

Canadian Pacific OIL & GAS LTD.

STRATIGRAPHY OF THE NORTHERN DISTRICT MACKENZIE

prepared by
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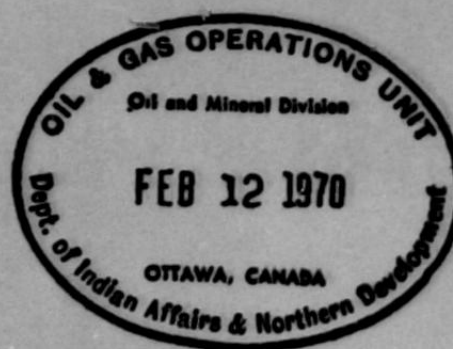
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TABLE OF CONTENTS

	<u>Page</u>
INTRODUCTION	1
ACCESSIBILITY	2
PHYSIOGRAPHY	3
VEGETATION	4
CLIMATE	6
PREVIOUS WORK	7
TECTONICS	8
PROTEROZOIC	8
PALAEOZOIC	9
MESOZOIC	10
STRATIGRAPHY	11
PROTEROZOIC	11
CAMBRIAN OR OLDER	11
Katherine Group	11
CAMBRIAN	11
MacDougal Group	11
Mount Clark Formation	12
Mount Cap Formation	12
Saline River Formation	13
Unnamed Cambrian	13
Depositional Environment	14
Cambro-Ordovician Contact Relations	14
ORDOVICIAN - SILURIAN	15
Exogeosynclinal Facies	15
Road River Formation	15
Miogeosynclinal Facies	16
Franklin Mountain Formation	16
Mt. Kindle Formation	16
Vunta Formation	17
Undivided Siluro-Ordovician	17
Contact Relations: Siluro-Ordovician	18
Contact Relations: Siluro-Devonian	19
Depositional Environment	19
DEVONIAN	20
Bear Rock Formation	20
Hume Formation	21
Hare Indian Formation	21
Kee Scarp Formation	23
Canol Formation	24
Imperial Formation	24
Hume-Canol Stratigraphy	25
CARBONIFEROUS	28
PERMIAN	28
TRIASSIC	29



	<u>Page</u>
JURASSIC	29
CRETACEOUS	29
LOWER CRETACEOUS	29
San Sault Group	29
Anderson River - Inuvik Area	29
JURASSIC - LOWER CRETACEOUS	30
Aklavik Range - Northern Richardson Mtns.	30
UPPER CRETACEOUS	31
Slater River Formation	31
Little Bear Formation	31
East Fork Formation	31
Caribou Hills Area	31
Aklavik Range	32
ECONOMIC GEOLOGY	32
PALAEOZOIC	32
CAMBRIAN	32
SILURO-ORDOVICIAN	33
DEVONIAN	33
Bear Rock Formation	33
Hume, Hare Indian and Kee Scarp	33
Formations	33
MESOZOIC	34
THE ANDERSON PLAIN PERMIT AREA	35
Discussion of Enclosure 7	35
RECOMMENDATIONS	37
SELECTED BIBLIOGRAPHY	38

ILLUSTRATIONS

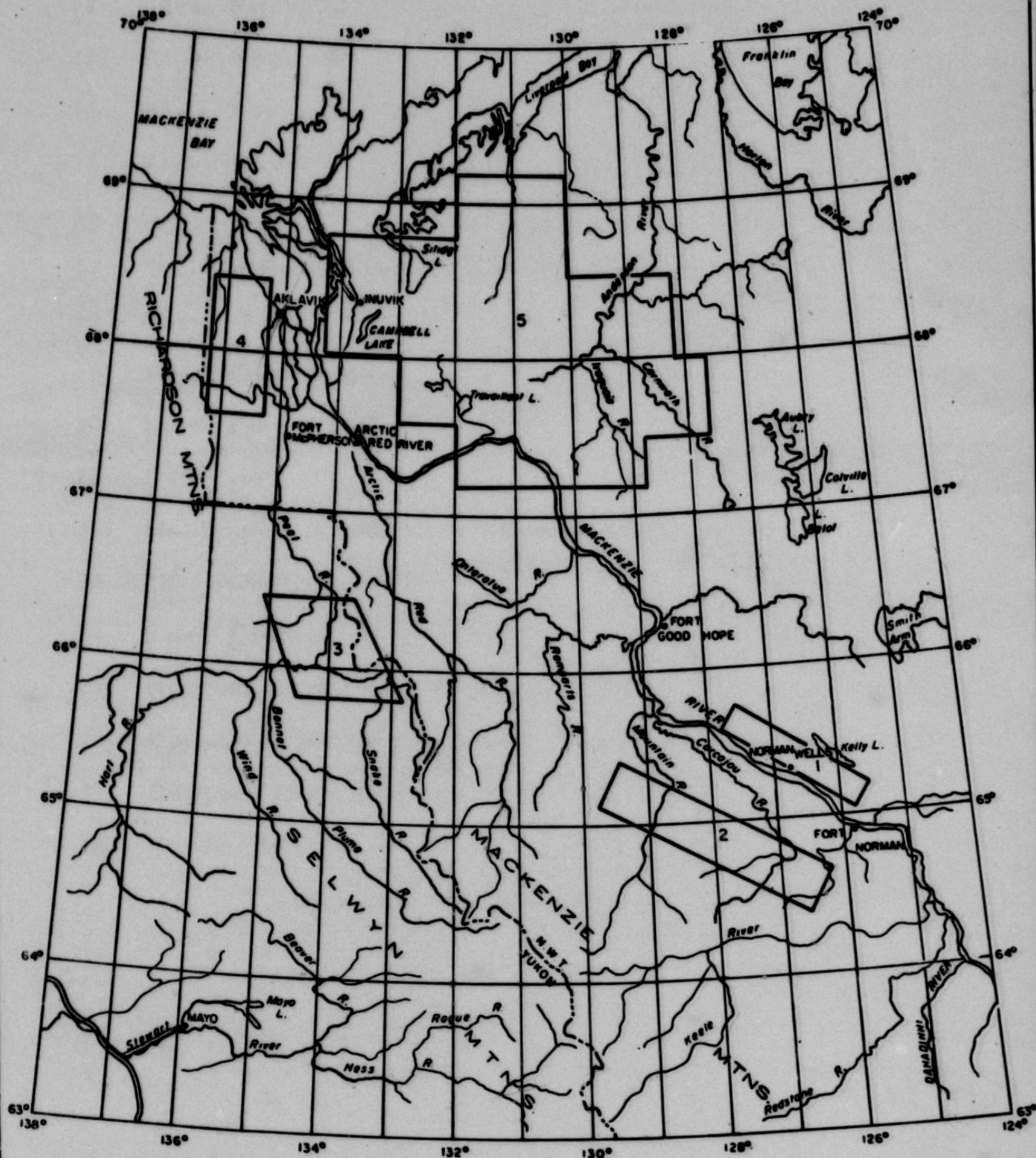
<u>Figures</u>	<u>Following Page</u>
1. Regional Location of Project Areas (Following Table of Contents)	
2. Physiographic Index Map of the District of MacKenzie	2
3. Mean daily temperatures in Northern Canada for January	5
4. Mean daily temperatures in Northern Canada for July	5
5. Averages and extremes of climatic data	5
6. Major Tectonic Elements of the District of MacKenzie and Yukon Territory	7
7. History of Devonian Nomenclature in the Central MacKenzie River Region	19
8. Regional Location Map of Canadian Pacific Oil & Gas F & N G Permits	34

ENCLOSURES IN ACCOMPANYING MAP CASE

1. Diagrammatic Columnar Sections, District of MacKenzie.
2. Stratigraphic Cross-Section A-A'.
3. Stratigraphic Cross-Section B-B'.
4. Stratigraphic Cross-Section C-C'.
5. Illustration of Stratigraphic Sections in the Northern Richardson Mountains with Tentative Correlation.
6. Station Location Map of the Northwestern Anderson Flains.
7. Areal Geology Map of the Northwestern Anderson Flains.

STRATIGRAPHIC SECTIONS

1. Schooner Creek
2. Canyon Creek 'A'
3. Canyon Creek 'B'
4. Prohibition Creek
5. Helluva Creek
6. Little Bear River
7. Rouge Mountain River
8. Carcajou Canyon
9. Dodo Canyon
10. Fantail Creek
11. Virgin Creek



REGIONAL LOCATIONAL MAP
OF
PROJECT AREAS
FIELD SEASON 1967

12. Gayna River 'A'
13. Gayna River 'B'
14. Hume River
15. Snake River
16. Solo Creek
17. South of Road River
18. Martin Creek
19. Mount Goodenough
20. North Fork Rat River
21. Rat River
22. Headwaters of "No Name" Creek 'A'
23. "No Name" Creek 'B'
24. Stony Creek
25. Headwaters of Fish Creek
26. Campbell Lake 'A'
27. Campbell Lake 'B'
28. Caribou Hills

INTRODUCTION

Acknowledgements

Geological field work was carried out during the summer season of 1967 in the Norman Range of the Franklin Mountains (Area 1), the Carcajou Range and eastern Canyon Ranges of the MacKenzie Mountains (Area 2), the Feel Plateau (Area 3), the Richardson Mountains (Area 4), the western Anderson Flains (Area 5).

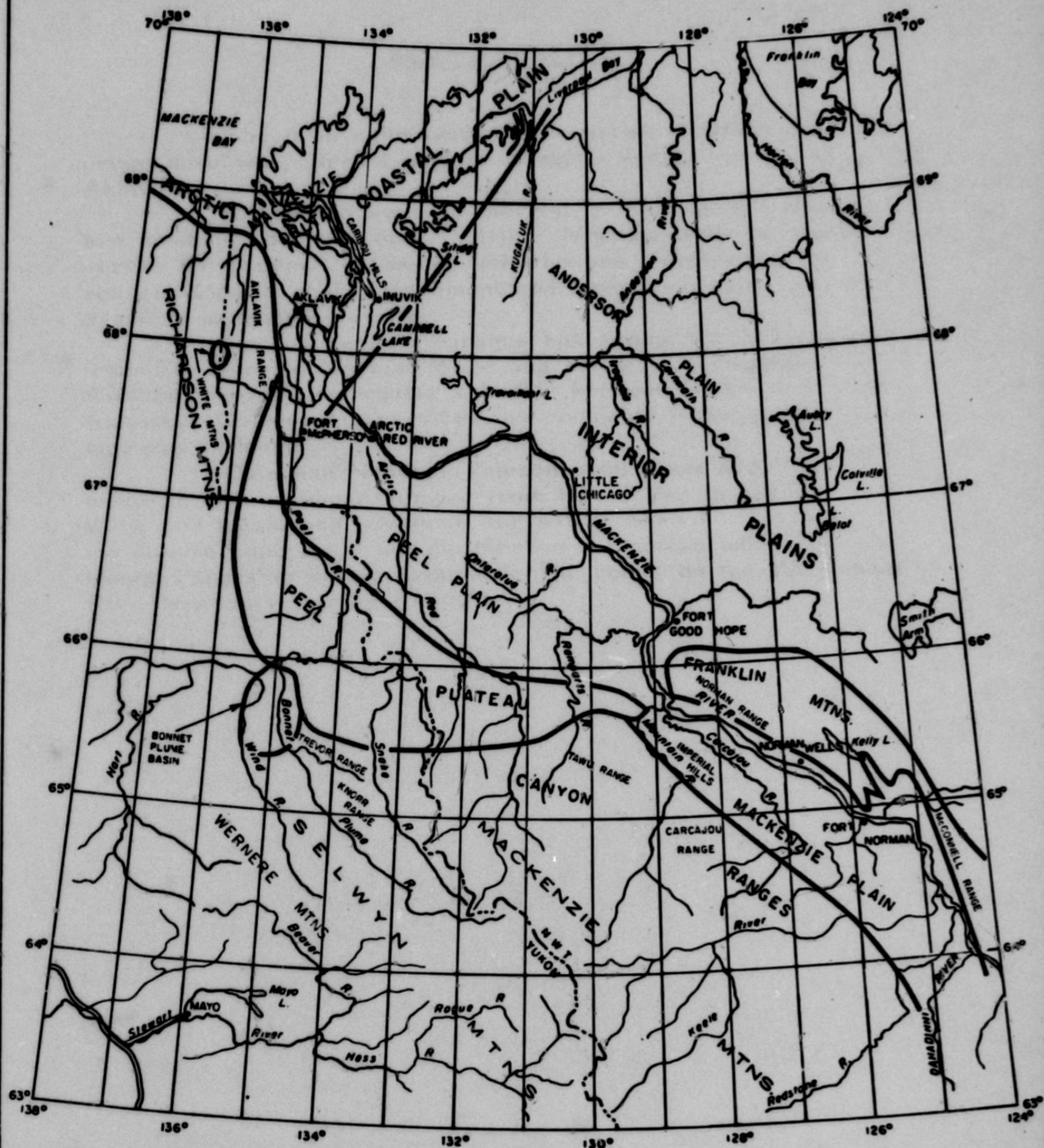
Those assisting the author in the field work were Canadian Pacific Oil & Gas geologists D. Cosijn, J. Hardy, and M. McKellar; geological assistant R. Palmer; and geological technician T. Wallace.

The party was supported by a Bell Model 47G-2 helicopter flown by pilot H. Tetz and serviced by mechanic J. Flesher of Klondike Helicopters Ltd. A de Havilland Beaver flown by pilot C. Mah of Gateway Aviation Ltd. provided fixed-wing support.

The cook, W. Tebbutt, and food services were supplied by M S F Industrial Consultants.

Geologist D. Cosijn, technician T. Wallace, and draughtsman G. Bobrovski assisted in the preparation of the report.

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PHYSIOGRAPHIC INDEX MAP
of
CENTRAL AND NORTHERN DISTRICT OF MACKENZIE

ACCESSIBILITY

The main settlements in the areas in which this field programme was carried out are Norman Wells, Inuvik and Aklavik.

Goods and services normal to isolated communities are available at Inuvik and Aklavik. Norman Wells primarily serves the Imperial Oil personnel who are employed at the refinery located at this settlement and limited services are available to others.

Pacific Western Airlines has scheduled air services from Edmonton to Norman Wells and Inuvik. Northward Aviation maintains a regular schedule between Inuvik and Aklavik. Charter air services are available from several carriers in Inuvik.

Canadian National Telecommunications provides telegram and telephone service from Hay River to Norman Wells and Inuvik and telephone service to Aklavik. During the summer and early autumn Northern Transportation has freight barges in service connecting all points on the MacKenzie River system with Hay River.

PHYSIOGRAPHY

The study area is divisible into three major provinces. The Interior Flains, the Arctic Coastal Flain and the Franklin Mountains, MacKenzie Mountains, Feel Plateau and Richardson Mountains of the eastern Cordillera. The MacKenzie River system drains the area with the exception of the Northern Anderson Flain which is drained by Anderson and Kugaluk River systems.

The Interior Flains comprise a vast area of gentle relief and low elevation over which glacial deposits are generally very thin. The MacKenzie Flain sub-province has elevations ranging from 100' - 150' along the river to 2300' in the Imperial Hills, which are a folded and faulted features associated with the Franklin Mountains. The Feel Flain sub-province is a low-lying poorly drained area. The only area of significant relief are the Grandview Hills west of Little Chicago which have a maximum elevation of 1500'. The southern portion of the Anderson Flains sub-province is higher in elevation, usually in the order of 1000', but is gentle in relief. The central and northern Anderson Flains are lower in elevation, 500 - 800', which gently decreases northward toward the Arctic Coastal Flain. The entire Interior Flains are characterised by muskeg and numerous lakes and small streams. That part of the Arctic Coastal Flain which fell into the study area included the MacKenzie Delta and the Caribou Hills. The Delta is an enormous area of approximately 7500 square miles with elevations ranging from 50' at Foint Separation at the head of the delta to sea-level approximately eighty miles north. Through its maze of lakes, muskeg and abandoned river channels are three main channels. The East Channel, along which Inuvik is situated, the Middle Channel and the Feel or West Channel upon which Aklavik is located.

The Caribou Hills rise along the East Channel north of Inuvik to an elevation of 500'. They are gentle rolling hills which separate the Delta on the west from the featureless coastal plain to the northeast.

The eastern Cordillera includes all those areas of major Laramide deformation. Those sub-provinces in which field work was carried out are the Franklin Mountains, the eastern ranges of the MacKenzie Mountains, the western Feel Plateau and the Richardson Mountains.

The Franklin Mountains are bounded on all sides by the Interior Great Flains. They plunge out to the north in the vicinity of Ft. Good Hope and to the south in the Wrigley area, and are separated from the MacKenzie Mountains to the west by the MacKenzie Flain sub-province. The Franklin Mountains are divided into two ranges, the Norman Range on the northwest, which exhibits the most continuous relief with elevations ranging up to 3400', and the McConnell Range to the south which is, at its

northern end, a discontinuous series of isolated peaks, most of which are about 2000' in elevation. Immediately to the north of Wrigley and extending southward, the McConnell Range forms a clearly defined mountain front with elevations in excess of 3000'.

The MacKenzie Mountains are bounded on the east by the MacKenzie Plains and the Peel Plateau, the Bonnet Flume Basin on the north, the Selwyn Mountains on the ~~east~~ west and on the south by the Rocky Mountains of the southern Cordillera. The MacKenzie Mountains are divided into several physiographic units. The Canyon Ranges of the eastern mountain front, between the Carcajou River area on the south to the northern extent of the MacKenzie Mountains near the Peel River, are the Carcajou Range, the Tawu Range, the Knorr Range and the Trevor Range. These ranges form a nearly continuous mountain front dissected by the Carcajou River, the Mountain River, the Ramparts River, the Arctic Red River, the Snake River and their tributaries, all of which are part of the MacKenzie River drainage. Where the mountains are bounded on the MacKenzie Plain and Peel Plateau the change in relief is sharp, quickly rising from elevations of 1500' - 2500' to elevations ranging from 5500' - 6700'. The exception to this is the Trevor Range on the north which reaches a maximum elevation of about 2700'.

The Peel Plateau is bounded on the west by the MacKenzie Mountains, the Bonnet Flume Basin and the Richardson Mountains, on the south and east by the Interior Plains, and on the north by the Arctic Coastal Plain. It is an area of gentle relief drained by the Peel River and its tributaries. Elevations are in the order of 1500' - 2000'.

The Northern Richardson Mountains are gentle in relief and are unique in that they are apparently unglaciated. They are characterised by rolling topography at elevations generally between 2500' and 3500'. The Aklavik Range, atypically rises abruptly above the Arctic Coastal Plain to the east. To the north, the Richardson Mountains gradually decrease in elevation towards the Arctic Coastal Plain. The White Mountains in the north central Richardson Mountains are a domal type feature of erosion resistant rocks exposed at high angles to the surrounding terrain.

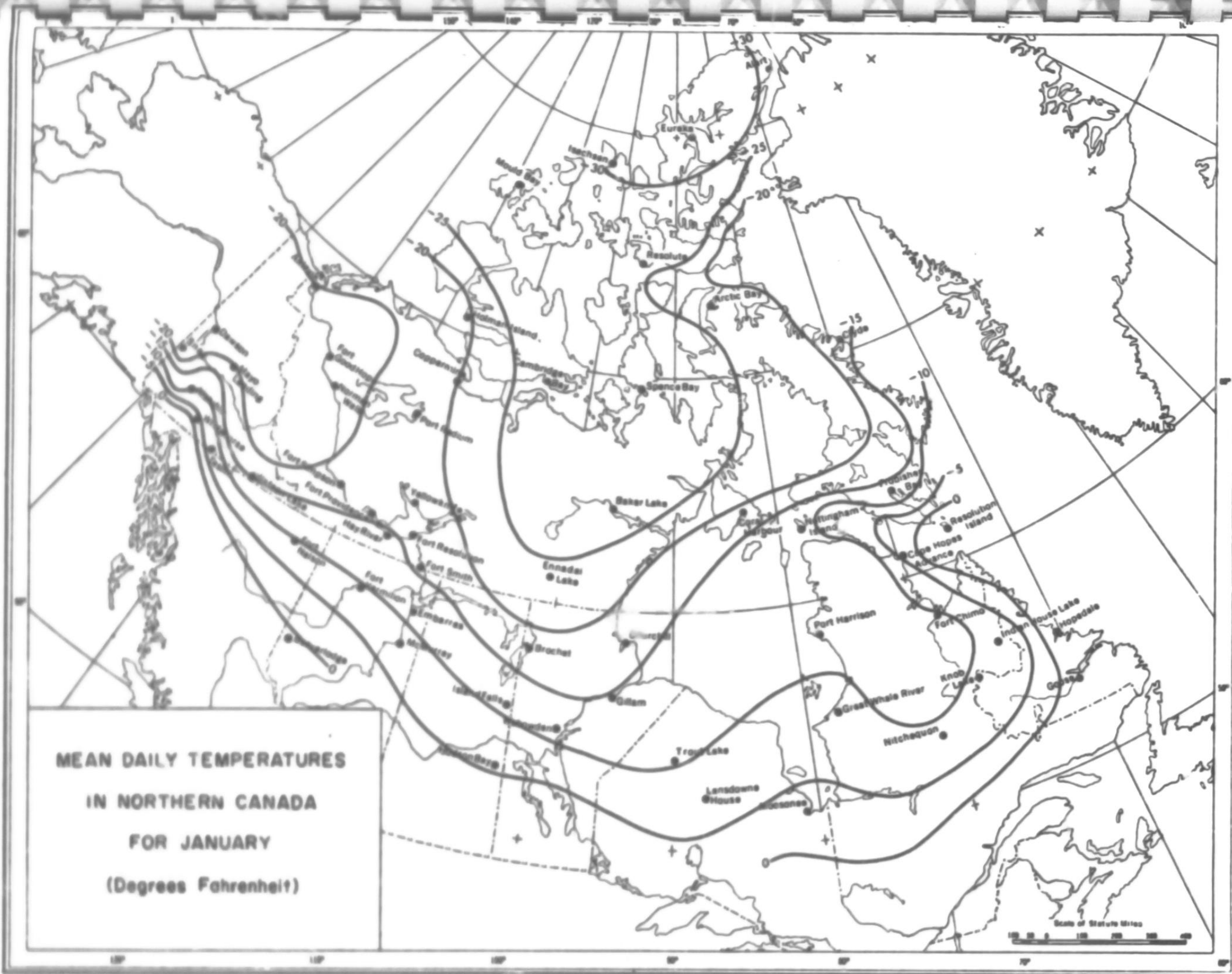
VEGETATION

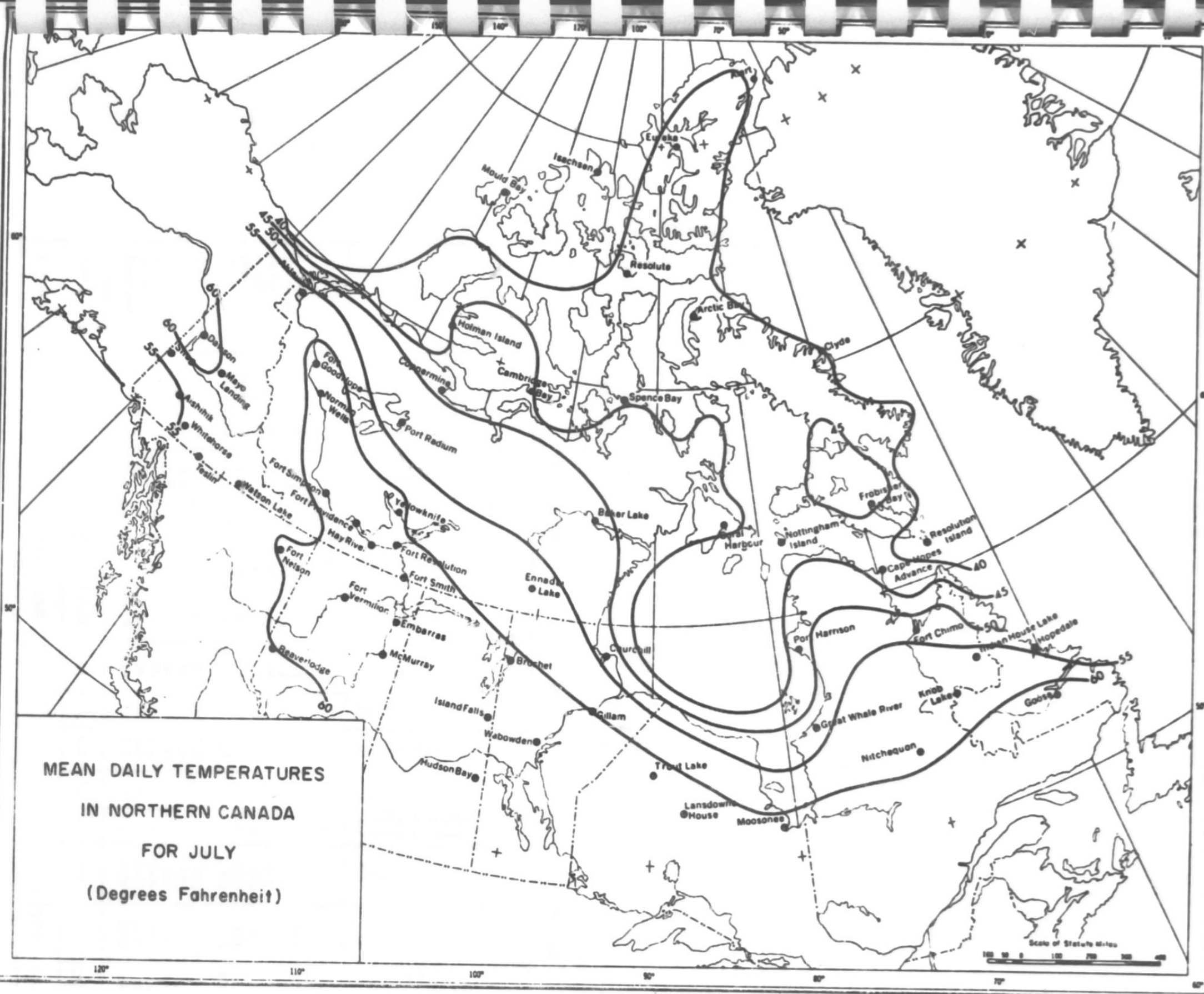
Throughout most of the Interior Plains and Peel Plateau vegetation is moderately heavy. Poplar, birch, spruce, alder and willow are normal to the area. Extensive poorly drained areas are muskeg covered. In the northern Anderson Plain and the Arctic Coastal Plains the forest cover gradually gives way to grass and mosses and occasional small birches. During the summer months these surfaces are generally water saturated and the irregular

growth and resulting hummocky surface of this short vegetation is apparent. Patterns of frost polygons in these areas are common.

Elevation is a limiting factor on the vegetation in the mountain area. The Northern Franklin Mountains are forested on the flanks but bare or grass covered above 2600'. The MacKenzie Mountains rarely carry forest cover and are generally bare of vegetation or are grass covered.

The Richardson Mountains generally are grass or moss covered except at its southern extremity where they are lightly forested.





AVERAGES AND EXTREMES OF CLIMATIC DATA

STATION Aklavik

LAT 68° 14'N

LONG 135° 00'W

ALTITUDE ABOVE M.S.L. 30 Ft.

	AIR TEMPERATURE							PERCENTAGE FREQUENCY OF DAYS WITH MINIMUM TEMPERATURES AT or BELOW					Mean Cloud Amount 10ths of Day Covered
	Mean Daily	Mean of Daily		Mean of Monthly		Highest Recorded	Lowest Recorded	-10°	-20°	-30°	-40°	-50°	
		Maximum	Minimum	Maximum	Minimum								
	°F	°F	°F	°F	°F	°F	°F						
January	-21.7	-14.7	-28.6	15	-50	44	-59	91	73	51	27	5	5.5
February	-18.9	-11.7	-26.1	15	-48	49	-62	88	68	43	16	3	5.5
March	-9.1	-0.1	-18.0	24	-40	49	-56	75	49	20	2	0	5.5
April	9.2	18.7	-0.5	47	-25	57	-44	28	10	2	0	0	5.5
May	30.0	37.8	22.1	58	2	77	-14	0	0	0	0	0	5.5
June	48.6	56.9	40.3	77	27	86	20	0	0	0	0	0	5.5
July	56.6	64.4	48.8	81	36	93	30	0	0	0	0	0	5.5
August	52.4	59.3	45.5	77	36	88	25	0	0	0	0	0	5.5
September	38.9	43.8	33.9	62	20	76	12	0	0	0	0	0	5.5
October	18.9	23.8	14.0	45	-9	55	-22	4	0	0	0	0	5.5
November	-4.4	1.5	-10.3	22	-30	44	-50	51	23	7	1	0	5.5
December	-17.7	-11.0	-24.4	14	-44	46	-54	88	66	32	11	2	5.5
Year	15.2	22.4	8.1	82	-54	93	-62						6.5
Period	1951 - 1960					1926 - 1960		1951 - 1960					

	PRECIPITATION						WIND		MEAN DAYS WITH		DEGREE DAYS			
	RAIN		SNOW		TOTAL (WATER)		MOST PREVALENT		Average Speed m.p.h.	Fog-Visibility less than 1/8 mile	Blowing Snow-Visibility 6 miles or less	Below 6' y	Below 30' y	Above 50' y
	Mean Amount	Days	Mean Amount	Days	Mean Amount	Maximum fall in 24 hours	Direction	Percentage						
	In.	No.	In.	No.	In.	In.								
January	0	0	4.3	9	0.43	0.43	S	29	6.0	2	3	2632	1563	0
February	0	0	2.0	8	0.25	0.34	S	23	5.6	2	3	2156	1246	0
March	0	0	4.1	9	0.41	0.25	NE	27	6.5	1	4	2232	1247	0
April	0	0	2.6	8	0.26	0.18	W	31	7.4	1	2	1574	687	0
May	0.03	1	1.5	5	0.18	0.21	W	29	7.3	2	2	1063	512	0
June	0.43	5	0.5	4	0.48	0.38	W	27	7.8	1	0	683	124	0
July	1.04	10	0	0	1.04	0.97	W	26	7.0	1	0	273	0	0
August	1.10	11	0.1	0	1.11	0.62	W	26	7.0	1	0	459	0	0
September	0.75	8	4.6	5	1.22	0.58	W	30	7.0	2	0	287	0	0
October	0.01	0	11.3	14	1.14	0.54	W	29	6.2	2	2	1424	657	0
November	0	0	6.1	13	0.61	0.36	W	30	5.2	2	3	2062	1064	0
December	0	0	5.1	12	0.51	0.22	W	30	5.7	2	5	2530	1529	0
Year	3.37	35	43.0	83	7.67	0.97			6.6	19	22	18017	8275	2302
Period	1951 - 1960											1950-60	1950 - 1959	

Average less than 1 percent

* Average less than 0.5

a Period 1955 - 1960

CLIMATE

The climate of most of the report area is such as to permit geological field work from about June 1 to September 15. The start of the season is governed by snow cover in the mountains and ice conditions on the lakes. In the Anderson River - Inuvik area, the lakes are not generally ice-free until the last week in June. Similarly ice on the MacKenzie River restricts barge traffic into the Delta until about June 15. In the latter part of the season low-lying stratus cloud results in poor flying conditions in the Richardson Mountains, northern Anderson Plain and over the coastal area. This climatic feature is the most restrictive factor in late summer operations. Precipitation is very light in the summer months with no appreciable snowfall and very little rain. Temperatures are moderate, falling within the high forties and mid-fifties.

The winter months are the most favourable for geophysical surveys which are restricted in the summer months by ground conditions in this generally poorly drained area. The importance of planning supply requirements in the spring to take advantage of inexpensive water transportation during the summer months cannot be over emphasised. The temperature and snowfall during the winter months are not extreme particularly in the northern District of MacKenzie which enjoys a moderating maritime influence over the somewhat colder continental climate of the interior.

A more detailed climatic synopsis of MacKenzie Delta, which would apply to western Anderson Plain and north Peel Plain may be seen in figures 3, 4, and 5.

PREVIOUS WORK

Exploration, primarily of a geographical nature, began with Sir Alexander MacKenzie who, in 1789, descended the MacKenzie River to the Beaufort Sea. He was followed between 1820 and 1850, by Franklin, Richardson, Back and Dease. In 1884 Ogilvie, of the Department of the Interior, made the first reliable maps of what is now the District of MacKenzie.

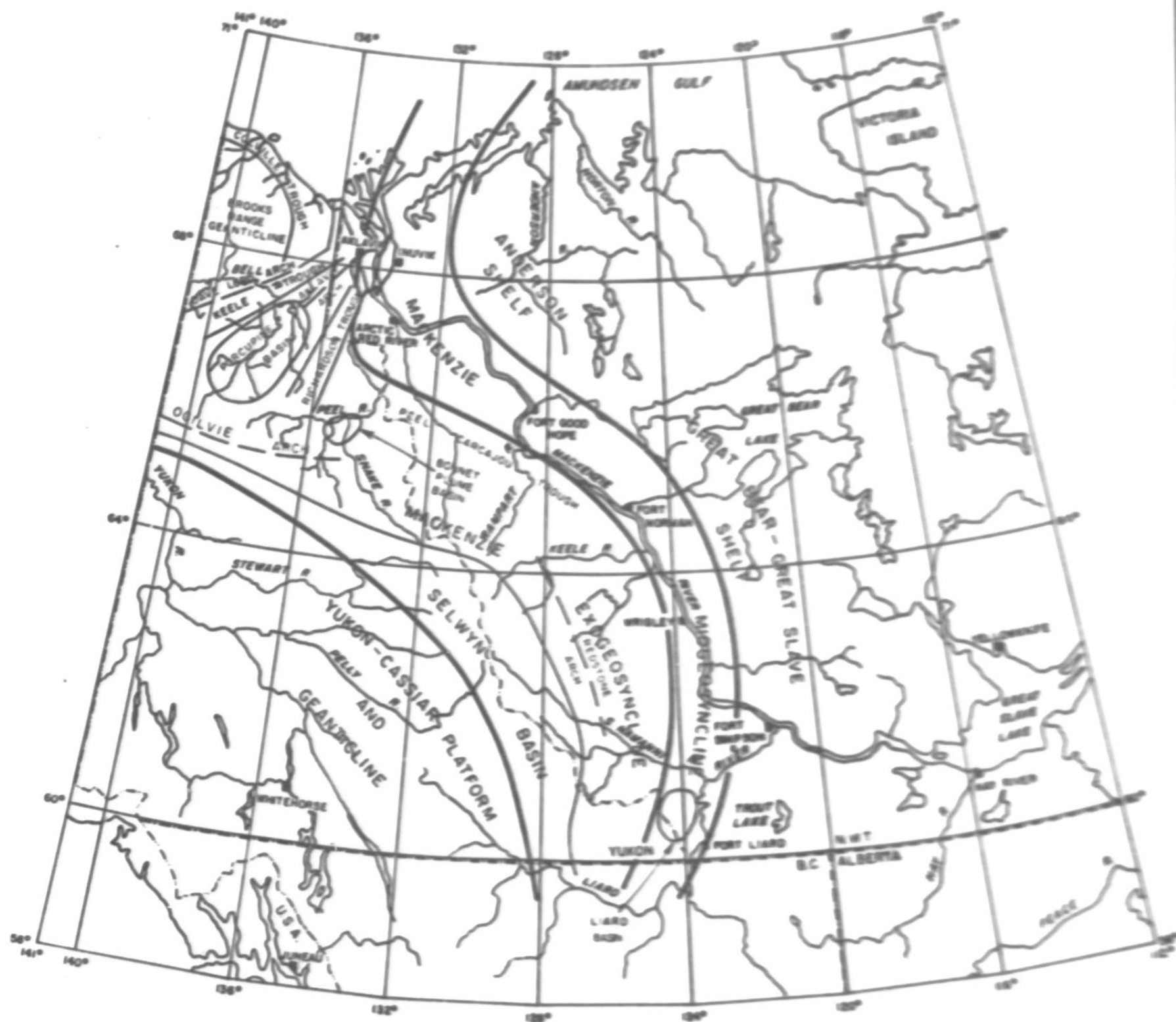
Pioneer geological exploration was begun by Bell of the Geological Survey of Canada in 1899 in the Great Slave Lake - Great Bear Lake area. Camsell mapped along the Peel River and Wind River in 1905. In 1907 Keele descended the Gravel River, since renamed the Keele River, from the Yukon Territory. In 1914, Cairnes mapped the geology of the International Boundary between the Yukon and Forcupine Rivers.

In 1919 Imperial Oil Ltd., began exploration leading to the discovery, in 1920 of Norman Wells field.

Between 1920 and 1923 Geological Survey of Canada geologists Kindle, Cameron, Williams, Whittaker, Hume and others mapped from Norman Wells south to Great Slave Lake.

In 1942, the Canol project, a joint venture by the Governments of Canada and the United States, was undertaken. Its object was to find additional oil reserves in the MacKenzie River area and construct a pipeline from Norman Wells to Whitehorse. Under the aegis of Imperial Oil and the United States Army and supervised by Dr. T. Link, exploration was carried out over much of the MacKenzie River system from the Delta to the Ft. Nelson River. Drilling and detailed geological field studies were made in the Norman Wells area.

The results from this work and new information were acquired prior to 1954 and summarised by Hume (G.S.C. Memoir 273). Since that time geologists of the Geological Survey of Canada and others have made available several reports on the area. Notable are, Gabrielse (1957) who did a reconnaissance geological survey of the northern Richardson Mountains, Jeletzky (1958, 1961, 1966, 1967) who studied the Mesozoic stratigraphy and palaeontology of the eastern slopes of the northern Richardson Mountains and Norford (1964) who undertook an Ordovician and Silurian study in the northern Yukon Territory.



INDEX MAP
of
MAJOR TECTONIC ELEMENTS
of
DISTRICT OF MACKENZIE AND YUKON TERRITORY

TECTONICS

The tectonic elements of the Western Canadian Sedimentary Basin pertinent to this report are the northeastern Interior Great Plains and the eastern margins of the Cordillera.

The Interior Great Plains is divided into two main parts. The shelf area to the east and the miogeosynclinal area to the west. The shelf area, designated the Anderson Shelf in the north and the Great Bear - Great Slave Lake Shelf to the south, is a large low-lying area thinly mantled with sediments which are structurally relatively undisturbed. The MacKenzie Miogeosyncline is a plains and mountains province. It received a moderate thickness of sediments during most of geological time and was generally not strongly deformed. The Franklin Mountains, MacKenzie Plain, Peel Plateau, Campbell Lake Uplift and Sitidgi Lake Fold Belt are in this structural province.

The eastern Cordillera is occupied by the MacKenzie Exogeosyncline. It is bordered by the miogeosyncline to the east and by the Yukon-Cassiar Platform and Geanticline to the west which was at least partially emergent throughout most of Phanerozoic time. It received great thickness of sediment and was quite strongly deformed. It contains the Redstone Arch on the south, the Peel-Carcajou Trough on the east, and the Bonnet Plume Basin, Ogilvie Arch, Richardson Trough, Porcupine Basin, Aklavik Arch, Keele Trough, Dave Lord Arch, the Brooks Range Geanticline and the Colville Trough in the north. These features are bordered on the west by the Selwyn Basin which was primarily a negative element throughout most of geological time.

PROTEROZOIC

The oldest known rocks in the Interior Great Plains and northern Cordillera are a sequence of shallow water clastics and carbonates derived from the craton and correlated with the Furcell Series.

The mid-Proterozoic Racklan Orogeny (Gabrielse, 1967) resulted in uplift and erosion of these rocks and produced an emergent source area along the Yukon Geanticline. A thick sequence of fine clastics, probably correlative with the Windemere Series, were deposited in the Selwyn Basin and out over the shelf area to the east. By the close of Proterozoic time the stable Yukon-Cassiar Geanticline and Platform, Selwyn Basin, the Redstone Arch, the Ogilvie Arch, the Dave Lord Arch, the Aklavik Arch, and the Selwyn Basin were established.

PALAEOZOIC

During early Palaeozoic time the Selwyn Basin and the Richardson Trough, an element formed during Cambrian time, were the dominant negative features. The Redstone and Ogilvie Arches appear to have been shallowly submergent.

Cambrian fine clastics, evaporites and carbonates were deposited across the Interior Great Plains, the eastern Selwyn Basin and in the Richardson Trough. In the Richardson Trough a series of graptolitic shales and limestones were first deposited in Upper Cambrian time in a sequence which continued until Middle Devonian Time. Very thin Upper (?) and Middle Cambrian rocks, lying unconformably on the Lower Cambrian, are found over the Redstone and Ogilvie Arches. If these two positive elements were contiguous it would have provided restriction for the deposition of the Upper Cambrian evaporite sequence of the eastern miogeosyncline.

Ordovician cherty shales and limestones overlie the Cambrian strata in the Richardson Trough, Porcupine Basin and Selwyn Basin while dolomites were formed over the shelf area. The contact is gradational and conformable in both provinces. In the Late Ordovician uplift along the western margins of the Redstone Arch, the MacKenzie Exogeosyncline and the Yukon Platform resulted in extensive erosion over these areas. The basinal area of the exogeosyncline, the miogeosyncline and the shelf area to the east apparently remained submergent.

Silurian dolomites of the miogeosyncline and the graptolitic shale and limestones of the basinal areas were deposited under the same conditions as prevailed throughout the Ordovician. These rocks were truncated by an extensive period of erosion at the end of Silurian or beginning of Lower Devonian time. The unconformity is angular in the Franklin Mountains of the miogeosyncline, a disconformity in the central MacKenzie Mountains and paraconformity (Norford, 1967) on the Porcupine River of the exogeosyncline.

Devonian evaporites and bedded carbonates were deposited over the eroded older Palaeozoic surface on the shelf and miogeosyncline while in the northern Selwyn Basin, the Richardson Trough and the Porcupine Basin of the exogeosyncline, the deposition of graptolitic shales and limestones continued. By Middle Devonian time the southeasterly transgressing sea was depositing uniformly thick shallow water limestones with intercalates shales and reefs on the shelf in the miogeosyncline and exogeosyncline. The end of Middle Devonian time was marked by the deposition of black bituminous shale which was deposited over the entire area under quiescent, probably stagnant, marine conditions. Late Devonian time marked the beginning of widespread tectonism throughout the Cordillera. Uplift was accompanied by intrusions in the Brooks Range Geanticline, the Yukon and Cassiar Geanticline, provided source areas for great thickness

of Upper Devonian clastics which were deposited in the exogeosyncline, miogeosyncline and the western shelf areas. These rocks grade from continental in the north and northwest to marine in the south and southeast.

Carboniferous clastics were deposited over much the same area and Lower Carboniferous carbonates were deposited on the northwest flank of the Dave Lord Arch. The Liard Basin was the only area in which the Carboniferous-Permian sequence is well represented. It is probable that the orogeny initiated during Late Devonian time continued into the Carboniferous. Conglomerates deposited on the southeast flank of the Dave Lord Arch - Aklavik Arch features indicate that this was an active positive element. Plutonic activities of Middle Carboniferous age is indicated immediately west of the Liard Basin. Uplift along the Yukon Platform may have provided a source area for Late Carboniferous clastics along its eastern margins.

Permian conglomerates overlie older rocks with striking unconformity in the Northern Richardson Mountains providing more evidence to support Upper Carboniferous orogeny. West of this clastic belt lie Permian carbonates in an off-shore position indicated that the Dave Lord Arch and Aklavik Arch were no longer emergent elements. Apart from the Northern Yukon, the Liard Basin continued to receive the clastic sedimentation. Plutonic activities west of the area has been reported as Permian age (Zielger, 1967). Similarly the Old Crow Intrusives of the Northern Yukon have been tentative K-AR age dated as Late Carboniferous or Permian (Wanless et al 1966, Baadsgaard et al 1961).

MESOZOIC

The Mesozoic Era was one of great mobility throughout the northern Cordillera. The rising Geanticline to the west acted as a source area for great thickness of marine and non-marine clastics grading from conglomerates along the geanticlinal margin to fine clastics into the east.

Triassic clastics were deposited in the MacKenzie exogeosyncline and, possibly in the western MacKenzie miogeosyncline. Carbonate rocks of Triassic age are found in the British Mountains of the extreme northwest Yukon.

Jurassic time marked the reactivation of the Brooks Range Geanticline and the submergence of the Colville Trough and the Keele Trough which were the site of deposition of thick marine and non-marine clastics.

Cretaceous clastics were deposited in the Jurassic negative areas and east and south across the miogeosyncline and shelf areas. The geanticlinal belt continued to be a source of clastics but by Late Cretaceous time sediments were also being derived from the Shield area. The initiation of Laramide orogeny in Late Cretaceous time marked the end of marine deposition.

Tertiary and Late Cretaceous non-marine clastics were deposited in the Bonnet Plume Basin and what is now the Arctic Coastal Plain.

STRATIGRAPHY

The emphasis of this systematic stratigraphic resume will be placed upon the facies found on the Interior Plains, the MacKenzie Miogeosyncline and the eastern margin of the MacKenzie Exogeosyncline.

PROTEROZOIC

No wells outside of the Great Slave Lake area have penetrated to the Precambrian nor is it exposed in the Franklin Mountains. Quartzites, dolomites and igneous rocks of the Hornby and Coppermine Groups dated as mid-Proterozoic (G.S.C. Map 30, 1963) outcrop along the western margin of the Canadian Shield north of Great Bear Lake. Non-fossiliferous green and maroon shales, tentatively dated as Proterozoic, outcrop in the Campbell Lake area.

Fine clastics and possibly dolomites of the Windemere series probably underlie the Phanerozoic succession over most of the eastern exogeosyncline, the miogeosyncline and the Interior Plains.

CAMBRIAN OR OLDER

Katherine Group

The Katherine Group, defined by Link in 1921, on the Carcajou River, is a succession of quartzites and interbedded shales of unknown thickness.

In Dodo Canyon, 553' of quartzites and shales were examined and are described in Section 9 which are believed to be the upper part of Link's Katherine Group. No fossils were found in this succession nor are any described in the literature so dating this sequence, therefore is problematical. Some writers place it entirely in the Proterozoic while others correlate at least the upper part with the Lower Cambrian Mt. Clark Formation of the Franklin Mountains. In Dodo Canyon the contact between the Katherine and the overlying MacDougal Group is apparently conformable and, in the absence of an unconformity, it is suggested that the Upper Katherine Group be considered no older than Lower Cambrian.

CAMBRIAN

MacDougal Group

The name MacDougal Group was applied by Link to a sequence of Cambrian shales, sandstones, evaporites and limestones.

Dodo Canyon on the Carcajou River was chosen as the location for the type section.

The Dodo Canyon section was examined and the succession measured and described in Section 9. Referring to Section 9, Link places the top of this unit above the interbedded limestones and shales at approximately 1880'. It is suggested, for reasons outlined later, that the Cambro-Ordovician contact be adjusted down to the thin conglomerate at 2048'. This conglomerate bed overlies maroon and bright green shales which could be correlative with the uppermost Saline River Formation of Middle (?) Cambrian age.

Mount Clark Formation

Williams (1923) described a sequence of quartzites, sandstones and conglomerates in the vicinity of Clark Mountain in the McConnell Range defining them as Mount Clark Formation. These strata are 620' thick and overlie shales of inferred Precambrian age. These rocks are reported to contain Scolithus, a worm ranging from Cambrian to Devonian.

Due to the lack of good zonal indicators dating the Mount Clark is difficult. It is conformably overlain by Middle Cambrian beds and therefore may be considered Middle Cambrian or older. Williams and Hume both favour a Lower Cambrian age.

The Mount Clark was not seen by this writer but on the basis of gross lithology it is suggested that at least part of the Mount Clark Formation be considered correlative to the Katherine Group quartzites of Link.

Mount Cap Formation

In the vicinity of the Cap Mountains of the McConnell Range, about 200' of grey and green shales with red sandstone and shale in conformable contact with the underlying Mt. Clark Formation were defined by Williams (1923) as Mount Cap Formation.

Mount Cap Formation does not outcrop in the area covered under this report. Subsurface studies, however, revealed an incomplete section in the Imperial Vermillion Ridge No. 1 well. The top was reached at 5580' and the well abandoned, still in Mount Cap Formation, at 5972'. Correlation with the MacDougal Group of the MacKenzie Mountains is hazardous but a tentative correlation could be made to Dodo Canyon as illustrated in Section 9.

Ptychoparia a Middle Cambrian trilobite is reported from the Mount Cap Formation by Williams and from the above correlated interval in the MacDougal Group by Nauss. A fragmented fossil collection was made from this interval on Dodo Canyon during the 1967 field season.

Saline River Formation

Five hundred feet of banded red and green calcareous shales interbedded with halite, gypsum and selenite conformably overlying Mount Cap Formation were defined as Saline River Formation by Williams in 1923. The type section lies in the Cap Mountains of the McConnell Range. Williams reports a Lingulella fauna of Lower Cambrian to Middle Ordovician range, but favoured a Middle Cambrian designation for Saline River Formation.

Uppermost Saline River Formation was examined on the Norman Range and is described in Section 5. In this succession 415' of massive bedded anhydrite and occasional gypsum with interbeds of red shale are overlain by 126' of green and red shale which is succeeded by 94' of interbedded dolomite and green shale transitional to the overlying massive Ordovician dolomites.

A tentative correlation to the uppermost MacDougal Group of the Carcajou Range is made to the interval 2048' - 2340' of Section 9.

In the subsurface, Saline River beds were penetrated in the Imperial Vermillion Ridge No. 1 well. This well penetrated a complete section of Saline River evaporites between 2550' and 5580', the lower 2215' being nearly all halite. The Imperial Loon Creek No. 2 well penetrated 473' of Saline River evaporites between 4620' and 5093' without reaching the Mount Cap Formation.

Unnamed Cambrian

On Virgin Creek 315' of sandstone, variegated shale and siltstone underlie Ordovician dolomite. This sequence is described in Section 11 where it appears to resemble the MacDougal Group of Carcajou Canyon.

On the Snake River 590' of sandstone and shale underlying Ordovician dolomites were examined and described in Section 15. These strata lie between 5190' and 5780'. The underlying beds are not exposed.

In the Road River area 815' of poorly exposed quartzite with sandstone and shale interbeds were examined. This succession is described in Section 17. The contact with the overlying limestone and shale sequence is covered. Furthermore it is likely that the Cambro-Ordovician boundary lies within this overlying sequence as Jackson (1962) reports Tremadocian graptolites in limestone and shales at the base of the Road River Formation at the type section.

In the subsurface the Atlantic Columbian Carbon Beavertail G-26 well reached variegated shales, dolomites and evaporites at 4570' and penetrated 330' before being abandoned

at 4900'. These rocks are possibly Saline River Formation correlatives. The Atlantic Columbian Carbon Arctic Circle Ontarature K-4 well encountered variegated shales, anhydrite, dolomite, sandstone and siltstone at 7942' bottoming at 8950' after penetrating 1008' of probable Cambrian rocks. The Atlantic Little Chicago N-32 well reached a total depth of 6420' after penetrating 90' of variegated shales and 40' of halite of probable Cambrian age.

DEPOSITIONAL ENVIRONMENT

To draw definite conclusions from such scant data as is presently afforded is hazardous in the extreme. It does appear however that, for the present time the depositional environment be considered extremely shallow marine or even continental in earliest Cambrian time and very shallow marine during Middle and Upper (?) Cambrian time. The possible exception to this thesis is demonstrated by the Saline River evaporites of the Norman Wells area. It is many times thicker than at the type section and similarly contrasts with its apparent correlative in the MacKenzie Mountains. It appears that there was a Middle (?) Cambrian evaporite basin of considerable size and unknown depth with its axis developed along the eastern margin of the MacKenzie miogeosyncline, which probably extended for an unknown distance east onto the shelf.

CAMBRO-ORDOVICIAN CONTACT RELATIONS

The contact relationship of the Cambrian with the overlying Ordovician is not fully understood. The absence of good faunal evidence except in the Richardson Mountains does little to aid in the solution of this problem.

On the Norman Range (Section 5) the contact is transitional. In Dodo Canyon (Section 9) a thin conglomerate bed overlies known Cambrian strata and is overlain by a transitional zone of limestone and shale. On Virgin Creek (Section 11) a breccia zone overlying Cambrian clastics is overlain by beds of sandstone, shale and dolomite transitional to the overlying Ordovician dolomites. The contact on the Snake River (Section 15) is marked by Cambrian sandstones grading into sandstones and arenaceous dolomites overlain by dolomites of Ordovician age. In the Richardson Mountains the Upper Cambrian and Ordovician form part of an unbroken marine cycle (Jackson, 1962).

All the wells previously described indicate a transitional,

conformable contact. All these wells were drilled in the geosyncline and no wells in the shelf area penetrated to the Cambrian.

It is therefore suggested that over the Interior Great Plains, the Cambro-Ordovician contact be considered conformable not ignoring the possibility that diastems could have occurred under the extremely shallow water conditions which probably prevailed.

Similarly in the miogeosyncline the contact is probably transitional although minor uplift may have temporarily interrupted the deposition along its western margin. As previously mentioned there is no evidence of an unconformity between the Cambrian and Ordovician in the Richardson Trough and this may be presumed true for most of the exogeosyncline.

ORDOVICIAN - SILURIAN

Because the faunas of the exogeosynclinal graptolitic facies and the miogeosynclinal shelly facies rarely are interbedded, correlation, apart from generalities, is everywhere very difficult to achieve. For this reason these systems will be discussed as they occur within the project area first in the exogeosynclinal facies and secondly in the miogeosynclinal facies.

Exogeosynclinal Facies

Road River Formation

Jackson (1962) erected the Road River Formation for a graptolitic shale and argillaceous limestone sequence in the Richardson Mountains. The type section is located on the Road River. Because of faulting an accurate thickness could not be determined at the type section but nearby sections indicate a thickness range of 5500' - 8700' in the Richardson Mountains and may be roughly divided into the lower carbonate unit and the upper graptolitic shale unit. It is unconformably overlain by "Middle Devonian Fort Creek Formation" and conformably overlies Cambrian sandstones, siltstones and shales.

The Road River Formation includes all the Ordovician and Silurian stages of Great Britain in a continuous unbroken sequence. This formation and its lateral equivalents were probably deposited over the entire Western Cordillera and certainly over much of the Arctic Archipelago.

1. Hare Indian Formation or possibly Canol Formation of Basset's nomenclature.

A faulted and incomplete sequence, largely in the lower carbonate unit, south of the type section was examined and is described in Section 17.

MIOGEOSYNCLINAL FACIES

A faunally clearly defined basinal facies contrasts sharply with the confused age dating of the fossil assemblages of the shelly facies.

While there is broad agreement on the zonation of the Ordovician and Silurian graptolite fauna the coral and brachiopod assemblages, which characterise the carbonate succession of these systems in the Northern Cordillera, are the subject of much discussion. In view of the fact that in the miogeosyncline and probably over the shelf, Ordovician and Silurian strata are represented by a continuous cycle of carbonate deposition and the contact between the two systems is conformable, age dating is not vital to a clear understanding of the stratigraphy of the immediate area.

Franklin Mountain Formation

Williams (1922) defined the Franklin Mountain Formation in the Mount Cap area of the MacConnell Range. He assigned a Lower Silurian age to 500' of shales grading upwards into limestones and overlain by Mt. Kindle Formation. Williams considered the Franklin Mountain-Mount Kindle contact to be unconformable. The lower contact, with the Middle (?) Cambrian Saline River Formation was not visible at the type section.

Williams (1923) and Laudon (1942 - ?) established the lower contact, finding it conformable, at Mt. St. Charles on the Great Bear River. The complete section exposed at this locality was seen to be 865' thick.

Douglas and Norris (1960, 1961, 1963) and Norris (1965) studied the Franklin Mountain Formation and its presumed correlatives to the west and south. It now appears that this formation ranges from Lower Ordovician to probably the base of the Upper Ordovician and certainly no higher than the base of the Lower Silurian. The contact with superjacent Mt. Kindle Formation is now considered conformable.

Mt. Kindle Formation

Williams (1922), in the Cap Mountain area of the McConnell Range, proposed Mt. Kindle Formation to include approximately 500' of limestones disconformably overlying Franklin

Mountain Formation and disconformably overlain by limestone breccias of Bear Rock Formation.

Williams (1923), Laudon (1942 - ?), Douglas and Norris (1960, 1961, 1963) and Norris have subsequently studied Mt. Kindle Formation and its probable correlatives to the north, west and south of the type area. Its age is now considered to range no lower than the base of the Upper Ordovician to the top (?) of the Middle Silurian. It is recognised to be conformable with the underlying Franklin Mountain Formation and disconformably overlain by Bear Rock Formation.

Vunta Formation

Norford (1964) proposed the name Vunta Formation to define about 2,853' of pelletoid, aphanitic and fine crystalline limestones that outcrop in faulted exposures along Vunta Creek and Fish Creek in the White Mountains of the Northern Richardson Mountains. It conformably or paraconformably overlies dolomites of Cambrian(?) age and is overlain by limestones and dolomites of Late Silurian age.

Undivided Siluro-Ordovician

Outside the type section areas and in the absence of fossils any differentiation of the Siluro-Ordovician into Franklin Mountains and Mt. Kindle Formations on lithological grounds is merely speculative. This succession was examined at several localities in the Franklin Mountains, the MacKenzie Mountains and, in the White Mountains. Fauna collections were made but at this writing determinations are not complete.

The Siluro-Ordovician section was found to be, in the Franklin Mountains and MacKenzie Mountains, chiefly grey microcrystalline to fine crystalline dolomite normally massive bedded and often containing chain corals and occasionally algal beds.

In the Norman Range 957' of Siluro-Ordovician beds exposed from the top of the Cambrian to within about 100' of the base of the Bear Rock were examined and are described in Section 5.

In the Carcajou Range of the MacKenzie Mountains, 1272' of Siluro-Ordovician were examined between the Cambrian and Bear Rock Formation in Dodo Canyon and are described in Section 9. A similar section on Virgin Creek, described between 963' and 3326' in Section 11 has exposed 2363' of Siluro-Ordovician carbonates. On Gayna River the 2426' of poorly exposed dolomites between Cambrian shales and breccias and bedded dolomites of the Bear Rock Formation are described in Section 12.

In the Trevor Range an incomplete section of Siluro-Ordovician was observed and is described in Section 16. It is characterised by grey fine crystalline dolomites with nodular and bedded chert and chain corals and brachiopods in the lower part of the section.

In the White Mountains a faulted limestone sequence, probably close to Norford's type section of the Vunta Formation, was examined. This sequence is described in Section 25. Correlating to the type section, the top of the Vunta Formation is probably at 2560' and the stratigraphically lowest rocks, probably still within the Vunta Formation, were at 4325', a total of 1765'.

In the Norman Wells area adjacent to the Norman Range Imperial Vermillion Ridge No. 1 penetrated 705' of Siluro-Ordovician dolomites before reaching the Cambrian at 2550'. Also Imperial Loon Creek No. 2 reached the Cambrian at 4620' penetrating 1280' of Siluro-Ordovician dolomite.

At the north end of the Discovery Range the Atlantic Columbian Carbon Beavertail G-26 well revealed 2652' of cherty, silty dolomite of Siluro-Ordovician age reaching the Cambrian shales at 4570'.

In the southern Anderson Flains Atlantic Little Chicago N-32 reached the Cambrian at 6290', penetrating 3705' of Siluro-Ordovician dolomites.

CONTACT RELATIONS

Siluro-Ordovician

Although Williams originally favoured a disconformable relationship between the Franklin Mountain Formation and the Mt. Kindle Formation later workers are of the consensus that this contact is gradational. In addition it is now widely believed that the Franklin Mountain - Mt. Kindle contact lies in the Ordovician and Mt. Kindle deposition was, therefore, continuous across the Siluro-Ordovician time line. Nowhere in the Siluro-Ordovician examined in this past field season was evidence for such an unconformity observed.

In the subsurface however, three wells examined, Atlantic Columbian Carbon Arctic Circle Ontaratie K-4, Atlantic Little Chicago N-32, and Atlantic Columbian Carbon Beavertail G-26, a persistent bed of white chert overlies cherty dolomites at 5220', 3690' and 2815' respectively. This marker lies in the upper part of the Siluro-Ordovician sequence and is suggestive of a disconformity.

In the Richardson Mountains of the exogeosynclinal sequence in the Road River Formation the contact is transitional although Norford(1964) reports the relationship to be para-

conformable in the Wernecke Mountains.

Siluro-Devonian

The widely varying thicknesses of remnant Siluro-Ordovician sediments of the miogeosyncline amply demonstrates their pronounced truncation which occurred at the end of Silurian or beginning of Devonian time. The angularity on this unconformity is not seen to be great but rather suggests a disconformable relationship.

The exogeosynclinal graptolitic shales of the Upper Road River Formation pass through the Siluro-Devonian boundary without hiatus demonstrating the negatively mobile Richardson Trough to be active into Lower Devonian time.

DEPOSITIONAL ENVIRONMENT

It would appear that during Silurian and Ordovician time sedimentation on the shelf and over the miogeosyncline was in a shallow marine environment. Its transitional contact with the subjacent Cambrian evaporites, its arenaceous, evaporitic nature particularly in the lower dolomites, the extremely thin interbeds of variegated shale, and the presence of chert in many of the observed sections all indicate shallow, quiescent, marine conditions.

The abundant coral and occasional algal remains preserved in spite of dolomitisation indicate that extensive reefing may have taken place along the western margins of the miogeosyncline. Large bioherms (?) of probable Ordovician age were observed in the vicinity of the Hornaday River of the shelf province.

The carbonate banks of the White Mountains and the Illtyd Range (Norford, 1964) adjacent to the basinal Road River graptolite sequence were probably deposited under very shallow marine conditions.

In the exogeosyncline the Road River Formation suggests deposition in a deep, steadily subsiding basin. Vertically graded bedding, extremely poor sorting and turbidites have been reported in the Southern Richardson Mountains by Norford and others. Sedimentary flow structures, plunging to the northwest, in overlying beds were observed on the Trevor Range along the eastern margin of this trough.

HISTORY OF DEVONIAN NOMENCLATURE IN THE CENTRAL MACKENZIE RIVER REGION

KINDLE and BOSWORTH
1921

SILURIAN	MIDDLE DEVONIAN	UPPER DEVONIAN	BOSWORTH SS & SHALE
			FT. CREEK SHALE
			BEAVERTAIL LS.
			RAMPARTS LS.
			HARE INDIAN RIVER SHALE
			BEAR MOUNTAIN FM.

HUME and LINK
1945

SIL. or DEV.	MIDDLE DEVONIAN	UPPER DEVONIAN	IMPERIAL FM.	
			FT. CREEK FM.	U. NON - BIT. SH.
				BIT. SH.
				REEF LS.
			LOWER SHALE	
			UPPER LS MEMBER	
			MIDDLE SHALE MEMBER	
			LOWER LS. MEMBER	
			BEAR ROCK FM.	

WARREN and STELCK
1950

UPPER DEVONIAN	IMPERIAL FM.	BOSWORTH SS.	
		SILTY SHALE	
		BIT. SH.	
FT. CREEK FM.	KEE SCARP FM.		
	LOWER FT. CREEK SHALE		
MIDDLE DEVONIAN	BEAVERTAIL LS.		
	RAMPARTS LS.		
	HARE INDIAN SHALE	RAMPARTS LS.	
		RAMPARTS SHALE	
PRE - MID DEV.	BEAR ROCK FM.		

BASSETT
1961

LOWER DEV.	MIDDLE DEVONIAN	UPPER DEVONIAN	IMPERIAL FM.	
			CANOL FM. ?	
			KEE SCARP ?	
			HARE INDIAN	
			HUME FM.	
			BEAR ROCK FM.	

DEVONIAN

Bear Rock Formation

Bear Rock Formation is derived from the Bear Mountain Formation of Kindle and Bosworth (1921) of which it is a part. Stelck (1945) defined 246' - 265' of dolomite breccia, bedded limestone and dolomite and massive gypsiferous dolomite and limestone, at Bear Rock, in the Ft. Norman area, as Bear Rock Formation.

The age of Bear Rock Formation has been considered Devonian or Silurian by a number of previous workers, (Stelck, Williams, Hume). The absence of faunal evidence in the breccias and evaporites has precluded exact dating in this facies. Douglas and Norris (1963) studying the Bear Rock in the McConnell Range placed this formation in the Middle Devonian but listed no fossil evidence. Basset (1961) reported fauna from basal Bear Rock as uppermost Silurian or lowermost Devonian. The overlying Hume Formation contains lower Middle Devonian fauna suggesting that most, if not all, Bear Rock Formation lies in the Lower Devonian.

This formation, which is characterised by boulder breccia cemented by microbreccia in the Norman Range, was examined on Schooner Creek and is described in Section 1. In the MacKenzie Mountains carbonate breccia is again characteristic of Bear Rock Formation but the breccia fragments are, on the average, smaller and bedded dolomite and limestone comprise a larger part of the total thickness than in the easterly Franklin Mountains in Section 1. This westward facies change illustrated in Stratigraphic Cross-section B-B¹ (Encl. 3) is observable on the Carcajou Range between the Little Bear River (Section 6) and the Gayna River (Section 12) and further west on the Trevor Range in Section 16, where the Bear Rock was seen to have only occasional breccia zones.

In the subsurface a relatively large number of wells have penetrated through the Bear Rock Formation. A number of these are shown on Stratigraphic Cross-section A-A¹ (Encl. 2) illustrating Bear Rock Facies relationships between evaporites, bedded dolomites and limestones. It is of interest to note that the breccia which characterised the Bear Rock Formation in the structurally disturbed area, has not been so far recognised in the wells drilled in the Interior Plains.

The origin of the Bear Rock Formation is the subject of much speculation. That it was deposited under very shallow marine conditions becoming increasingly evaporitic to the southeast and east is apparent as shown on Stratigraphic Cross-section B-B¹ (Encl. 3). The brecciation was, no doubt, some time after deposition and is, most probably, a solution-collapse type.

The contact of Bear Rock with the overlying Hume

Formation was seen everywhere to be sharp, however Stelck reports it to be transitional and conformable at Bear Rock. Basset (1961) suggests that because of the sharp lithological change that the contact may be disconformable in central MacKenzie area.

Although the contact is sharp in many areas a study of both surface and subsurface information suggests that the boundary is transitional and conformable.

In the exogeosyncline the Bear Rock equivalent lies within the graptolitic shale unit of the Road River Formation.

Hume Formation

The term Hume Formation was proposed by Basset (1961) for the sequence of fossiliferous limestone and calcareous shale which overlies Bear Rock Formation and underlies Hare Indian Formation. The type section is located on the Hume River at 65°20'30" N, 129°58'00" W.

The abundance of zonal indicators has permitted the dating of Hume Formation to be fixed as Eifelian and early Givetian.

This formation is well exposed throughout the Norman Range, the MacKenzie Mountains, and the Anderson Flains. It was examined at several localities and is described in many measured sections. The Hume Formation is commonly comprised of three units: the upper grey, fine grained, bioclastic limestone unit bearing a rich fauna; a middle shaly limestone and calcareous shale unit; and a lower grey fine crystalline, fossiliferous limestone unit. Throughout the miogeosyncline this formation retains a remarkable uniformity of lithology but on the western margins of the miogeosyncline it becomes increasingly shaly over its total thickness, as was observed in Section 16, examined on Solo Creek.

In the exogeosyncline the graptolitic shale unit of the Road River Formation may occupy the Hume interval on Road River but southward in the Ogilvie Mountains, Jackson reported the top of Road River Formation to be stratigraphically lower and overlain by upper (?) Hume limestone with the lower Hume Formation equivalents in the Upper Road Formation.

The contact with the overlying Hare Indian Formation is normally sharp but occasionally transitional. This latter case is best illustrated in the Atlantic Columbia Carbon Beavertail G-28 well where upper Hume limestones interdigitate with Lower Hare Indian shale. This writer regards this contact as conformable.

Hare Indian Formation

Hare Indian River Formation was first defined by Kindle and Bosworth (1921) on the MacKenzie River, below the Ramparts

gorge, and in the vicinity of the Hare Indian River. Later usage has shortened the name to Hare Indian Formation. At the type section it was described as dark grey to black shales and limey shales with many thin limestone beds. These shales were recognised to be overlain by the limestones outcropping in the Ramparts gorge now correlated with the Kee Scarp Formation of the Norman Wells area. The base was reported to be not exposed at the type section.

Hume and Link (1945) described 700' of green-grey calcareous shale with limestone interbeds on the Imperial River naming them the "Middle Ramparts Shale Member". This unit is correlative with Hare Indian River Formation of Kindle and Bosworth (refer to figure 7).

Canol geologists working in the area of Kee Scarp development, used "Lower Fort Creek" to designate the Hare Indian interval.

The Hare Indian Formation outcrops in Canyon Creek in the Norman Range and is described in Section 2. It is sporadically exposed as black pyritiferous yellow weathering shale with some limey beds and bearing crinoids and brachiopods. It is seen to overlie Hume Formation and be overlain by the "Canyon Sandstone", an informal unit occupying part of the Kee Scarp position in the off-reef facies.

Hare Indian Formation commonly outcrops along the MacKenzie Mountain front as dark grey to black shales, weathering yellow and red, occasionally siliceous and bituminous. Such a sequence was examined in Carcajou Canyon where the basal Hare Indian is described from 0 to 248' in Section 8. On the Anderson Flain along the Carnwath, Iroquois and Wolverine Rivers, the Hare Indian is seen to outcrop as green, red, and grey shale facies which are usually soft, calcareous, fossiliferous occasionally sulphurous and gypsiferous. The basal Hare Indian in this facies is usually a black bituminous shale. At the Hare Indian - Canol contact, an arenaceous (?) limestone was commonly present immediately underlying the Canol Formation. In the subsurface the green shale and siltstone facies is common to many wells in the central MacKenzie area while the more marine dark grey to black shale facies has been examined in the IOE Tree River H-38 well.

In the exogeosyncline the marine facies is lithologically indistinguishable from the overlying Canol Formation. Whether or not it is present or has been removed by pre-Canol erosion is, as yet, uncertain.

The age of Hare Indian Formation is Givetian. The fauna are reported to bear strong affinities to the assemblages of Upper Hume Formation and Lower Kee Scarp Formation.

The contact of Hare Indian Formation with the superjacent Kee Scarp and Canol Formations is discussed later

under an expanded heading but it suffices to say here that it is transitional and conformable with Kee Scarp Formation and in sharp contact with the Canol Formation.

Kee Scarp Formation

Kindle and Bosworth (1921) named the fossiliferous limestone sequence at Ramparts gorge as Rampart Limestone underlain by the Hare Indian Formation and overlain by the Beavertail Limestone. Hume and Link (1945) showed the Rampart and Beavertail Limestone to be facies equivalents and recommended the latter be dropped and the unit designated as Upper Ramparts Limestone Member. In 1942 Stelck defined the Kee Scarp Member of the Fort Creek Formation in the Norman Wells area. At the type section it is 165' thick, the upper 120' was described as light grey coralline reef, the lower 45' as argillaceous brown-grey limestone interbedded with shale. This sequence was considered to be overlain by Upper Fort Creek Formation the basal part of which is now considered Canol Formation, and underlain by Lower Fort Creek Formation, now recognised as Hare Indian Formation of Kindle and Bosworth. It then follows that Stelck's Kee Scarp Member is synonymous with the Upper Ramparts Limestone Member of Hume and Link. Basset (1961) recommended that the name Kee Scarp Formation be applied to this unit.

The boundary relationships of the Kee Scarp Formation were only studied in outcrop on the Gayna River in the MacKenzie Mountains. At this locality 28' of Kee Scarp bioclastic limestone overlies Hare Indian shale and is overlain by Canol Formation. This sequence is described in Section 13. In the subsurface Kee Scarp Formation is the producing reservoir in the Norman Wells field and is recognised in several wells outside the Norman Wells vicinity as far north as the Ft. Good Hope area. Some of these wells are illustrated in Stratigraphic Cross-section A-A¹. That Kee Scarp Formation is not always reefal limestone is apparent from a subsurface study but to erect an "upper" and "lower" or "reef" and "off-reef" formational nomenclature in the Beavertail-Ramparts sense of Warren and Stelck to an already semantically and stratigraphically confused units seems unwise at this stage.

Because of faunal complexities and the uncertainty of the nature of the upper contact relations the age of Kee Scarp Formation is not entirely certain, however the greater part, if not all, of this unit lies within the Givetian with the overriding proviso that uppermost Kee Scarp may extend into the Upper Devonian.

The contact between the Kee Scarp and overlying

Canol Formation is presently a subject of controversy and is considered in the broader context of Middle Devonian and Frasnian sedimentation under a later heading.

Canol Formation

Kindle and Bosworth (1921) applied the name Fort Creek Formation to a sequence of black bituminous shales with limestone interbeds and a basal petroliferous sandstone outcropping on Thunder River, a tributary to the MacKenzie River, north of Ft. Good Hope.

Subsequently Canol geologists applied the term to include all the Middle Devonian from the top of what is now recognised as Hume Formation up to a stratigraphic position higher than intended by Kindle and Bosworth. This unfortunate expansion of Fort Creek Formation contributed to stratigraphic confusion of much of the Middle Devonian. Basset (1961) redefined the Fort Creek (sensu Kindle and Bosworth) and proposed the name Canol Formation for the black bituminous shale unit overlying the Kee Scarp Formation at Powell Creek on the MacKenzie Mountain front. At the type section the unit is 75' thick conformably overlain by argillaceous siltstones and soft black shale of the Imperial Formation and is underlain by cherty and shaly limestones of Kee Scarp Formation.

The contact of the Canol with the superjacent Imperial Formation was seen at very few localities and no comparative thicknesses of the Imperial Formation were obtained. On such scant observations definite conclusions cannot be drawn on the nature of the contact relations however it is everywhere sharp and does not appear disconformable.

Apart from sponge spicules the unit has so far proved non-fossiliferous. Until more palaeontological data are available and the nature of this formation's relationship with adjacent formations are better understood, the age of Canol Formation is open to question. This writer, however, tentatively places the Canol in the lowermost Upper Devonian.

Imperial Formation

Imperial Formation was first named Bosworth Sandstone and Shale by Kindle and Bosworth in 1921 for a sequence of shallow marine and continental sandstones, shales and siltstones. At the same time Bosworth called the same sequence Camp Creek series. Kindle (1936) finding "Bosworth" preoccupied, renamed the formation Carcajou Mountain Beds proposing Carcajou Ridge as the type section. Link (1942) suggested moving the type

section to a location of superior exposure on the Imperial River where 1,988' of Imperial Formation outcrop was described by Laudon (1943).

As Fort Creek Formation was redefined as Canol Formation, Basset (1961) placed the base of Imperial Formation at the top of the bituminous black shales of the Canol Formation. The top of the Imperial Formation is located at the disconformable contact with the overlying Cretaceous.

The Imperial Formation was not a subject of stratigraphic study in this past field season. Only the lowermost beds were examined to attempt to determine the nature of their contact with the subjacent Canol Formation which appears to be sharp but formable.

The age of Imperial Formation has been fixed as Upper Devonian. Frasnian fossils have been identified by Link (in Hume, 1954) at 1000' above the base of the formation. This does not preclude the upper part of the formation being as young as Famennian.

HUME - CANOL STRATIGRAPHY

It is convenient for purposes of discussion to consider the total sequence from the base of the Hume Formation to the top of the Canol Formation as an integrated stratigraphic unit.

Firstly, as mentioned previously, the stratigraphy of this gross interval has been badly confused since Kindle and Bosworth made their initial examinations in 1921. These two investigators were largely correct in their interpretation of the stratigraphic succession only failing to recognise what is now defined as the Hume Formation. Subsequent workers proposed several alternate interpretations until Basset (1961) proposed a nomenclature which, with the inclusion of Hume Formation, returned to essentially the Kindle and Bosworth interpretation. It is not within the scope of this paper to detail the development of the Devonian stratigraphy in this area but Figure 7 is included for the reader's information.

That which follows is this writer's interpretation of Hume - Canol deposition and contact relationships. It should be drawn to the reader's attention that any conclusions are drawn without the benefit of faunal speciation from collections made in this past field season. At the time of this writing palaeontological determinations on this material have not been completed.

The transgressive Devonian marine conditions which deposited shallow marine carbonates and evaporites of the Bear Rock Formation continued without hiatus into basal Hume Formation.

The onlapping Hume Formation was deposited over a

relatively flat sea floor gently tilted to the west and southwest under widespread, stable, open marine conditions. The lower half of the formation is characterised by argillaceous fossiliferous limestones and calcareous shales across the miogeosyncline while the upper limestone unit, often bioclastic, carries a particularly rich brachiopod, coral, and occasional stromatoporoïd fauna. The westward gradation to a deeper water environment is recognised by increased argillaceous content.

The Hume Formation is conformably and, in some instances, transitionally overlain by three distinct facies of the Hare Indian Formation, the open marine shale and limestone facies, the near shore shale and siltstone facies and the limestone reef facies.

The Hare Indian open marine facies is characterised by grey to occasionally black shales which are often bituminous and occasionally pyritiferous and siliceous. The resemblance of these rocks to the shales of the Canol Formation, particularly in the basal part of the formation, has contributed to the miscorrelation of these units. The uniformity of thickness and lithology of this facies suggests that it was deposited in a broad, very shallow, open marine environment, over a flat sea floor with circulation restricted by depth of water.

The near shore shale and siltstone facies of the eastern miogeosyncline and shelf has a basal black bituminous shale member. This euxinic shale can also be recognised in the western miogeosyncline. In the near shore facies it is commonly bituminous and contains spores and occasional plant remains. In both facies it is characterised by Tentaculites. In the near shore facies the upper Hare Indian Formation is commonly green to grey-green calcareous shale with siltstone, sandstone and limestone interbeds. On the Anderson River drainage system the Hare Indian often contains sulphur and gypsum crystals. The contact with the overlying Canol Formation is often marked by a limestone bed. The Hare Indian Formation is now suspected to have a limestone reef facies which extends from the top of the Hume Formation to the base of the Canol Formation through the stratigraphic position occupied by Kee Scarp Formation at Norman Wells. It is suggested that the Atlantic Columbian Carbon Shoals C-31 well has encountered this facies. The high limestone and limey clastic content of the top of the Hare Indian Formation in the near-by Atlantic Columbian Carbon Beavertail G-26 well strongly indicates this probability. This interpretation is illustrated on Stratigraphic Cross-section A-A¹ (Encl. 2).

If this is the case then the Kee Scarp Formation of the present nomenclature must be considered a member of the Hare Indian Formation.

The Kee Scarp - Canol or, in off-reef areas, Hare Indian - Canol contact is problematical. Stelck considered the

contact to be unconformable on Canyon Creek and marked by the "Canyon Sandstone". An examination of this area rather suggests that the "Canyon Sandstone" is an off-reef facies of the Kee Scarp Formation. Within the upper Hare Indian Formation sandstone and siltstone sections are commonly found, particularly in conjunction with limestone beds. On a tributary to the Wolverine River in the Anderson Flain the Hare Indian - Canol contact was seen to be sharp but conformable. Where the Hare Indian Formation is in the dark grey bituminous facies lithological differentiation from the Canol Formation is very hazardous and apparent thinning in the Hare Indian on this criteria should be viewed with caution. To cite the absence or thinning of Kee Scarp Formation as a criteria is unwise due to its random nature of deposition.

The palaeontological evidence for a sub-Canol disconformity is indirect. Although the Hare Indian carries a rich fauna distinct from the Imperial Formation the intervening Canol has so far proved barren of fossils excepting sponge spicules. Whether or not this reported lack of affinity between the Imperial and Hare Indian - Kee Scarp fauna results from hiatus or changed environment is possibly speculative at this time.

The correlation between the carbonate facies of the miogeosyncline and the limestone and shale facies of the exogeosyncline is as yet an unresolved palaeontological problem and conclusions drawn by this writer on the existence of a mid-Devonian unconformity would be an unqualified opinion. Jackson (1962) at the type section reports Road River Formation to be unconformably overlain by "Fort Creek Formation" to which he assigns an Upper Devonian age but gives no supporting palaeontological evidence. Norford (1964) reports an angular unconformity beneath "Devonian" siliceous shales at the type section of Road River Formation and a disconformable relationship between Road River Formation and "Devonian" shales on Trail River and Canyon Creek but a paraconformable contact on Roayl Creek. The uniformity of thickness of Canol Formation across the miogeosyncline does not suggest that it was deposited upon an eroded surface - unless that surface was a peneplain.

The apparently thicker section of cherty black shales in the off-reef position in the Norman Wells area are possibly not Canol shales but Hare Indian shales in an euxinic back-reef environment such as the Hare Indian shales of Canyon Creek (Section 2) at the southeast end of the Kee Scarp type section.

Stratigraphic support can be found for a westward truncation of the Hare Indian - Canol interval by the attenuation of this sequence between the Richfield et al Grandview Hills No. 1 well and the Richfield Foint Spearation No. 1 well. This apparent thinning is in the order of 35' per mile. Whether mid-Devonian erosion is responsible or those beds correlated as basal Imperial Formation are Givetian in age, or thinning is a result of a Givetian high in the Foint Separation area is conjectional.

In summary this writer would favour, informally at least, reducing the Kee Scarp Formation to member status within the Hare Indian Formation. If a Hare Indian - Canol unconformity cannot be proved then the Canol Formation could possibly be considered part of a larger stratigraphic unit grouping the present Canol, Kee Scarp and Hare Indian Formations.

CARBONIFEROUS

Exploration in the northern District of MacKenzie has so far considered the Lower Palaeozoic Systems as the primary objectives. The focus of investigation of this project has similarly been placed on the Lower Palaeozoic, the Upper Palaeozoic, and Mesozoic record receiving only superficial examination.

Carboniferous rocks were not examined in outcrop during the 1967 field season. Gabrielse (1957) reports Carboniferous clastics in the northern Richardson Mountains and Zielger (1967) describes clastics of Chester age in the Snake River area. To the writer's knowledge no wells drilled in the miogeosyncline have encountered Carboniferous strata and they are presumed absent due to erosion or non-deposition.

PERMIAN

Permian rocks which commonly outcrop in the Richardson Mountains were examined on a tributary to the Rat River and are described in Section 20. At this locality they are a distinctive sequence of red weathering conglomerates which unconformably overlie the lower Palaeozoic sequence and are unconformably overlain by Cretaceous rocks. These rocks are the basal unit of a probably much thicker, now truncated, clastic succession.

To the south on the Vittrekwa River a boulder conglomerate of Permian or Permian-Pennsylvanian age unconformably overlies Imperial Formation of Upper Devonian age. On the Trail and Road Rivers a continental or brackish water fine clastic sequence of Permian or Permian-Pennsylvanian age is in an angular unconformity with underlying Upper Devonian beds.

Zielger (1967) and Gabrielse (1966) have suggested that Permian deposition was confined to the exogeosyncline.

MESOZOIC ERA

TRIASSIC

Rocks in the Triassic system are apparently not widespread within the project area and none were recognised during the execution of these field studies.

Marine Upper Triassic shales and limestones have been reported from the headwaters of the Caribou River in the southern Richardson Mountains (G.S.C. Map 10, 1963). Jeletzky (1967) proposed the name Brat Creek Formation for a sequence of coarse clastics, bituminous shale and coal of about 500' in thickness outcropping in the Rat River Gorge in the Aklavik Range. He tentatively assigned it a late Triassic age.

JURASSIC

Jurassic rocks were not recognised in the project area apart from the Northern Richardson Mountains and are discussed under the heading Jurassic - Lower Cretaceous.

CRETACEOUS

For the purposes of this report the Cretaceous System is divided into Upper and Lower Cretaceous on all surface sections, stratigraphic cross-sections and maps. In the absence of palaeontological information formational divisions are, at this stage, very uncertain on lithological grounds alone. Cretaceous strata can easily be confused with one another and with the Imperial Formation which it commonly overlies.

In the Aklavik Range and northern Richardson Mountains no formation names are applied to the Mesozoic but the informal stratigraphic sub-divisions of Jeletzky (1960) are used.

LOWER CRETACEOUS

San Sault Group

The name San Sault Group was proposed by Stewart (1945) for about 1000' of marine sandstone and shale of Lower Cretaceous age outcropping on the Mountain River. It disconformably overlies Devonian rocks and is disconformably (?) overlain by the Upper Cretaceous Slater River Formation. This group is possibly, in part, correlative with the Ft. St. John Group of the Liard Plateau.

Anderson River - Inuvik Area

All Cretaceous rocks, the Caribou Hills excepted, in this area are mapped as Lower Cretaceous. This does not preclude the possibility that Upper Cretaceous rocks are not present and may not be found by a more intensive study of the area. In the northern part of this area, between the Wolverine River, the Kugaluk River and the coast only very widely scattered outcrops of black bentonitic shale were found.

These rocks contain Lower Cretaceous ammonites. The Cretaceous was seen to be very thin and forms a nearly featureless plain. The thickest exposed section was about 100' thick and over much of the area the total thickness probably does not exceed that figure. The Cretaceous is thicker towards the south but it is probably nowhere thicker than 400' north of the MacKenzie River and west of the Anderson River.

JURASSIC - LOWER CRETACEOUS

Aklavik Range - Northern Richardson Mountains

This area contains the most complete record of Mesozoic sedimentation in the northern part of the District of MacKenzie. It was a tectonically active area receiving great thickness of sediment during its submergence from Jurassic to mid Upper Cretaceous time.

The stratigraphy is complicated by facies changes, unconformities and Laramide and possibly Albian tectonics. As yet no formal stratigraphic designations have been proposed to subdivide this part of the Mesozoic. Jeletzky has produced several exhaustive reports on the area and has zoned the fauna and divided the section into several informal stratigraphic units.

The purpose of our investigation in the area was to obtain as complete a lithological record of the area as possible within the time available. Several surface sections were measured and described in Sections 18 to 24. These sections have been tentatively correlated to Jeletzky's stratigraphy and an illustration (Encl. 5) is included to show their relative stratigraphic position. It would appear that a complete Jurassic-Cretaceous record was obtained except for the Albian shale and siltstone division and the upper half of the Upper Cretaceous shale division. If these tentative correlations are correct, Section 20 includes about 1600' - 1900' of Mesozoic, presumably Jurassic rocks, which are older than the oldest rocks described by Jeletzky.

The total Jurassic record would then be comprised of about 2900'. The lower 2000' being predominantly sandstones and the upper 900' chiefly silty shales and siltstones.

The Lower Cretaceous sequence has a basal sandstone and carbonaceous fine clastic and coal section which varies from 0' to about 1000' - 1200', a middle shale and siltstone succession of about 1700' and an upper sandstone sequence of about 1000'. The uppermost Lower Cretaceous strata which were not seen, the Albian shale and siltstone

division, is reported by Jeletzky to be about 300 - 800' thick.

The entire Jura-Cretaceous, including the Upper Cretaceous, so far recognised is in the order of 7000' - 8000' in this area.

UPPER CRETACEOUS

SLATER RIVER FORMATION

The Slater River Formation was proposed by Stewart (1945) for a shale sequence of Senonian - Turonian age outcropping on the MacKenzie River below the mouth of the Little Bear River. Stewart estimated a total thickness of 1000' at the type locality. Parker assigned 2150' to this formation in the Mountain River area.

The Slater River Formation possibly correlates, in part, with the Fort Nelson Formation of the Liard Plateau.

LITTLE BEAR FORMATION

Link (1921) proposed the Little Bear Formation for 780 - 850' of continental and near continental sandstones, sandy shales and coal seams outcropping on the Little Bear River. It conformably and transitionally overlies the Slater River Formation. This formation was not examined in the field but published literature suggests that due to the lenticular nature of beds that regional correlation outside of the type locality is uncertain.

EAST FORK FORMATION

Stewart (1945) described 850' of plastic marine shales on the Little Bear River as East Fork Formation. It is reported to conformably overlie Little Bear Formation and be overlain by Tertiary conglomerates. The literature states that East Fork Formation is not recognised north of the Little Bear River.

CARIBOU HILLS AREA

A sequence of continental and near continental coarse clastics, shales and lignite beds, which are described in Section

28, outcrop in the Caribou Hills along the eastern margin of the MacKenzie Delta north of Inuvik.

The base of this measured section at 744' is just above shales which are reported (V. Zay Smith & Assoc.), on the basis of palynological determination, to be Lower Cretaceous in age. The overlying strata are referred to by many investigators as Upper Cretaceous and Cenozoic. Our examination of this sequence has not further clarified this designation but, as much of the section is rich in plant remains, a palynological study of samples taken might yield additional information. The relatively well sorted and well bedded strata of the basal and middle parts of this section grade into coarse, poorly cemented conglomerates and essentially uncemented sandstones at the top. In the opinion of this writer these poorly consolidated rocks are of Cenozoic age. If this assumption is correct then the total Upper Cretaceous thickness in this locality, is less than 700'.

The Caribou Hills, excepted, no rocks of Upper Cretaceous age were identified between the Anderson River and the MacKenzie Delta.

AKLAVIK RANGE

Rocks of Upper Cretaceous age are apparently not well represented in this area. Jeletzky reports Cenomanian shales in excess of 1000' thick on the eastern slope of the Aklavik Range. On Stoney Creek 365' of shales, claystones and siltstones and limey beds were examined. These rocks are described in Section 24 and are tentatively correlated, on the basis of lithology and structural position, with the dark grey shale member of Jeletzky's Upper Cretaceous shale division.

ECONOMIC GEOLOGY

The ultimate use of this study is to determine oil and gas possibilities in this part of the Canadian Sedimentary Basin. A summary and general evaluation of the stratigraphy of the area is presented with this point of view.

PALAEOZOIC

Cambrian

The Cambrian system cannot be considered a prime

objective. The lowermost clastic sequence of the central District of MacKenzie are well indurated sandstones and quartzites. The overlying Mt. Cap Formation has so far been seen to be near shore evaporitic shale and appears to be a poor source rock. The Saline River evaporite basin which probably extended from Little Chicago to at least as far south as Ft. Norman thins markedly to the west where it is represented in a relatively thin gypsum and shale (?) sequence in the Carcajou Range and as a shale and quartzite succession in the Atlantic Columbian Carbon Arctic Circle Ontario H-34 well. It is possible that a carbonate bank could have formed along the margins of this basin or along the eastern margins of the Richardson Trough.

Siluro-Ordovician

The Siluro-Ordovician contains potential reservoir rocks. Porosity was noted in some surface sections and several wells have tested appreciable amounts of salt water and recorded pressures indicating good reservoir characteristics. The laterally adjacent Palaeozoic basinal shales are potential source rocks. Traps could be found in biohermal, but more probably, biostromal carbonate banks, porosity pinch-outs in the bedded dolomites or, if it is in fact present, traps along a Siluro-Ordovician unconformity.

Devonian

Bear Rock Formation

The Bear Rock Formation is an attractive exploration target. This formation is generally anhydritic in the south becoming increasingly marine to the north and west. Porosity could result from subsurface leaching of interstitial and interbedded evaporites. Good incipient porosity could have been developed on the shelf margins in the pelletal limestone bank of the upper Bear Rock. Drillstem testing has revealed a variance of porosity development which indicate porosity pinchouts are common. One recently drilled well, Atlantic Columbian Carbon Shoals C-31 reports recovering a small amount of oil from the Bear Rock on a drillstem test.

Hume, Hare Indian And Kee Scarp Formations

This interval offers the most attractive prospect. The Kee Scarp Formation is the productive formation in Norman Wells field and it seems unlikely that there are not

more oil-bearing reefs of a similar nature to be found within the general Norman Wells area and elsewhere. The greater possibility of discovering reefing built up from a Hume platform for several hundred feet does, in the light of these studies, seem probable. This is illustrated in Stratigraphic Cross-section A-A¹.

MESOZOIC

The basal Cretaceous San Sault Formation might, under favourable structural conditions, be considered a potential reservoir, but the best prospect in the Mesozoic System is undoubtedly to be found in the Arctic Coastal Plain.

The B.A. Shell I.O.E. Reindeer D-27 well, drilled on Richards Island, about sixty miles north of Inuvik, was abandoned in Upper (?) Cretaceous shale after penetrating a continental or near continental clastic sequence of 12,668'. Drillstem testing recovered salt water and unmeasured quantities of gas. Bearing in mind that the Upper Cretaceous is absent in the immediate Inuvik area and was found to be less than 1000' thick in the Caribou Hills, this well demonstrates a marked seaward subsidence of geosynclinal dimensions along the northern continental margin during Mesozoic time. Both the possibilities for traps and adjacent source rocks make this prospect geologically extremely favourable.

REGIONAL LOCATION MAP

OF

CANADIAN PACIFIC OIL AND GAS FIELD PERMITS

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A P P E N D I X

TABLE OF CONTENTS

	<u>Page</u>
COMPILATION OF FIELD OBSERVATIONS	i
NORMAN WELLS AREA	ii
Kee Scarp	ii
Schooner Creek	ii
Canyon Creek	iii
Hume River	iii
ANDERSON RIVER AREA	iii
Anderson River	iii
Andrews River	iv
CARNWATH RIVER AREA	vii
CROSSLEY RIVER AREA	vii
IROQUOIS RIVER AREA	ix
KUGALUK RIVER	xi
NORTH LITTLE CHICAGO	xii
THUNDER RIVER	xiii
WOLVERINE RIVER	xiv
Miscellaneous - Wolverine River	xiv
INUVIK - AKLAVIK AREA	xiv
Campbell Lake	xiv
Jurassic Butte	xv
Northwest Aklavik	xvi
PEEL PLATEAU AREA	xvii
Trail River and Road River West	xvii

COMPILATION OF FIELD OBSERVATIONS

This compilation is exclusive of those observations described in measured sections.

NORMAN WELLS AREA

Kee Scarp

Schooner Creek
Hume River

Canyon Creek

ANDERSON RIVER AREA

MAR Anderson River

ARJ
AC Andrew River
ARM

CW Carnwath River

CLM Crossley Lake Area

CKC
LIM Iroquois River Area
I

KRM
KR Kugaluk River

NLCH North Little Chicago

TRM-6 Thunder River

WC
WJ Wolverine River Area

INUVIK - AKLAVIK AREA

MCL Campbell Lake

JB1 Jurassic Butte

PEEL PLATEAU AREA

PPJ Fermo-Penn

NORMAN WELLS AREA

KEE SCARP (Type Section: Kee Scarp Norman Wells)

		<u>First Ridge</u>
1 ¹	0-7'	Limestone: Brown/brown-grey, very fine crystalline brecciated. Secondary calcite medium crystalline, corals rare.
1 ²	7-11'	Limestone: Brown, dense very fine/fine crystalline, many corals.
1 ³	11-16'	Limestone: Brown, very fine/fine crystalline, many corals
		<u>Second Ridge</u>
1 ⁴	Covered 0-16'	(± shaly) Limestone: Brown/brown-grey, dense, many corals.
		<u>Third Ridge</u>
1 ⁵	Covered 0-6'	(± shaly) Limestone: Grey-brown fine/coarse crystalline. Organic material rare. Nodular.
	6-16'	Covered
1 ⁶	15-25'	Limestone: Brown, dense brecciated, rare algal material. Fine crystalline secondary calcite.
		<u>Cliff</u>
1 ⁷	Covered (0-15) 15-20'	(± shaly) Limestone: grey/grey brown, secondary calcite, highly organic, algal, crinoids.
1 ⁸	20-35'	Limestone: brown, very coarse crystalline, completely organic.
1 ⁹ 1 ¹⁰	35-85'	Limestone: Brown, matrix fine crystalline, very rich in algal material and crinoids.

SCHOONER CREEK

1. The organic zone, below the dense chocolate brown limestone, sometimes increases in thickness.
2. Load casting in the organic zone.

CANYON CREEK

In the black Hare Indian - Canol shale a limestone bed, dark grey, microcrystalline with fossils (brachiopods, crinoids).

HUME RIVER

HR 44P & 45 Grab samples from the Siluro-Ordovician.

ANDERSON RIVER AREA

ANDERSON RIVER

Photo 97 SW/68-5/48

- MAR 19F East end of outcrop of Hume - here about 50' exposed in river bank. Argillaceous limestone and light grey calcareous shale, interbedded - well bedded limestone beds up to 1' diameter. Strike 35°, dip 5° E., good fossil collection Phillipsastrea, Atrypa arctica, Spinatrypa, Favosite? (small corallites) Schuchertella, Plectospirifer? Streptelasma? and other solitary corals, Proteus, Stringocephalus? Crinoid stems, Composita?
- MAR a 20' of thinly well bedded limestone cryptocrystalline with occasional shaly beds 6" in top 4' - overlain by 40' of black shale and limestone interbedded.

MAR 20F Schuchertella at base.

Limestone

Shale

3/4

3/4

1 1/2

3

1 1/2

5

1

1

5

2 1/2

—

5 3/4

16 1/4

ANDREWS RIVER

Photo 107A 128/8 #250

- ARJ 1F Starts in Hare Indian Formation. Shale, green-grey, fissile, part waxy, slightly calcareous, fossiliferous: Tentaculites, Brachiopods. No dip taken due to slump; quasi horizontal.
- ARJ 2F 3°/295° 5°/315° Hare Indian Formation. Shale, grey and green grey, fissile, calcareous. Towards top white mica seen on bedding planes. Some thin limonitic bands, shale 1/2" thick. Cliff 80 feet exposure. Two dips taken, conforming with general dip. Much slumping precludes accurate readings. Fossils: Small brachiopods, stromatoporoids.
- ARJ 3 Hare Indian shale, description as above. Not able to measure dip, but general trend is about 20°. No sample taken.
- ARJ 4 Outcrop in four parts: Photo 107A 128/8 #252
- A. Black, rusty weathering, very fissile, gypsiferous, calcareous, fairly resistant to weathering. Some very thin (1/2") black limestone and some bedded calcites. Suggestion that shales at top (15' of Unit A) may be dark brown in colour.
 - B. 15" of black, thin bedded limestone, very shaly. Many? Tentaculites? and very poorly preserved brachiopods, fragments. Dip taken on limestone band, very accurate. Beneath it, 15" black calcareous shale, 6" hard black siltstone, 15' black, fissile shale as above. Tentaculites.
 - C. Black calcareous shale more resistant, sub-conchoidal fracture mudstone but too fissile, very fissile, very calcareous, white gypsiferous bloom. Litho sample ARJ-4L. Some clear gypsum crystals, 20' estimated.

Top of Hume

- D. Limestone: dark grey - grey, microcrystalline,

rubby bedded, coquinoid. Brachiopods included Atrypa. Limestone only seen for 3' before lost in stream or covered at end of outcrop. Fossil sample taken. ARJ-4A-F. 50 yards from ARJ-4. Small fault cuts out Hume.

Photo 107A 128/8 #253

- ACa Hare Indian, Shale: brown/green fissile, slumping.
- ACb Hare Indian, Shale: an anticline with gentle dips.
- ACI Hume Limestone: dark grey with interbedded shale.
- 187°/6° Many fossils (Atrypids, Leiorhynchids,
- 183°/7° Rostrospiriferids, Rhynchonellids, Gastropods, Pelecypods)
- ACc 81°/7° Hume Limestone: dark grey
- ACd 138°/8° Hume Limestone
- Photo 107A 128/3 12901-213
- ACe Hare Indian Shale
- AC2 95°/22° Hume Limestone: dark grey, many fossils
- 95°/21° Corals, Brachiopods, Gastropods, Crinoids, More than in ACI
- AC3 Hare Indian Small outcrop of Hare Indian shale (black) overlying the Hume. (Hare Indian fossils: Tentaculites, Brachiopods and Gastropods)
- AC4 Hume, many fossils
- AC5 275°/5° Hume
- ACf Hume
- ACg 292°/3° Hume
- ACH 109°/2° Hume
- ACi 312°/3° Hume
- ACj 217°/2° Photo 107A 128/3-12901-211
- Hume
- ACK Hume
- ACI Hume
- ACm 95°/6° Hume
- AC23 110°/5° Hume

Photo 106P 128/2 12901-285

- AC24 170°/6° Hume, Limestone: fossils, solitary corals common.
- AC25 265°/8° Hume Limestone: limey shale with shaly limestone. Total thickness 50-60'. Lower part many solitary corals. Corals (solitary and colonial, brachiopods, gastropods, crinoids)

Photo 106P 128/1 12901-103

- AC26 61°/4° Hume, Limestone: dark grey

Photo 107A 128-5/101

ARM-15F Black calcareous shale, good fissility weathers black with white excrecence (gypsum?) - fairly rich in Tentaculites - Canol, occasional thin beds 1" of Black argillaceous limestone.

ARM-16F Photo 107A/128-5/102
15' black shale with white excrecence underlying, about 30' recessive black shale, ie. Canol type dip component 5° down stream (NW) true dip, strike 334°

Photo 107A 128-5/102 with Tentaculites

ARM-17F Immediately below black shale as at ARM-15F and ARM 16F top of limestone, black, dark grey, bioclastic, argillaceous thinly bedded - 1" rich Brachiopod fauna, Composita? Occasional Strophemanid abundant Crinoid stems, occasional Spinatrypa, Thamnopora Bryozoa spp. Top 1' limestone gradational into shale and has ripple marks. Dip 5° W/004°.

ARM-18F Photo 107A 128-5/102
Strike 4°, dip 3° E on bed of limestone, crypto-crystalline thinly bedded with Phillipsastrea and Favosites colonies (Favosites small corallites) in creek overlain by black shale calcareous and black argillaceous limestone interbedded. Well bedded 3"-6", 15" thick unit, overlying black shale with Tentaculites. Base of this shale is same as at ARM-17F. Anticlinal reversal between ARM-17F and ARM-18F.

Photo 107A 128-5/102

ARM-18F Occasional Hexagonaria.
Photo of Phillipsastrea - Reel 3, frame 20 Anderson River. Medium grained bioclastic limestone with abundant Phillipsastrea colonies up to 3' diameter also Atrypa arctica, Crytina? ribbed Trilobites, Spinatrypa, solitary corals, Bryozoa, strike 004°, dip 3° E.

Photo 107A 128-4/181

ARMa 30' Canol typical did not see Tentaculites, very cursory look - weathering to whitish, yellow or reddish cast.

CARNWATH RIVER AREA

Photo 106P 128/4 168

CW1 Black shale, blocky, good laminated and brown green shale, fine in talus Hume. In the black shale Gastropods.

Photo 106P 128/6 69

CW2 195°/7° Hume Limestone

CW# 50°/2° Hume Limestone

Photo 106P 128/6 71

CW4 175°/3° Hume Limestone
170°/5°

CW5 326°/6° Hume Limestone

CROSSLEY RIVER AREA

Photo 107A 129-5/91

CLM-7 In this creek most northerly outcrop - everything north is glacial - no Cretaceous. Talus outcrop is shale, black, hard, fissile in part and interbeds of argillaceous siltstone with some finely macerated plant debris. Whole is crudely bedded, with some cross-bedding, occasional ferruginous (and calcareous?) nodules - gypsum weathers out on surface. This is Canol-Imperial.

CLM-8 (estuarine - lacustrine)
Bench forming unit with good dip slope - dip to south - at top about 15' siltstone, light grey brown, sandy and argillaceous, laminated finely cross-bedded with lenses and interbeds 6" thick of shale, medium grey and grey clay or shale pellets 1/2" to 1" in diameter, occasional ferruginous concretions 1" to 2" occasional indeterminate plant material overlies shale, medium grey, soft recessive, laminated siltstone sample. This is Imperial.

Photo 107A 129-5/95

CLM11 Outcrop in creek of shale, black fissile in places brittle, (like Canol) and weathering with a yellowish or light brownish cast CLM-II (b), in other places

with appearance of Cretaceous as in Kugaluk River CLM-11 (a). Thin bands of siltstone, sand with very fine specks of carbonaceous material. One at top has single Brachiopod. Fragment CLM-II (c) Leirorhynchus? This outcrop is most likely Canol.

- CLMa Bare patch black shale brittle, fissile, weathered light grey and light yellow brown - Canol.
- CLMb Could not land here but flew down creek - all section between here and CLM-II is Canol.
- CLM-12 Photo 107A 129-5/91
Light green grey sand, siltstone as at CLM-8, but not outcropping, only float
- CLMc Photo 107A 129-6/51
Very poor outcrop in bank.
- CLMd Photo 107A 129-5/93
Small patch of Canol - similar to CLMa - weathering light grey to reddish brown - from air only.

Photo 107A 129-6/50
- CLM-14 (Horizontal)
40' of light grey, sandy, siltstone, with fine carbonaceous material dark grey clay pellets fine grained white mica and worm tracks - small scale cross-bedding and lenses of light grey silty shale. Whole unit identical with CLM-8 and bench forming.

Photo 107A 129-7/312
- CLM-e About 5' Imperial overlying Canol - no real outcrop.
- CLM-i Mesa with Canol in slopes and across top between here and CLMg, float at top of Imperial - like siltstone - so there probably a thin veneer forming bench.

Photo 107A 129-6/45
- CLMg See under CLM-i
- CLMh Canol float NW of here, is no outcrop from here to CLM-i. Canol mostly poor outcrop.

- CLMi See CLMh
- CLMj Photo 107A 129-7/310
Canol lowest outcrop in creek and covers plateau behind.
- CLMk Canol with a little Imperial type siltstone - probably top Canol.

IROQUOIS RIVER AREA

Photo / 12697 (107A 130-1 CKC)

- CKC1 Canol Shale: dark grey/black, blocky, red brown, weathering. No measurement, bad outcrop.
- CKC2 115°/6° 1/2 Canol Shale: dark/grey/black, blocky, red brown, yellow weathering.
- CKC2 F On top of Canol shale is a conglomerate with mollusca.
- CKC3 Imperial, Sandstone: light/dark grey, very fine/fine, well bedded with carbonaceous material, well rounded. In the sandstone beds a conglomerate 4-5". Most places eroded, cross-bedding, feldspar, chert. Real #3, no. 9-10.
- CKC4 Canol Shale: black, blocky, red/brown weathering red. The top of this outcrop is covered (no Imperial).
- CKC5 135°/4° Canol Shale: black/dark grey, bottom blocky, above sandstone light grey weathered.
- CKC6 275°/7° Canol Shale: dark/grey/black, blocky sed, weathering.
- CKC6F (30' S of 6) Sandstone/siltstone: grey/brown/buff, very fine with fossils: Brachiopods, corals.
- CKC7 Limestone: light grey, microcrystalline, irregular bedded. Limestone with fossils: Corals ± Top Hare Indian. Measured thickness Canol 95' (CKC7-CKC10).
- CKC8 Hare Indian Shale: grey/brown/green, fissility, mica, waxy. On top of this shale a limestone. A part is covered between the limestone and the shale.
- CKC9 Limestone (Top Hare Indian)
- CKC10 Imperial.
- CKC11F Fossils Imperial (6) Plants.

Photo 107A 129-5/103

- LIM9F About 50' shale, light grey green, weathering recessive, light grey waxy rarely with fine

LIM10F

grained, white mica and very finely divided carbonaceous material - rare crinoid stems, one Pelecypod straight nautiloid? tracks? (Hare Indian) At edge of mesa highest unit is thinly bedded, shaly, silty limestone and calcareous shale, not all well exposed - rich brachiopod fauna, with Cyrtina, Marinia, Strophomenids, Crinoid stems, Trilobites, Bryozoa. Between this point and LIM 9F is continuous shales as at LIM9F.

Photo 107A 129/i-104 176/5

I¹

Hare Indian - Shale light/dark grey, sometimes light brown grey, weathered, with some limey shale beds. The limey shale beds are dense (1/2 - 1 cm) loadcasting in these beds. Fossils: fish scales? The limey beds mostly in the lower part.

I² 13278°

Hare Indian - Shale light/dark grey, brown/green, weathered. Limey shale at the bottom. Fossils: fish scales?

I³ 55°13°

Hare Indian - Shale light/dark grey, limy, with more dense beds of shaly limestone 3". Fossils: same as above fish scales.

I⁴

Hare Indian - Shale black/light/dark grey, purple, and yellow weathered, pyrite. Secondary crystals of gypsum. No measurement.

Photo 107A 129/4 336 274/3

I⁵

Hare Indian - Shale: dark grey with limestone beds. The shale is sometimes limy. The limestone beds have sediment structures (loadcast) dense. Fossils, Tentaculites? Sometimes yellow weathered (sulphur) and red brown.

Photo 107A 129/3-247 210/II

I⁶

Hare Indian - Shale same as above, dark grey, with dense limestone beds. Fossils, Tentaculites, Lingula? Photo (John H.). Reel 2 #32.

I⁷

Hare Indian - Shale dark grey with limestone beds.

I⁸

Hare Indian - Shale dark grey (Brown/green weathered). No measurement, bad outcrop.

KUGALUK RIVER

Photo 107A 131-4/169

KRM-1F
KRM-2

Palynology
Lithology

About 100' medium grey shale with interbedded argillaceous siltstone. Siltstone is finely micaceous with carbonaceous specks and indeterminate plant material fine grained feldspar (?) ferruginous specks and silt-sized quartz. Shale is carbonaceous and crudely bedded, moderate fissility ripple marked-occasional small scale cross-bedding.

Photo 107A 131-4/169

KRMa

Same as KRM-1, about 20' of outcrop - top of bank

KRM-b

Same as KRM-1 and 2 about 10' outcrop on top of bank

KRM-3

On Kugaluk River 100' exposure of black, soft bentonitic shale. No silt or sand, laminated with numerous large calcareous concretions up to 3' diameter - many probably around ammonites - many large ammonites and bones?

Photo 107A 131-1/101

KRM-5

30' light grey and orange weathering, bentonitic soil (recent glacial?) overlying Imperial sampled (Spores)

KRM-6

Photo 107A 130-6/180

Imperial sampled nearest to Cretaceous - well bedded, hard quartz siltstone, argillaceous, partly carbonaceous, plant remains, shows loadcasts, ripple marks, normal tracks and small scale cross-bedding in siltstones - Beds up to 1 foot but laminated scale cross-bedding in siltstones - Beds up to 1 foot but laminated weathers flaggy joining at right angles (vertical) flat lying.

Photo 107A 131 5#A 12843-338

KRI L

Imperial Shale - solitary outcrop. Isolated outcrop exposes 15 feet interbedded shales and siltstones, medium grey/green grey in colour. Bedding horizontal. Siltstone shows fluting, worm casts, small bedding structures. Shale very fissile, micaceous in part, grading occurs - silt, massive,

subconchoidal fracture, grades up into fissile shale. Siltstone: shale 60 - 40%.

- KR2 L No outcrop seen - talus of flaggy fine - very fine sandstone and grey green siltstone. Sandstone poorly sorted subangular quartz grains and subangular/round feldspar. Much clay grade material 50% Chloritic? Siltstone grey, green flaggy, very poorly sorted. Some weathered shale, paper thin. 1 - 1 1/2 thick flags sedimentary, iron, sandstone, fine grained as above with ferruginous, dark grey, metallic lustre. Some orange fine grained limonite spots.
- KR3 Massive bedded siltstone grey/grey green, mainly homogenous, in parts 1 - 18" thick. Some grading into 3-4" thin green grey shaly partings. Silt: shale 9:1 occasional thin 1/2" bands iron pan. 10'.
- KR4 Interbedded shale and siltstone, ratio 50:50. Siltstone more, Fe stained than below, light grey, very finely micaceous, quite fissile. Often finely laminated. Beds 2-3" thick siltstone 3-4" thick shale. Shale - dark grey, black, soft. Bedding horizontal. Dark carbonaceous specks seen in some of the siltstone.
- KR5 L No outcrop seen. Exposed talus slope of flaggy very fine grained, poorly shed light green-grey sandstone with many bottom structures - flute casts, load casts, ripple marks. Flags 1/2 - 2" thick. Some dark grey rusty weathering iron rich sandstone. (Some fine grained sandstone flags). Flags more predominant but also considerable grey green and dark grey shales. Some flags have laminae, full of carbonaceous specks. Further up slope some poor outcrop of 9" partings very fine grained sandstone slumped. No reliable dip. Sandstone poorly sorted, light grey, green, micaceous, some thin silty shale partings. The sandstone has scattered grey shale flakes embedded in homogenous sandstone material Fe stained sandstone has tiny rare flecks pyrite.

NORTH LITTLE CHICAGO

Photo 106 0 130/3 116

N.L.Ch 1 In the talus: Limestone with fossils. Dark limestone

microcrystalline with many fossils; brachiopods, Gastropods, Corals, black shale, bituminous.

N.L.Ch 2 Shale: dark, dense, irregular bedded, no limestone. On the slope (loose) very fine siltstone. Light grey/brown sandstone very fine rather dense.

N.L.Ch 3 Sandstone: grey/brown, micro/very fine rather dense with many fossils (Brachiopods) 2' below a grey limestone, microcrystalline, 1 1/2 feet thick with shale at the top and at the bottom. The shale has a red/brown weathering and is sandy.

THUNDER RIVER

TRM-6 Canol in Thunder River.

WOLVERINE RIVER AREA

Photo 107A 129/2-243

W.C. a Shale, dark grey/black, irregular surface after breaking.

W.C. b 285/6 Canol, Shale: black, dense, thicker layers, red/yellow, weathering.

W.C. c 315/9 Siltstone: Concretous with pyrite, dense, sometimes faulted. Rich with iron. Same as above, gypsum. Light grey limestone, micro-cryptocrystalline and dense, thinly layered, yellow weathered pyrite.

W.C. 1 Limestone: light grey, micro/cryptocrystalline, dense with light grey limey shale. Trilobites in the limestone. Thickness 1-2" bituminous.

W.C. 2 Shale: grey/green/brown, many with limestone beds. Limey shale, thinly bedded, easily to break, (different from the shale above). Limestone beds 1 - 2" light grey limestone micro-cryptocrystalline. Fossils; Trilobites, Crinoids, Brachiopods.

W.C. 3 Good outcrop. Shale: grey/green/brown, sometimes limey (top) lower silty, waxy interbedded with the shales are limestone beds 1-2" thick, light/dark grey limestone micro-cryptocrystalline. Well bedded, dense. Fossils: Brachiopods and Gastropods.

W.C. 4 Shale: grey/brown, good fissility, decreasing limestone beds, (lower in the section). Mainly shale. Some fossils in the shale: Brachiopods.

Photos 107A 129 /2 24 Hare Indian outcrops.

- WJ 1 Dip 5°/25° E. of N, fairly reliable.
Agrees with general trend of outcrop which in places is badly slumped. Outcrop green, grey/green slightly waxy, with occasional tentaculites. Fissile, massive bedded turnout. No sample. 150' downstream thin beds brown shale 1/4" thick, one every 6" etc., origin of limonite not seen.
- WJ 2 No outcrop, but Hare Indian shale debris (as above) in cuts. Digging reveals poorly bedded shale.
- WJ 3 No true outcrop for measurement purposes, but digging reveals bedded shale in attitude of slump or creep. Shale soft, waxy, green/grey, fairly fissile. Hare Indian. No fauna seen.
- WJ 4 Photo 107A 129/1-125
Extensive outcrop of Hare Indian shale. Two dips taken, 6°/005° E of N, and 5°/350° E of N of which the latter is more reliable. Shale, grey, very fissile verging on paper shale, more brittle. Occasional scattered very small 1/2" discs. nodular, limonitic shale. Tentaculites noted.

MISCELLANEOUS - WOLVERINE RIVER

- A. Top of Scarp: 40' sandstone and shale. Sandstone poorly sorted, fine - very fine grained, bn, in 3-4 feet beds, grading sharply at top to green silty shale, about 2 1/2 - 2 feet. Samp A: Imperial. Some of the sandstone has shale pellets. Colour of sandstone, light grey to grey green.
- B. Dark grey very fissile shale, with rare thin limonitic sandstone bands, limonitic weathering in stream and in part on shale.

INUVIK - AKLAVIK AREA

CAMPBELL LAKE

- MCL-23F See Mosaic - 107B2W1/2
30' of Hume? black limestone microcrystalline to very fine grained micrite, slightly bituminous well bedded, irregular surface (like interference ripples) 3-6" beds - no clay or shale, fauna of Brachiopods, solitary corals, trilobites, crinoids - mainly unrecognisable - probably Atrypa arctica? Lithology

similar to Campbell Lake dip 15° to 85°.

- MCL-24 Photo 107B 133-4/214
Unconformity Cretaceous/Imperial
Cretaceous silty sandstone medium sorted, friable
small scale cross-bedding, interbedded with silty
carbonaceous shale dark grey, with small scale
interlensing, fine grained silty sandstone overlying
medium grey siltstone - white mica and indeterminate
plant remains.
- MCL-25F Mosaic 107B-2W1/2
Outcrop of limestone medium to grey, thinly rubbly
bedded, to poorly and well bedded, occasional
stringers white chert, slightly argillaceous in part
mainly very fine grained micrite-fairly abundant
fauna, small Brachiopods only one type (Composita?)
Syringopora? (Bear Rock) Dip 21° to south.
- MCL-26 Mosaic 107B2 W1/2
Well bedded dark grey lime dolomite, unfossiliferous
(Bear Rock?) Dip 9° to south.
- MCL-a Dolomite slightly limey dark grey, cryptocrystalline,
strongly "brecciated" with fine lattice of fine calcite
veins - rare crinoid ossicles otherwise unfossiliferous,
dip 5° - 10°.
- MCL-27f Limestone medium grey bioclastic medium grained -
abundant Crinoid ossicles occasional Proteus - Hume
aspect -crudely bedded. Hume type Crinoid stems.
- MCL-b About 50' crudely and thickly bedded encrinite - rather
bituminous overlying section at MCL-28F and same as
MCL-27F.
- MCL-28F About 15' black, bituminous limestone wavy bedded
3-6" - common Brachiopods, (Proteus), Crinoids,
cryptocrystalline, fine calcite veins - correlates to
MCL-23F in River.

JURASSIC BUTTE - Reconnaissance

Location: Small southwest-tending creek immediately
south of Jurassic Butte.

There is good correlation from Mt. Goodenough to
the south side of the creek, where the "Yellow" and "Brown"
sandstones can be seen in the cliff. The stream follows a

demonstrable fault line.

On the north side of the creek there is about 100' of scree material, which from its size and attitude is near outcrop. This sandstone is medium-coarse grained, clean and quartzitic.

It is not correlative with the "Goodenough sandstones" but has a character reminiscent of the lowest sandstone in the Martin Creek section.

This sandstone was followed to a point about 3/4 miles to the north, where the following section was noted. All thicknesses are estimated. The outcrop is fault bounded.

Top: Medium-coarse grained sandstone, as above, about 80 feet sandstone, fine grained brown-grey/brown, very argillaceous, hard well bedded, flaggy, argillaceous content about 40%. Plant remains, flage 2-3" thick, 70 feet shale, black, dark brown, very silty, mica, carbonaceous about 75 feet sandstone with thin shaly and argillaceous sandstone partings. Sandstone fine grained subround/round quartz with orange limonite specks, many plant remains including roots and fossil wood. Bedding poor in 1 to 2 foot beds. Large Bellemnites in various attitudes (sample JBJ-IF).

Beneath these beds is a thick massive conglomerate; whose junction with the overlying strata is not seen. There is approximately 150' of conglomerate, which rests with gentle angular unconformity on rocks of probable Permo-Pennsylvanian age.

Conglomerate: Matrix a red finely brecciated siliceous mudstone, with large (up to cobble-sized) rounded tabular red stained pebble of black chert. Much net-veining, mostly calcite about 150'. Angular unconformity. Sandstone thinly bedded, ochrous. General northerly dip. Mudstone light grey-green siliceous sandstone.

The above conglomerate is probably the conglomerate seen by K. G. Alexander described in Section 20 (permo-Pennsylvanian).

This section is also fault bounded against a series of red and variegated shales, with a white gypsiferous gloom. The beds are extremely disturbed, and are probably associated with an intrusion similar to that described by Cosijn and Palmer in the Aklavik Area.

NORTHWEST AKLAVIK

The cirular features (L.F. Martin) are connected with a fault. Big crystals of gypsum, chalcopryite and galena are found in this area and are related to an epidote diorite dike.

FEEL PLATEAU AREA

TRAIL RIVER

Angular unconformity between Permo-Penn and Upper Devonian: Irregular, angular with demonstrable onlap of Permo-Penn beds. No conglomerate seen but in places a well sorted medium grained sandstone.

- Upper Devonian:
- (1) Shale: medium grey, weathered brown, silty, fissile small 1" diameter iron-stone nodules.
 - (2) Sandstone: 1"-1 1/2" horizons, very fine/fine grained, poorly sorted, scattered carbonaceous plant remains, some bottom structures - flutes, load casts, sandstone/shale ratio 1:15.
 - (3) Some nodular horizons, nodules flattened ellipsoidal, iron stained, siliceous mudstone with disseminated pyrite.

- Permo-Penn:
- (1) Shale: brown, blocky, mudstone character, occasional large iron-stone nodules, 2"-3" diameter.
 - (2) Sandstone: grey, siliceous, med./fine grained, sub-rounded, 3"-6" beds. Sandstone/shale ratio 1:4 or 5, occasional black chert grains, coaly plant remains in medium grained poorly sorted sandstone. Some micaceous shale similar to Upper Devonian and the sandstone weathers in flags with often red coloration.

The Permo-Penn in this outcrop has (a) thicker more siliceous sandstone (b) coaly plant remains as opposed to fragments (c) blocky brown shale as opposed to fissile grey shale. Bedding is generally contorted tectonically and post depositional. PPJ-1F - plant fragments from horizon 3" above the unconformity.

ROAD RIVER WEST

Angular unconformity between Permo-Penn and Upper Devonian. Permo-Penn beds are vertical.

- (1) Sandstone and shale: massive, flaggy. The sandstones are grouped in 10-20' series with thick shales sections between. Sandstone: grey, medium/coarse grained, poorly sorted,

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STRATIGRAPHY OF THE NORTHERN DISTRICT MACKENZIE

prepared by
K. G. ALEXANDER

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1967

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OIL AND GAS LIMITED

Surface Section Name CARIBOU HILLS

SECTION 28

Location NTS 107 B lat 68°38' long 134°05'

Area CARIBOU HILLS-REINDEER DEPOT

Province DISTRICT OF MACKENZIE, NWT

Youngest Fm. UPPER CRETACEOUS

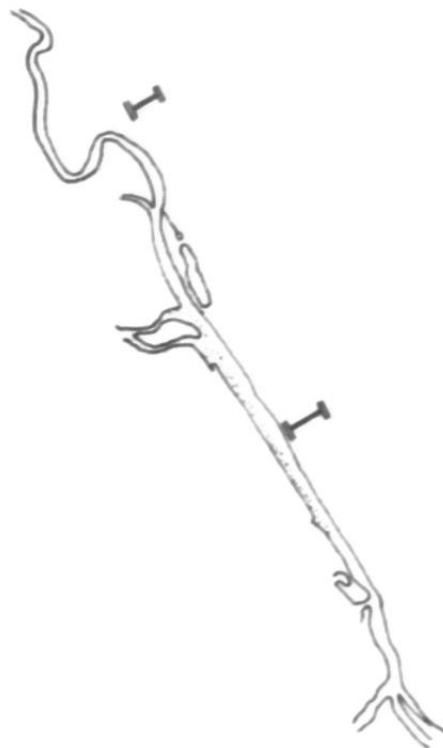
Oldest Fm. UPPER CRETACEOUS-TERTIARY?

Exposure Quality GOOD

Geologist D. Cosijn, H. R. Palmer

Date July 18 & 19, 1967

134°00'
68°45'



134°00'
68°30'

INFORMATION SUMMARY

DESCRIPTION

TOP MEASURED SECTION

Se. sltst: lt brn, red vthrd, org, some
blk chert grt
This part of the outcrop is covered
w/ numerous pbls, two possibilities:
1. pbls in ss as bds
2. glacial pbls falling down the slope

Sh: brn/dk brn, carb wood ran

Cal: sandier on top, w/ less pbls grdg/
sltst

Sh: brn, blk, carb strgs, ool in col,
ben sandier

Cal: pbl w. sort, v rd, (1/8"-1")
Sh: brn, blk, ben, sdy/slt, v mica
ss: wh/lt gr, f gr, v/ool boat pbl
(pbls 1/8"-1") ss: lt gy f/mgr subang, grd bds
Cal: pbls 5-1/8" sub ang rdg, p sort
Sh: gy brn, mic & carb, wood runs

Slstst: lt gy/gy brn, mica, w/ool egl bds
p sort, 1"-3", red/brn vthrd.

Slstst: yel vthrd, v/brn & blk sh: carb
intbds wood ran ool.

Lsg: yel/brn to red/brn, v/ a blk carb
bd below, wood ran ool

Sh: dk brn/brn, w/ wood ran

ss: s & pa vt/f gr, sub ang, brn vthrd,
w/ egl & sh: brn, blk, intbds sltst

ENGINEERING DATA

CHM-7

Date July 18 & 19, 1967

INFORMATION SUMMARY



DEPTH FORMATION TOPS FATHOMS	POSITIVE VALUES	POSITIVE VALUES	LITHOLOGY	DESCRIPTION
				TOP MEASURED SECTION
78				Sh: elst: 1/2 m. brn, red whrd, org, some
89				Sh: dk brn, red whrd, org, some
110				Sh: dk brn, red whrd, org, some
122				Sh: dk brn, red whrd, org, some
136				Sh: dk brn, red whrd, org, some
143				Sh: dk brn, red whrd, org, some
158				Sh: dk brn, red whrd, org, some
205				Sh: dk brn, red whrd, org, some
250				Sh: dk brn, red whrd, org, some
326				Sh: dk brn, red whrd, org, some
343				Sh: dk brn, red whrd, org, some
360				Sh: dk brn, red whrd, org, some
484				Sh: dk brn, red whrd, org, some
500				Sh: dk brn, red whrd, org, some
510				Sh: dk brn, red whrd, org, some
570				Sh: dk brn, red whrd, org, some
607				Sh: dk brn, red whrd, org, some
618				Sh: dk brn, red whrd, org, some
638				Sh: dk brn, red whrd, org, some
652				Sh: dk brn, red whrd, org, some
654				Sh: dk brn, red whrd, org, some
669				Sh: dk brn, red whrd, org, some
744				Sh: dk brn, red whrd, org, some

Canadian Pacific

OIL AND GAS LIMITED

Surface Section Name CAMPBELL LAKE 'A'
SECTION 26
Location NTS 107 B lat 68°11' long 133°29'
Area CAMPBELL LAKE - ROCKY HILL
Province DISTRICT OF MACKENZIE, NWT
Youngest Fm. HUME FM
Oldest Fm. HUME FM
Exposure Quality FAIR
Geologist J.W.J. Hardy, M.G. McKellar
Date July 15, 1967



INFORMATION SUMMARY

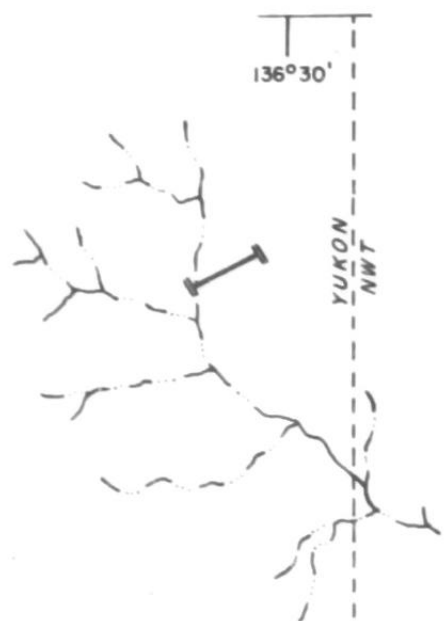
Apart from the basal exposure the outcrop is a cliff section. Reference photo - 107B, flight line 133-4, series A-13406, #210.

DEPTH FORMATION TOPS SHOWS	POSITIVE GRADES	LITHOLOGY	CRYSTAL GRAIN SIZE FRAGMENT SIZE FOOTPRINTS - DIAG. TYPE SCALING - DIA. TYPE PERCENT OF FRAMEWORK	DESCRIPTION	COL-17 SL-22
69				TOP MEASURED SECTION Ls: bf/brn, micxl, dns, w/ many calcite crystals angle of dip 10°	
122				Ls: m gy, micxl, dns, w/ 3" ccq band, Brac, Cer, Strom, Amph	
155				Ls: dk gy/blk, micxl, in 2' bds, sec w thn (12") shv intbds, seat Brac frags @ 135', seat calcite crystals Ls: dk gy, micxl, sub concn frags, dns, w bdd, mas, (3') & vertical jointing	
247				Ls: a/a w/ sec thn shv prigs, for 30% styl dominantly a/a w/ sec flaggy (1") blk, bit ls intbds for 2'	
				COVERED	
				Ls: mic/vfzl, w/approx 20% seat biofrag mat inc Crin & Bry	

Canadian Pacific

OIL AND GAS LIMITED

Surface Section Name HEADWATERS OF FISH CREEK SECTION 25
 Location NTS 116 P lat 67°52' long 136°32'
 Area RICHARDSON MOUNTAINS-WHITE MTNS
 Province YUKON TERRITORY
 Youngest Fm. SILURO-ORDOVICIAN
 Oldest Fm. VUNTA
 Exposure Quality GOOD
 Geologist J.W.J. Hardy, H.R. Palmer
 Date August 23, 1967



INFORMATION SUMMARY

Beds from 0-270' were at top of section and inaccessible. Thickness and lithology is estimated.

DESCRIPTION

DEPTH FORMATION TOPS SHOWS	POROSITY TYPES	POROSITY GRADES	LITHOLOGY	CRYSTAL GRAIN SIZE FRAGMENT SIZE	ROUNDING — DIAG. TYPE	SORTING — DIAG. TYPE	PERCENT OF FRAMEWORK	DESCRIPTION	ENGINEERING DATA
100			?					La: 1/2' bda w/thn ptgs	
200			?					Has cliff form to bed: lt. gy	
270								TOP MEASURED SECTION La: lt. gy, micst, interbed w/lt. dk. gy/bk, a bed, finely 1/2-1/4" thk	
420								La: brn, argst, sl. dol, one twin holed crin. see AMPHYBOLITE (?) Zone of brn brnc ls w/lrg vugs, much vn calcite	PCJ-7P SIL-DEV
480								La: brn-ey, argst, f. bda v/calcite vns, minor interbed 1/2" blk micst	
585								No exposure. From surrounding ridges appears to be similar to above	
600									
650								La: blk, fxl, al. ady	
675								La: dk/ey-brn, argst, 1'-3' bda, interbed w/lt. thn bda, one lat. blk, micst, and brn casts replaced by sec calcite	
700									

SIL-DEV

PCJ-6P
PCJ-5P

3200			
3300			
3332		La: dk gy/blk, arpxl, mas, w/rr small Crin oss	
3385		La: dk gy, fxl w/large Crin & Brac oca colonial Cer, 17/3 bds	CJ-2F SIL
3435		La: lt/m gy, micxl, sucresie, oca eol Cer	
3555		La: m gy/gy brn, mas, micxl, seat Crin, oca eol Cer, calcite vns	
3595		La: m gy/blk, arpxl, mas rr Crin oss, Cer, intbds blk ned oht at top of unit	CJ-1F ORD/DEV
3700		La: blk, arpxl, thn bdd La: dk gy/lt gy, arpxl, rr Crin oss	
3750		La: m/dk gy, arpxl, w/irreg patches dol: lt gy, arpxl, Strom com, rr chain Cer, single Cast, thn bd	
3800		NO EXPOSURE RECESSIVE WTHRD	
3900		La: m gy, arpxl, v/vns wh calcite. Bds 4"/1", intbd ls: blk arg/shy	
3915		La: gy, arpxl, hd mas, 3' bds, wthrd lt gy, vns wh calcite, oca lmn flecks & strained calcite	
4000			

44

4325

Canadian Pacific

OIL AND GAS LIMITED

Surface Section Name STONY CREEK

SECTION 24

Location NTS 106 M lat 67°21' long 135°20'

Area RICHARDSON MOUNTAINS

Province DISTRICT OF MACKENZIE, NWT

Youngest Fm. UPPER CRETACEOUS

Oldest Fm. UPPER CRETACEOUS

Exposure Quality GOOD

Geologist J.W. J. Hardy

Date August 24, 1967

INFORMATION SUMMARY



DEPTH FORMATION TOPS SHOWS	POROSITY GRADES	LITHOLOGY	CRYSTAL GRAIN FRAGMENT SIZE	ROUNDING — DIAG TYPE	PERCENT OF FRAMEWORK	DESCRIPTION	ENGINEERING DATA
TOP MEASURED SECTION							
50						Sh: dk gy, silt, w/thn siltst, lam, mic, play frag Sh: siltst, lam w/ plant rem Sh: dk gy, silt, sily near top	SCJ-2P ?
100							
135						La: sily, brn wthrd, 9" thk Siltst: dk gy, sily, 50% sily, w/ccc bds siltst: calc & better consol Sh: gy w/thn la: lam Clyst: dk gy, sily, calc calc	
168							
200						La: sily 1" bd Clyst: dk gy, silt, calc sily, lam	
235						La: sily 1" bd Clyst: dk gy, silt, calc sily, lam	
250							
267						Siltst: s. bd, s. consol Mudst: lt gy, w/thn strg ss: sily play frag	
297						Clyst: dk gy, sily, silt, w/siltst, mgy, carb Siltst: mgy, inthd w/ siltst: arg, w/ccc carb mat, calc play frag, siltst: sh 60:40%	
315							
335						ss: gy, fgr, wthrd, lt gy, f lam, feldspathic w/carb floata, gentle x bd, mass bd, w/inthd sh & siltst, p. consol arg, play frag	SCJ-1P L JURA / E. CRET
365							

Canadian Pacific

OIL AND GAS LIMITED

Surface Section Name "NO NAME" CREEK 'B'

SECTION 23

Location NTS 106 M lat 67°51' long 135°40'

Area RICHARDSON MOUNTAINS

Province DISTRICT OF MACKENZIE, NWT

Youngest Fm. LOWER CRETACEOUS

Oldest Fm. LOWER CRETACEOUS

Exposure Quality POOR / FAIR

Geologist J.W.J. Hardy, H.R. Palmer

Date August 20, 1967



INFORMATION SUMMARY

135°30'
+ 67°45'

DEPTH FORMATION TOPS SHOWS	POROSITY GRADES	LITHOLOGY	CRYSTAL GRAIN SIZE FRAGMENT SIZE ROUNDING - DIAS TYPE SORT NO. - DIAS TYPE PERCENT OF FRAMEWORK	DESCRIPTION	ENCLINING DATA
67				TOP MEASURED SECTION Se: m gy, v arg, 50% sly & alt, subrd qts, carb, mica, mag, v p bdd, Balm. 0 52' bdd altat: ss/altat 70%/30% 40' w/more altat (50%/50%)	BMJ-17
115				Sh: gy/brn gy, alty, w/thn arg ss stringers, Fe-st bands, al calc pyr.	
125				Sltst: gy, sdy, arg & base, v p bdd, carb	
140				Se: gy, v arg, 50% qts gr, eubang, carb	
				Sltst: m gy, p thn bdd, hrd, bench forming, and Fe-st band, w/spherical calc nod nod, v hd due to much f diam pyr	
200				Sh: dk gy, sft, blk, f mica, see Parat, nod bands, w/see bands - m gy, alty, Fe-st, al calc	
363				Sh: dk gy, alty, v mica carb, intbdd w/ altat, carb, v mica, see bds ss: (9/12*)	
385				low & bds mica, far qts, arg MOSTLY COVERED: talus appears to be sh: brn-gy, sft, blk, Fe exposed slope shows sh: m gy, fin, f mica, v/sh: dk gy, v mica, w/thrd m gy, see Fe-st horizons ben al calc near top. 0 20' sh ben alty, v/see bds altat: shy, mica	
				The basal shales of this section are immediately above the conglomeratic layer at the top of the sandstone forming the base of Section 19.	

Canadian Pacific

OIL AND GAS LIMITED

Surface Section Name HEADWATERS OF
"NO NAME" CREEK 'A' SECTION 22
Location NTS 106 M lat 67°53' long 135°42'
Area RICHARDSON MOUNTAINS
Province DISTRICT OF MACKENZIE, NWT
Youngest Fm. LOWER CRETACEOUS
Oldest Fm. UPPER JURASSIC
Exposure Quality POOR / FAIR
Geologist J.W.J. Hardy, H.R. Palmer
Date August 21, 1967



INFORMATION SUMMARY

135° 30'
+ 67° 45'

Elevation Feet	Lithology	Description	Engineering Data
85		TOP MEASURED SECTION Ssl wh, f/m gr, mas, qtz, sl fld (5%), fild ch, w/bd, thin cal bd, pbl, qtz, Ssl brn/gy, f gr, flaggy, qtz gr, subrd, 10% arg mat, sl carb, ool lmn stn, sh pal	
95		Ssl dk gy, thin bdd, mica, inthdd w/alt, cal ss have ripple marks, grooves casts, vertical worm tubes COVERED: a exp f gr as @ top	
105		Ssl gy brn, p bdd, (1-3" units) w/gr, qtz v 10% arg mat, fms patchy, brn lmn, stn v carb mat, lmn, pebbles, lra u: shaped worm tubes, play found @ top Ssl brn, lmn, v carb, mica, dk sh inlthdd, slk, mica COVERED: same slope reveals gy gn sh a slty sh	
160			
200			
225			

NNJ-2P
KIMM/NEOC

821

COVERED: across slope consists of dk gy
silty sh & thin bedded carb slts

921

COVERED: across slope consists of sh: blk,
silt, blk, rusty withrd

4' bench alt: dk gy, p strd, w/
some v f gr sd

1171

probable fault, throw relatively small
Ss: lt orange, withrd wh, qtz, f/mgr, subrd, have
silt, mainly ss, w/ thin silt per str, gr have
Fe surf patina, mss
Ss: silt, qtz, gr f gr, subrd, flaggy

1206

1312

Ss: brn gy, withrd wh, arg, f gr, flaggy,
sl silt

FAULT: causing repetition of strata from
1171-1271

Ss: lt orange, wh/hf withrd, f/m gr, qtz, subrd,
silt w/ ool per str, lim spots, b displayed
x-bds

1411

Ss: silt, f gr, dk gy/brn gy, withrd bf/wh,
flaggy (2-6")

1476

BASE OF TOP SANDSTONE MEASURED BY K. G.
ALEXANDER AUGUST 18th, 1967

2

OIL AND GAS LIMITED

SECTION 21

Area RICHARDSON MOUNTAINS

Province DISTRICT OF MACKENZIE, NWT

Youngest Fm. CRETACEOUS

Oldest Fm. CRETACEOUS

Exposure Quality GOOD

Geologist† J.W.J. Hardy, H.R. Palmer

Date August 22, 1967



INFORMATION SUMMARY

DEPTH FORMATION TOPS SHOWS	POROSITY GRADES	LITHOLOGY	CRYSTAL GRAIN FRAGMENT SIZE	POORING - DIAG TYPE	PERCENT OF FRAMEWORK	DESCRIPTION	ENGINEERING DATA
						TOP MEASURED SECTION	
35						Sh: gy, w/ subordinate intbed altat: vel & con in 2' bds of ss: lt gy. Sh: lt gy, lam, thin bd, con con, intbed w/ dk gy Sa: sh: 70:30, thin bds shi carb, some p con Sa: w/ ripple marks, con ss: 8:92, 8 gy, thin, sh, at con, ve-at bds, sect shallower towards top	
109						Sh: brn, aft Sa: br, uncongl, or mugs, thin sh, pte Sh: br, uncongl, or mugs, thin sh, pte ve-at bds, petrified wood in thin	
133						Sh: br, r, gy, clay, uncongl, clay, wthrd br/gy, thin bds w/dk gy, carb, clay, thin, plex con at top Sa: br, r, gy, calcareous, 5%, m, congl, a mic, x bds, thin ve-at bds, con ss: uncongl por, plex frag	JCJL
169						Sa: gy, r, gy, uncongl, clay, br wthrd thin carb bds, plex frag	JCJL
195							
230						INTERMITTANT EXPOSURE	
287						Sh: brn, r, gy, clay, uncongl, clay, wthrd br/gy, thin bds w/dk gy, carb, clay, thin, plex con at top Sa: br, r, gy, calcareous, 5%, m, congl, a mic, x bds, thin ve-at bds, con ss: uncongl por, plex frag	
320						Sh: brn, r, gy, clay, uncongl, clay, wthrd br/gy, thin bds w/dk gy, carb, clay, thin, plex con at top Sa: br, r, gy, calcareous, 5%, m, congl, a mic, x bds, thin ve-at bds, con ss: uncongl por, plex frag	
340						Sh: brn, r, gy, clay, uncongl, clay, wthrd br/gy, thin bds w/dk gy, carb, clay, thin, plex con at top Sa: br, r, gy, calcareous, 5%, m, congl, a mic, x bds, thin ve-at bds, con ss: uncongl por, plex frag	
375						Sh: brn, r, gy, clay, uncongl, clay, wthrd br/gy, thin bds w/dk gy, carb, clay, thin, plex con at top Sa: br, r, gy, calcareous, 5%, m, congl, a mic, x bds, thin ve-at bds, con ss: uncongl por, plex frag	

Canadian Pacific

OIL AND GAS LIMITED

Surface Section Name NORTH FORK
 RAT RIVER SECTION 20
 Location NTS 106 M lat 67°52' long 135°52'
 Area RICHARDSON MOUNTAINS
 Province DISTRICT OF MACKENZIE, NWT
 Youngest Fm UPPER JURASSIC
 Oldest Fm PERMO - PENN
 Exposure Quality POOR
 Geologist K.G. Alexander, T.J. Wallace
 Date August 18, 1967



INFORMATION SUMMARY

DEPTH FORMATION TOPS SHOWS	POROSITY TYPES POROSITY GRADES	LITHOLOGY	CRYSTAL GRAIN FRAGMENT SIZE ROUNDING - DIAG TYPE SORTING - DIAG TYPE PERCENT OF FRAMEWORK	DESCRIPTION	CONTINUING DATA
				TOP MEASURED SECTION	
80				Ss: gn, s, vv srtg, v rd, oln, lnn, tt, mas	
				Ss: v dk gy brn/m gn, v srtg, v tt, hd intbdd w/ss: lt brn, f/m gr, lnn, carb ptgs, hd, tt	
225				Sh: blk, sub fls, thn bdd, Fe, intbdd w/ss: dk brn, fgr, lnn band, lt, thk bdd	
280				Ss: lt gy, vgr, f, v srtg, oln, hrd, tt, thn bdd, vthrd brn	
315				Ss: dk brn, vgr, v hd, dna, tt, thn/m bdd, vthrd brn	
420				Ss: lt gy, vgr, fair srtg, mas, resistant, red vthrd	
640				Ss: m brn/ m gy, v srtg, flaggy, thk bdd/ mas, vthrd mar & m gy	

...e. v. l. g. p. v. rtd, l. g. g. y, t. h. e. n.
mas, v. h. r. d. m. a. r. & m. g. y

860

Se: lt, gy, e. gr, p. rtd, o. e. pbl, Fe stn,
calc, tt, r. r. b. r. e. in s. c. r. e. e.

1025

COVERED: top of interval is pbl egl, matrix
orig v/v rd oht & qtz pbls in ss matrix

1140

MOSTLY COVERED:
Se: v lt brn, Fe, oht, qtz, subang, fair
rtg, calc, intbdd v/egl: pbl/obl, oht,
qtz, w rd, mas

1388

Cgl: a/a

1421

COVERED: appears to be ss: v lt brn, w
gr, v rtd, hd, tt, subang, m bdd

1779

V e ss/f egl: fair rtg, ang, oht, qtzt, tt,
recessive, red v. h. r. d.

1959

Bree: ang, oht, qtz, thk/mas bdd, bree
mat 2ml, in silty matrix

1779

V s ss/f ogl: fair, arg, ang, cht, qst, tt,
recessive, red whrd

1959

Bree: ang, cht, qst, thk/mss bdd, bree
mat 2ol", in siltst matrix

2234

Cht: blk, thn/m bdd intbdd w/sh: dk gr,
v fin, Fe, see thn bd siltst

2369

COVERED

3

Canadian Pacific

OIL AND GAS LIMITED

Surface Section Name MOUNT GOODENOUGH

SECTION 19

Location NTS 106 M lat 67°56' long 135°27'

Area RICHARDSON MOUNTAINS

Province DISTRICT OF MACKENZIE, NWT

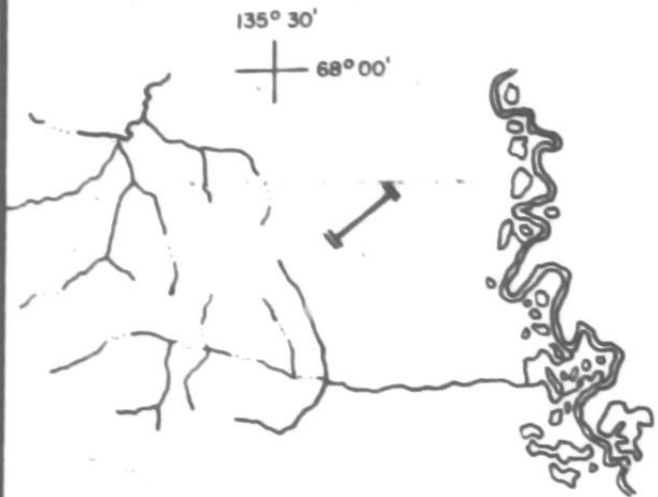
Youngest Fm. LOWER CRETACEOUS

Oldest Fm. LOWER CRETACEOUS

Exposure Quality FAIR/GOOD

Geologist J.W.J. Hardy, H.R. Palmer

Date August 17, 1967



INFORMATION SUMMARY

There is noticeable thinning from North-South between the two upper Sandstones in this section. The "Goodenough Sandstone" is used as a correlation between this section, section 18 and section 22. It tends to shale out to a certain extent towards the south.

DEPTH FORMATION TOPS SHOWS	POROSITY TYPES GRADES	LITHOLOGY	CRYSTAL GRAIN FRAGMENT SIZE ROUNDING - DIAG. TYPE SORTING - DIAG. TYPE PERCENT OF FRAMEWORK	DESCRIPTION	ENGINEERING DATA
				TOP MEASURED SECTION	
				Ss: Intbdd w/sh: 70:30, ss vthrd yel, fgr, qtz, al feldspathic, mas bdd (67-81)	
125				Sh: Intbdd w/ss: sh, dk brn/blk, carb in pt, mica, ss, fgr, carb, rusty vthrd, ripple marks	
275				Ss: gy, fgr, carb spec, feldspathic, 1 1/2-2' bdd, vthrd yel, x bdd, Intbdd w/ss: n/a, clayey	
400				Ss: brn/gy, fgr, 5% feldspar, carb spec, mas, vthrd yel, ripple marks, gentle x-bdg	
450				BASE OF "GOODENOUGH SANDSTONE"	
465				Ss: mgr, p bdd, carb, mas, Intbdd w/ss: clay, w bdd	
500				COVERED RECESSIVE INTERVAL: seen in places as siltst: dk gy, mica, carb	
525				Sh: dk gy, alty, w/ss: mgr, vfg, arg, p srt, x bdd, w plant run in 1' bdd, sh, ss ripple 20:50, 5' x bdd lam sh: fgr at top	
				thin Ps-st, fgr qtz ss @ 570	
600				Siltst: dk gy, carb, mica	
645				Ss: mgr, fgr, p srt, arg, carb spec, plant run, mas bdd, vert 2" worm tubes	
665				Siltst: dk sh, v carb plant run, p bdd	
685				Ss: mgr, arg, carb	
				Siltst: dk gy, carb, p bdd, plant run	
790				COVERED	

1695

1715

slat hd

Forest hd

2075

COVERED: pos sh a/a, moved to next cliff where exposure was excellent and estimated difference in stratigraphic interval - 100'

2165

Cal: blk & gy, subang, oht pble (1-2") & ve matrix of blk & gy, oht (1' thk)
 Sa: wh, vfgf/rgr, sh in last 6', w/sipple marks, load & flute casts, l. lam, p. strd
 Sh: dk gy, mica, w/slat: mica, & ss: vfgf, p. strd, w/plant frags, whole sequence is p bdd and grd
 Slat: dk gy/blk, v mica, p bdd, ady in pt, play con
 Sh: blk, mica, pyp, oot play, nod

2235

2255

2275

13

Canadian Pacific

OIL AND GAS LIMITED

Surface Section Name MARTIN CREEK

SECTION 18

Location NTS 107B lat 68°10' long 135°40'

Area RICHARDSON MOUNTAINS

Province DISTRICT OF MACKENZIE, NWT

Youngest Fm. LOWER CRETACEOUS

Oldest Fm. UPPER JURASSIC

Exposure Quality GOOD

Geologist J. W. J. Hardy, H. R. Palmer

Date August 8-12, 1967

135°30'

68°15'

INFORMATION SUMMARY



DEPTH FORMATION TOPS SHOWS	POROSITY GRADES	LITHOLOGY	CRYSTAL GRAIN FRAGMENT SIZE ROUNDING — DIAG. TYPE SORTING — DIAG. TYPE PERCENT OF FRAMEWORK	DESCRIPTION	ENGINEERING DATA
				TOP MEASURED SECTION Sh: m gy, biky, gyp, al calc	
				Sh: brn & gy brn, w/ thin lam sdy alst prominent band brn nod Fe-st predominant band brn nod Fe-st gradational return to sh, m gy, biky, a/a	
				band of brn nod Fe-st Sh: m/dk gy, biky w/ brn lam, wthrd sh, gyp bloom com from 295' to base of unit, incr in flattened brn nod, Fe-st bands, calc w/ calcite septa, sil spherules nod, 12-15" com.	MCJ-1L
425				BASE OF MEASURED SECTION: between this exposure and the one below is an unexpected gap of 1/2 miles amounting to a calculated stratigraphic thickness of ~ 1100 feet. Topography suggests that the area is probably faulted.	MCJ-1P NEOCOMIAN (BARR)
4525				So: gy, f/mgr, fri, osh, wthrd, ssat ir aly matrix carb plant rem, intgran por, (25-30%), sss low angle x-hd covered: sss slope sdy (from unconsl sd) & much ssaly sh, recessive	
4550				2' exposure of mag ss, hf f/m gr, fri, intgran por, (25-30%) carb plant rem	

Sh: m/dk 27

Sh: m/dk 27

2820

2855

2880

Sh: 10-10% dk. chs. a bdd. lam. w/lead
a right side, see giant frags. see also a small
ch: w. 27/28. 27. f. lam. f. dia
2855: included: al. f. chs. alty. sale. f. lam. lam. ch: 27/28
2880: 27/28. alty. sale. 100 in. thin bda or 100 in. (2-1)
a included ch: 27/28. 27. alty
Sh: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o

2995

Sh: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o

3000

Sh: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o
in the 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o
Lst: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o

3070

graded or yellowed ss. 14 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o
vf/fgs. f. f. lam. grad/altat. grad/sh.

3100

Sh: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o
Lst: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o

3140

Sh: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o
Lst: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o

Lst: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o

Lst: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o

Sh: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o
giant Fe-st nod. h' dia

3330

3345

COVERED
Sh: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o
Lst: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o

3405

Sh: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o

3425

Lst: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o

3460

Sh: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o
Lst: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o

3480

Sh: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o
Lst: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o

3505

Sh: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o
Lst: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o

3535

Sh: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o
Lst: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o

3565

Sh: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o
Lst: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o

3595

Sh: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o
Lst: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o

3640

Sh: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o
Lst: 27/28. 27. 27. f. lam. 27. 27. w/lead. a w/o

3

OIL AND GAS LIMITED

ROAD RIVER SECTION 17

Area RICHARDSON MOUNTAINS

Province YUKON TERRITORY

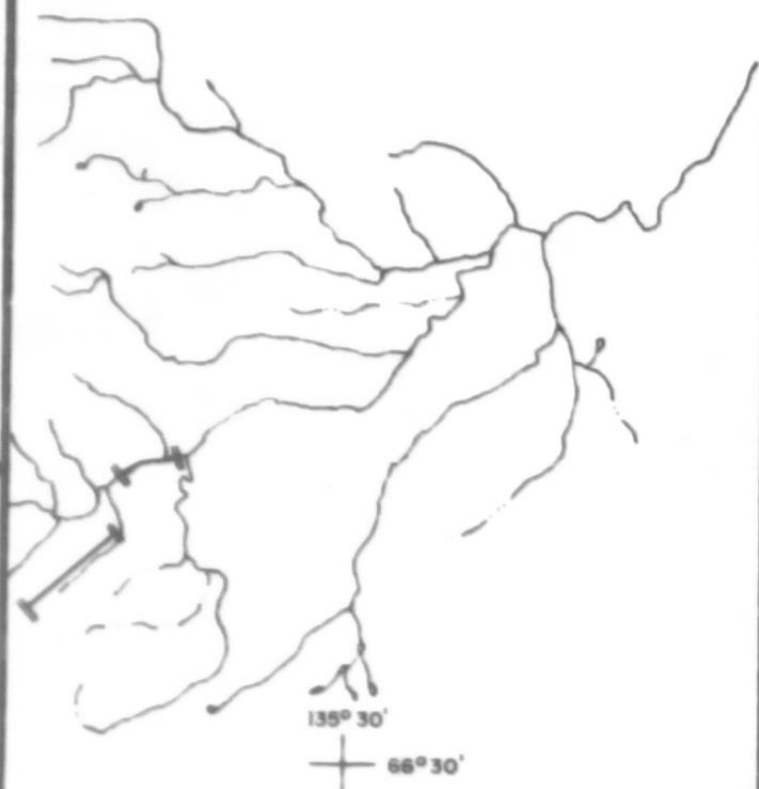
Youngest Fm. ROAD RIVER FM. ?

Oldest Fm. PRE-CAMBRIAN / CAMBRIAN

Exposure Quality FAIR / GOOD

Geologist: D. Cosijn, H.R. Palmer, J.W.J. Hardy

Date August 1-3, 1967



INFORMATION SUMMARY

[illegible]

889
820

ls: dk gy/bk, micxl
sh: ls gy, w/interbedded ls, mdt, ls bds 7-12"
sh w/ mdt, calc

dominantly ls. A arg ls w/interbedded sh, blk
ss sil

1100

sh: dk gy/bk, blk, lsy

1130

for bd - Brown. Grin

COVERED

RCR-7

1170

ls: brn/gy brn/ ls brn, micxl, lam, 2 bds
sh: ls dk brn, v bdd, A thin vshrd, sh, calc
interbedded w/ ls micxl, w lam, calc arg

1180

for arg. br, calc, Brown. Grin, some pss

RCR-47

SIL-DEV

1250

sh: dk brn/bk, blk, w/ interbedded ls w/fgs,
lam (1-5" bds) at folded

1290

FAULTED AND COVERED FOR 14 MILES.
IMPOSSIBLE TO ESTIMATE STRATIGRAPHIC
THICKNESS. SECTION CONTINUES ON RIDGE
TO SOUTHWEST OF CREEK.

0

ls: dk/bk, micxl, w/bdd sh, thin bdd,
and flow strata.

25

FAULTY - ERODED ZONE

80

COVERED
MOSTLY COVERED pss ls in gy, vfxl, bdd
sh, folded

fault - deeply eroded sh

355

ls: dk gy, vfxl, bdd sh, ls, calc, ss
calc sh

385

ls: dk gy, lam, ls lay, ss, sh, dk, arg
ss, ss, ss

RCR-7
ORD-DEV

Sh: gy/gy brn/blk, blk, cele, w/nod lead
casting
Lo: dk gy/blk, nickel, w/sec cele vns

Sh: 89/89-784/81K; Intbda v/la: N10X1

Lab: gy, mioxl, sec calc, w/sh: gy/gy brn

LS: gy bon dk gy/blk, son eale vne, inttd
ls: blk, miazl

bed struts, load & flow east

SEE ABOVE, LAST 2 PAGES

Lot: dk/bk w/ a brace on the frag ($\frac{1}{2}$ - $1\frac{1}{2}$ ")

WHT CN gy/blk a gy brn. cslc. yel whrd
lnshd w/lal dk gy/hlk mio/fml lcm,
v bnd. swlo vns awn. dccrassing sh

a bd os! f. grs. sale (1st bd)

2860

a bd ss: f. gr. sale (1" bd)

3035

ls: blk, mlox1, w bdd, lam, sea sale vns

3135

COVERED

3440

test: dk gy, w bdd, w/sea intbds sh: blk, blk, & ss: vgr

3545

COVERED

3950

test: dk gy, w bdd w/sea bd ss: vgr, sale, intbds w/sh: blk, blk

4110

5

Canadian Pacific

OIL AND GAS LIMITED

Surface Section Name SOLO CREEK

SECTION 16

Location NTS 106 E lat 65°50' long 134°15'

Area RICHARDSON MOUNTAINS - TREVOR RGE.

Province YUKON TERRITORY

Youngest Fm. HARE INDIAN FM.

Oldest Fm. SILURO-ORDOVICIAN

Exposure Quality GOOD

Geologist D. Cosijn, H. R. Palmer

Date July 30, 1967



INFORMATION SUMMARY

This section was measured in three parts and plotted as one continuous section.

DEPTH FORMATION TOPS SHOWS	POROSITY GRADES	LITHOLOGY	CRYSTAL GRAIN FRAGMENT SIZE	ROUNDING - DIA. TYPE SORTING - DIA. TYPE	PERCENT OF FRAMEWORK	DESCRIPTION	ENGINEERING DATA
0 TOP HARE INDIAN FM. ?						COVERED	
70						Sh: gy brn w/ intbdd ls: dk gy, brcc, Crin	
192 199						ls: dk gy, micxl, sh Sh: dk gy/blk, calc, ool chy ls: w bdd	
302 315 325						Sh: brn/gy brn, calc, blk Sh: blk, blk Sh: blk, blk/ris, pyr, w/lat brcc, A ool, strom, brcc, Crin (star & square ool)	
420						COVERED	
500						ls: lt gy, vf/fxl, w o brcc, Crin, Brcc, Cor, Strom COVERED	
527 540 545 550 560 HUME FM. 590						ls: blk, mic/vfxl, non calc, woxl ls: gy brn/ool bfn, mic/vfxl, ool calc, Cor, Crin Sh: blk, blk/ris, pyr ls: dk gy/blk, mic/vfxl, non ls: dk gy/blk, mic/vfxl (1' - 1' 1/2'), intbdd sh: blk (1' - 1' 1/2' bds), lead coating of the ls bds ls: dk gy/blk, w ool bds sh: dk gy/blk calc w/ool developed during sedimentation due to slumping, the nod are micxl ls & ool varicoloured	
620							

SC-8P

OIL AND GAS LIMITED

SECTION 15

Area MACKENZIE MOUNTAINS-CARCAJOU RGE.

Province DISTRICT OF MACKENZIE, NWT

Youngest Fm. BEAR ROCK FM.

Oldest Fm. CAMBRIAN

Exposure Quality GOOD

Geologist M.G. McKellar, D. Cosijn

Date August 5, 1967



INFORMATION SUMMARY

[illegible]

640

700

COVERED: yel. sandy soil suggests a
shy marker

Deli: a/a

SR51-L

1845

1905

Deli: arg, limy, recessive, withrd yel

SR50-L

Braai: a/a

1905

Brasi a/a

2240

NO OUTCROP COVERED: on talus slope abnt,
lrg boulders of dol: m/dk gy, arpxl,
wthrd dk gy, abnt Strom & ocs colonial
& solitary Cori, us cham type but fauna
has SILURO-ORDIVICIAN aspect, g vug pop

3185

Dol: lt gy, arpxl, intbdd w/sht, blk, v
bdd, bds 6-12"

3225

Dol: w. gr, limy, w. vug pop: at top
occ. Rhynchonellid Brac of SILURO
ORDIVICIAN type & relis Cori unbed
nature & lateral discontinuity suggests
biohermal growth in this interval;
several similar features occur along
strike

3185

Dol: lt gr, crpxl, intbed w/cht, blk, w
bdd, bds 6"-12"

3225

Dol: w gr, lmy, vsg & vsg. por. at top
Sec. a rhynchonellid trace of SILURO
ORDOVICIAN type & relic Cori. unbed
nature & lateral discontinuity suggests
bihermal growth in this interval;
several similar features occur along
strike

3465

Dol: blk, crpxl/ v f gr, w bdd, bds 6"-24"

SILURO-
ORDOVIC

g per in calcite lined vugs

about Crin stem & Brach frage @ 4050'

4180

4195

Brach: blk/crpxl ls frage in ls matrix,
blk, crpxl, w bdd
Sh: blk, w/Grp & sec inarticulate Brach

4295

4320

ls: blk, crpxl, w bdd 1" bds, intbed w cht,
blk, ls/cht, 60:40
Sh: blk, bds w/chr. neg & con 1" bands blk
cht intbed w/ls: dk gr, crpxl, sh gr, 40
len in 12" bds, Grp in sh, sh/ls, 70:30

(n.t in situ)

4585

ls: dk gr, arg, thin lam, intbed & intbed w/

SR-46L

585

del. dk. gr. arg. thin lam, intlam & interlam w/
sh. blk. calc in pri. unit recessive

560

del. dk. gr. arg. w/ a slight bulge comprising
4850-4860

545

del. dk. gr. arg. mac, bench forming, @
4855 calcite lined zone (1-2") w/ bds,
10% 1st arg. mottled, many concentric
spherical algae (1/2")

SR45P

510

del. dk. gr. arg. subrd. w/ up to 50% calc
ad. intlam 0/ calc 2/6, unit w bds, recessive

510

del. dk. gr. arg. w/ calc. subrd. w/ r/r
or wh. arg. calc w. intlam, w lam, flaggy
(flags 3/4-1/2"), this unit is transitional
to the overlying arg del w/ no depositional
break

5

525

del. dk. arg. w/ calc of algal/calc
del. a/a

540

del. dk. arg. - 1st calc. zone, 1st 10% w/ calc. arg. &
calc. 1st 10% calc. zone

540

del. dk. arg. (1/4-1/2") w/ calc. subrd. 25% calc
w/ calc. intlam w/ lam (10-15") w/ arg
del. a/a, ripple marks com

570

del. dk. arg. typical of McDougal Group, 100%
calc. calc. del. exposed



Canadian Pacific

OIL AND GAS LIMITED

Surface Section Name HUME RIVER Youngest Fm. CANOL FM.
SECTION 14 Oldest Fm. HUME FM.
 Location NTS 106 H lat 65°20' long 129°56' Exposure Quality GOOD
 Area MACKENZIE MOUNTAINS - CARCAJOU RANGE Geologist J. W. J. Hardy, M. G. McKellar
 Province DISTRICT OF MACKENZIE, NWT Date June 12, 1967

INFORMATION SUMMARY



		T.P. MEASURED SECTION		
HARE INDIAN FM.		sh: dk gy/blk, org wthrg, v thn bd, sil, pyr, bit, calc		HC28L
50		ls: m gy, vfxl, Brac, coquina		HC27LP
67		ls: m dk gy, vfxl, bit near top, scat Brac, Cor		HC26L
75		ls: gy, vfxl, nod, w/ thn gy/grn calc sh prtgs, scat Brac		HC25L
100		POOR OUTCROP		HC24L
		sh: lt gn, sl calc, scat s Brac, p pres		HC23L
133		POOR OUTCROP		
HUME FM.		ls: dk gy, buff wthrd, w/ arg ls, v Cor, scat Bry twigs		HC23L
144		COVERED		
160		ls: m/dk gy, vfxl, sub-lith, flaggy bdg, bds 6-9", abnt colonial Cor		HC22L
180		photo 1/33		
		ls: s.s.e., sl thk bdd, 9-12" bds		HC20L
210		ls: m gy, vfxl, mas, frag		HC19L
240				HC18L
250		ls: m/dk gy, thn bdd, rblv, sl arg prtgs, vfxl		HC17L
260		ls: dk gy, f xl, mas, scat fos, Cor		HC16L
280		ls: m/dk gy, f xl, fos, mas, w/ 12" & 12" bds, some vert frac w/ xln calcite thn		HC15L
		arg prtgs, fos, scat Brac, Cor, Trilo		HC14L
300		ls: dk gy, micxl, w bdd, 12" bds, v thn sh prtgs, sl fos, scat colonial Cor, rr Brac	M DEV	HC13L
315		ls: lt gy, pyr, p fos, mas		
328		COVERED		HC12L
		ls: dk gy, buff wthrd, vfxl, w bdd, fos near base, thn sh prtgs, Brac shell brec, scat Cor, rr planispiral Gast		HC11L
350				HC10L
360		COVERED		
370		ls: intbdd w/ dk gy/blk sl calc sh, Brac, Cor		
385		COVERED		
400		ls: gy, vfxl, homogenous, sbconch frac, thn bdd, Cor	STEFANIAN	HC9AL
405		sh & ls: ls subordinate, thn bdd, some coquina horizons w/ Brac Crin ossicles	HC9L	HC9AP
418		ls: m gy, fxl, och wthrg, scat Brac frag		HC8L
425		ls: intbdd w calc sh, sh predom 6" & 10", sh: brn, brn wthrg		HC7P
			STEFANIAN	HC6P
450		ls: thn bdd, vfxl, coquina, Brac frag, Crin ossicles, Trilo pygidia, sh subordinate, sh lt gy, calc		HC5P
465		sh: m gy calc, w/ subordinate thn rub ls; ls dk gy, sblith w/ some horizons packed w/ comminuted Brac & Gast frag		5L
475		ls: gy, wthrd gy, och stn, crpxl, sblith, Brac, intbdd ls & sh, sh subordinate, ls: med gy, vfxl		4L
		sh: calc, 3-12" bd		3L
		ls: dk gy, wthrd dk gy/ och, calcilitic w/ clear f gr calc xls, mas & flaggy bd		

OIL AND GAS LIMITED

SECTION 13

Area MACKENZIE MOUNTAINS - CARCAJOU RGE.

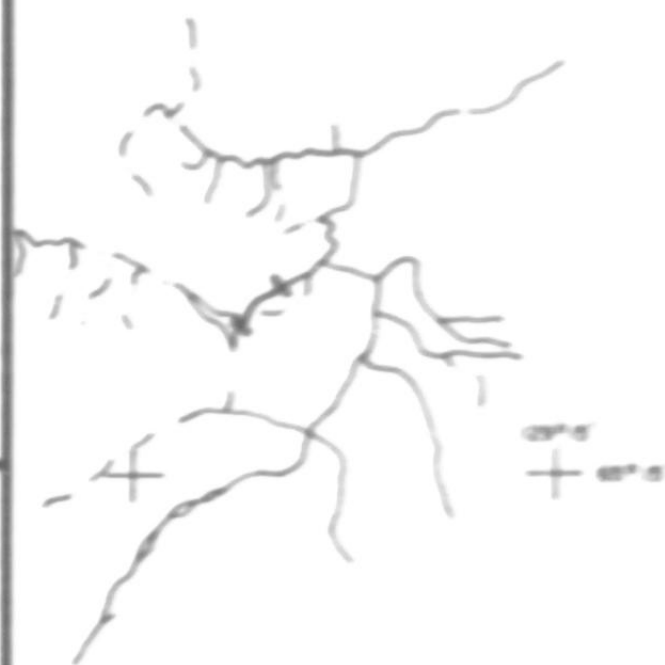
Youngest Fm. CANOL FM

Oldest Fm. HUME FM

Exposure Quality POOR

Geologist† M. G. McKellar, D. Cosijn

Date June 23, 1967



INFORMATION SUMMARY

[illegible]

Canadian Pacific

OIL AND GAS LIMITED

Surface Section Name GAYNA RIVER 'A'

SECTION 12

Location NTS 106 H lat 65°17' long 129°32'

Area MACKENZIE MOUNTAINS-CARCAJOU RGE.

Province DISTRICT OF MACKENZIE, NWT

Youngest Fm HUME FM.

Oldest Fm CAMBRIAN

Exposure Quality FAIR / POOR

Geologist M.G. McKellar, D. Cosijn

Date June 23, 1967



INFORMATION SUMMARY

Photo reference - NTS 106H, flight 129-5, photo A-12697-148. Top of section correlates with base of section 13, six miles east.

DEPTH FORMATION TOPS SHOWS	POROSITY TYPES	POROSITY GRADIENTS	LITHOLOGY	CRYSTAL GRAIN FRAGMENT SIZE BOUNDING - DIAS TYPE SCOTING - DIAS TYPE PERCENT OF FRAMEWORK	DESCRIPTION	IN NITING DATA
0 TOP HUME FM					TOP MEASURED SECTION Ls: blk/brn, f gr, bit in prt, w bdd bds (6"-24") sl arg in middle prt, mas thru, abnt colonial cor at base	
91					Sh: blk, calc, p fia, intbdd w/l: blk, shy, mixl, thn & rubbly bdd, recessive wthg thru	
218					Bree	GR-IF EIFELIAN
278					NO O/C COVERED	
305					Ls: dk gy/blk, vf xl, w/calcite vns, thn bdd (12"-2") w/ minor intbds blk calc sh	
591					Sh & Ls: S a a w/ sh - 70%	
633					Ls: S a a w/ intbds of f bree & Sh: Blk calc - 30%	
670 BEAR ROCK FM					Dol: brn/lt gy, dol bree, fairly w bdd, (6-24") often lam w/ slump struc, appears to be quite shallow wtr,	

AMPHIPORA (?) = 860

GR-2P
SIL - DEV

Dol: lt gy, micxl

Small Brae, chain Cor, Crin w/ star
columns

GR-3P
RICH

Dol: w/ intbdd cht, gy and vb

Dol: recessive wthrg, pos arg

Dol: w/ minor intbdd vh cht, abnt fas,
colonial Cor, chain Cor, Halysites (?),
Favosites (?) and fasciculate type,
reefoid, vug por, rynchonellid. Brae
lowest occurrence at 1320'

GR-4P
RICH

GR-5P
RICH

Dol: lt gy vf xl, w bdd (12"-36"), sec's
algal mat, cht red

3058

Del: lt. gr. w/ xl. w/ lt. gr. ch. mod, vug
por // hdg w bdd (6")

VALUS SLOPE, Pos del

3050
3055

Del: lt. gr. w/ xl. algae & calc filler,
fract, w bdd (6"-24")

VALUS SLOPE, covering del?

3385
CAMBRIAN

Sh: red. (CAMBRIAN)

OIL AND GAS LIMITED

SECTION II

Location NTS 106 H lat 65°12' long 128°29'

Area MACKENZIE MOUNTAINS-CARCAJOU RGE.

Province DISTRICT OF MACKENZIE, NWT

Youngest Fm. HUME FM.

Oldest Fm. CAMBRIAN

Exposure Quality FAIR / GOOD

Geologist M. G. McKellar, H. R. Palmer

Date June 19, 1967

128°30'

65°15'



INFORMATION SUMMARY

DEPTH FORMATION TOPS SOUNDINGS		SPACING CORRECTIONS	SPACING CORRECTIONS	LITHOLOGY	DESCRIPTION	REMARKS
TOP MARK FM					Top Measured Section	
123					Lat. 14. brn, w/f gr, mas, one Cor	
160					Shi blk, arda to 10, blk, bit, w/ solitary and adlonial Cor	
400					COVERED - Pce sh, s a a	
500					Bruc! frog to 12", crudely bdd, sl gyp	
530					Lat 14. brn, w/f gr, mas, one Cor	
640					COVERED - NO OUTCROP	
700					Lat 14. brn, w/f gr, mas, one Cor	

BIT 25701100

COVERED - NO OUTCROP

Del: 1t gy, 20% ed dien & intbdd, more recessive wthrg than units above and below

Del: 1t gy, 20% ed dien & intbdd, more recessive wthrg than units above and below

COVERED - NO OUTCROP

Del: 1t gy, 20% ed dien & intbdd, more recessive wthrg than units above and below

Del: 1t gy, 20% ed dien & intbdd, more recessive wthrg than units above and below

Del: 1t gy, 20% ed dien & intbdd, more recessive wthrg than units above and below

Brac

RICH

VC2F

RICH

VC1P

Del: 1t/m gy, 20% ed dien & intbdd, more recessive wthrg than units above and below

2165					Wh. silt filled vns and frac in bal 100' of unit
2500					Some vug por
					Sh: lt gy, med w/ ool brcc bds, algal mat, v bdd, cliff forming
					Some vug por
					Some vug por
3167					Dol: lt gy, w/ thn bds (6") A prtg of Sh: gy calc, slty more shy at base
3228					Ss: f gr slty intbd w/ sh: dol w/ algal mats and brcc at base, mud cracks and ripple marks com, transitional to unit above, -appears disconformable on unit below - strike 60 degrees dip 50 degrees N

OIL AND GAS LIMITED

Youngest Fm. BEAR ROCK FM.

Oldest Fm. BEAR ROCK FM.

Exposure Quality FAIR

Geologist D. Cosijn, J.W.J. Hardy

Date June 19, 1967

127°30'

65°00'

TOP BEAR ROCK		TOP MEASURED SECTION	
0		ls: dk gy-brn, w/ brec dol, sl bit	
50		ls: gy brn, vfxl, w bdd, transitional mn to the RUMBLE FW	
65		ls: blk, vfxl w/ intbdd brec, sl bit, dol thr, slumped & covered at base	
210		COVERED	
240		ls: dk gy, mic/vfxl, w bdd (5-20 cm) calcite, mxl	VII3
256		dol: gy/brn gy, limy w/ AMPHIFORA, irreg bdg, p-p por	
262		dol: gy/yel gy, mic/vfxl, small vug w/ sec calcite mxl, irreg bdg	
271		dol: lt gy/lt yel gy, micxl, calc part	VII2
285		ls: dk gy/blk, irreg bdg, thin, mic/vfxl	VIII
		dol: dk gy, brec, g bdg	

1815		Algae, algal mats and calc plugged vugs		
1880				
		ls: lt gr, arg, intbdd w/ sh: dk gr, w/ bdd, 10"-12", sh: 10"-12"		DC18L
		ls: 12"-14", wthrd ls gr, recessive		
2048				
2048	SALINE RIVER FM			
		Cgl: s, w/ ss blks in sdy calc gyp matrix		DC17L
		Poor O/C - top 10' sh: mar/bright grn, waxy		
		COVERED		
2394	MOUNT CAP FM			
		Sh: blk, lam		DC16L
		Sh: ss, ls, intbdd, fcs, Tril., ool Brach	E-M.C	DC17P
			C-PERM	DC16P
2400			S.A.A	DC15P
2428				
		ss: intbdd sdy sltst, w bdd (12"-24") bench forming, ripple marks common at top, Tril.	E.C	DC14P
2607		Sh: blk, wthrd lt gr, ool red ls: lt gr		DC13L
2625		Sh: red, wthrd red & ool gn, thin bdd, ool nod calcite bands		DC12L
2825		Sh: blk, fcs, lam, soft w/ ls: blk micxl arg, wthrd, lt gr		DC11L
2994		Sh: blk, sft, fcs, lam, wthra blk ool rad ss f/med gr w srid, qtz 90%		DC8L DC9L
3041	KATHERINE GRP.	ss: wh, f/m gr w srid, 100% qtz, sil, ool bdd, top 1/3 cliff forming, wthr buff		DC7L
3168		NO O/C		
3192		Sh: bright gn, fcs/p fcs, ool rad, recessive		DC6L

Canadian Pacific

OIL AND GAS LIMITED

Surface Section Name ROUGE MOUNTAIN RIVER
SECTION 7

Youngest Fm. HUME FM.

Oldest Fm. HUME FM.

Location NTS 96 D lat 64°35' long 126°45'

Exposure Quality GOOD

Area MACKENZIE MOUNTAINS - CANYON RANGE

Geologist D. Cosijn, J.W.J. Hardy, T.J. Wallace

Province DISTRICT OF MACKENZIE, NWT

Date June 17 & 18, 1967

INFORMATION SUMMARY



TOP HUME FM

216

ERODED

573 568
583 578
590 590
605 600

620
636

677
697

740

BEAR ROCK FM

ls: dk gy/ dk gy brn, v f xl, sec calcite, m/cxl, w bdd.
ls: dk gy, mechl, irreg bdd, ned
ls: gy, vfxl, sec calcite, c/vol, irreg bdd, bd thk 5-10 cm.
ls: gy-yel gy, wthrd/shy ls, irreg bdd
ls: gy, vfxl, calcite f/mxl
ls: dk gy, dk brn, vfxl, calcite m/cxl, irreg bdd, thk 5-10 cm.
sh: dk gy, limy, thn bdd, micxl
ls: gy, vfxl w/ calcite c/vcxl
ls: gy brn/brn gy, vfxl, calcite lam, w bdd

COVERED - sh, gy-grn, limy

ls: gy/brn gy, vfxl/fxl, calcite lam, sdy, cross bdd, thn bdd

BEAR ROCK: heavily weathered
TRANSITION 28 - ls: brn, lam w/ some brec

VII

1 of

OIL AND GAS LIMITED

Youngest Fm. HUME FM.

SECTION 6 _____

Oldest Fm. SILURO - ORDOVICIAN

Location NTS 96 D lat 64°27' long 126°26'

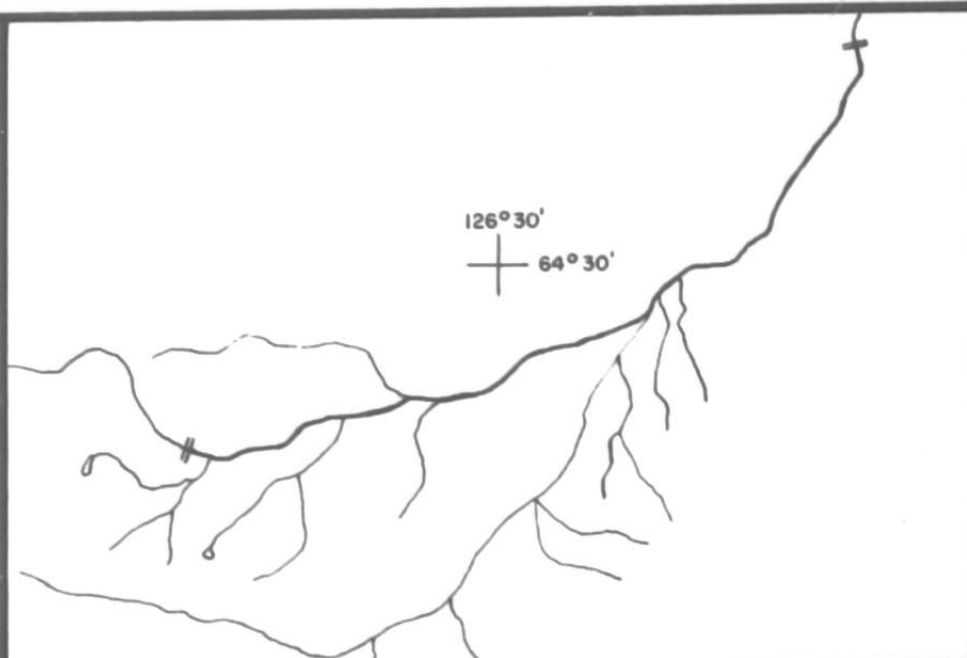
Exposure Quality GOOD

Area MACKENZIE MOUNTAINS - CANYON RANGE

Geologist D. CosijnProvince DISTRICT OF MACKENZIE, NWT

Date June 14, 1967

INFORMATION SUMMARY

[illegible]

Canadian Pacific

OIL AND GAS LIMITED

Surface Section Name PROHIBITION CREEK

Youngest Fm. HUME FM.

SECTION 4

Oldest Fm. BEAR ROCK FM.

Location NTS 96 E lat 65° 10' long 126° 13'

Exposure Quality FAIR

Area FRANKLIN MOUNTAINS - NORMAN RANGE

Geologist D. Cosijn, H. R. Palmer

Province DISTRICT OF MACKENZIE, NWT

Date June 12, 1967

INFORMATION SUMMARY



TOP HUME FM		TOP 7 MEASURED SECTION		
		Alternating bds of <i>gy</i> / <i>dk gy</i> , <i>vt/fal ls</i> , w/ <i>sec calcite</i> , <i>sfmal</i> , <i>bit</i> , <i>top frag. rubl.</i> , <i>Cor</i> , <i>Brac</i> and <i>choc brp</i> , <i>mic/vfal ls</i> w/ <i>calcite vns</i> // to <i>bdg</i>		122P
128		<i>sh: gy, limy / lat gy, vfal, shv</i>		123P
166		<i>ls: dk brn gy, vfaia/fria, sec calcite, mal, rubl, frag, Spt, Brac, Crin, sst</i>		
239		<i>sh: gy, limy</i>		
250		COVERED		
BEAR ROCK FM				
?				

OIL AND GAS LIMITED

Province DISTRICT OF MACKENZIE, NWTDate June 8 & 9, 1967

A sketch map of the study area, showing a coastline. A cross marks the study site. The coordinates 126° 15' and 65° 15' are indicated on the map.



Surface Section Name	CANYON CREEK 'A'	Youngest Fm.	"CANYON SANDSTONE"
	SECTION 2	Oldest Fm.	HUME FM.
Location	NTS 96 E lat 65° 15' long 126° 30'	Exposure Quality	FAIR
Area	FRANKLIN MOUNTAINS - NORMAN RANGE	Geologist	D. Cosijn, H. R. Palmer, T. J. Wallace
Province	DISTRICT OF MACKENZIE, NWT	Date	June 8 & 9, 1967

INFORMATION SUMMARY

Uncompleted section in the Hume Formation.
Lower Hume Formation covered, upper Hume
Formation not measured.

[illegible]

Canadian Pacific

OIL AND GAS LIMITED

Surface Section Name SCHOONER CREEK
SECTION I

Location NTS 96 E lat 65° 17' long 126° 35'

Area FRANKLIN MOUNTAINS - NORMAN RANGE

Province DISTRICT OF MACKENZIE, NWT

Youngest Fm. HUME FM.

Oldest Fm. SILURO - ORDOVICIAN

Exposure Quality FAIR

Geologist D. Cosijn, H.R. Palmer

Date June 5 & 6, 1967

INFORMATION SUMMARY



126° 30'
+ 65° 15'

MEASURE SECTION			
0	TOP HUME FM	Alternating bds of choc brn gy ls, vfxl w/ sm calc vns, dk gy brn, micxn/vfxln ls w/ sec calcite.	111
46		COVERED	112
66		Alternating bds of gy brn ls, micxn w/ calc vns // to bd, bdg irreg due to compaction, fos, Gast, Crin and dk gy/blk ls, micln/vfxln w/ calc m cxln fos, Cor, Bry, Gast	113P 114P & 115 116, 117, 118P 119P
111		sh: gy, calc. (This interval partly covered. Sh found by digging through overburden)	120P M DEV
156		ls: gy, sh, vfxl, alternating thk ls bds (<8"), thn, sh, ls bds (<1") micxl	121 122
173		ls: gy brn/ dk gy brn, irreg bdg pln, rubl, Brac, Cor	123P M DEV (DN)
211		ls: gy/ gy brn, w lam, mic/vfxl, calcite xls,	124
234		ls: dk brn gy, vfxl, calcite xls, g lam/ vg lam w/ sh, ls at base	125
254	x	dol: dk brn, limy, brec w/ lt gy limy bds intbdd, mic/vfxl, anhy, lam, bca more irreg oriented.	126 127
334		no samples (COVERED)	
374		dol: brn, g lam dol: lt brn gy, fxl w/ vug due to lchg	128 129
400		dol: cgl, anhy or gyp mtx cgl: yel brn, fxl, dol, xl mtx anhy or gyp, some por dol: lt gy, mxl w/ vug, c/vc sec dol along vug rims, g por dol: gy-brn brn, vfxl, w bdd dol: gn brn/gy, vfxl, hi dol, g vug por, gts conc (1.5 dia)	130
415-417-418	x v		
426	v		
468	P	dol: brn, mxl, v g p-p por, hi dol	
479	P	cgl: gy, (1-4 cm) just above sgl a dk dns dol w/ no por	131
494		SECTION DISCONTINUED DUE TO FAULTING	