



ILLUSTRATIONS TO ACCOMPANY
MEMORANDUM REPORT
OF THE
NORTH AND SOUTH FORT NORMAN
AND WRIGLEY LEASE BLOCKS

MEMORANDUM REPORT
STRUCTURAL AND STRATIGRAPHIC INVESTIGATION
OF THE
NORTH AND SOUTH FORT NORMAN
AND WRIGLEY LEASE BLOCKS
IN THE
McCONNELL RANGE OF FRANKLIN MOUNTAINS, N.W.T.

750-1-5-11



SCIENCE SERVICES DIVISION
TEXAS INSTRUMENTS
INCORPORATED

MEMORANDUM REPORT
STRUCTURAL AND STRATIGRAPHIC INVESTIGATION
OF THE
NORTH AND SOUTH FORT NORMAN
AND WRIGLEY LEASE BLOCKS
IN THE
McCONNELL RANGE OF FRANKLIN MOUNTAINS, N.W.T.

750-1-5-11 [REDACTED]

Prepared for

CANADIAN RESERVE OIL AND GAS LIMITED
Calgary Alberta



by
GEOPHOTO SERVICES, LTD.



October 1971

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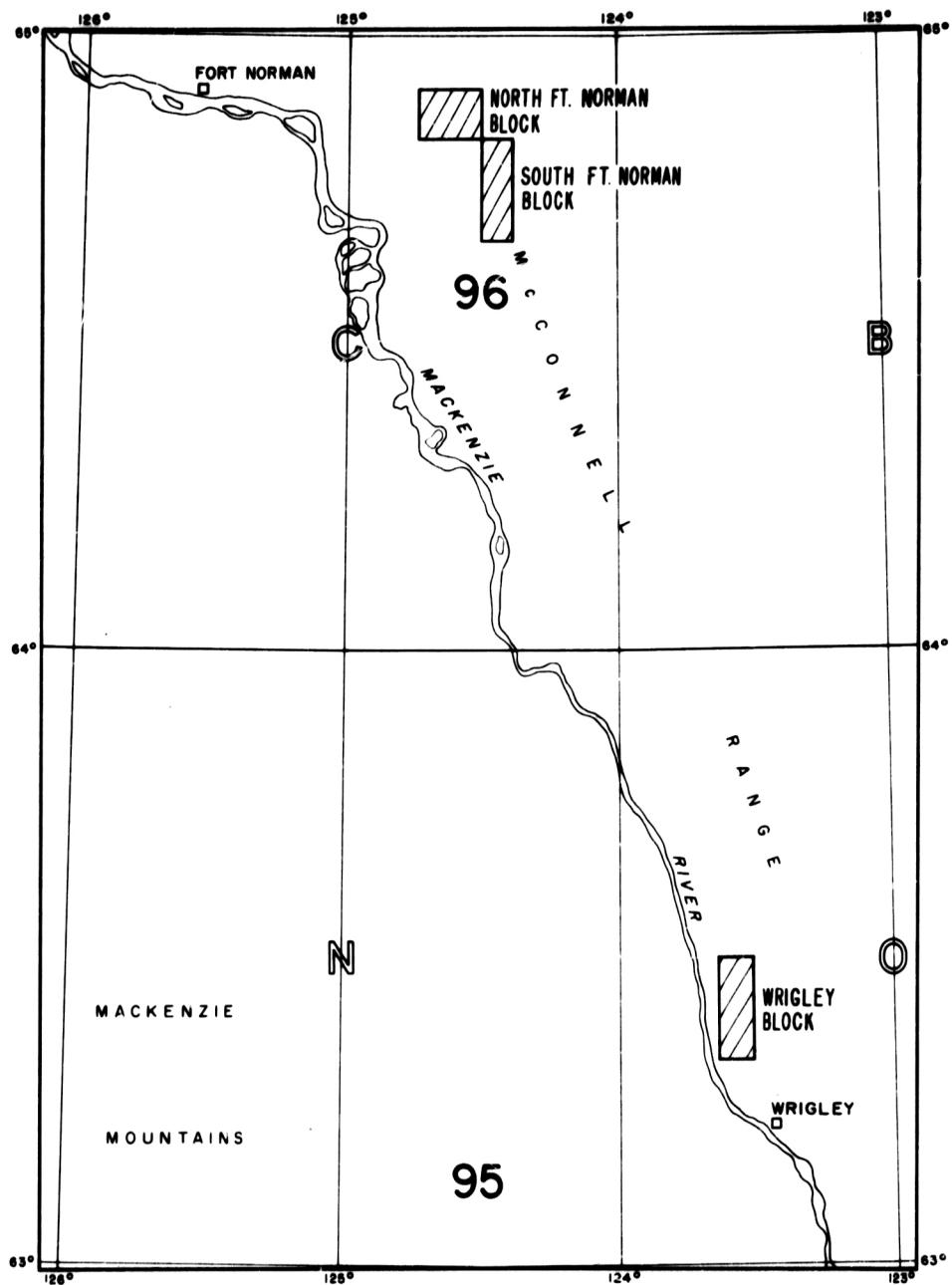


Figure 1
INDEX MAP
FRANKLIN MOUNTAINS REGION

INTRODUCTION

Location and Permit Names

The locations of the three permit blocks studied by Geophoto Services, Ltd. during July 1971, are shown on the accompanying index map (Figure 1). The permit blocks; North Fort Norman, South Fort Norman and Wrigley, were named by Geophoto with the approval of Canadian Reserve Oil and Gas Limited. The blocks are all located within the McConnell Range of the Franklin Mountains, N.W.T.

Access

Work in the North Fort Norman and South Fort Norman blocks was conducted by helicopter from a base in the Roman Catholic Mission of Father Labat at Fort Norman. Meals were prepared by Mr. and Mrs. Ed McPherson at the village. The Wrigley Block work was based from the home of Mr. Tom McGovern who is the Department of Transport base manager at Wrigley. Of 20 actual days in the field, approximately five and one-half days flying time was lost due to inclement weather or high winds over the mountain areas.

Personnel

Geophoto Services, Ltd.

J. T. Jorgenson - party chief

E. Breitag - geologist

Associated Helicopters Ltd.

E. B. Hemingson - helicopter pilot

E. H. Wise - helicopter engineer

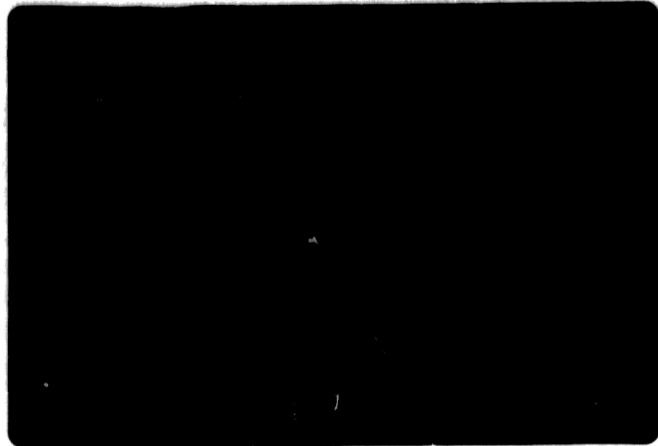


Plate 1a - View south, east photo, North Fort Norman stratigraphic section. Cretaceous or Upper Devonian in valley to left, Hume Formation flatirons in center, Bear Rock Formation to right.

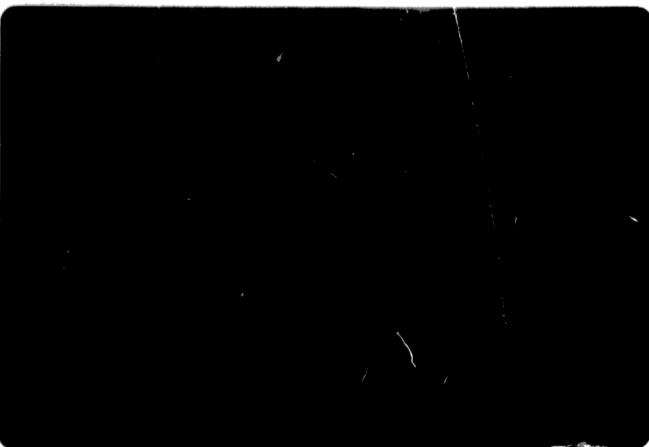


Plate 1b - View south, central photo, North Fort Norman stratigraphic section. Hume Formation flatirons to left, Bear Rock Formation forms remainder of mountain.



Plate 1c - View south, west photo, North Fort Norman stratigraphic section. Bear Rock Formation to left, basal contact with underlying Mount Kindle at base of bare slope in left center of photo.

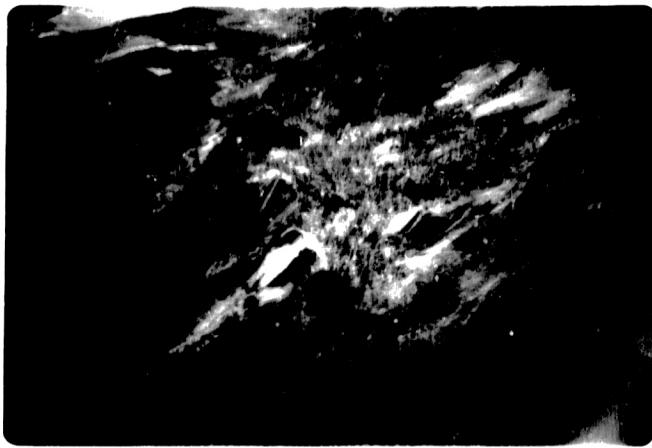


Fig. 1. Aerial photograph of the steep, rocky mountain slope where the *Leptothrix* infestation was found.

the infestation was found. The infestation was found in the upper part of the slope, where the soil was thin and the vegetation sparse.

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Fig. 2. Aerial photograph of the steep, rocky mountain slope where the *Leptothrix* infestation was found.

The infestation was found in the upper part of the slope, where the soil was thin and the vegetation sparse. The infestation was found in the upper part of the slope, where the soil was thin and the vegetation sparse.

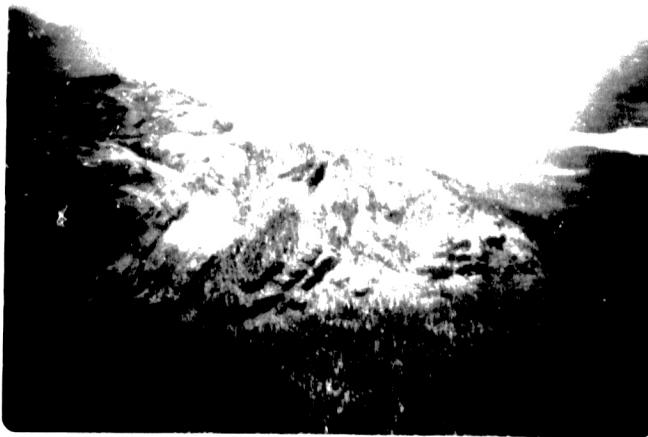


Fig. 3. Aerial photograph of the steep, rocky mountain slope where the *Leptothrix* infestation was found.

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Purpose of Study

The purpose of this field study was to make a hydrocarbons structural and stratigraphic evaluation of the three block areas and to measure and sample the most complete possible stratigraphic sections within the North and South Fort Norman blocks. Time limitations did not allow field section measurement within the Wrigley Block; however, a partial Devonian sequence at Mount Gaudet was photogrammetrically measured subsequent to the field study.

This report consists of separate descriptions of the geologic findings within each of the three individual permit blocks.

NORTH FORT NORMAN BLOCK

Stratigraphy

A stratigraphic section was measured of approximately 1,850 feet of Silurian, Lower Devonian and Middle Devonian carbonate rocks at a point across the McConnell Range 2-3/4 miles north of the permit boundary. This locality was selected over one within the permit due to accessibility, structural simplicity and a more complete section (Figure 3, North Fort Norman Section, in pocket). The rocks below the base of the measured section are mostly covered by talus deposits or form inaccessible cliffs. However, these cliff exposures appear from a distance to consist of thin to thick bedded, resistant, buff, orange and gray weathering carbonate rocks of the basal part of the Silurian-Ordovician Mount Kindle and Ordovician Franklin Mountain Formation of the Ronning Group. The top of the measured section is defined by a complete interval of very resistant, bedded limestones of the Middle Devonian Hume Formation. These rocks are overlain by

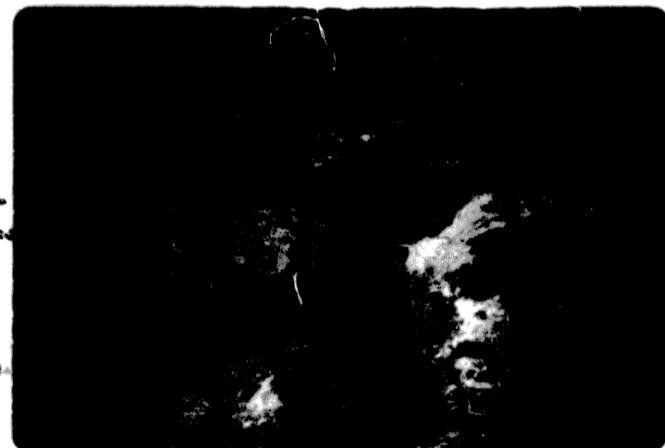


Plate 2 - North Fort Norman section. Platy to thin bedded Mount Kindle dolomite. Sample SC-1-8 at 360'.



Plate 3 - North Fort Norman section. Thin-medium bedded Mount Kindle dolomite. Note vuggy porosity. Sample SC-1-9 at 370' ±.



Plate 4 - North Fort Norman section. Platy bedded Mount Kindle dolomite. Sample SC-1-12 at 480'.



Plate 5 - section. thin bedded limestone SC-1-16

Plate 6 - section. bedded limestone Bear Rock Sample S

Plate 7 - section. ferous limestone of Hume

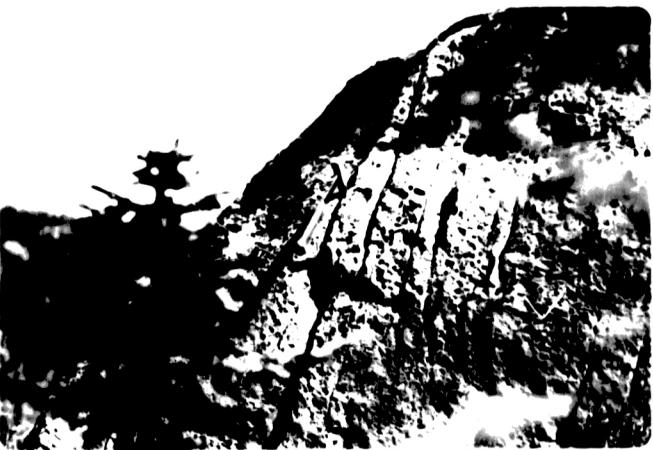


Plate 5 - North Fort Norman section. Basal Bear Rock Formation poorly to non-bedded limestone breccia. Sample SC-1-16 at 675'.

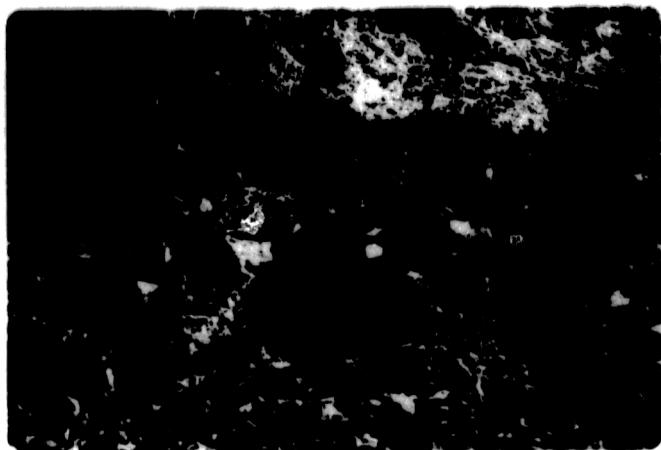
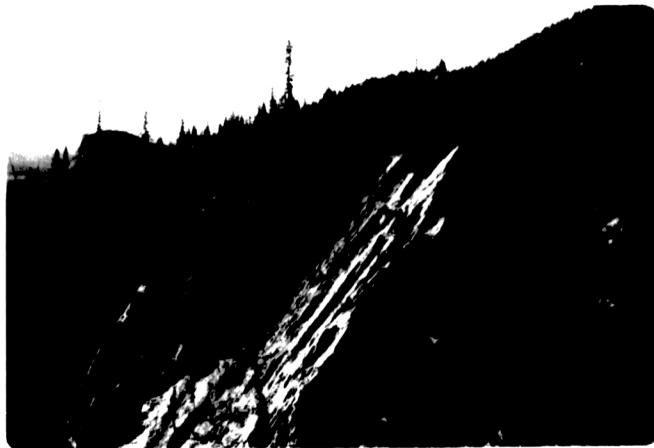


Plate 6 - North Fort Norman section. Typical massive, non-bedded limestone breccia in Bear Rock Formation. Sample SC-1-19 at 900'.



Plate 7 - North Fort Norman section. Well bedded, fossiliferous limestones in upper part of Hume Formation.





soft shales of Upper Devonian or Cretaceous age which are covered mainly by glacial till.

Tertiary sediments poorly crop out west of the McConnell Range. According to Dawson (in Bell, 1957) these rocks are Lower Eocene in age and consist of poorly consolidated gravel, sand, shale and lignite.

The lower 675 feet of the Geophoto stratigraphic section consists of a uniform sequence of gray, thin to medium bedded dolomite. The rocks are mainly tight but some fair, vuggy porosity is present at the 360-395 feet interval and again at the 435-455 feet interval. The basal 50 feet is fossiliferous and contains horn corals. The entire dolomite sequence is assigned to the Mount Kindle Formation because of the presence of corals, uniform lithology and the general similarity to Williams' (1923) Mount Kindle Formation at Mount Charles on Great Bear River.

The Mount Kindle Formation is overlain by approximately 670 feet of poorly to non-bedded, unfossiliferous, gray limestone breccia of the Bear Rock Formation. The brecciated character of the entire sequence is quite uniform with the clasts ranging from pebble to boulder in size. Porosity is considered poor throughout the Bear Rock sequence. The contact is sharp between the brecciated limestones and the underlying Mount Kindle dolomites. The top of the Bear Rock is herein considered to coincide with the disappearance of brecciation at 1,355 feet. It is interesting to note that at Williams' (1923) Mount Charles section the Lone Mountain Formation (Bear Rock) consists of 530 feet of dolomite which is only in part brecciated.

The Hume Formation is approximately 495 feet thick and consists of thin to thick bedded, dark gray limestone, the upper half of which is fossiliferous. In general, the formation characteristically crops out as a resistant, thicker bedded

upper and lower flatiron-forming member separated by a less resistant and thinner bedded member. Porosity throughout the sequence is generally poor, however, fair fracture porosity is present at 1570-1610 feet.

Structural Geology

A detailed map was prepared of the North Fort Norman Block and adjacent areas (Figure 2, in pocket) based in part on photogeologic information and in part on field observations. The block is structurally divisible into three parts. The dominant structural and topographic feature is the narrow, northerly trending, east dipping, block faulted McConnell Range which separates soft, topographically featureless Tertiary clastic rocks to the west from equally featureless Cretaceous and possibly Upper Devonian clastics to the east. The Tertiary and Cretaceous outcrop areas were closely examined by helicopter traverses but no bedrock outcrops could be found. These areas have been severely glaciated and covered by thick glacial till.

Evaluation

Structural conditions favorable for entrapment of hydrocarbons do not appear, from surface evidence, to exist within the North Fort Norman Block. However, a relatively large, northerly plunging anticline is exposed along a major unnamed stream one mile southeast of the permit area. This anticline probably persists for an unknown distance north of the major stream and the west flank of the structure lies along the east side of the permit area. This anticline is probably the northward extension of Big Smith anticline which lies to the southeast in the South Fort Norman Block.



Plate 8 - East view, location of South Fort Norman stratigraphic section in Mount Kindle Formation dolomites. Base of section in lower right of photo to section top at rounded mountain top extreme left center of photo. Overturned Bear Rock Formation on higher mountain in background within an adjacent fault block.

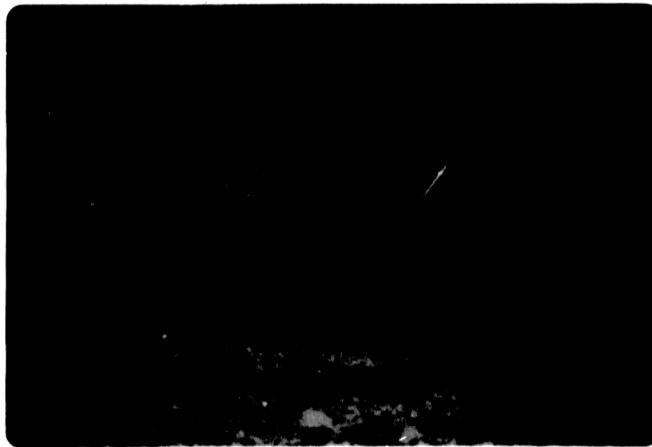


Plate 9 - North view, South Fort Norman Block. Standing on south dipping Bear Rock Formation gypsum beds at axis of Big Smith anticline south of permit boundary. Looking at faulted Hume Formation limestones north of Big Smith Creek on west flank of the anticline.



Plate 8 - East view, location of South Fort Norman stratigraphic section in Mount Kindle Formation dolomites. Base of section in lower right of photo to section top at rounded mountain top extreme left center of photo. Overturned Bearfoot Formation on higher mountain in background within an adjacent fault block.



Plate 9 - North view, South Fort Norman dolomite. Standing on south slope of the Mount Kindle Formation, looking back to the top of the South Fort Norman dolomite. The dolomite is light-colored and shows signs of weathering and erosion. The base of the dolomite is dark and appears to be a dolomite formation. The dolomite is overlain by a light-colored, possibly dolomite, formation."/>

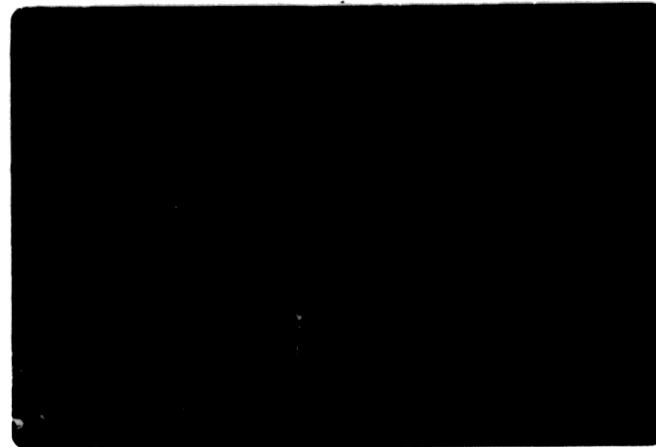


Plate 10 - East dipping Cretaceous shale with thin interbedded siltstone and sandstone, east flank Big Smith anticline, 0.5 miles east of anticlinal axis along large, alluviated unnamed stream at north edge South Fort Norman Block.

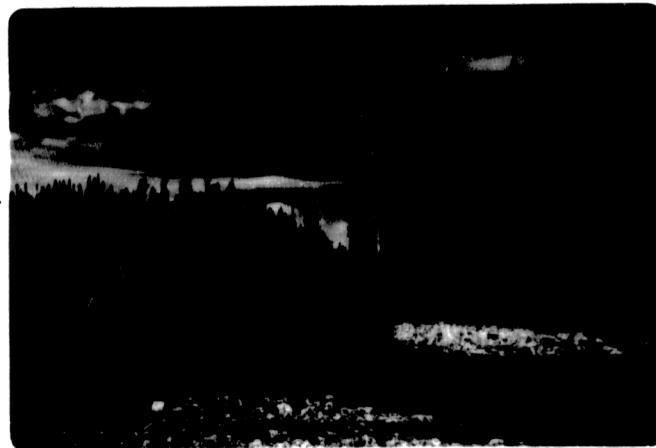


Plate 11 - East dipping Cretaceous sandstone with interbedded shale along Big Smith Creek, east flank upstream from upper Hume contact in South Fort Norman Block.

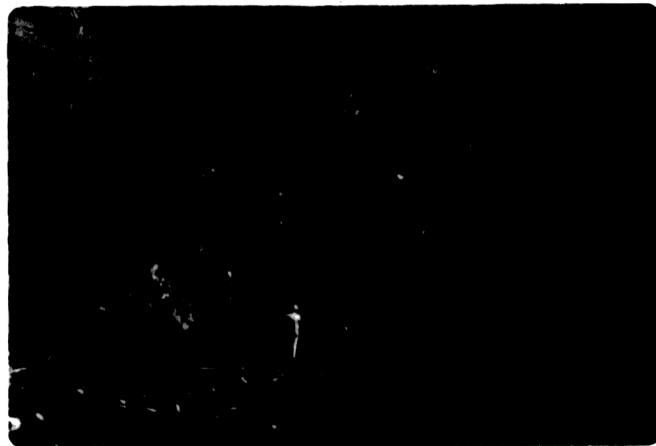


Plate 10 - East dipping Cretaceous shale with thin interbedded siltstone and sandstone, east flank Big Smith anticline 0.5 miles east of anticlinal axis along large, alleviated unnamed stream at north edge South Fort Norman Block.



Plate 11 - East dipping Cretaceous sandstone with interbedded shale, east Big Smith Creek, east flank unnamed stream from lower Mississippian contact in south Fort Norman Block.

SOUTH FORT NORMAN BLOCK

Stratigraphy

The oldest exposed rocks within the South Fort Norman Block are those of the Lower-early Middle Devonian Bear Rock Formation. The formation consists of an unknown thickness of poorly bedded to non-bedded brecciated limestone and thin bedded gypsum. These rocks are fairly well exposed in the core of and on the flanks of Big Smith anticline immediately south of the permit boundary and farther south at higher elevations within the McConnell Range. The brecciated limestone and gypsum forms a characteristic sinkhole topography in the vicinity of Big Smith anticline.

The Bear Rock is overlain by well bedded, gray limestone of the Middle Devonian Hume Formation. The Hume is well exposed as a 400+ foot high cliff immediately north of Big Smith Creek in the southwest corner of the permit and in the canyon of Big Smith Creek where it crosses over Big Smith anticline. The Hume does not crop out elsewhere on the east flank of the anticline, where its absence is postulated to be caused either by faulting along the Little Smith fault or is covered by glacial till. In the southeast corner of the permit area, along Big Smith Creek, the Hume is overlain by a thick succession of interbedded gray shale, siltstone and buff weathering sandstone of Cretaceous age. The unfossiliferous, soft, gray shales immediately overlying the Hume limestones may be of Upper Devonian age.

The South Fort Norman measured stratigraphic section location (Figure 5, in pocket) was chosen because it is the closest and thickest representative Ronning Group sequence which underlies the Bear Rock Formation exposed in the permit block, however, neither the top nor base of the Ronning is exposed. Lithologically the dolomites of the South Fort Norman section are nearly identical with the Mount Kindle Formation dolomites of the North Fort Norman stratigraphic section but

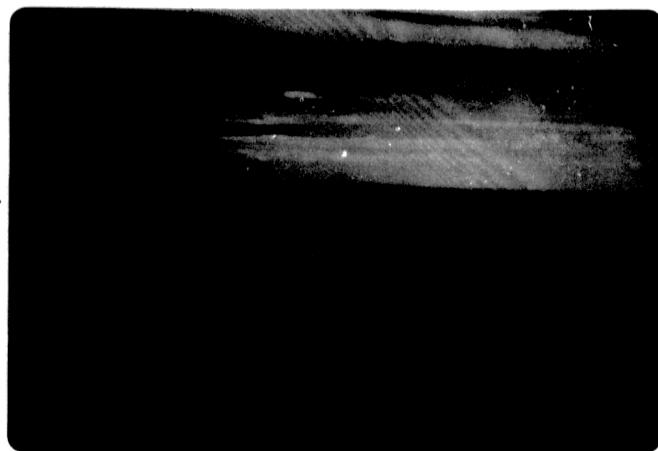


Plate 12 - Northeast view from top of rounded mountain (Plate 8), along Big Smith anticline, south of South Fort Norman Block and south of Big Smith Creek. Core of anticline expressed as sinkhole topography formed in brecciated limestone and gypsum of Bear Rock Formation. Crest of anticline follows top of ridge in center of photo. South area of independent surface closure on ridge near photo center.



FIGURE 12.—Northwest view (caudal) of emerald smelt (male, 330 mm) from Big South Fork, 10 miles southwest of Kentucky River, Kentucky. The fish and a pair of blue gills are shown. Gills are not often seen in smelt, but are often found in trout species. (Photograph by G. E. Hart, U. S. Fish and Game Commission.)

contain appreciably more thin, lenticular chert beds and calcite and quartz filled fractures. The exposed section is approximately 555 feet thick and is composed of thin to medium bedded, gray, finely crystalline, cherty, unfossiliferous dolomite. Fair fracture porosity is present in the upper and lower part of the South Fort Norman section. The underlying Franklin Mountain Formation could not be sampled on nearby outcrops due to inaccessibility and structural complexity but was observed from a distance to consist of cliff forming, thin to thick bedded, orange and buff weathering, carbonate rocks. Cambrian rocks do not crop out in the immediate vicinity of the measured section but may be present in a prominent valley one mile to the southwest.

Structural Geology

The South Fort Norman Block is occupied by Big Smith anticline. As presently understood, the anticline is elongate, asymmetric to the east, faulted and regionally plunges northward from a large southeasterly trending and bounding fault. This fault truncates the south end of the anticline. The fold extends northward approximately 14 miles to and beyond the north permit boundary. The anticline has one well defined area of independent structural closure 1.8 mile south of the permit boundary and one possible area of fault closure or poorly defined faulted independent closure within the south-central part of the permit about one mile north of Big Smith Creek. An east-west trending set of transverse minor faults along Big Smith Creek separates the two areas of closure. These faults probably have considerable transcurrent left lateral movement as shown by the offset of the axial crest of Big Smith anticline. To the south, the east flank of the fold is bounded by Little Smith fault to a point as far north as Big Smith Creek. Here, the fault appears to die out in Cretaceous or

Upper Devonian shales and the contact between the shales and underlying Hume limestones appear unfaulted from cursory field examination. Consequently, north of Big Smith Creek, the east flank of Big Smith anticline is defined by an inferred normal contact between Devonian and Cretaceous rocks. In this area the Hume Formation does not crop out as it does on the west flank of the anticline but is inferred to be covered by glacial till. An alternate interpretation to explain the absence of the Hume north of Big Smith Creek is that it is cut out by a northward extension of Little Smith fault along the east flank of Big Smith anticline. However, the presence of a major fault could not be confirmed in the field between Big Smith Creek and the large alluviated drainage along the north boundary of the permit block.

West of the permit boundary, a north-south trending fault, upthrown to the east displaces east dipping Hume limestones against Cretaceous shales. A north plunging syncline is present between the fault and Big Smith anticline.

Evaluation

Big Smith anticline is of sufficient magnitude to warrant further investigation by seismic methods. A clear concept of the surface structure cannot be made on the ground due to incomplete bedrock outcrops and extensive cover by glacial till. However, the fold was confirmed in the field a short distance south of the permit boundary, along Big Smith Creek, and its probable northward axial extension along the unnamed alluviated valley in the extreme north part of the permit. In addition, as the fold is eroded deep into the Bear Rock Formation, any potential reservoir beds in the Ronning Group would be encountered at a relatively shallow depth.

WRIGLEY BLOCK

Stratigraphy

With the advice and consent of Canadian Reserve, a ground examination of the stratigraphic section within the Wrigley Block was not attempted due to time limitations. However, it could be ascertained from helicopter reconnaissance observations that the formational rock distribution shown on the accompanying geologic map (Figure 6) is correct.

The Ordovician Franklin Mountain Formation and overlying Ordovician-Silurian Mount Kindle Formation of the Ronning Group do not crop out within the Wrigley Block but are well exposed in the McConnell Range to the east.

At Mount Kindle, Douglas and Norris (1963) state that the Franklin Mountain Formation is 1,265 feet thick and consists of a basal 105 feet of platy, fine-grained, gray limestone and calcareous shale, overlain by 155 feet of light brownish gray weathering, gray, fine grained, thinly bedded dolomite, in turn overlain by 260 feet of yellowish brown, pale green and red shales with some thin bands of finely laminated quartzose sandstone and silty dolomite. The upper part of the formation consists of 745 feet of light yellowish gray to medium brown weathering dolomite which is fine grained, light gray to light brownish gray and platy to thinly bedded.

In the vicinity of Mount Kindle, Douglas and Norris (1963) estimated that the Mount Kindle Formation is 900 feet thick and consists of gray to yellowish gray weathering dolomite which is medium to massively bedded, light brownish gray to light gray, micro-medium crystalline, sugary and, in part, finely vuggy. The basal beds are reefy and contain Upper Ordovician large colonial corals and the upper beds contain early Silurian fossils.

In the McConnell Range the Franklin Mountain Formation is underlain by



Plate 13 - North view to Mount Gaudet, northern Camsell Range, Wrigley Block. "Mount Gaudet" fault along base of range separates west dipping, folded Middle Devonian Hume Formation and early Middle-Lower Devonian Bear Rock Formation in hanging wall from tree covered foot wall strata of Upper Devonian Fort Simpson Formation.



Plate 14 - West view to Mount Gaudet, northern Camsell Range, Wrigley Block. (Same caption as Plate 13).

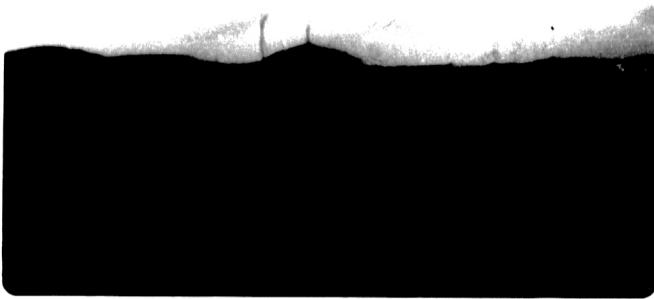


Plate 13 - North view to Mount Gaudet, northern Caron Range, Wrigley Block. "Mount Gaudet" fault along base of range separates west dipping, folded Middle Devonian Hume Formation and early Middle-Lower Devonian Bear Rock Formation on hanging wall from tree covered foot wall strata of Upper Devonian Fort Simpson Formation.



Plate 14 - West view to Mount Gaudet, northern Caron Range, Wrigley Block. (Same exposures as Plate 13).

about 500 feet of buff, green and red shale, salt and gypsum of the Middle Cambrian Saline River Formation (Williams, 1923). The underlying Middle Cambrian Mount Cap Formation was estimated by Williams (1923) to be about 200 feet thick and consist of poorly exposed light green to light orange-red and yellowish orange weathering, soft, fissile, light olive-green shale. The Lower Cambrian Mount Clark Formation underlies the Mount Cap shales. Williams (1923) described the formation at Cap Mountain as consisting of 450 feet (Douglas and Norris, 1963) of light and dark purplish red weathering sandstone which is white, banded, fine grained, massive to thinly and irregularly bedded and, in part, cross bedded. Bell (1957) measured some 736 feet of Mount Clark strata at Cap Mountain but apparently placed the Cambrian-Precambrian contact at a lower horizon than Douglas and Norris (1963).

The Mount Clark Formation is unconformably underlain by Proterozoic clastic sedimentary rocks of the Lone Land Formation and other unnamed units.

The Lower-early Middle Devonian Bear Rock Formation is the oldest sequence exposed within the Wrigley Block. These rocks consist of typical poorly to non-bedded, massive, brecciated limestone and dolomite with some anhydrite. At Mount Gaudet the faulted formation was photogrammetrically calculated to be a minimum of 1,785 feet thick. This thickness figure is excessive when compared with Douglas and Norris (1963) reported thickness of 1,070 feet in McConnell Range to the east and may be caused by structural complexities not observable on the air photographs.

Near Mount Gaudet the Bear Rock Formation is overlain by the Middle Devonian Nahanni Formation. The Nahanni is photogrammetrically calculated to be about 620 feet thick and forms well exposed light-gray-weathering cliffs and flatirons which overlie a persistent recessive (shale?) interval approximately 215 feet thick.

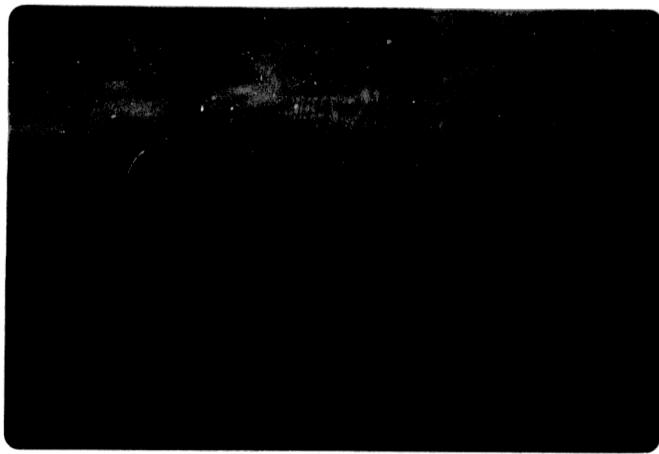


Plate 15 - North view, center of Wrigley Block showing west dipping, faulted Bear Rock Formation of Camsell Range overlying southwest dipping Upper Devonian Fort Simpson and Middle Devonian Nahanni Formations along west flank of McConnell Range.



FIG. 15. - Northflow, eastern of Nahanni Falls, showing a most dangerous, turbulent, Deep, Dark River, caused by a great volume of water, and a rapid current, due to the great amount of water impounded in the Nahanni River, and the great amount of water falling in the Nahanni River.

at the top of the massive, brecciated Bear Rock. The recessive interval may be equivalent to the Middle Devonian Headless Formation. In the north part of Camsell Range, Douglas and Norris (1963) described the Nahanni as comprising 360 feet of light to medium dark gray, fine to coarse-grained, thick to medium bedded limestones separated by covered intervals.

Within the Wrigley Block, the Nahanni Formation is overlain by soft, fissile, gray to black shale with interbedded siltstone and some sandstone which Douglas and Norris (1963) assign to the Upper Devonian Fort Simpson Formation. The formation is extensively covered by glacial till and does not crop out within the Wrigley Block except at a location along Mackenzie River one mile southwest of Mount Gaudet and in several poor cliff exposures along Ochre River.

Structural Geology

The "Mount Gaudet" fault is the dominant structural feature within the Wrigley Block. This fault is named the Camsell thrust by Douglas and Norris (1963). "Mount Gaudet" fault is one of a succession of thrust faults which bound the northern Camsell Range to the east and have formed a west dipping homoclinal succession of Middle Devonian and older rocks of the hanging wall in fault contact with foot wall strata of essentially Upper and Middle Devonian age which form the westerly dipping flank of McConnell Range. At Mount Gaudet the Middle Devonian and older beds of the hanging wall form a series of minor but prominent steeply-west plunging folds which are truncated by the "Mount Gaudet" fault.

Evaluation

No structural conditions were observed within the Wrigley Block which would suffice for significant entrapment of hydrocarbons. Folds may be present within the poorly exposed Upper Devonian outcrop areas but they probably would not be of sufficient amplitude to warrant serious consideration.

SUMMARY

Structural and stratigraphic evaluations were made in three petroleum lease blocks held by Canadian Reserve Oil and Gas Limited. Partial stratigraphic sections were measured and sampled in two of the blocks.

The North Fort Norman and Wrigley Blocks are partly underlain by Middle and Lower Paleozoic carbonate rocks but lack any surface indication of structural conditions favorable for the accumulation of hydrocarbons. These areas are not recommended for further investigation.

The South Fort Norman Block is mainly occupied by a relatively large anticline. The fold exhibits one well defined independent surface closure south of the permit area and a poorly defined fault closure or faulted independent surface closure within the south part of the permit. Surface structural conditions over parts of the anticline are incompletely understood due to poor outcrops and glacial cover. However, the fold is of sufficient amplitude for the entrapment of appreciable hydrocarbons at a shallow target depth in Ordovician-Silurian carbonate rocks. Reconnaissance seismic work is recommended to further evaluate the anticline.

Respectfully submitted

GEOPHOTO SERVICES, LTD.

Jon T. Jorgenson
Jon T. Jorgenson
Senior Petroleum Geologist

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Figure 3

CANADIAN RESERVE OIL AND GAS LTD.

St. Charles River Area, McConnell Range of Franklin Mountains, N.W.T.

MEASURED BY GEOPHOTO SERVICES, LTD., JULY, 1971, USING 5' ROD.

SECTION - NORTH FORT NORMAN BLOCK

COORDINATES - 64°57' North Latitude
124°39' West Longitude

CODE NO. - G 71, SC-1 to 39

SAMPLES - 50 FEET AND LITHOLOGIC CHANGES

MAP - 96 E/NE

AIRPHOTO - 253 FLIGHT - A 11974

MOSAIC - 96 C/15
LOCATION - Across the McConnell Range between Little Bear and St. Charles Rivers. Section is located 1/2 mile north of triangulation point, elevation 1694 feet.

SYSTEM AND SERIES	FORMATION	FOOTAGE		POROSITY		PERMEABILITY		FIELD DESCRIPTION	PALEONTOLOGY
				Poor	Fair	Good	%		
CRET. OR U. DEVON								Section overlain by soft shale or glacial deposits.	
								75' LIMESTONE, dark gray, weathers light gray, thick to massive bedded, finely crystalline, slightly fetid, well indurated, very resistant. Uppermost member of Hume Formation. SC-1-38 at 1775'. SC-1-39 at 1800' (same lithology as above).	
MIDDLE DEVONIAN	HUME	495' +						90' LIMESTONE, dark gray, weathers rubbly tan to light gray, flaggy to thin bedded, finely crystalline, fair induration, weakly resistant, argillaceous (?). SC-1-36 is random samples of 1685'-1775' interval.	Corals and shells abundant particularly at 1765'-75'. SC-1-37.
								15' LIMESTONE, dark gray, weathers medium to light gray, and brown, thin to medium bedded, microcrystalline, well indurated, resistant. SC-1-35 at 1675'.	Very sparse corals, shells, crinoid stems.
								35' LIMESTONE, recessive, medium gray, weathers tan, platy bedded, fair induration, finely crystalline, tight, slightly fetid. SC-1-34A at 1645'.	Fossiliferous.
								25' LIMESTONE, dark gray, weathers mottled, tan and light gray, thin-medium bedded, microcrystalline, well indurated, resistant, slightly fetid. 1610' beginning of resistant outer flatirons. SC-1-34.	Moderately abundant fossil shells.
								40' LIMESTONE, dark gray, weathers tanish gray and rubbly, thin flaggy irregularly bedded, microcrystalline, fair induration, moderately resistant, slightly fetid. Fair fracture porosity. SC-1-33 at 1585' is typical sample.	Abundant fossil shells.
								120' Mainly covered and recessive, SC-1-31 at 1485' is LIMESTONE, dark gray, fissile-flaggy-thin bedded, argillaceous, weakly resistant, SC-1-32 at 1530' is same lithology and contains poorly preserved fossil shells.	Fossiliferous.

LOWER-EARLY MIDDLE DEVONIAN

MIDD

BEAR ROCK

670'

		120' Mainly covered and recessive, SC-1-31 at 1485' is LIMESTONE, dark gray, fissile-flaggy-thin bedded, argillaceous, weakly resistant, SC-1-32 at 1530' is same lithology and contains poorly preserved fossil shells.	Fossiliferous.
		20' LIMESTONE, dark gray, weathers light gray, thin flaggy to medium bedded, microcrystalline, well indurated, moderately resistant, slightly fetid. SC-1-30.	
		10' LIMESTONE, dark gray, weathers light gray, shaly-flaggy bedded, recessive.	
		15' LIMESTONE, dark gray, weathers light gray, thick to massive bedded, microcrystalline, well indurated, very resistant, minor pinhead vugs, slightly fetid. SC-1-29.	
		10' Recessive covered interval of LIMESTONE, dark gray, weathering brown, flaggy bedded.	
		25' LIMESTONE, dark gray, weathers light gray, lower 5' slabby bedded, upper 20' thin to medium bedded, microcrystalline, moderately-well bedded, moderately resistant. SC-1-28.	
		15' Recessive covered interval. Contains black, calcareous, carbonaceous SHALE, fragments in soil.	
		5' BRECCIA, limestone, clasts and matrix, weathers light-medium gray, thin slabby bedded, weakly resistant. SC-1-27 at 1350'.	
		40' Recessive covered interval.	
		10' BRECCIA, limestone, clasts and matrix, dark gray, weathers tanish gray, thin-flaggy and well bedded, microcrystalline, fair induration, weakly resistant, pinhead size rounded calcite concretions, moderately fetid, breccia fragments to 6". SC-1-26.	
		50' BRECCIA, same as 1200'-1250' interval. SC-1-25 at 1250'. All limestone breccia rocks between 900'-1300' are massive, homogeneous and non-bedded.	
		50' BRECCIA, same as 1150'-1200' interval, brecciation above 1200' very apparent, some limestone fragments of boulder size. SC-1-24 at 1200'.	
		50' BRECCIA, same as 1100'-1150' interval, also numerous fractures and voids filled with calcite. SC-1-23 at 1150'.	
		50' BRECCIA, same as 1050'-1100' interval. SC-1-22 at 1100'.	
		50' BRECCIA, same as 1025'-1050' interval. SC-1-21 at 1050'.	
		25' BRECCIA, same as 950'-1025' interval. SC-1-20 at 1025'.	
		75' BRECCIA, same as 900'-950' interval. SC-1-19 at 950'.	
		50' BRECCIA, limestone clasts and matrix, medium gray, weathers light gray with tan mottling, microcrystalline, well indurated, very resistant, non-bedded, homogeneous, massive, conglomerate and breccia limestone clasts of pebble to boulder size. SC-1-18 at 900'.	
		40' Talus covered slope.	2 ft

RONNING GROUP (MOUNT KINDEL)

675'.

homogeneous, massive, conglomerate and breccia limestone clasts of pebbles to boulder size. SC-1-18 at 900'.

140' Talus covered slope.

60' BRECCIA, limestone, clasts and matrix, medium-dark gray-brownish light gray, weathers light gray, platy bedded, well indurated, moderately resistant. SC-1-17A at 700'. SC-1-17B at 730', SC-1-17C at 760'.

25' BRECCIA, limestone, clasts and matrix, dark gray, weathers light gray, poorly to non-bedded, finely crystalline, strongly indurated, resistant, slightly dolomitic. SC-1-16.

20' Recessive and covered. Scattered outcrops of DOLOMITE, medium gray, weathers very light gray, thin flaggy bedded, fair induration, weakly resistant, microcrystalline, tight. SC-1-15.

40' Recessive covered interval.

30' DOLOMITE, tanish light gray, weathers mottled light and dark gray, platy bedded, microcrystalline, well indurated, weakly resistant, tight. SC-1-14.

40' Recessive covered interval.

20' DOLOMITE, light tanish gray, weathers mottled cream and medium gray, thin bedded, microcrystalline, well indurated, resistant. Minor grain-sized black chert. SC-1-13.

15' Recessive covered interval.

35' DOLOMITE, light gray-tanish gray, weathers tan-medium gray, thin platy bedded, micro-to finely crystalline, fair induration, weakly resistant. Slightly calcareous upper 10'. SC-1-12.

20' Recessive covered interval.

40' DOLOMITE, medium-light gray, weathers mottled tan and gray, thin-medium bedded, finely crystalline, well indurated, very resistant, poor vuggy porosity, increases to fair toward top. Vugs to 1/4 inch. SC-1-11.

5' DOLOMITE, brownish-olive gray, weathers mottled tan and gray, platy to thin bedded, microcrystalline, moderately resistant, fair induration. SC-1-10.

10' Recessive covered interval.

20' DOLOMITE, medium gray, weathers mottled tan and medium gray, thin-medium bedded, micro-finely crystalline, resistant, well indurated, fair vuggy porosity. Vugs 1/8 - 1/2 inch. SC-1-9.

20' DOLOMITE, light tanish gray, weathers mottled tan and light gray, micro-crystalline at 360' and finely crystalline at 370', platy bedded, moderately resistant, well indurated, fair vuggy porosity. SC-1-8.

25' Recessive covered interval.

30' DOLOMITE, tan-medium gray, weathers tanish gray, thin bedded, finely crystalline, moderately indurated, tight. SC-1-7.

10' Covered recessive interval.

55' DOLOMITE, medium gray-light brownish gray, weathers light brownish gray, thin bedded, micro-finely crystalline, slightly calcareous in some thinner beds, moderately resistant, slightly fetid, tight. SC-1-6.

45' Recessive covered interval.

3 of

ORDOVICIAN - SILURIAN

RONNING GROUP (MOUNT KINDEL)

675'

	20'	DOLOMITE, light tanish gray, weathers mottled cream and medium gray, thin bedded, microcrystalline, well indurated, resistant. Minor grain-sized black chert. SC-1-13.
	15'	Recessive covered interval.
	35'	DOLOMITE, light gray-tanish gray, weathers tan-medium gray, thin platy bedded, micro-to finely crystalline, fair induration, weakly resistant. Slightly calcareous upper 10'. SC-1-12.
	20'	Recessive covered interval.
	40'	DOLOMITE, medium-light gray, weathers mottled tan and gray, thin-medium bedded, finely crystalline, well indurated, very resistant, poor vuggy porosity, increases to fair toward top. Vugs to 1/4 inch. SC-1-11.
	5'	DOLOMITE, brownish-olive gray, weathers mottled tan and gray, platy to thin bedded, microcrystalline, moderately resistant, fair induration. SC-1-10.
	10'	Recessive covered interval.
	20'	DOLOMITE, medium gray, weathers mottled tan and medium gray, thin-medium bedded, micro-finely crystalline, resistant, well indurated, fair vuggy porosity. Vugs 1/8 - 1/2 inch. SC-1-9.
	20'	DOLOMITE, light tannish gray, weathers mottled tan and light gray, micro-crystalline at 360' and finely crystalline at 370', platy bedded, moderately resistant, well indurated, fair vuggy porosity. SC-1-8.
	25'	Recessive covered interval.
	30'	DOLOMITE, tan-medium gray, weathers tanish gray, thin bedded, finely crystalline, moderately indurated, tight. SC-1-7.
	10'	Covered recessive interval.
	55'	DOLOMITE, medium gray-light brownish gray, weathers light brownish gray, thin bedded, micro-finely crystalline, slightly calcareous in some thinner beds, moderately resistant, slightly fetid, tight. SC-1-6.
	45'	Recessive covered interval.
	5'	DOLOMITE, medium gray, weathers light gray, thin platy bedded, micro to finely crystalline, weakly resistant, some minute vugs, tight. SC-1-5.
	25'	Recessive covered interval.
	15'	DOLOMITE, light gray, weathers light gray, thin bedded, finely crystalline, well indurated, resistant, slightly fetid, minor small vugs, tight. SC-1-4.
	50'	DOLOMITE, medium gray, weathers light gray, platy to medium bedded, micro-crystalline, well indurated, resistant, slightly vuggy, tight. SC-1-3.
	25'	DOLOMITE, brownish gray, weathers light gray, thin bedded, finely crystalline, well indurated, moderately resistant, tight. SC-1-2.
	25'	Recessive covered interval.
	50'	DOLOMITE, medium to light gray, weathers grayish tan, thin to medium bedded, finely to microcrystalline, well indurated, resistant, slightly fetid, tight. SC-1-1.

Talus covered slope.

Brachiopods, horn corals and thin beds of fossil hash.

4 of 4

Figure 5

CANADIAN RESERVE OIL AND GAS LTD.

McConnell Range of Franklin Mountains, N.W.T.

MEASURED BY GEOPHOTO SERVICES, LTD, JULY, 1971, USING 5' ROD

SECTION - SOUTH FORT NORMAN BLOCK

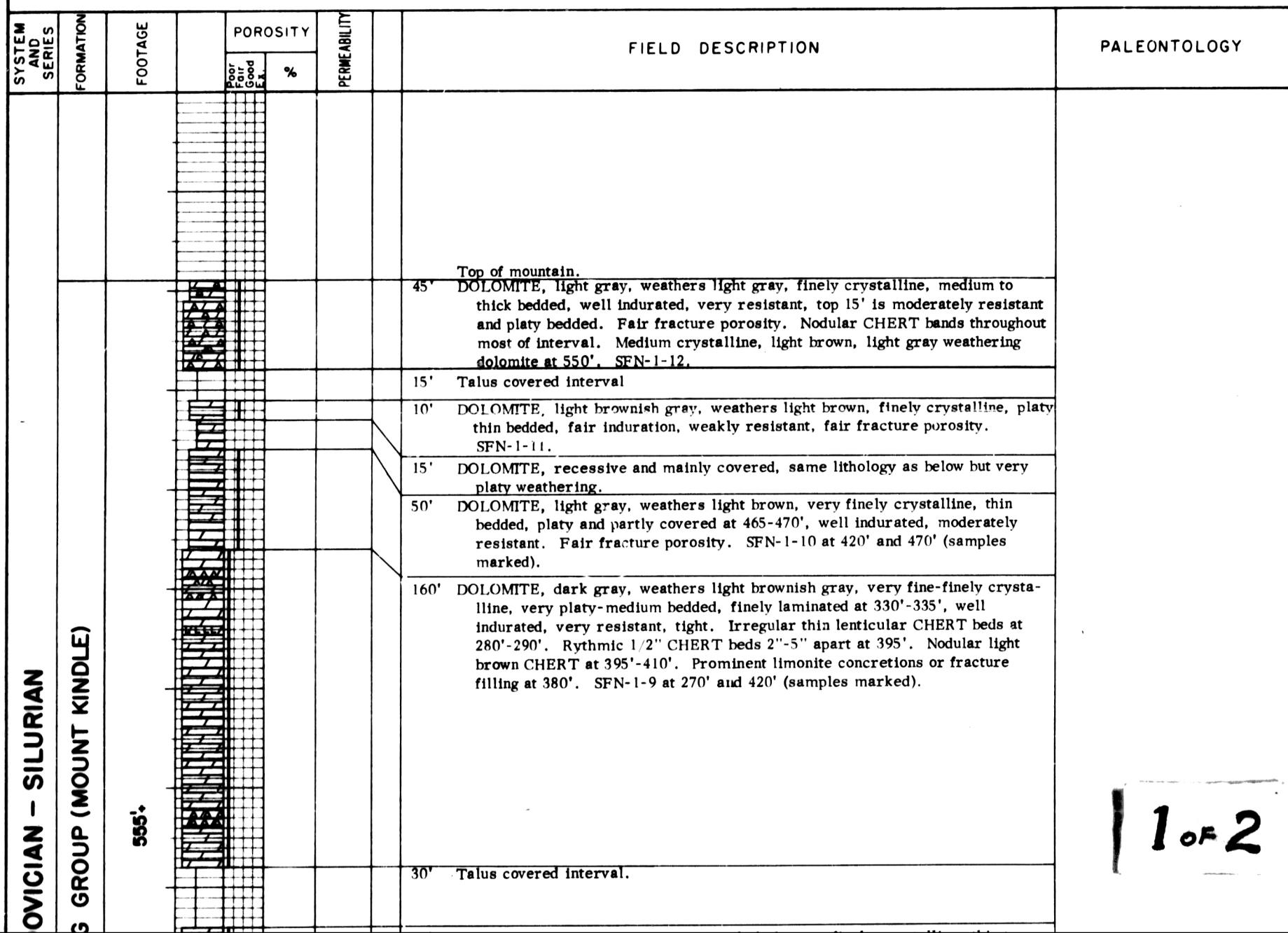
COORDINATES - 64°37'30" North Latitude
124°30' West Longitude

CODE NO. - G 71, SFN-1 to 12

SAMPLES - FIFTY FEET AND LITHOLOGIC CHANGES

MAP - 96 C/NE

AIRPHOTO - 149 FLIGHT - A 11974

MOSAIC - 96 C/ 9-10
LOCATION - At a flat-topped mountain within the McConnell Range between Big Smith and Little Smith Creeks. Elevation approximately 2,000 feet.

1 of 2

ORDOVICIAN - SILURIAN

RONNING GROUP (MOUNT KINDE)

555'

platy weathering.	
50'	DOLOMITE, light gray, weathers light brown, very finely crystalline, thin bedded, platy and partly covered at 465-470', well indurated, moderately resistant. Fair fracture porosity. SFN-1-10 at 420' and 470' (samples marked).
160'	DOLOMITE, dark gray, weathers light brownish gray, very fine-finely crystalline, very platy-medium bedded, finely laminated at 330'-335', well indurated, very resistant, tight. Irregular thin lenticular CHERT beds at 280'-290'. Rythmic 1/2" CHERT beds 2"-5" apart at 395'. Nodular light brown CHERT at 395'-410'. Prominent limonite concretions or fracture filling at 380'. SFN-1-9 at 270' and 420' (samples marked).
30'	Talus covered interval.
10'	DOLOMITE, medium gray, weathers light brown, finely crystalline, thin to medium bedded, well indurated, moderately resistant, tight. Abundant quartz-filled fractures. SFN-1-8.
35'	Recessive covered interval.
70'	DOLOMITE, light to medium gray, weathers light brown-brownish gray, fine-medium crystalline, thin-medium bedded, well indurated, moderately resistant. Minor 1"-2" lenticular, light brownish gray CHERT beds throughout at irregular intervals. Fair vuggy porosity at 150'-155' and 170'-185'. SFN-1-6 at 115'. SFN-1-7 at 150', 160', 170', 180' (footage marked on samples).
15'	DOLOMITE, light brown, weathers light brown, finely crystalline, flaggy-platy bedded, fair induration, recessive. SFN-1-5 at 114'.
60'	DOLOMITE, brownish gray, weathers light brownish gray, finely crystalline, flaggy-thin bedded, weathers blocky near top, well indurated, resistant. Fair fracture porosity, poor vuggy porosity. Some interbedded thin banded CHERT at 75' and 100'. Top 25' DOLOMITE, medium gray, weathers tan-medium brownish gray, moderately resistant, finely crystalline, slabby-thin bedded, well indurated, moderately resistant, poor fracture porosity. SFN-1-2 at 40', SFN-1-3 at 75', SFN-1-4 at 100'.
15'	Recessive covered interval.
25'	DOLOMITE, light gray, weathers light brownish gray, finely crystalline, thin-medium bedded, well indurated, tight. Thin interbeds of light gray-white lenticular CHERT. Moderately resistant. SFN-1-1.
Talus covered long slope.	

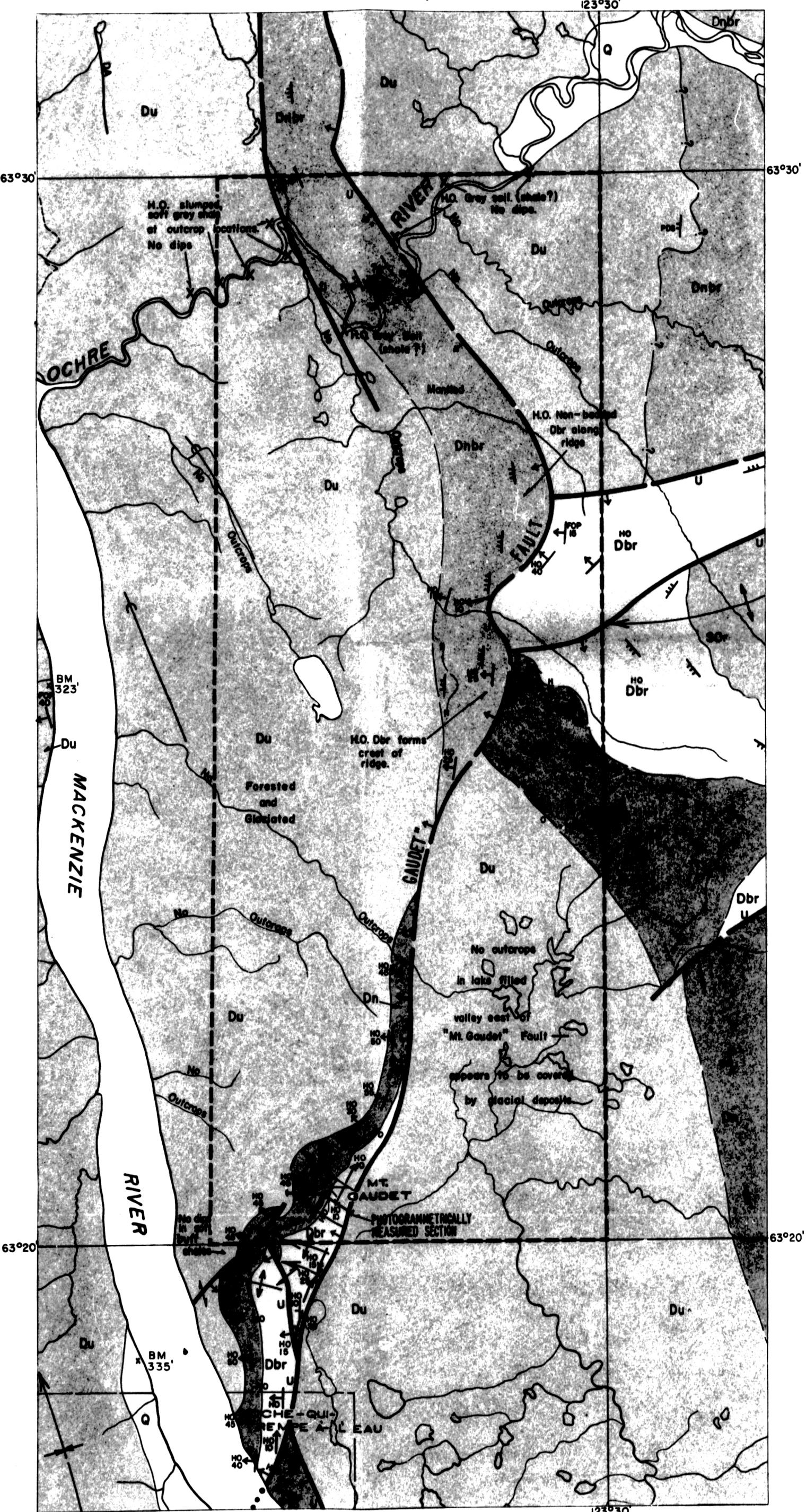


Figure 6
GEOLOGICAL MAP
WRIGLEY BLOCK
N. W. T.
PREPARED FOR
CANADIAN RESERVE OIL AND GAS LTD.



A SUBSIDIARY OF
TEXAS INSTRUMENTS INCORPORATED

SCALE
1:63,360 - 1 inch to 1 mile
5000 2000 1000 0 5000 10,000 FEET
1/2 1/4 0 1 2 MILES

OCTOBER 1971

MAP UNITS

QUATERNARY	Surficial deposits	
TERTIARY	Nonmarine clastic rock	
CRETACEOUS	Shale and sandstone	
UPPER DEVONIAN	Shale and sandstone	
MIDDLE-LOWER DEVONIAN	Hume -H- base upper or Nahanni -N- base resistant member Bear Rock	
SILURIAN-ORDOVICIAN	Mt. Kindle Franklin Mtn	
CAMBRIAN	Saline River Mt. Cap	

GEOLOGIC SYMBOLS

	Bedding appears horizontal on photographs
	Dip group 1, less than 3°
	Dip group 2, 3° to 10°
	Dip group 3, 10° to 25°
	Dip group 4, 25° to 45°
	Dip group 5, 45° to nearly vertical
	Bedding appears vertical on photographs
	Overturned bedding
	General dip of beds having subordinate folds
	Dip and strike. Amount of dip cannot be determined on photographs.
	Dip component
	Field observed dip from published map
	Possible dip slope
	Strike line. Direction of dip cannot be determined on photographs
	Helicopter observation
	Field observation
	Fault. Dip of fault plane and upthrown side Dashed where indefinite, dotted where concealed
	Strike-slip fault
	Distinctive alignment
	Glacial lineation. Direction of ice movement indicated
	Anticline. Arrow denotes plunge. Diamond denotes approximate position of apex
	Syncline. Arrow denotes plunge. Break and cross bars denote approximate position of high point
	Structural terrace
	Monocline
	Contact, dashed where indefinite
	Key horizon
	Lithologic break
	Outcrop area
	Identifies isolated or faulted segment with labelled area
	Permit boundary

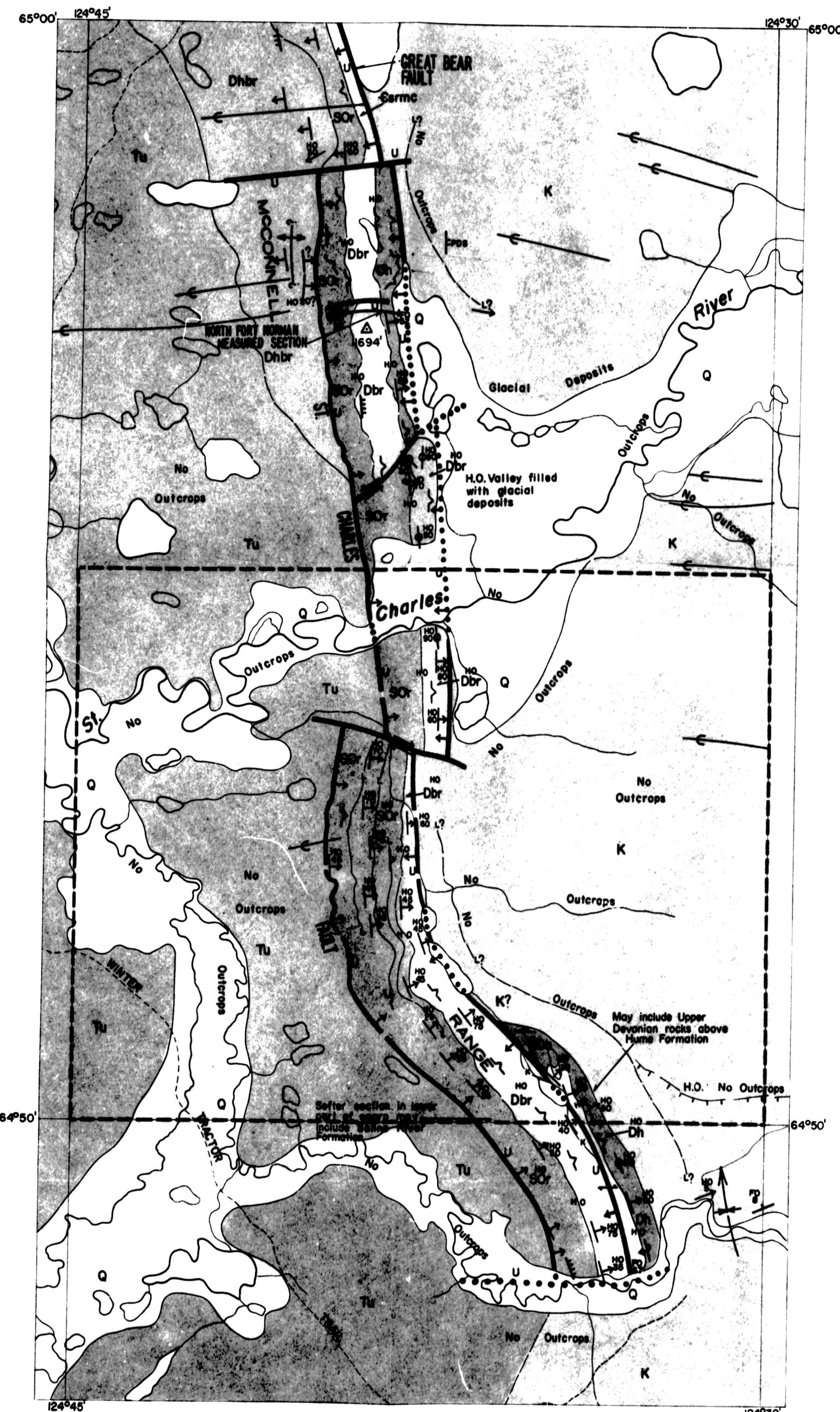


Figure 2
GEOLOGICAL MAP
NORTH FORT NORMAN BLOCK
N. W. T.
PREPARED FOR
CANADIAN RESERVE OIL AND GAS LTD.



A SUBSIDIARY OF
TEXAS INSTRUMENTS INCORPORATED

SCALE
1 63,360 - 1 inch to 1 mile
5000 2000 1000 0 5000 10,000 FEET
1/2 1/4 0 2 MILES

OCTOBER 1971

MAP UNITS

QUATERNARY	Surficial deposits	Q
TERTIARY	Nonmarine clastic rock	Tu
CRETACEOUS	Shale and sandstone	K
UPPER DEVONIAN	Shale and sandstone	Du
MIDDLE-LOWER DEVONIAN	Hume —H— base upper or Nahanni resistant member Dbr Bear Rock	Dbr or Dn
SILURIAN-ORDOVICIAN	Mt. Kindle Franklin Mtn. Ronning Group	SOr
CAMBRIAN	Saline River Mt. Cap	Cermc

GEOLOGIC SYMBOLS

- ⊕ Bedding appears horizontal on photographs
- Dip group 1, less than 3°
- Dip group 2, 3° to 10°
- Dip group 3, 10° to 25°
- Dip group 4, 25° to 45°
- Dip group 5, 45° to nearly vertical
- Bedding appears vertical on photographs
- Overturned bedding
- General dip of beds having subordinate folds
- Dip and strike. Amount of dip cannot be determined on photographs.
- Dip component
- ↑ FOP
↓ POS Field observed dip from published map
- Possible dip slope
- Strike line. Direction of dip cannot be determined on photographs
- HO Helicopter observation
- FO Field observation
- Fault. Dip of fault plane and upthrown side
— Dashed where indefinite, dotted where concealed
- Strike-slip fault
- DA Distinctive alignment
- Glacial lineation. Direction of ice movement indicated.
- Anticline Arrow denotes plunge. Diamond denotes approximate position of apex
- Syncline Arrow denotes plunge. Break and cross bars denote approximate position of high point
- Structural terrace
- Monocline
- Contact, dashed where indefinite
- Key horizon
- L Lithologic break
- X Outcrop area
- Identifies isolated or faulted segment with labelled area
- Permit boundary