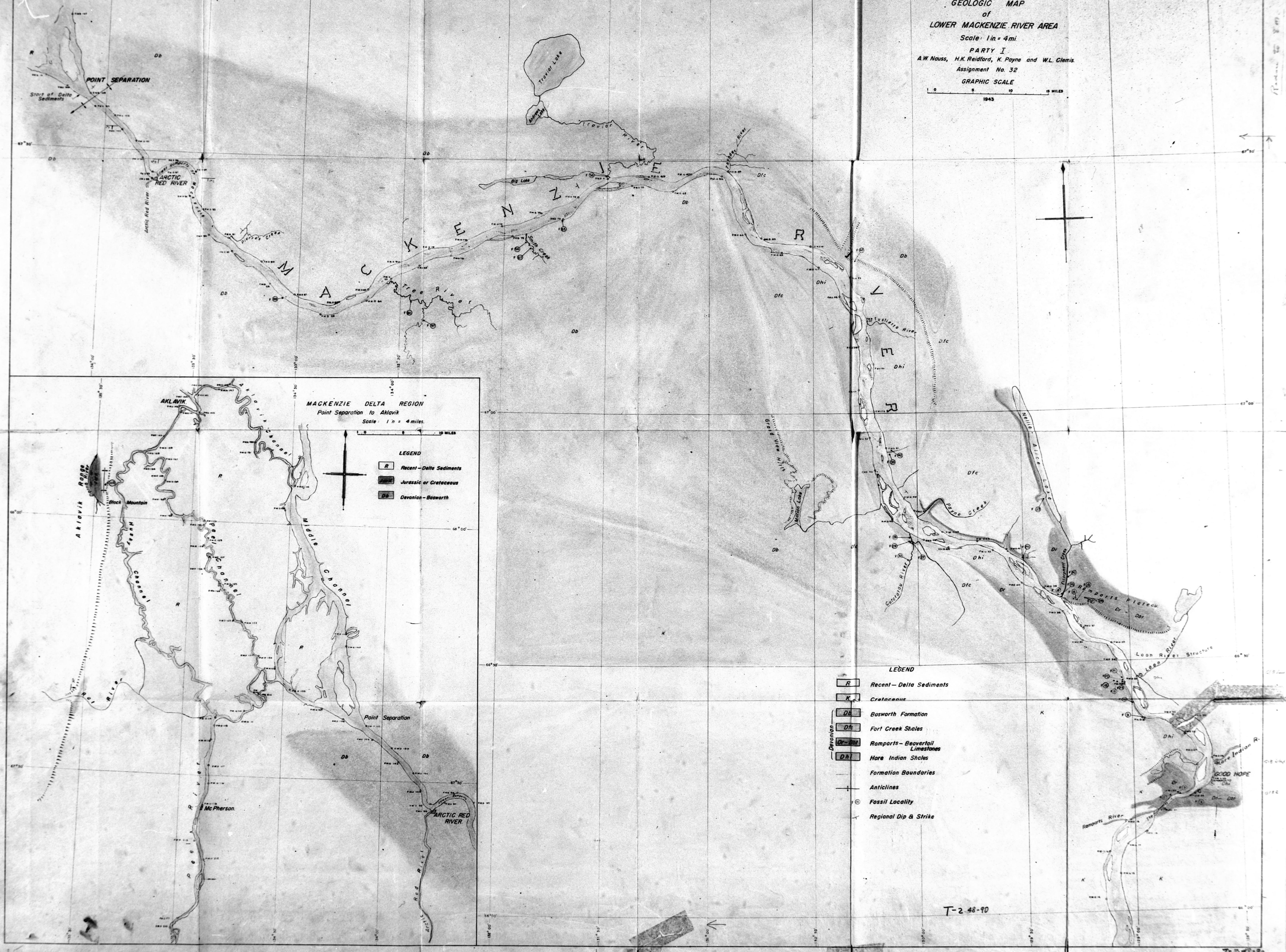
Scale: 1 in = 4 mi.

PARTY I  
A.W. Nauss, H.K. Reidford, K. Payne and W.L. Clemis  
Assignment No. 32

GRAPHIC SCALE

1 0 5 10 15 MILES

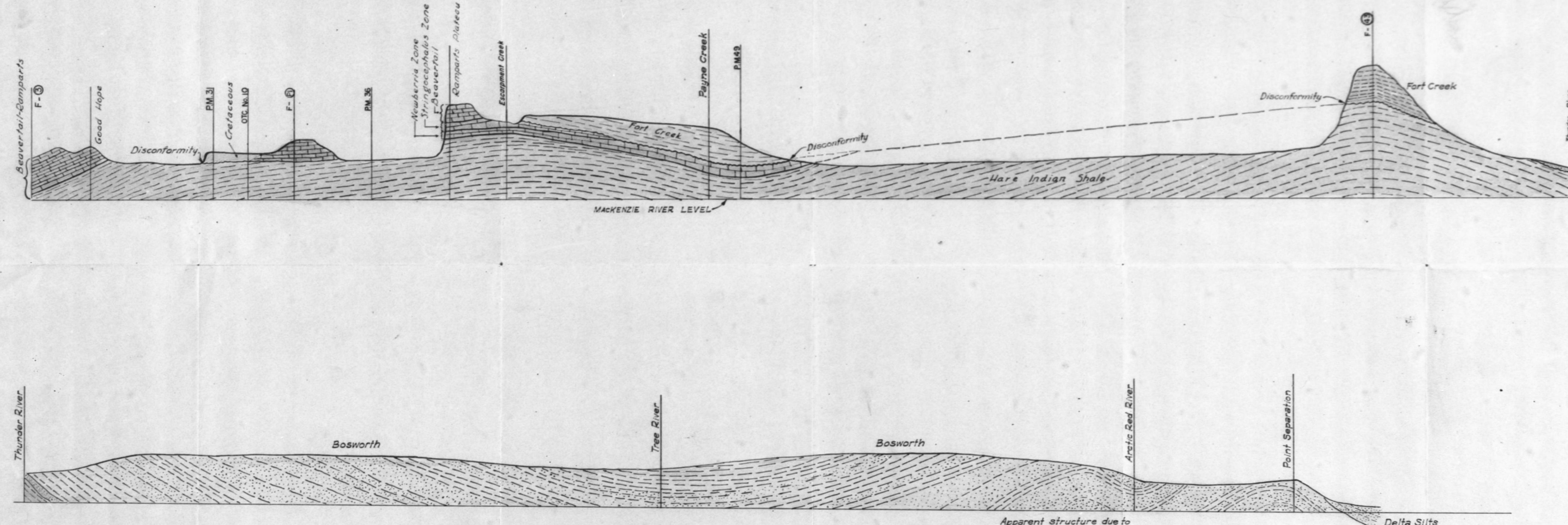
1943



PROJECTED  
CROSS SECTIONS  
ALONG MACKENZIE RIVER FROM GOOD HOPE TO POINT SEPARATION

HORIZONTAL SCALE 1" = 4 MILES  
VERTICAL SCALE 1" = 200 FEET

ASSIGNMENT NO 32



F-2.247

